# The Gravity of Experience*

Pushan Dutt†
INSEAD

Ana Maria Santacreu
Federal Reserve Bank of St. Louis

Daniel A. Traca
NOVA School of Business and Economics

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## Abstract

In this paper, we establish the importance of experience in international trade for reducing trade costs and facilitating bilateral trade. In an augmented gravity framework, with a very comprehensive set of fixed-effects and trend variables, we find that a 1% increase in experience at the country-pair level reduces trade costs by 0.09% and increases bilateral exports by 0.345%. We utilize multiple identification strategies including difference-in-difference and instrumental variables. To provide insights into the mechanism by which experience increases bilateral trade, we employ both placebo tests and model based tests. These tests indicate that there are spillovers in experience and that experience reduces bilateral trade costs, especially variable trade costs. We close by showing that experience matters more for country-pairs that are distant, non-contiguous, lack colonial links and legal ties to one another.

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† Corresponding author: INSEAD, 1 Ayer Rajah Avenue, Singapore 138676; Pushan.Dutt@insead.edu

# 1 Introduction

Emerging markets have grown rapidly in the couple of decades, exhibiting long-anticipated convergence to the levels of development of advanced countries, accompanied by large reductions in global poverty and a rise of a significant middle class (Milanovic, 2012). While countries in Latin America and Sub-Saharan Africa have exceeded their past growth performance, this performance has not matched the growth trajectories of India and China, and other emerging countries in Asia (Diao, McMillan and Rodrik, 2017). More importantly, only a subset of countries, mainly in Asia have managed rapid and sustained growth rates enabling them to catch up, while growth accelerations in countries in Latin America and Africa have eventually petered out (Hausman, Pritchett and Rodrik, 2005). What sets apart countries in Latin America and Sub-Saharan Africa is that both the rapidly growing countries in Asia today, and the erstwhile Asian Tigers plus Japan, have relied on an export-oriented industrialization path (Rodrik, 2014). These experiences suggest that openness plays an important role in the process of development.[1] A natural question that arises is why in the face of declining trade costs, and improvements in transportation technology, have only some countries and regions managed to become part of global value chains and emerged as export powerhouses (Baldwin, 2011).

The gravity model analyzing bilateral exports between country-pairs has traditionally been used to understand the importance of trade costs. However, the underlying importance, the persistence, and heterogenous incidence of various gravity variables for trade flows remains poorly understood (Head and Mayer, 2013a). Multiple studies have identified a persistent and even rising role for gravity variables for cross-border trade such as distance, borders, language and colonial ties (Disdier and Head (2008); Head and Mayer (2013a); Head and Mayer (2013b); Egger and Lassmann (2012) and Head, Mayer and Ries (2010)). Prior work, in order to reconcile these persistent effects of such gravity variables for trade, often alludes to informational costs, cultural differences, and the importance of business and social networks in overcoming informal barriers to international trade (Rauch, 1999; Greif, 1994, Chaney 2014). For instance, Grossman (1998) argues that estimated distance effects are too large to be explained by shipping costs and that cultural differences and lack of familiarity account for the persistence of distance, while Anderson and van Wincoop (2004) stress the role of information barriers, contracting costs and insecurity. Head, Mayer and Ries (2010) attribute the decline in trade between countries that shared a colonial link to the depreciation of trade-promoting capital embodied in institutions and networks. Feyrer (2009) uses the closure of the Suez Canal as a natural experiment that introduced time-series variation in distance to show that the transport cost component of

[1] Sachs and Warner (1995) and Frankel and Romer (1999) find a strong relationship between openness and growth.

distance accounts for less than half the estimated effect of distance. Head and Mayer (2013b), drawing on the analogy of dark matter, coin the term 'dark trade cost' and argue that these gravity variables capture some unmeasured and unknown sources of resistance.[2]

In this paper, we introduce a new perspective on trade costs. We take as given that there are some unobserved or 'dark' trade costs, some of which are captured by traditional gravity variables, while others are embedded in the error term. We show that a key factor driving the decline in such bilateral trade costs is the cumulative experience in exports. When a country starts exporting to a new destination, a large component of trade costs is related to the novelty and uncertainty of selling in an unfamiliar environment, identifying customer preferences, engaging with foreign shipping agents, customs officials or consumers, and navigating an uncharted legal and regulatory context (see Anderson and van Wincoop, 2004; Kneller and Pisu, 2011). Experience from repeated local interaction can be effective in gaining familiarity, acquiring information, and building contacts. These in turn, contribute to dampening costs associated with the shipment, border crossing, and distribution in the destination country. Hence the accumulation of experience works to overcome the informational, contractual and cultural barriers, some of which are captured by gravity variables, suggesting that experience reduces trade costs and expands bilateral trade flows. To the extent that trade costs decline with experience, it explains why East Asian countries who initially adopted export promotion strategies, remain export powerhouses to date. It also provides a rationale for export as a way for discovering comparative advantage (Hausman and Rodrik, 2003) and for export promotion, even temporary export promotion, a strategy commonly used by the East Asia miracle countries (Lederman, Olarreaga and Payton, 2010).

Our paper first establishes a strong and robust role of experience for trade between pairs of countries, using both aggregate trade as well as trade disaggregated at the 4-digit level. We pay particular care to omitted variable concerns by employing multiple identification strategies. Second, we employ both model-based and placebo tests to shed light on the mechanisms by which experience increases bilateral trade. Third, we show that experience matters more for countries that are geographically distant, non-contiguous, lack colonial ties and do not share a common law legal system. Country-pairs that lack such ties are also ones that have higher unobserved trade costs and to the extent that experience reduces trade costs, it plays a stronger role in facilitating bilateral trade.

[2]Head and Mayer (2013b) show that 72%–96% of the trade costs associated with distance and borders are attributable to the dark sources (read unknown) sources of resistance. Some papers attempt to directly incorporate these forces through networks ( Rauch and Trindade, 2002), immigration links (Head and Ries, 1998, Bastos and Silva, 2012), contractual enforcement problems (Anderson and Marcouiller, 2002, and Berkowitz et al 2006) , corruption (Dutt and Traca, 2010), or learning (Allen, 2014 and Chaney, 2014), or bilateral trust (Guiso, Sapienza and Zingales, 2009).

Our empirical specification augments the bilateral gravity equation, the literature´s workhorse, to account for the role of experience, measured at the level of the country-pair. We allow for both depreciation in experience over time and for diminishing returns in experience for trade. We base our experience measure on the number of years of positive trade between a pair of countries. At the country-pair level, we have sufficient variation in experience, both across countries and over time, which allows us to measure experience precisely and identify its importance in lowering trade costs and increasing trade.[3] Interpreting the estimates of experience as causal in the gravity setting, requires that experience at the country-pair level is exogenous to unobserved bilateral trade costs. This is challenging in our context since omitted variables affect both the current value of trade and our experience measure based on the number of years of strictly positive trade. We first account for this with a very demanding specification that includes country-year fixed effects, country-pair fixed effects, and country-pair specific trends. Country-year effects capture all export enhancing measures and attractiveness of a destination, including a pro-export outlook particular to an exporter over time. Country-pair effects account for all time-invariant unobserved variables that effect both experience and bilateral trade while the pair-specific trends accounts for secular decline in unobserved trade costs at the country-pair level. In this preferred specification, which is essentially a difference-in-difference specification, we rely on *breaks* in experience to identify the coefficient. For country-pairs with an unbroken trading relationship, experience will be absorbed by the country-year dummies and pair-specific trends. Identification relies on a temporary termination and subsequent re-initiation of trade which induces a break in the experience measure. Here we find that a elasticity of trade with respect to experience of 0.345. Equivalently, a 1% increase in experience reduces unmeasured trade costs by 0.09%. This is a very robust finding - it survives a battery of checks where we use different estimation techniques (parametric and non-parametric), deploy alternate samples and data sets, and account for measurement error in our experience variable.

Our next identification strategy uses two instruments for experience at the country-pair-year level, drawing on the geographic spread of export (e.g., Chaney 2014) and historical ties between countries (Mitchener and Weidenmier, 2008). The first instrument uses experience of the exporter in countries that are contiguous to the destination but not part of the same preferential trade arrangement as the destination. The second instrument uses experience in countries that were the same empire or the same administrative entity as the destination for a long period (25-50 years in the twentieth century, 75 years in the nineteenth and 100 years before.) Our main identifying assumption for a causal interpretation is that omitted trade-costs making a

[3]Data on bilateral trade is consistently available from 1948. By contrast, firm-level trade data is not widely available for large numbers of country-pairs and usually span short time-series. With firm data, there are also censoring and selection (firms die or are acquired) issues.

given destination differentially more attractive for a particular exporting country for both experience and bilateral exports are orthogonal to the exporter experience in the destination's neighbors and experience in countries that were the same administrative entity in the past. We are able to demonstrate that our instruments are strong and we provide some evidence on the validity of the exclusion restriction.

It is well known that a significant proportion of the trade matrix is populated with zeros. In our previous identification strategies, we ignore country-pairs that have never traded with one another.[4] This is a concern for us given that our experience measure is based on the aggregation of a dummy variable that takes the value 1 during years of strictly positive exports at the country-pair level, and 0 otherwise. To correct for this bias, we use the methodology of Santos Silva and Tenreyro (2006). Their methodology treats bilateral trade as a count variable and uses the Poisson Pseudo-Maximum Likelihood (PPML) to estimate the coefficients. A key advantage of the PPML specification is that it does not throw away the zero observations, so country-pairs that never traded, or ones that stopped trading but did not re-initiate trade also contribute to the coefficient on experience.[5] We also adopt the two-step methodology of Helpman, Melitz and Rubinstein (2008) that explicitly models zeros and corrects for the self-selection of firms into export markets.

Finally, the use of aggregated bilateral trade data does not allow us to account for composition effects, which could bias our results on the role of experience increasing trade. Sectors that have a lower elasticity with respect to distance could be trading more over time due to specialization. To control for this possibility, we run our augmented gravity equation using country-product-level data at the 4-digit level of disaggregation (with the caveat that we have a shorter sample of data since we are using product level data that span the period 1962-1999). Even when we control for composition effects, we obtain a similar coefficient for experience with such disaggregate data. With this data, we are also able to deploy an alternate identification strategy where we restrict the exporting country to a single origin and add industry-year and destination-year fixed-effects. Here identification relies on variation in experience by 4-digit sectors over time. We pick 5 of the largest exporting countries: USA, China, Japan, Germany and India and find an experience elasticity of trade ranging from 0.65 to 0.81.

Overall, our results imply a strong role of experience for trade. Motivated by our empirical findings, we turn to understanding the mechanisms by which experience affects trade costs. We begin by conducting a series of placebo tests to evaluate whether experience allows exporters to learn about unobserved trade costs (unobserved to the econometrician) in the destination market. First, we show that *importing* experience does not matter for bilateral exports, allowing us to rule out the possibility that our export experience measure is

[4] Please note that we do not ignore zeros in the construction of our experience measure.

[5] Absent the zeros, taking the log of trade drops these observations.

some proxy for slow moving bilateral ties. Second, we construct placebo experience measures by a) randomly assigning experience in a destination to its neighbor in the same region and b) by randomizing the dummy for positive trade and using this to construct experience measures. The coefficients and significance of these measures allow us to confirm that it is indeed experience of the origin in the destination that matters. Finally, we replace bilateral exports with bilateral FDI and show that export experience matters negatively for FDI between country-pairs. This allows us to infer that our export experience is not simply a proxy for deeper integration between country-pairs (which would increase FDI) but is likely related to bilateral trade costs, which should boost exports and reduce FDI (an alternate way to serve the destination market).

Next, we decompose the effect of experience on bilateral exports into an effect on the extensive (number of products at the 6-digit level) and on the intensive margins of trade (average exports per product). Within a standard Melitz-Chaney heterogenous firm model, this allows us to understand whether exports reduce fixed and/or variable costs of trade and whether there are spillovers in experience. We find a positive effect of experience on both margins. Such a finding within models suggests a) spillovers in experience since the extensive margin adjusts; and b) that experience must decrease the bilateral variable costs of trade since the intensive margin increases with experience. If experience reduced only the fixed costs of trade, the intensive margin would either decline (in the presence of spillovers in experience) or remain unchanged (in the absence of spillovers).

Our paper contributes to the trade costs and gravity literature in three ways. First, we establish a role for experience in bridging "unmeasured" trade costs associated with informational barriers and cultural differences within the gravity framework. Overcoming such informational, contractual and cultural barriers is also important for economic development. Experience enables countries to expand trade not just along the intensive margin, but also enables entry of new products (and firms) along the extensive margin. Global interactions between suppliers and buyers through trade also allows for the diffusion of ideas and techniques to produce new products (Buera and Oberfield, 2016; Perla, Tonetti and Waugh, 2015). This channel introduces a dynamic aspect to trade costs, as these barriers are overcome over time with accumulated experience. Second, we provide both direct and indirect evidence that the effects of experience are shared among exporters and non-exporters, which complements the recent literature focusing on the role of networks and search in export decision (Eaton et al, 2012; Chaney, 2014). Third, we provide insights into the mechanisms by which experience reduces trade costs - via spillovers and by reducing variable trade costs.

The remainder of the paper is organized as follows. Section 2 augments the traditional gravity specification with experience at the bilateral level; Section 3 presents our empirical estimates of experience utilizing a series of identification strategies, correcting for zeros, and for composition effects; Section 4 focuses on the

mechanism by which experience increases trade; Section 5 highlights the heterogeneity in experience effects and presents some further robustness checks; Section 6 concludes.

## 2 Experience and the gravity equation

The gravity equation is the current workhorse for estimating the importance of trade costs for bilateral trade. There are several theoretical frameworks supporting the gravity specification, with exports from country $o$ (exporter/origin) to country $d$ (importer/destination) in time $t$, denoted by $X_{od,t}$, given as

$$\ln X_{od,t} = \alpha_o \mu_{o,t} + \alpha_d \mu_{d,t} - \theta \ln \tau_{od,t} + e_{od,t} \tag{1}$$

$\mu_{o,t}$ and $\mu_{d,t}$ are exporter and importer-year dummies that capture attributes of the exporting- and the importing-country, respectively, including size and their multilateral trade resistance (Anderson and van Wincoop, 2003). $\tau_{od,t}$ measures bilateral trade costs, with $-\theta$ as the elasticity of exports with respect to trade costs.[6] In the standard equation $\ln \tau_{od,t}$ is specified in terms of bilateral gravity variables, as shown below.

$$\ln \tau_{od,t} = \sum_{m=1}^{M} \gamma_m z_{od,t}^m \tag{2}$$

where $z_{od,t}^m$ are the $M$ gravity variables and $\gamma_m$ are parameters. Head and Mayer (2013a) perform a meta-analysis and identify as main variables the trade and currency agreements, capturing trade policy, and distance, contiguity, shared language, and colonial links, which measure geographic, cultural, and historical barriers. Substituting (2) in (1) yields an estimable specification

$$\ln X_{od,t} = \alpha_o \mu_{o,t} + \alpha_d \mu_{d,t} - \sum_{m=1}^{M} \theta \gamma_m z_{od,t}^m + e_{od,t} \tag{3}$$

This equation can be estimated using data on bilateral trade flows and the bilateral gravity variables. For bilateral trade flows, two data sources are available. First, International Monetary Fund's *Direction of Trade Statistics* DOTS provides data on aggregate bilateral exports from 208 exporters to 208 importers over the time period 1948-2006. Second, UNCTAD's COMTRADE provides data on bilateral trade between pairs of countries at the Harmonized System 6-digit (HS-6) level of disaggregation. The HS-6 data spans 5017 product categories, for the time period 1988-2006 for 183 importers and 248 exporters. For each year,

[6] $\theta$ has different interpretations depending on the micro-foundations for the gravity equation. It is the elasticity of substitution (minus one) among varieties in Anderson and van Wincoop (2003), the parameter in the Pareto distribution of firm productivities in Chaney (2008) and the parameter governing the dispersion of labour requirements across goods and countries in Eaton and Kortum (2002).

COMTRADE covers more than 99% of all world trade. The advantage of the DOTS data is the coverage over time, while the COMTRADE data allows us to decompose total exports into an extensive and an intensive margin.[7]

For the gravity variables, we use data from the CEPII gravity database (www.cepii.fr). Geographic distance is measured as the logarithm of the distance (in kilometers) between the two most populous cities. Contiguity is a dummy variable that takes the value 1 if the country-pair shares a common border. Common language is captured by a dummy that equals 1 if the country-pair shares a common official language. Colonial relationship takes the value 1 if a country-pair was ever in a colonial relationship (one country was the colonizer and the other colonized or vice versa). Data on these variables are obtained from the CEPII gravity databases (www.cepii.fr). We also create a dummy variable that captures common law legal origins, from Glaeser and Shleifer (2002) (other finer classifications of civil law, Scandinavian law did not seem to matter). We include also policy-related gravity variables, from Head and Mayer (2013b). We use a dummy variable that captures membership in a currency union. Data on currency unions are from Head, Mayer and Ries (2010). Multilateral market access is captured a dummy variable that takes the value 1 if both trading partners are members of the GATT/WTO and 0 otherwise. Bilateral preferential trade arrangements are captured by a dummy variable which takes the value 1 if both trading partners are members in a preferential trade arrangement (PTA). Data on WTO membership and PTAs are from the CEPII and updated via the WTO website (www.wto.org). Unilateral preferential access is in terms of the Generalized System of Preferences (GSP) where trade preferences are granted on a non-reciprocal basis by developed countries to developing countries. We code a dummy variable as 1 if the importing county grants a GSP to exporter. GSP data are from Andrew Rose's website and updated from the WTO website.

## 2.1 Measuring experience

Exporting to a new geographic market entails the discovery of (i) the cheapest, most reliable transport; (ii) the best way to get goods through customs, (iii) the right partner for distributing and promoting the goods locally or (iv) the preferences and dispositions of customers.Eaton et al. (2012) and Freund and Pierola (2010) emphasize learning in a destination country, where producers need to incur costs to find new buyers or new products. In contrast, in Albornoz et al (2012) uncertainty is not destination-specific and firms learn about export profitability as a whole. Allen (2014) models a search process to acquire market information. Although firms may engage in pre-entry research, experience is a vital element of this discovery process.

[7] We use the former to measure experience at the bilateral level and the latter to measure bilateral trade and the extensive and intensive margins.

The initial contact with a new market environment unavoidably raises unexpected challenges that push the firm to find quick, imperfect solutions. Experience with the local reality helps the firm gain familiarity and find better, cheaper solutions for future shipments, thereby lowering trade costs. Several studies at the firm-level find that export success stems from the firm's experience in the business community in the destination country (Artopoulos, Friel and Hallak, 2013; Kneller and Pisu, 2011). In addition to benefiting the firm, experience is also likely to be shared among networks of firms (Eaton et al, 2012; Clerides et al., 1998); Iacovone and Javorcik, 2010). This implies that experience acquired historically by some exporters contributes to increased familiarity by fellow exporters, and even crosses over to non-exporters. Much of this research on export experience is restricted to a single country. Available firm-level datasets cover relatively few exporting countries over short time-spans yielding limited dispersion and potential measurement error in experience measures, and, therefore, imprecise estimates for the effects of experience.

Our focus is on trade costs and experience at the bilateral level. Therefore, for any pair of countries $o$ and $d$ at time $t$ in our sample, experience is based on the number of years with strictly positive exports from $o$ to $d$ from 1948 or year of independence to year $t-1$. We use the DOTS database, that has the most comprehensive coverage of bilateral trade, to code the number of years of strictly positive exports. This allows us to measure experience very accurately. Experience at the bilateral level is of course an aggregation of firm-level experience. Further, we are assuming complete spillovers in experience across firms and sectors, a relatively strong assumption. We evaluate this subsequently by measuring spillovers directly with more disaggregate trade data and indirectly, by checking if experience affects the extensive margin of trade.

While we could also use cumulated past exports from the origin to the destination country environment as a measure of experience, such a measure is influenced by the unit value of exports. In addition to changes in the price of exports, experience based on past exports would also be influenced by changes in the sectorial composition of country's exports, both in terms of comparisons across countries and its evolution in time, creating unwanted spurious variation. The experience measure based on years of trade is easier to interpret and has smaller measurement error.[8]

Figure 1 shows the distribution of number of years of strictly positive trade since 1948 for all country-pairs in the year 2006: 3.1% of the country-pairs have just initiated trade (experience equals 0 years,) while the median and the mean trading relationship are for 14 and 21.7 years. The variable is right-censored for

[8]We recognize that our measure of experience does not distinguish between small and large shipments and assumes that experience spills over. We check the sensitivity of our results to dropping small shipments. Subsequently, as a further robustness check, we use the cumulated value of exports at the 4-digit industry level as our experience measure. With disaggregate data, changes in composition and unit values are also less of a concern.

country-pairs that had strictly positive trade on or before 1948: 7.8% of the country-pairs have a trading relationship at the maximum of 58 years (from 1948 to 2006). Finally, the peak around years 13 and 14 arises from the breakup of the Soviet Union and of Yugoslavia and Czechoslovakia in 1992.[9] In robustness checks, we will account for zero trade, for the censoring of the experience variable, and for the formation of new countries in Eastern Europe around 1992-1993.

## 2.2 A non-parametric look at the data

We start with a non-parametric approach to provide evidence on the importance of experience for bilateral trade. We estimate equation (3) with a complete set of 58 dummy variables, one for the number of years of strictly positive trade, so that experience is simply the cumulated number of years of trade. This specification is flexible in that it makes no functional form assumption, captures depreciation in experience and allows for diminishing returns in experience. We include all gravity variables as well as county-year fixed effects. With 0 years of trade as the omitted category, each coefficient captures the cumulated impact of experience on bilateral trade for a country-pair relative to a country-pair with zero experience. These coefficient estimates along with the 95% confidence bounds are shown in Figure 2.

The figure illustrates three findings. First, all the experience dummies are significant at 1%. Second, in terms of magnitude, the coefficient estimates imply a very strong role for experience. An additional year of experience, on average, increases bilateral trade by 6%. Alternately, comparing trade between a country-pair with the median level of experience of 22 years, to a country-pair with 0 experience (or half the experience), trade in the former is 165% (66%) higher. Another way to think of the magnitude, is that 5 years of experience is equivalent to both country-pairs joining a preferential trading area or sharing a common language, while 9 years of experience is equivalent to a colonial link or sharing a common currency.[10] Third, the relationship seems approximately log-linear. We do see some evidence for non-linear effects - visually, we see a stronger role for experience from years 1-13 and a decline thereafter.[11]

We next introduce a single flexible measure of the stock of experience in the gravity model, where we allow for depreciation in experience and employ a flexible log-log specification that can capture diminishing

[9] In constructing the experience variable, we coded all countries that were formerly part of the Soviet Union, Czechoslovakia and Yugoslavia as new countries and set experience to zero in their first year of trade after 1992. The exceptions are trade with the Soviet Union which was merged with Russia and with West Germany which was merged with Germany. These choices, while reasonable since exporters plausibly faced a new environment, may also create measurement error in experience.

[10] We base these comparisons on structural gravity estimates in the recent survey paper by Head and Mayer (2013a).

[11] The slight decline at 58 years of experience is an artefact of the COMTRADE data - this decline does not show up if we use the DOTS data.

returns of trade with respect to experience.

### 2.3 Experience-adjusted gravity specification

We follow the learning-by-doing literature and construct an experience measure (Levitt, List and Syverson, 2013) that allows for the depreciation of experience or "forgetting". We code a variable $I_{od,t} = 1$ if there are strictly positive exports from $o$ to $d$ at data $t$, and define experience at time $t$ as accumulated according to a perpetual-inventory process:

$$E_{od,t} = I_{od,t-1} + \delta E_{od,t-1}$$

The experience for country pair $od$ at time $t$ is the sum of two components: a fraction $\delta$ of the previous accumulated experience and the existence of strictly positive trade in the previous period. $\delta$ parametrizes the fraction of experience that is retained from one period to the next with $\delta = 1$ indicating complete retention where past interactions count as much as recent interactions and $\delta = 0$ indicating complete forgetting or depreciation. With $\delta = 1$, experience is simply the cumulated number of years of strictly positive trade.

Given that Figure 2 suggests diminishing returns, we use the natural log of experience.[12] Our experience-adjusted specification for trade costs

$$\ln \tau_{od,t} = \sum_{m=1}^{M} \gamma_m z_{od,t}^m - \lambda \ln (E_{od,t}) \tag{4}$$

We expect $\lambda > 0$ with $\lambda < 1$ implying diminishing returns in experience for trade costs. Substituting in (1) yields an estimable specification for the gravity equation that accounts for the effect of experience.

$$\ln X_{od,t} = \alpha_o \mu_{o,t} + \alpha_d \mu_{d,t} - \sum_{m=1}^{M} \theta \gamma_m z_{od,t}^m + \theta \lambda \ln (E_{od,t}) + e_{od,t} \tag{5}$$

The coefficient $\theta\lambda$ is the experience elasticity of trade, with $\theta\lambda < 1$ implying diminishing returns in experience for bilateral trade.

Therefore, we estimate the following non-linear system of equations

$$\ln X_{od,t} = \alpha_o \mu_{o,t} + \alpha_d \mu_{d,t} - \sum_{m=1}^{M} \theta \gamma_m z_{od,t}^m + \theta \lambda \ln (E_{od,t}) + e_{od,t} \tag{6a}$$

$$E_{od,t} = I_{od,t-1} + \delta E_{od,t-1} \tag{6b}$$

[12] We also carried out a series of tests to choose the functional form for experience. First, we tried the standard Box-Cox transformation. Unfortunately, as is common in datasets with a large number of observations, the test rejects the log-specification in favor of the linear and the linear in favor of the log. Other tests such as the Cox-Pesaran test and the Davidson-Mackinnon J-test yield a similar finding. We follow prior practice and pick the specification with the lowest chi-square statistic in the Box-Cox test and the lowest z-statistic in the Cox-Pesaran test and the J-test. This selects the log specification for experience.

We estimate equations (6a and 6b) by non-linear least squares to obtain estimates for the retention parameter $\delta$, and for the elasticity of export with respect to experience, $\theta\lambda$. We use the aggregate COMTRADE data to measure bilateral trade flows, the DOTS data starting in 1948 to measure experience, and the previously described measures of gravity variables. Given that non-linear least squares is difficult to implement with a large set of dummies, we first obtain a robust estimate of $\delta$ with increasingly comprehensive sets of fixed-effects, and use this estimate to construct the stock of experience. We then use this experience measure and deploy multiple identification strategies to establish the effect of experience on trade. These include a difference-in-difference technique with pair-specific fixed effects and pair-specific trends, an instrumental variables estimate, and the PPML methodology of Santos Silva and Tenreyro (2006) that accounts for zeros in trade. In all specifications, standard errors are adjusted for clustering on country-pairs to account for serial-correlation.

Column (1) in Table 1 uses a very basic specification without any fixed-effects. We estimate a retention rate of 0.963 implying that slightly less than 4% of experience is lost each year. While we can statistically reject that $\delta = 1$, substantively it is very close to 1. Column (2) adds a time trend. The time trend term is actually negative rather than positive, and the estimated experience elasticity is slightly higher. Therefore it is accumulated experience that matters rather than the passage of time since initiation of trade. Column (3) uses time dummies instead of a time trend which leaves the estimates for retention and experience unaffected. Column (4) uses 188 exporter dummies, 169 importer dummies and 18 year dummies and is the most demanding specification in the non-linear least-squares context. The coefficient on the retention parameter exceeds but is very close to 1, while the elasticity of trade with respect to experience declines marginally to 0.798.

Column (5) adds 5487 exporter-year and importer-year fixed-effects, which is the preferred specification for gravity models (Head and Mayer, 2013a). Our estimate in Column (5) of Table 1 yields $\delta = 0.995$ and elasticity of exports with respect to experience $\theta\lambda = 0.887$. If $\theta$ is the Pareto shape parameter from Chaney (2008) or the parameter governing the dispersion of labour requirements across goods and countries in Eaton and Kortum (2002), then a reasonable value is $\theta = 4$. and $\lambda = 0.221$ so that unmeasured trade costs decline by 0.221% for every 1% increase in experience. Overall, while there is little loss in experience over time, we do have diminishing returns in experience for trade costs and overall trade.[13]

Finally, if we estimate a traditional gravity equation without experience as an independent variable we

[13] We also estimated equations (6a) and (6b) with time-dummies using a Poisson specification that takes zeros in the trade-matrix into account. this yields $\delta = 0.912$ and $\theta\lambda = 0.771$, very similar to the estimates in Table 1. Adding country-year dummies was computationally infeasible.

obtain coefficients on the gravity variables that are significantly higher in absolute terms (14% for distance and legal system; 4% for contiguity; 4% for colonial link; and 37% for language). In other words, accounting for experience significantly reduces the magnitude of the effect of the standard gravity variables, that have trade costs embedded in them.

# 3 Identification

Absent a randomized controlled experiment, which is obviously infeasible in the context of countries, establishing causality is a challenge. We employ a variety of identification strategies to provide evidence that experience matters strongly for bilateral trade. Since identification assumptions are not entirely free of criticism we deploy a multitude of identification strategies, robustness checks, and placebo tests, and show that the cumulative evidence strongly confirms the importance of experience.

## 3.1 Dyadic fixed-effects, pair-specific trends, and lagged dependent variable

Our initial estimate of the elasticity of trade for experience is shown in Column 5 of Table 1 is 0.887. This specification uses country-year fixed effects and relies on variation in experience both across country-pairs and within country-pairs over time. The fixed-effects absorb any effects that are particular to changes in variables at the exporter-year level and the importer-year level (e.g., investment in ports, infrastructure, doing business indicators that facilitate or impede trade, changes in the relative importance of sectors at both the exporting or the importing country). While we also use the standard array of pair-specific gravity variables, they remain necessarily incomplete. For instance, any unobserved dyadic effects that affect both the onset of trade (and therefore our experience measure) as well as trade today would lead to an upward bias in our coefficient on experience. Therefore, we account for unobserved time-invariant dyadic effects by including 25,581 dyadic fixed effects. Since these dyadic effects are time-invariant, we also include pair-specific linear time-trends, one for every country-pair. This is the most demanding specification accounting for all exporter and importer-year terms, all time-invariant characteristics at the dyadic level, as well as for any unobserved country-pair specific variables that evolve in a linear fashion. For instance, if we believe that trade barriers between country-pairs decline in a gradual fashion (e.g., elimination of tariffs after joining a trading arrangement happens only gradually) these should be accounted to some extent, though not entirely, by the pair-specific trends.

With such a comprehensive set of dummies, non-linear squares becomes computational infeasible. Therefore, we used a simpler way to identify the coefficient for $\delta$. We constructed the experience variable for

various values of $\delta \in [0,1]$ in increments of 0.05. We then used this variable in the gravity equation with country-year, country-pair dummies and pair-specific linear trends, and picked the value of $\delta$ that yields the best fit. This results in $\delta = 0.905$, which means that close to 10% of experience is lost each year.[14] In all subsequent specifications, of the gravity equation with country-year dummies we set $\delta = 0.905$. The equation we estimate is

$$\begin{aligned} \log X_{od,t} &= \alpha_o \mu_{o,t} + \alpha_d \mu_{d,t} + e_{od} * t - \sum_{m=1}^{M} \theta \gamma_m z_{od,t}^m + \theta \lambda \ln (E_{od,t}) + e_{od,t} \\ \text{where } E_{od,t} &= I_{od,t-1} + 0.905 * E_{od,t-1} \end{aligned} \tag{7}$$

In this specification, which is essentially a difference-in-difference specification, identification relies on breaks in trade. For country-pairs with a break in trade, the dummy for strictly positive trade $I_{od,t}$ switches from 1 to 0. When trade re-starts for this pair, the experience measure corresponding to this observation is lower, given that the retention parameter $\delta < 1$. On the other hand, for country-pairs that have traded continuously since 1948 (e.g., US and Canada,) the experience measure will be absorbed by the country-year dummies. Identification therefore does not rely on country-pairs with continuous trade. Column 1 in Table 2 shows that the experience elasticity of trade of 0.345 so that unmeasured trade costs decline by 0.09%, which is both statistically significant and substantive. The estimate implies that for a country-pair with the median level of experience (5 years of positive trade), an additional year of trade increases bilateral exports by 6%. For countries in the 75th percentile of experience (greater than 19 years of positive trade), an additional year of trade increases bilateral trade by only 0.6%, indicating both depreciation of experience and diminishing returns to experience for bilateral trade.

Next, we attempt to account for slow moving unobserved dyadic influences on trade that may not evolve in a linear fashion by including a lagged dependent variable following Eichengreen and Irwin (1998). This specification also allows us to distinguish between the short vs. long run effect of experience. This estimate is shown in Column 2 of Table 2. [15] The coefficient on experience increases marginally to 0.402. However, this coefficient captures only the short-run experience elasticity of trade. Our estimates imply that the long-run experience elasticity of trade equals $\frac{0.402}{(1-0.068)} = 0.431$. In fact, we are unable to reject that this long-run estimate of experience elasticity equals the estimate in Column 1.[16]

[14] Another way to see is the difference in our experience measure for a country-pair that has 60 years of positive trade vs. a pair that has 20 years is only 1.4 log points.

[15] The Least Squares Dummy Variables estimator, is inconsistent in the presence of lagged dependent variables. However when the number of time periods is large, as is the case here, this bias goes to zero.

[16] This test yields a chi-square test statistic of 0.8 and a p-value of 0.37. Adding further lags of the dependent variable increases the coefficient estimate for experience.

### 3.2 Instrumental variable estimates

Even with a very comprehensive set of fixed-effects and dyadic trends, we only account for selection on observables. Any unobserved time-varying bilateral variable not captured by the pair-specific trends that affects both the onset of trade and trade flows, can still result in biased estimates. Therefore, our second identification strategy relies on instruments for experience $E_{od,t}$. As instruments, we need variables that are correlated with our causal variable of interest, namely experience, but uncorrelated with any other determinants of bilateral exports. In particular, the instrument should matter strongly for experience (strong instrument) but should not affect bilateral exports except through the experience channel (exclusion restriction).

We draw on recent work on the geographic spread of exports to construct our instruments. Chaney (2014) builds a network model of trade and shows that if a firm exports to a destination, it is then more likely to subsequently enter a new destination that is geographically close to the first destination. Evenett and Venables (2002) examine 23 developing countries between 1970 and 1997, and show that a product is more likely to be exported from a certain country if the origin country is supplying the same product to nearby markets. Carrère and Strauss-Kahn (2014) use product level data for non-OECD exporters and find that experience is first acquired in neighboring, easy to access destinations before reaching to more distant, richer partners and ultimately serving the OECD.[17] We exploit this pattern of the geographic spread of exports to construct our first instrument for experience as the experience of the origin $o$ in all countries that are contiguous to destination, and take the simple average across all neighbors. For this to be valid, it instrument should be strongly correlated with experience in the destination, but exogenous to unobserved trade costs faced by exporters from $o$ in the destination $d$. To ensure that this is a valid instrument, we average only over neighboring countries of $d$ that are not part of a preferential trading arrangement with $d$. Under a PTA, there may be spatial correlation in unobserved trade costs and excluding these countries may invalidate the exclusion restriction. Call this instrument $E^{nbr}_{od,t}$.

Our second instrument relies on historical links between destination countries based on whether they were part of the same empire and/or administrative entity in the past (Mitchener and Weidenmier, 2008). We average the experience of $o$ over countries that were or are the same state or the same administrative entity for a long period (25-50 years in the twentieth century, 75 years in the nineteenth and 100 years before) as the destination $d$. This definition covers countries belonged to the same empire (Austro-Hungarian, Persian,

[17] Morales et al. (2015) use Chilean data to show that the entry of an exporter in a particular market increases the likelihood of his entry into other similar markets. In particular, they find that firms are more likely to export to countries sharing a border with countries to which they were exporting in the previous period. Similarly, Eaton et al (2008) use data on Colombian exporters to show that these exporters use neighboring markets as stepping stones to other Latin American markets.

Turkish), countries that have been divided (Czechoslovakia, Yugoslavia, India) and countries that belong to the same administrative colonial area (e.g., Philippines and Mexico were subordinated to the New Spain viceroyalty). The data are from CEPII.[18] Call this instrument $E^{same}_{od,t}$.

Our key identifying assumption is that experience of the origin in the neighbors of the destination and experience in countries that were historically part of the same state/empire/administrative entity as the destination is unrelated to bilateral exports from $o$ to $d$ (except through its effect on experience $E_{od,t}$). Overall, we identify the experience effect on bilateral trade by basing it on the systematic component of experience for the neighbors of the destination, and experience in countries that were the same as the destination, rather than destination-specific idiosyncrasies. We continue to implement our preferred specification which includes country-year and country-pair dummies as well as pair-specific trends. Inclusion of these comprehensive set of controls allows us to guard against a wide range of threats to our identifying assumption.

The first-stage yields

$$E_{od,t} = \underset{(0.139)}{0.525} E^{nbr}_{od,t} + \underset{(0.134)}{0.307} E^{same}_{od,t} + controls$$

with standard errors in parentheses. Both instruments matter strongly for experience. Column 3 in Table 2 reports a first-stage partial $R^2$ of 0.24 and a first-stage F-statistic of 947.26 which easily clears the first-stage relevance tests, including the Stock-Yogo weak instruments test, indicating that our instruments are strong. The coefficient on experience increases marginally to 0.379. In fact, the instrumental variable estimates are qualitatively and quantitatively similar to those presented in Column 1 of Table 2. We also report the Hansen $J$-test of overidentification (OID) restrictions in Table 2, which tests the null hypothesis of overall validity of the instruments by analyzing the sample analog of the moment conditions used in the estimation process. Rejection of this null hypothesis casts doubt on the validity of the instruments. As Table 2 shows we obtain a $p-$value of 0.31 showing that our instruments are uncorrelated with the error term in the second-stage gravity equation.

The OID test is not a true test of the exclusion restrictions. It simply checks if all subsets of the instruments asymptotically return the same estimate of the effect of experience. While we use a comprehensive set of dummies and trends, it could be argued that an exporter's experience in neighboring countries simply reflects its region-specific exporting strategy. In this case, experience in neighbors affects bilateral trade not only via experience but also via some unmeasured channel that is exporter-region-year specific. To guard against this possible violation, we also included exporter-region-year dummies in the IV specification.[19]

[18] Note that 444 country-pairs are neighbors but not part of the same country while 150 country-pairs were part of the same country in the past but are non-contiguous.

[19] The regional classification is East Asia & Pacific, Europe & Central Asia, Latin America & Caribbean, Middle East &

Column 4 in table 2 shows a significant coefficient on experience of 0.294.

We also evaluated the validity of the instruments by restricting our sample to only oil exporters. It seems reasonable that these countries are likely to export to a destination regardless of whether they have experience in the neighboring countries or in countries that were the same as the destination. We can think of these exporting countries as "always takers" - countries where the instrument does not matter for experience. Any relationship between the instruments and the log of exports for such exporters is indicative of violation of the exclusion restrictions. For these countries, a reduced form regression of the two instruments (and other gravity variables) on bilateral exports shows that these instruments are statistically insignificant.

### 3.3 Zeros in the trade matrix

Helpman, Melitz and Rubinstein (2008), and Haveman and Hummels (2004) highlight the prevalence of zero bilateral trade flows. For the bilateral DOTS data used to construct experience, 25% of all possible bilateral trade flows show a zero value. Unobserved trade costs can endogenously create zeros and taking logs removes them from the sample, creating selection bias. In fact, our previous identification strategy ignores country-pairs that have never traded with one another and have experience of zero for the entire time period of the study. This information is potentially important and ignoring it may bias our estimates. Santos Silva and Tenreyro (2006) also show that log-linear specification of the gravity model in the presence of heteroskedasticity leads to inconsistent estimates.[20]We follow them and treat bilateral trade as a count variable and use the Poisson Pseudo-Maximum Likelihood (PPML) to estimate the following equation.

$$X_{od,t} = \exp\left[\alpha_o \mu_{o,t} + \alpha_d \mu_{d,t} + e_{od} * t - \sum_{m=1}^{M} \theta \gamma_m z_{od,t}^m + \theta\lambda \ln\left(E_{od,t}\right)\right] + e_{od,t}$$

Since the dependent variable is trade, rather than the log of trade, it not only eliminates the heteroskedasticity bias but also allows us to include zeros in the trade matrix. As before we include country-year, country-pair effects, and pair-specific trends. Column 5 in Table 2 shows a significant increase in the coefficient on experience to 0.977. One key difference between PPML and OLS is that the former puts a lot more weight on high expected trade dyads, since it tries to minimize the distance between real and expected trade in levels rather than in logs. This inflates the coefficient of experience.[21]

North Africa, North America, South Asia and Sub-Saharan Africa.

[20]If the error term in the standard log specification is heteroskedastic, its log is not orthogonal to the log of the regressors, leading to inconsistent estimates of the gravity elasticities.

[21]This is similar to Santos Silva and Tenreyro (2006) who find PTA effects are smaller using OLS compared to those using PPML.

Helpman, Melitz and Rubinstein (2008), adopt an alternate approach. They argue that firms self-select (or not) into exporting, which leads to a heterogeneity bias, driven by changes in the composition of firms that export. We adopt their two-step methodology and estimate a probit model that predicts the probability of strictly positive trade, for each year in the panel, $\rho_{od,t}$, using the gravity variables and country-fixed effects. For the exclusion restrictions, we follow them and use a common religion index in the probit model: $\sum_k (\mathrm{R}_{k,o} \times \mathrm{R}_{k,d})$,where $\mathrm{R}_{k,j}$ is the share of religion $k$ in country $j$ ($j = o, d$). HMR argue that this variable is affects the fixed costs of trade and therefore the probability of trade but not the variable costs of trade[22]. Next for each year we use the probit model to predict two values: a latent variable $z_{od}$ that determines self-selection into exports as $\widehat{z}^*_{od} = \Phi^{-1}(\rho_{od})$ and the second $\widehat{\overline{\eta}}^*_{od} = \phi\left(\frac{\widehat{\overline{z}}^*_{od}}{\Phi(\widehat{\overline{z}}^*_{od},)}\right)$ which is the inverse Mills ratio.[23] In the second-step, HMR claim that the following transformation of the gravity equation gives consistent estimates

$$\log X_{od,t} = \alpha_o \mu_{o,t} + \alpha_d \mu_{d,t} + e_{od} * t - \sum_{m=1}^{M} \theta \gamma_m z^m_{od,t} + \theta \lambda \ln(E_{od,t}) + \beta_{e,\eta} \widehat{\overline{\eta}}^*_{od,t} + \widehat{\overline{z}}^*_{od,t} + \widehat{\overline{z}}^{*^2}_{od,t} + \widehat{\overline{z}}^{*^3}_{od,t} + e_{od,t}$$

where $\widehat{\overline{z}}^*_{od,t} = \widehat{z}^*_{od} + \widehat{\overline{\eta}}^*_{od}$ for each year $t$. The polynomial in $\widehat{\overline{z}}^*_{od,t}$ is an approximation of an arbitrary increasing function of the latent variable $z_{od,t}$, which controls for firm-level heterogeneity and $\widehat{\overline{\eta}}^*_{od,t}$ is Heckman correction for sample selection bias, again estimated year by year.

Column 6 in Table 2 shows that correcting for sample selection and heterogeneity bias, we obtain a coefficient estimate of experience to 0.339, which is indistinguishable from the baseline estimate in Column 1. The inverse Mills ratio and the polynomial in $\hat{z}^*_{od,t}$ (not shown) are significant at 1%, with signs similar to ones obtained in HMR (2008), showing the importance of correcting for the biases associated with zeros in the trade matrix. Similar to HMR, we find that the bias correction are dominated by the influence of unobserved firm heterogeneity rather than sample selection.

### 3.4 Composition effects: Augmented gravity with disaggregate data

The use of aggregated bilateral trade data does not allow us to account for composition effects, which could bias our results on the role of experience in increasing trade. For instance, our results may reflect that sectors with a lower elasticity with respect to distance (or other trade costs) are exporting more over time

[22] The set of religions we use is more comprehensive than that of HMR (2008), including $k$ = Bahais, Buddhist, Chinese Universist, Christianity, Confucian, Ethnoreligionist, Hinduism, Jainism, Judaism, Islam, Shinto, Sikhism, Taoists and Zoroastrian. The data are from the Association of Religion Data Archives.

[23] HMR show that $z_{od}$ is the ratio of the export profits of the most efficient firm to the common fixed export cost for exporters from $o$ to $d$, is a latent variable and selection of firms into export markets is a monotonic function of this variable.

due to increased specialization. To control for this possibility, we run our augmented gravity equation using country-product-level data at the 4-digit level of disaggregation with the caveat that we have a shorter sample of data since we are using product level data that span the period 1962-1999. With disaggregate data, we also exploit variation in experience within country-pairs across industries and over time to identify the effect of experience. It also allows us to construct multiple measures of experience - at the industry-country-pair level, as well as destination-specific experience across sectors. The latter captures spillovers in experience across 4-digit sectors.[24]

We use the bilateral commodity trade data from NBER-UN available at the 4-digit SITC Rev. 2 level of disaggregation. Even though we lack rich firm-level trade data to accurately measure firm export experience for a large set of destinations, the 4-digit commodity trade data is a reasonably good compromise. It spans years 1962-1999 allowing us to measure experience relatively accurately, and covers 98% of world trade. With disaggregate data, we implement another change - measuring experience as cumulated exports rather than cumulated years of positive trade. With aggregate data, since changes in composition of exports over time and in unit values create measurement error in our experience variable, we chose to base the experience measure on number of years of trade. At the disaggregate level, the concerns related to changes in the composition of exports or in unit values over time are mitigated, though not completely eliminated. Therefore, our experience measures are based on the cumulated value of trade, rather than an indicator variable that captures trade vs. no-trade. The measure is more aligned with the learning-by-doing literature and also allows us to capture the intensity of experience since we now distinguish between 'small' and 'large' trade flows.[25][26]

While the NBER-UN 4-digit export data starts in 1962, a significant product reclassification was undertaken in 1983 (from SITC Rev 1 to SITC Rev 2). Given the potential for this re-classification inducing measurement error, for estimation we use data only from 1984 onwards.

We construct own experience at the industry-country-pair level $E^k_{od,t}$ as

$$E^k_{od,t} = X^k_{od,t-1} + \delta_1 E^k_{od,t-1} \tag{8a}$$

[24] Spillovers are partly facilitated by trade associations and export promotion bodies (Lederman, Olarreaga and Payton, 2010), worker mobility (Molina and Muendler, 2013), and partly by simple observation (Segura-Cayuela and Vilarrubia, 2008). For instance, Artopoulos et al (2011) use a detailed case study of firms from four export sectors in Argentina, to show how pioneers' export experience diffuses to other firrms who follow the pioneer into exporting.

[25] The NBER-UN data set includes data provided they exceed $100,000 per year with some trade flows included below this cutoff.

[26] Our results also work when we measure experience in terms of years of positive trade.

where $X^j_{od,t-1}$ is the value of exports from $o$ to $d$ in 4-digit industry $k$ and $\delta_1$ is the retention parameter for own-learning. Next, for each origin country, we also measure destination-specific experience as

$$E_{od,t} = \sum_k X^k_{od,t-1} + \delta_2 E_{od,t-1} \tag{8b}$$

This measure is based on the sum of exports across sectors to a particular destination and captures spillovers across 4-digit industries. We allow for a distinct retention parameter $\delta_2$. For completeness, we also include a measure of industry-specific experience which is based on cumulating exports across destinations for each sector.

$$E^k_{o,t} = \sum_d X^k_{od,t-1} + \delta_3 E^k_{o,t-1} \tag{8c}$$

The industry-specific experience is related to the comparative advantage of a particular sector as well as to experience in production reducing production costs, rather than to experience in exporting to a particular destination that reduces trade costs. We use these three experience measures in a gravity equation for exports at the industry-country-pair level.

$$\ln X^k_{od,t} = \alpha_o \mu_o + \alpha_d \mu_d + \alpha_t \mu_t - \sum_{m=1}^{M} \theta \gamma_m z^m_{od,t} + \theta \lambda_1 \ln\left(E^k_{od,t}\right) + \theta \lambda_2 \ln\left(E_{od,t}\right) + \theta \lambda_3 \ln\left(E^k_{o,t}\right) + e_{od,t} \tag{8d}$$

As with the aggregate data, we estimate equations (8a)-(8d) using non-linear least squares, estimating the three retention parameters indexed by $\delta$ and the three experience elasticities indexed by $\theta\lambda$. With more than 5 million observations, we estimate this system first without any dummies (Column 1 in Table 3) and then with origin, destination, and time fixed effects (Column 2 in Table 3). In both specifications we estimate an elasticity of export experience that is industry and destination specific of 0.9 and a retention parameter $\delta_1 = 0.64$. The retention parameter $\delta_2$ for the destination-specific experience is 0.002 in Column 1 and declines to 0 when we add the fixed-effects. This suggests that for destination-specific experience across sectors, there is almost no retention beyond the previous period. At the same time, we do observe spillovers across sectors - a 1% increase in destination-specific experience across sectors, increases bilateral sectorial trade by 0.055%. We can think of this as a lower bound for spillovers since $E^k_{od,t}$ aggregates all trade within each 4-digit sector for a particular. Therefore, the estimated coefficient also encapsulates spillovers across sub-categories within a 4-digit sector.

Using more comprehensive fixed effects is computationally infeasible. Therefore, in Column 3, we set the retention parameters to the estimates in Column 2, and re-estimate the equation (8d) with exporter-year and importer-year fixed effects. We observe a slight decline in the coefficient of own experience and a more than halving of the coefficient for destination-specific experience. Despite the decline, there still remains a significant role for both own and destination-specific experience.

Next, we evaluate the robustness of experience to an alternate identification strategy with disaggregate data. We restrict the exporting country to a single origin and add industry-year and destination-year fixed-effects. Since we restrict the data to a single origin country, identification relies on variation in experience by 4-digit industry over time. In this specification, coefficients on destination-specific and industry-specific experience are subsumed in the destination-year fixed-effects and industry-year fixed-effects, as are all gravity variables including all unobserved pair-specific trade costs. We pick 5 of the largest exporters: USA, China, Japan, Germany and India. For each of these we find an experience elasticity of trade ranging from 0.653 to 0.813, which is higher than that of our preferred specification in the aggregate data (with country-pair dummies and pair-specific trends).

Comparing the coefficient estimates in Table 2 to those in Table 3, we find a) experience depreciates faster at the country-pair-industry level while retention is stronger at the country-pair level and b) experience has a bigger impact at the country-pair-industry level with the caveat that identification relies on cross-industry variation in the former. Both are intuitive - experience is more likely to be retained at the aggregate level in the presence of spillovers while the higher coefficient indicates that experience matters more within a particular sector selling in a destination. Overall, we are able to confirm that our results are not driven by composition effects and that there are spillovers in experience.

# 4 The mechanism

Next we turn our attention to understanding the mechanisms by which experience promotes bilateral trade. Our contention is that experience allows exporters to learn about trade costs, especially unobserved trade costs (unobserved to the econometrician) in the destination market. We evaluate this in two ways. First, we carry out a series of placebo tests that indicate that export experience of the origin in the destination, reduces bilateral trade costs in the destination. Second, we decompose bilateral exports into an extensive and intensive goods margin, and draw on a standard Melitz-Chaney model to infer the mechanism by which experience affects trade by reducing trade costs.

## 4.1 Placebo tests

In our first placebo test, we examine whether the *importing* experience of country $o$ from $d$ matters for *exports* from $o$ to $d$. To the extent that the importing experience at the country-pair level also cumulates slowly over time, a significant effect of this variable would lead us to suspect that our exporting experience measure is some proxy for slow moving bilateral ties and not destination-specific trade costs encountered by

exporters. This would render the interpretation of our findings questionable. Row 1 of Table 4 shows that importing experience of the origin from the destination does not matter for bilateral exports from the origin to the destination.

Second, we randomly varied the dummy for strictly positive trade $I_{od,t}$. For each country pair, we generated a random sequence of 0's and 1's and replaced the dummy $I_{od,t}$ with this random sequence. An experience measure for such a random sequence does not matter for bilateral trade as shown on Row 2. Third, we followed a quasi-randomization procedure and assigned the experience of each exporter in a particular destination to the alphabetical neighbor of the destination country from the same region. This allows us to check if our experience measure is simply picking up omitted variables that are specific to a particular region. Row 3 shows that this placebo measure does not affect bilateral exports. Next, we assign the experience of each exporter in a particular destination to the alphabetical neighbor of the exporter from the same region. Row 4 shows we obtain a negative coefficient on this placebo experience measure. Overall, these placebo tests demonstrate that it is the experience of the exporter in the destination that really matters for bilateral exports.

Finally, it may be argued that our experience measure is simply a proxy for deeper integration between country-pairs, which may manifest itself as harmonization of worker, product and environmental standards, IP regulations, tax rules, etc. In fact, recent preferential trading arrangements increasingly emphasize such issues over formal trade barriers. As such our experience may be unrelated to unobserved pair-specific trade costs. To examine this, we replace the dependent variable with a measure of bilateral FDI stock from CEPII, available for a single year 2004.[27] We find a strong *negative* role for experience (see Row 5 of Table 4). To the extent that export experience facilitates bilateral trade by reducing trade costs, our finding is consistent with the contention that FDI and exports are substitutes for serving a particular destination.[28]

## 4.2 The margins of international trade

Next, we analyze the effect of experience on the extensive and intensive product margins of international trade. Chaney (2008) provides closed-form solutions of how declines in variable and fixed bilateral trade costs affect the two margins, under the assumption that firm productivity follow a Pareto distribution. Examining the coefficient on experience for the two margins thereby allows us to infer whether experience reduces the fixed vs. variable costs of trade and whether there are spillovers in experience.

[27] In this cross-section, we include only exporter and importer fixed-effects.

[28] We also experimented with sales of foreign affiliates of multinationals from origin $o$, in country $d$.The coefficient on the export experience measure is again negative but insignificant.

Following Eaton, Kortum, and Kramarz (2004), Dutt et al (2013) and Flam and Nordstrom (2007), we decompose bilateral exports $X_{od,t}$ as the product of an extensive margin ($N_{od,t}$), defined as the number of 6-digit products traded, and an intensive margin ($\overline{x}_{od,t}$), defined as the volume of exports per product so that

$$X_{od,t} = N_{od,t} * \overline{x}_{od,t} \tag{9}$$

Interpreting each 6-digit sector as a firm allows us to map our empirical findings to the Chaney (2008) model.

In Chaney (2008), a reduction in either fixed or variable costs leads to more entry into a bilateral export market and thus increases the extensive margin. A reduction in *fixed* costs typically reduces the intensive margin: the increase in entry does not affect export sales of incumbents and the average exports per firm is brought down even further by the fact that the entrants are less productive and enter at a smaller scale than incumbents. A reduction in *variable* costs increases the export revenues of incumbents, but this is counteracted by entry of new firms with lower productivity and hence lowers sales than the incumbents. When productivities follow a Pareto distribution, the average export per product does not change so the intensive margin is unaffected by a change in variable costs. Dutt et al (2013) show how this knife-edge result changes for distributions other than Pareto. With other plausible distributions a drop in variable costs leads to an increase in the intensive margin.

If experience reduces bilateral trade costs, the effect on the each margin will depend upon a) whether there are spillovers in experience across sectors/firms and b) whether experience reduces the fixed or variable costs of trade. Consider a scenario where there are no spillovers in experience and experience reduces only the fixed costs of trade of incumbents. In this scenario, neither the extensive nor the intensive margin is affected by experience. Alternately, if experience reduces variable trade costs but there are again no spillovers in experience, we should expect no adjustments in the extensive margin along with an increase in the intensive margin. Here the number of products exported should remain unaffected as potential entrants do not benefit from experience while incumbent firms increase their exports raising the export per product. Therefore, the extensive margin will increase with experience only if there are spillovers in experience. If experience spills over and reduces only the fixed costs of trade, the intensive margin should decline (there is no impact on exports of incumbent firms but the new entrants enter at a smaller scale reducing export per product). Finally, if experience spills over and reduces the variable costs of trade, the impact on the intensive margin is ambiguous - exports of incumbent firms increase which raises export per product but entry at a smaller scale reduces export per product. The effect is zero for the Pareto distribution but positive for other plausible distributions.

Table 5 shows the effect of experience on the two margins of trade for our baseline specification that

includes country-year dummies, dyadic fixed effects and dyadic trends. Columns 1 reproduces our baseline estimate from Table 2 while Columns 2 and 3 show that both the extensive and the intensive margin increase with experience. Approximately 34% of the increase in overall trade coming via an adjustment of the extensive margin, and 64% coming via the intensive margin. The fact that the extensive margin increases with experience indicates that there are spillovers in experience across 6-digit sectors. This is in line with our findings with disaggregate data where we demonstrate spillovers in experience across 4-digit sectors. The fact that the intensive margin increases with experience allows us to rule out the case that experience reduces only the fixed costs of trade. Overall, these results are consistent with a mechanism where export experience spills over across firms/sectors and where experience reduces the variable costs of trade.

# 5 Heterogeneous effects and robustness checks

## 5.1 Heterogeneous effect of experience

In our baseline specification, standard gravity variables such as distance are absorbed in the country-pair dummies. At the same time, to the extent that these gravity variables are proxies for unobserved trade costs, we should expect a higher coefficient on experience when countries are remote in the sense that they are geographically distant, non-contiguous, do not share a common language, or past colonial links. This would also support our contention that the mechanism by which experience matters is via a reduction in unobserved trade costs. We examine this by estimating our model by splitting our sample based on each gravity variable. All splits are based on binary gravity variables except distance. For distance, we split the sample into three sub-samples based on mean $\pm 1$ standard deviation of distance.

Table 6 shows that experience matters for non-contiguous while it is insignificant for contiguous country-pairs. Experience also has a bigger effect on dyads that do not share a colonial relationship. For language, the finding is reversed - experience matters more for country-pairs that share the same language. To the extent that experience in trade facilitates information flows, sharing a language probably makes this more effective, which will be reflected in a stronger role for experience. The effect of experience is non-monotonic in distance - experience has a small and insignificant impact for countries that are relatively close to one another (less 2800 kms apart), it then increases to 0.349 (for pairs whose distance ranges from 2801 to 13300 kms), and subsequently declines marginally to 0.327 (for pairs that are mire than 13,300 kms fro one another). Overall, our results are in line with our contention that experience matters more for countries that are remote as measured by standard gravity variables, with common language as the sole exception.

We also examined if the effect of experience changes over time. We estimated a more demanding version

of equation (7) where we allowed the experience coefficient to vary by year, interacting it with year dummies. None of the interaction terms were significant while the coefficient on experience remained significant and stable at 0.32.

## 5.2 Censoring, country re-classification, small shipments

Next, we perform a further set of robustness checks where we continue to include country-year and pair-specific fixed-effects as well as pair-specific trends. First, our experience variable based on the DOTS data is right-censored at 10.49 (equivalent to 58 years of continuous trade since 1948 with a retention parameter of 0.905). To account for the right-censoring, we added a dummy variable for all censored observations. Including this dummy does not change the sign, significance, or magnitude of the estimates. An alternative dataset from the Correlates of War (COW) Project tracks bilateral trade from 1870-2006 (Barbieri, Keshk and Pollins, 2012). Relying on this data to construct experience may mitigate the right-censoring concern. However, the COW data, by going further back in time, requires fairly strong assumptions about shifts in country identities through division, unification, and emergence from colonial rule. Of more concern is the fact that COW provides trade data on former colonies in Asia, Africa and Latin America only when they become independent. In contrast, the DOTS data captures bilateral data for these countries prior to colonization. Therefore, experience constructed on the basis of COW data is also not free of measurement error. For this reason, we use the DOTS-based measure as our main measure of experience, and use the COW-based measure to examine the impact of censoring at 58 years. With experience constructed using COW data, the coefficient on experience increases slightly to 0.364.[29]

Our findings for experience may be confounded by shifting political boundaries in Easter Europe following the collapse of communism. Therefore, we sequentially dropped 14 countries that were part of the Soviet Union, the 4 countries that formerly constituted Yugoslavia, and finally Czech Republic and Slovakia. In all cases, we observe a marginal increase in the coefficient of experience. Finally, in the DOTS data, trade below $5,000 is set to zero, given the accuracy levels acknowledged by the IMF. Therefore, very small shipments are excluded in constructing our experience measure. Beyond $5000, we do give the same weight to small and large shipments in constructing the experience measure, based as it is on dummies for positive bilateral trade. This may lead to an over-estimation of the effect of experience. We therefore evaluate the sensitivity of our results to dropping small shipments by dropping the smallest 1 and 5% of bilateral export shipments. There is a marginal decline in the coefficient for experience to 0.315 and 0.291 but it remains strongly significant.

[29] All results are available upon request.

# 6 Conclusion

Episodes of rapid convergence of productivity and economic miracles are characterized by policies favoring increases in exports. Important examples are China and East Asian countries. These experiences suggest that exports plays an important role in the process of development. The failure of other countries and regions to exhibit such export-driven catch-up can be partly attributed to their failure to overcome trade barriers. Differences in accumulated export experience that reduces unmeasured trade barriers is a way to reconcile these differences.

Our paper finds that experience matters for bilateral exports, and that the effect is strong and persistent. Our non-parametric estimates show that an additional year, on average, increases bilateral trade by approximately 6%, while a parametric specification that controls for country and country-pair fixed effects as well as pair-specific trends and gravity variables, estimates an elasticity of bilateral trade with respect to our measure of experience of 0.345. We also provide insights into where experience matters the most - for country-pairs that are remote in terms of most standard gravity variables. This supports the contention that these gravity variables are to some extent proxies for unmeasured 'dark' trade costs.

A series of placebo and model-based tests helps shed light on how experience matters for bilateral trade. Our results are consistent with experience reducing the variable costs of trade and with spillovers in experience. We recognize that there are interesting dynamics and spillovers at the firm level as an emerging literature has started to document (e.g., Eaton et al, 2012) and that we are unable to shed much light on. However, with the short time-span of existing firm-level data, measuring experience accurately at the firm-level is a non-trivial task. Addressing the specific effects of experience at the firm-level, and the spillovers across firms remains a challenge for future work, as the time span of firm-level datasets expands.

Our results help understand why some countries and regions who accumulated export experience in the past (e.g., those in East Asia) continue as export powerhouses despite tremendous declines in transport costs and communication technology. Given our finding that the benefits from experience tend to be shared among firms and industries, the presence of dynamic effects opens the possibility of external effects and the scope for policy: supporting the entry of early exporters, even temporarily, may lower the trade costs for non-exporters and encourage entry. The fact that we find depreciation in experience and an upper-bound for its effect means that countries in Latin America and Sub-Saharan Africa can yet overcome the advantage of the traditional export powerhouses.

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Table 1: Experience and Bilateral Trade: Aggregate Data

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| Retention parameter δ | 0.963*** | 0.961*** | 0.962*** | 1.019*** | 0.995*** |
| | (0.002) | (0.002) | (0.002) | (0.001) | (0.001) |
| Experience | 0.753*** | 0.817*** | 0.817*** | 0.798*** | 0.887*** |
| | (0.011) | (0.011) | (0.011) | (0.009) | (0.018) |
| Both in GATT/WTO | -0.048*** | 0.022** | 0.020* | 0.010 | 0.193*** |
| | (0.011) | (0.011) | (0.011) | (0.018) | (0.062) |
| PTA | 0.279*** | 0.258*** | 0.258*** | 0.719*** | 0.724*** |
| | (0.011) | (0.011) | (0.011) | (0.02) | (0.053) |
| GSP | 0.174*** | 0.021 | 0.025* | 0.157*** | 0.241*** |
| | (0.015) | (0.015) | (0.015) | (0.018) | (0.048) |
| Common currency | 0.375*** | 0.414*** | 0.409*** | 0.163*** | 0.278** |
| | (0.045) | (0.045) | (0.045) | (0.043) | (0.121) |
| Distance | -1.127*** | -1.134*** | -1.132*** | -1.261*** | -1.259*** |
| | (0.006) | (0.006) | (0.006) | (0.007) | (0.018) |
| Contiguity | 0.878*** | 0.839*** | 0.842*** | 0.563*** | 0.537*** |
| | (0.028) | (0.029) | (0.029) | (0.028) | (0.082) |
| Colonial relationship | 0.869*** | 0.877*** | 0.867*** | 0.913*** | 0.946*** |
| | (0.026) | (0.026) | (0.026) | (0.026) | (0.088) |
| Common language | 0.362*** | 0.356*** | 0.357*** | 0.423*** | 0.449*** |
| | (0.015) | (0.015) | (0.015) | (0.016) | (0.039) |
| Common law | 0.83*** | 0.788*** | 0.794*** | 0.406*** | 0.380*** |
| | (0.018) | (0.018) | (0.018) | (0.021) | (0.053) |
| GDP exporter | 1.018*** | 1.016*** | 1.017*** | 0.443*** | |
| | (0.003) | (0.003) | (0.003) | (0.023) | |
| GDP importer | 0.873*** | 0.869*** | 0.873*** | 0.690*** | |
| | (0.002) | (0.002) | (0.002) | (0.027) | |
| Time trend | | -0.070*** | | | |
| | | (0.001) | | | |
| Time dummies | No | No | Yes | Yes | NA |
| Country dummies | No | No | No | Yes | NA |
| Country-year dummies | No | No | No | No | Yes |
| Country-pair dummies | No | No | No | No | No |
| Pair specific trends | No | No | No | No | No |
| Observations | 226223 | 226223 | 226223 | 226223 | 240873 |
| $R^2$ | 0.69 | 0.69 | 0.69 | 0.76 | 0.76 |

Standard errors in parentheses are clustered on country-pair: * significant at 10%; ** significant at 5%; *** significant at 1%
Columns 1-5 show non-linear least squares estimates; Column 6 uses δ with best fit

Table 2: Identification

| | (1) Baseline | (2) Baseline + Lagged DV | (3) IV estimate | (4) IV estimate | (5) PPML | (6) HMR correction |
|---|---|---|---|---|---|---|
| Experience | 0.345*** | 0.402*** | 0.379*** | 0.294*** | 0.977*** | 0.339*** |
| | (0.047) | (0.090) | (0.090) | (0.104) | (0.124) | (0.048) |
| Both in GATT/WTO | -0.041 | -0.063 | -0.051 | -0.052 | -0.085 | -0.067 |
| | (0.065)) | (0.066) | (0.065) | (0.066) | (0.069) | (0.071) |
| PTA | -0.053 | -0.009 | -0.052 | -0.113* | 0.113*** | -0.074 |
| | (0.048) | (0.046) | (0.048) | (0.054) | (0.024) | (0.055) |
| GSP | 0.119 | 0.083 | 0.118 | 0.011 | -0.268*** | 0.081 |
| | (0.109) | (0.104) | (0.109) | (0.135) | (0.060) | (0.115) |
| Common currency | 0.106** | 0.076* | 0.106** | 0.065 | 0.051 | 0.167** |
| | (0.049) | (0.044) | (0.049) | (0.059) | (0.033) | (0.072) |
| Lagged trade | | 0.068*** | | | | |
| | | (0.006) | | | | |
| Country-year dummies | Yes | Yes | Yes | Yes | Yes | Yes |
| Country-pair dummies | Yes | Yes | Yes | Yes | Yes | Yes |
| Pair specific trends | Yes | Yes | Yes | Yes | Yes | Yes |
| Exporter-region-year dummies | No | No | No | Yes | No | No |
| Observations | 240873 | 203650 | 240873 | 240873 | 326115 | 216550 |
| $R^2$ | 0.94 | 0.94 | 0.94 | 0.94 | 0.99 | 0.93 |
| First-stage F-statistic | | | 947.26*** | 1019.36*** | | |
| First-stage Partial $R^2$ | | | 0.24 | 0.28 | | |
| OID test *p*-value | | | 0.31 | 0.14 | | |

Standard errors in parentheses are clustered on country-pair; * significant at 10%; ** significant at 5%; *** significant at 1%;
Retention parameter $\delta = 0.905$;
Column 6 includes the inverse Mills ratio that accounts for the selection bias and a polynomial term that accounts for the heterogeneity bias (not shown)

Table 3: Experience and Bilateral Trade: Disaggregate Data

| | (1) Pooled | (2) Pooled | (3) Pooled | (4) USA | (5) China | (6) Germany | (7) Japan | (9) India |
|---|---|---|---|---|---|---|---|---|
| Retention parameter $\delta_1$ | 0.649*** | 0.636*** | 0.636 | 0.636 | 0.636 | 0.636 | 0.636 | 0.636 |
| | (0.0005) | (0.0005) | | | | | | |
| Retention parameter $\delta_2$ | 0.002*** | 0.000001*** | 0.000001 | 0.000001 | 0.000001 | 0.000001 | 0.000001 | 0.000001 |
| | (0.0004) | (0) | | | | | | |
| Retention parameter $\delta_3$ | 1.368*** | 1.350*** | 1.350 | 1.350 | 1.350 | 1.350 | 1.350 | 1.350 |
| | (0.001) | (0.001) | | | | | | |
| Experience (destination and industry-specific) | 0.946*** | 0.878*** | 0.741*** | 0.763*** | 0.715*** | 0.813*** | 0.743*** | 0.653*** |
| | (0.003) | (0.002) | (0.004) | (0.012) | (0.019) | (0.010) | (0.013) | (0.018) |
| Destination-specific experience (across 4-digit industries) | 0.054*** | 0.055*** | 0.021*** | | | | | |
| | (0.001) | (0.001) | (0.003) | | | | | |
| Industry-specific experience (across destinations) | 1.107*** | 1.114*** | 0.139*** | | | | | |
| | (0.001) | (0.001) | (0.004) | | | | | |
| Both in GATT/WTO | 0.005*** | -0.069*** | 0.037 | | | | | |
| | (0.002) | (0.002) | (0.032) | | | | | |
| PTA | 0.090*** | 0.201*** | 0.046*** | | | | | |
| | (0.002) | (0.002) | (0.011) | | | | | |
| GSP | 0.058*** | -0.044*** | -0.045*** | | | | | |
| | (0.002) | (0.006) | (0.012) | | | | | |
| Common currency | 0.110*** | -0.047*** | -0.074** | | | | | |
| | (0.006) | (0.001) | (0.030) | | | | | |
| Distance | -0.208*** | -0.257*** | -0.046*** | | | | | |
| | (0.001) | (0.003) | (0.007) | | | | | |
| Contiguity | 0.345*** | 0.271*** | 0.096*** | | | | | |
| | (0.003) | (0.002) | (0.018) | | | | | |
| Colonial relationship | 0.040*** | 0.179*** | -0.017 | | | | | |
| | (0.002) | (0.002) | (0.015) | | | | | |
| Common language | 0.172*** | 0.062*** | -0.004 | | | | | |
| | (0.002) | (0.002) | (0.013) | | | | | |
| Common law | 0.097*** | 0.013*** | 0.017 | | | | | |
| | (0.002) | (0.001) | (0.014) | | | | | |
| GDP exporter | 0.070*** | 0.086*** | | | | | | |
| | (0.001) | (0.001) | | | | | | |
| GDP importer | 0.256*** | 0.293*** | | | | | | |
| | (0.001) | (0.005) | | | | | | |
| Time dummies | No | Yes | NA | NA | NA | NA | NA | NA |
| Country dummies | No | Yes | NA | NA | NA | NA | NA | NA |
| Country-year dummies | No | No | Yes | Yes | Yes | Yes | Yes | Yes |
| Industry-year dummies | No | No | No | Yes | Yes | Yes | Yes | Yes |
| Observations | 5084671 | 5084671 | 5084671 | 507494 | 201630 | 266319 | 335204 | 110595 |
| $R^2$ | 0.40 | 0.43 | 0.74 | 0.82 | 0.82 | 0.87 | 0.84 | 0.76 |

Standard errors in parentheses are clustered on country-pair: * significant at 10%; ** significant at 5%; *** significant at 1%

Table 4: Placebo Tests

| **Specification** | Coefficient on experience | Coefficient on placebo variable |
|---|---|---|
| 1. Import experience of exporter | | 0.012 |
| | | (0.040) |
| 2. Randomize dummy for positive trade | | -0.006 |
| | | (0.024) |
| 3. Assign experience to alphabetical neighbor of importer from same region | | -0.030 |
| | | (0.028) |
| 4. Assign experience to alphabetical neighbor of exporter from same region | | -0.039 |
| | | (0.024) |
| 5. FDI stock as dependent variable | -0.131*** | |
| | (0.032) | |

Standard errors in parentheses are clustered on country-pair: * significant at 10%; ** significant at 5%; *** significant at 1%. The retention parameter δ is set to 0.905 in all rows and columns. All specifications include country-year, country-pair dummies and pair-specific trends.

Table 5: Extensive and Intensive Margins of Trade

| | (1) Bilateral Exports | (2) Extensive margin | (3) Intensive margin |
|---|---|---|---|
| Experience | 0.345*** | 0.116*** | 0.228*** |
| | (0.047) | (0.018) | (0.042) |
| Both in GATT/WTO | -0.041 | -0.016 | -0.035 |
| | (0.065)) | (0.029) | (0.057) |
| PTA | -0.053 | -0.041* | -0.011 |
| | (0.048) | (0.023) | (0.041) |
| GSP | 0.119 | 0.057 | 0.063 |
| | (0.109) | (0.039) | (0.099) |
| Common currency | 0.106** | 0.030 | 0.076* |
| | (0.049) | (0.026) | (0.044) |
| Country-year dummies | Yes | Yes | Yes |
| Country-pair dummies | Yes | Yes | Yes |
| Pair-specific trends | Yes | Yes | Yes |
| Observations | 240873 | 240873 | 240873 |
| $R^2$ | 0.94 | 0.97 | 0.85 |

Standard errors in parentheses are clustered on country-pair;
* significant at 10%; ** significant at 5%; *** significant at 1%
The retention parameter δ is set to 0.905 in all columns.

Table 6: Variation of Coefficient on Experience Across Model Specifications

| *Split On Gravity Variable* | Coefficient on experience [Gravity variable = 0] | | Coefficient on experience [Gravity variable = 1] |
|---|---|---|---|
| Contiguity | 0.345*** | | 0.340 |
| | (0.047) | | (0.492) |
| Colonial relationship | 0.346*** | | -2.999 |
| | (0.047) | | (6.737) |
| Common language | 0.327*** | | 0.414*** |
| | (0.050) | | (0.148) |
| Common law | 0.422*** | | 0.338*** |
| | (0.165) | | (0.049) |
| Distance | 0.207 | 0.349*** | 0.327*** |
| | (0.148) | (0.055) | (0.140) |

All specifications include country-year, country-pair dummies and pair-specific trends.
Standard errors in parentheses are clustered on country-pair; * significant at 10%; ** significant at 5%; *** significant at 1%; The retention parameter $\delta$ is set to 0.905 in all columns
All splits are based on binary variables except for distance; for distance we split the sample into three parts, 1 std. dev. above mean, mean ± 1 std. dev, and 1 std. dev. below mean

**Figure 1: Distribution of Experience in 2006**

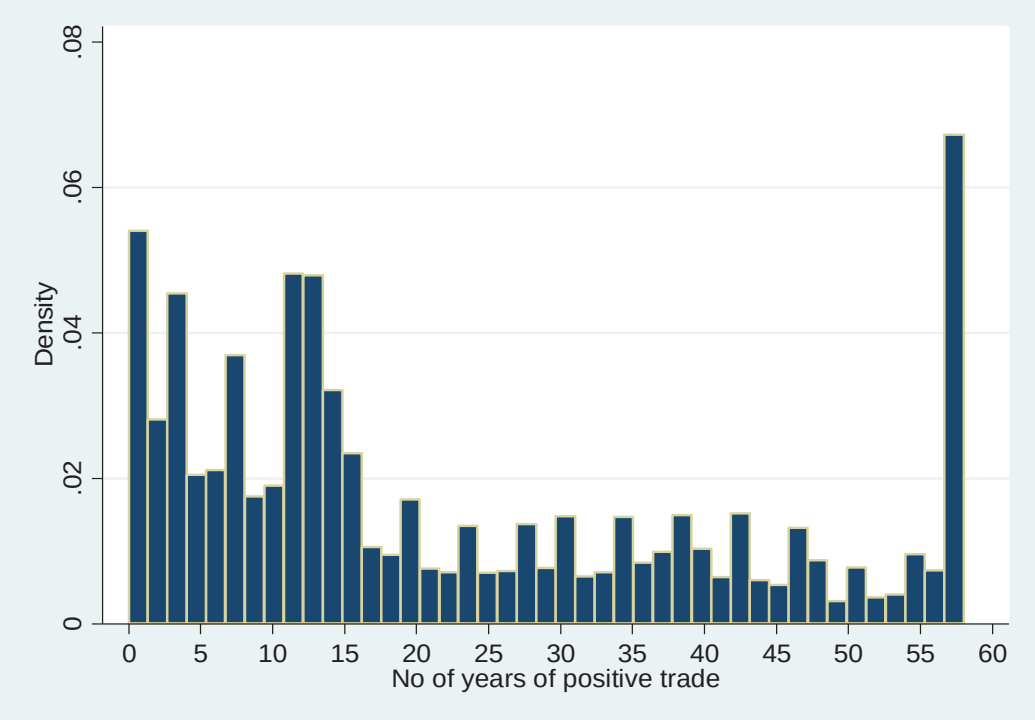


**Figure 2: Cumulative Effect of Experience on Logged Bilateral Trade (Coefficient estimate with 95% confidence interval)**