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History, Culture, and Trade: A Dynamic Gravity Approach

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Abstract

What determines trade patterns? Habit persistence in consumer tastes and learning-by-doing in production imply that history and culture matter. Deriving a dynamic gravity equation from a simple model, it is shown that cultural similarity is a product of history, so that trade patterns are a function of bilateral GDP, current trade costs, and the past history of trade costs. Using a trade data set which spans from 1870 to 2000, I demonstrate that many gravity variables operate via lagged trade, that historical trade shocks matter, and that trade patterns are persistent, even across centuries.

Keywords: Dynamic Gravity Equation, Endogenous Preferences, Habit Persistence, Learning-By-Doing

JEL Classification: F10, F12, F22, N70

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[1] http://www.econ.ucdavis.edu/graduate/campbe11/index.htm

What determines trade patterns? The gravity equation, hailed as one of the most empirically successful paradigms in economics, posits that bilateral trade flows are a function of GDP and current trade costs. This paper shows that general models of either habit persistence in consumer tastes or market-specific fixed costs (such as learning-by-doing) in production lead to a simple dynamic gravity equation in which trade patterns are a function of bilateral GDP, current trade costs, and the past history of trade costs. This equation can help explain various empirical conundrums of international trade, including why geography variables work just as well for services as they do for goods (Kimura and Lee, 2006), why typical empirical gravity variables such as former colonial status (Rose, 2000) and religion (Frattiani and Kang, 2006) are correlated with trade,[2] why one-time trade shocks, such as Romalis (2006) documents for NAFTA or exchange-rate shocks as in Krugman (1987), take time to reach their full effect, and why trade patterns are persistent, even across centuries (this new empirical fact is documented in Table 1 below). The model can also offer a partial explanation for why the significance of distance in the gravity equation has not decreased apace with declines in transport costs (see Table 2).

Bilateral trade is remarkably persistent, *as trade patterns in 1870 can predict some 21% of trade in 2000 (Table I),* in the 26-country, 131-year trade database created by Jacks, Meissner, and Novy (2008). Neither the raw correlation of *46%*, nor the significance of trade lagged 130 years diminishes once the standard gravity controls, including contemporaneous GDP, are added, and similar results are attained for the post-war period with a much larger IMF Direction of Trade Statistics (DOTS) database, displayed in Appendix Table 1. Bilateral trade in 1955 is a better predictor of trade in 2005 than is GDP. While various theories, including a Heckscher-Ohlin, factor endowments-based theory, might imply that trade patterns should be persistent if factor endowments evolve slowly, the remarkable persistence of trade patterns – *even across centuries* – implies that a serious formal investigation of the role of history in trade is warranted, and that a dynamic gravity equation is preferred to a static equation.

[2] The possibility does exist that a partial explanation is that these are tariff correlates. In "Achieving Peace and Prosperity in the Greater Middle East", Ed Gresser documents that the US has higher tariffs on goods coming from Muslim countries, available at http://www.ppionline.org/.

Log Trade in:	1870	1890	1910	1928	1955	1969	1980	1995
Coefficient	0.328*	0.338*	0.445*	0.590*	0.822*	0.875*	0.974*	1.005*
Std. Error	(0.06)	(0.05)	(0.05)	(0.06)	(0.07)	(0.04)	(0.03)	(0.01)
Observations	130	142	147	148	146	149	149	149
R-Squared	0.21	0.255	0.321	0.376	0.515	0.768	0.911	0.984
Corr. w/ 2000:	0.46	0.56	0.59	0.65	0.73	0.89	0.96	0.99

Table 1: Dependent Variable, Log Trade 2000

* significant at 1%; 26 country sample from Jacks, Meissner, Novy (2008).

If the consensus view among economists is correct, that trade is important for economic development, then the results in Table 1 imply that history is important for development as well. The seeming dependence of trade on lagged values also implies that one needs to be careful with panel data, as trade flows from one year (or *century*) to the next are highly correlated, meaning that the errors are not likely to be independent, as is often assumed. And the inclusion of country-pair fixed effects and year dummies does nothing to solve the independence issue.

While there are several plausible reasons why the coefficient on the log of distance has not decreased apace with declines in transport costs, including regional biases in trade liberalization (think NAFTA, MERCOSUR, or the EU), and a movement from Heckscher-Ohlin-type trade, heavy in commodities and resource-intensive goods based on factor endowments, toward a world where goods are finely differentiable and subject to increasing returns, the puzzling failure of the size and significance of distance to diminish is another motivation for reconsidering the interpretation that geographic variables merely proxy contemporaneous trade costs. Here, too, dynamic gravity provides a partial explanation, as the "past trade costs" term is usually changing only very slowly for most country pairs, but increasing for country-pairs such as Australia and the UK since colonization.[3]

[3] Since the "distance puzzle" was first noticed in postwar data by Levinsohn and Leamer (1995), much research has been done, including Jacks (2009), Carrère and Shiff (2005), and Berthelon and Freund (2008). The second new empirical fact documented in this paper is that the distance puzzle -- quite surprisingly -- goes back centuries.

Table 2: The Distance Puzzle Across Centuries				
Regression Type	OLS	OLS	Between	Between
Time Period	1900	2000	1870-1914	1946-2000
Log Distance	-1.353*	-1.860*	-1.601*	-1.570*
	(0.26)	(0.15)	(0.26)	(0.14)
Log Domestic GDP	1.298*	1.314*	1.301*	1.222*
	(0.15)	(0.08)	(0.16)	(0.08)
Border Dummy	2.096**	1.334**	2.297**	1.287**
	(0.99)	(0.55)	(1.02)	(0.54)
Island Dummy	2.973*	0.599**	3.100*	1.115*
	(0.52)	(0.29)	(0.53)	(0.28)
Observations	144	149	6209	7896
Number of pairid	144	149	148	149
R-squared	0.514	0.741	0.526	0.701

Dependent Variable Log Trade. Standard errors in parentheses; 26 country sample from Jacks, Meissner, Novy (2008). + significant at 10%; ** significant at 5%; * significant at 1%.

A dynamic gravity equation can be derived from either a simple, micro-founded model of habit persistence in consumer tastes or by market-specific learning-by-doing in production. The key idea is that trade costs are one determinant of relative prices, and these relative prices determine production and consumption baskets, which are then persistent, owing to sunk costs and human nature. Hence, gravity variables such as distance and past colonial status are also proxies for "cultural differences" in addition to proxying contemporaneous trade costs, where cultural differences are defined simply by the taste and the learning-by-doing parameters.[4] Habit

[4] The basic insight of Anthropology is that there are few, if any, cultural universals. Conversely, most economic models, interestingly, assume away any cultural *differences*. In any case, there are no universally agreed upon definitions for culture. My own Cultural Anthropology professor defined culture by sharing a story passed down from an old professor of his, who once surprised his party guests by suddenly informing them that the hamburgers they had been served were made with dog meat. Culture was then defined as that visceral gut reaction which caused the party guests to groan and spit out their food, as the western cultural taboo against eating dog is strictly learned (and shared). I shall take a culturally academic-Economist route and give culture a precise mathematical definition -- the CES taste parameters -- which does not preclude the possibility of cultural universals.

persistence and learning-by-doing imply that culture, and thus trade, is a function of the past history of all trade costs.

The idea of habit persistence and the time-nonseparability of preferences emanates from the growing literature on "endogenous preferences," including Bowles (1998), and on models of cultural formation, such as Rauch and Trindade (2004). This literature is supported by three key empirical micro studies, Naik and Moore (1996), Logan and Rhode (2008), and Atkin (2009) each of which finds empirical support for the proposition that past relative prices determine current tastes using data on food consumption.[5] Habit persistence in aggregate consumption (a slightly different phenomenon) is also a common feature of models in macroeconomics, such as in Carroll, Overland, and Weil (2000), and International Economics in models of the current account (Gruber 2004), with most studies finding significant empirical support.

Learning-by-doing is likewise not a new concept, probably pre-dating John Stuart Mill (1848), who popularized infant industry protection. In their 1985 book synthesizing new trade theory with the old, Helpman and Krugman wrote: "In practice, it is likely that one of the most important sources of economies of scale (and of imperfect competition) lies in the dynamic process by which firms and industries improve their technologies." Although the authors did not explicitly include dynamic models in their book, they did suggest that "a major goal of further work will have to be to develop a truly dynamic trade theory."[6] While Krugman (1987) and Krugman and Baldwin (1989), among others, followed up with dynamic models of learning-by-doing, to date, neither models of habit persistence nor models of learning-by-doing have made an impact on the gravity literature. And while some researchers who work with gravity might try dynamic specifications, Eichengreen and Irwin (1998) being the most prominent, and may also

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[5] Indeed, the idea of habit persistence goes back even further. In 415 B.C., Euripides wrote the play *Trojan Women*, in which Andromache says: "But if the choice is between a miserable life, mother, if it is between a miserable life and death, death is preferable. Because the dead feel no misery and they know nothing of grief, whereas for the living mortals, *if a happy woman falls into misery she must deal with the memory of the joy she previously enjoyed*. Her soul seeks the joys of the past." Although Andromache was speaking of persistence in the aggregate, if goods are imperfectly substitutable, this would translate to the type of persistence discussed in this paper. In more recent times, writer and psychologist Virginia Satir says that "The will to survive is not the strongest instinct in humans, the strongest instinct is to do what is familiar."

[6] Helpman, Krugman, p. 38-39.

suspect that the geographic variables proxy cultural differences, this is rarely stated, and these dynamic specifications were never derived from any model, nor has there been any attempt among practitioners of gravity to model how these cultural differences might have arisen.[7] This paper strives to help fill the gap.

An example of how the theory works in practice is that in 1704, the cost of rice in London was 25 times the price in Canton (Allen 2004), and today, China consumes 10 times as much rice as the US on a per capita basis.[8] This cannot solely be due to the fact that China is poor and rice is a cheap necessary good (or perhaps even a giffen good for some rice farmers), as even Japan, where rice is vastly more expensive than in the US due to an import quota, consumes about four times as much rice as the US on a per capita basis.[9] Hence, while part of the reason that the US has such a significant share of world rice exports (about 10-15%, although declining)[10] is due to factor endowments -- California is a good place to grow rice -- and agricultural subsidies, another factor is that Americans do not demand as much rice as do East Asians, who consume relatively more rice due to the long history of relative prices which has embedded rice in their preferences -- which I label "culture".[11]

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[7] Some other examples of dynamic versions of gravity used in practice without model-based theoretical justification are Cho, Kim, and Koo (2003), Martinez-Zarzoso, Nowak-Lehmann, and Horsewood (2009), Berger and Nitsch (2008), and de Nardis, De Santis, and Vicarelli (2009).

[8] USDA, Foreign Agricultural Service (FAS), Aug 2002, at http://www.foodmarketexchange.com/datacenter/product/grain/rice/detail/dc_pi_gr_rice0802_01.htm. The UK consumes even less per capita than does the US.

[9] *Ibid.*

[10] Childs, Nathan and Burdett, Amy, "The US Rice Export Market", USDA Special Article, http://www.ers.usda.gov/briefing/Rice/SpecialArticle/USricemarket.pdf.

[11] Another example of this came to me while I was presenting an earlier draft of this paper at a conference in Guanajuato, Mexico, when I asked my homestay mother why she did not drink or serve wine, like my home-stay family in Spain did. She replied, "*Aqui en Mexico, nosotros bebemos coca!*" ("Here in Mexico, *we* drink Coca-Cola!") This is likely due to the long history of relative prices, as wine production was forbidden in Mexico in colonial times, as Mexico was forced to import wine, expensively, from Spain. Indeed, Miguel Hidalgo first got into trouble with the authorities was when he taught peasants to grow vines, which was illegalized by the *peninsulare* authorities (see Fehrenbach's *Fire and Blood: A History of Mexico*). On the other hand, Mexico and the US share a

Consider that Japan imports some 25 billion disposable chopsticks annually from China, and not just because the close distance makes it economical and China is endowed with relatively more cheap labor, and forests filled with tropical timber unmolested by environmental protections, but also because Japanese people are culturally preconditioned to eat with chopsticks instead of forks and spoons.[12] This is a cultural influence that developed due to the close proximity of China and Japan historically, and due to the cultural pull – very much like the pull of gravity – of China.

The chopsticks trade is not explained solely by persistent tastes, however, as making chopsticks, similar to Adam Smith's pin factory, is subject to learning-by-doing. Since Chinese have been using chopsticks for centuries, it is plausible that they might have a learning-by-doing advantage over a potential South Asian, African, or South American entrant into the lucrative Japanese *waribashi* (throw-away chopsticks) market. Hence, once Japan had industrialized, countries near Japan with a similar, shared culture, such as South Korea and Taiwan, where a significant number of people even speak Japanese due to colonization, had an advantage in development – and hence this model of trade is also a model of economic growth. If history matters for trade, it must also matter for development.

The modest goal of this paper is to write down a simple model with tastes determined by habit persistence (section I) and learning-by-doing in production (section II), to derive a gravity equation from each (they are combined in the Unpublished Appendix), to introduce a new method of estimating gravity equations based on the theory, and to show that the implications of a general version of such a model have significant explanatory power for the evolution of trade, even across centuries (section III). Section IV concludes by highlighting some possibilities for future work.

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border and relatively low trade costs, which may explain why American products such as Coca-Cola have become so embedded into the identity of Mexicans.

[12] Mildly interesting articles on chopsticks production can be found here: http://homepage.mac.com/mstrauch/greenchopsticks/read05bidne.html. Occasional Canadian and US producers have entered the market hoping to capitalize on North America's large endowment of timber, but apparently without success.

I. A Model of Habit-Persistence in Consumer Tastes

This section introduces a simple model in which trade flows are determined by tastes, and tastes evolve via habit persistence, leading to a "dynamic" gravity equation in which trade flows are a function of the past history of all trade costs.

In the tradition of Anderson (1979), and following Feenstra (2004), Anderson and van Wincoop (2003) and Novy (2008), I assume that a representative consumer in country (or region) j maximizes utility given by:

(1.1) $$\left(\sum_{i=1}^{C} \beta_{ij}^{\left(\frac{1-\sigma}{\sigma}\right)} c_{ij}^{\left(\frac{\sigma-1}{\sigma}\right)} \right)^{\left(\frac{\sigma}{\sigma-1}\right)}, \sigma > 1$$

The units of consumption, c_{ij} denote all varieties of goods produced in country i and consumed in country j. One key difference between this and Anderson and van Wincoop (2003) and Novy (2008) is that the taste parameters β_{ij} vary between countries, a specification also used by Combes *et. al.* (2005). These taste parameters are how I shall incorporate history into the model. Each country is subject to a budget constraint $Y_j = \sum_{i=1}^{C} p_{ij} c_{ij}$ (1.2), where p_{ij} is the price of a good produced in country i and sold in country j. Maximizing (1.1) subject to (1.2), and using the definition of exports $x_{ij} = p_{ij} c_{ij}$ and Samuelson (1952) iceberg transport costs, so that $p_{ij} = p_i \tau_{ij}$, leads to:

(1.3) $$x_{ij} = \frac{Y_j \left(p_i \tau_{ij} \beta_{ij} \right)^{1-\sigma}}{P_j}$$

Where $P_j = \sum_i (p_i \tau_{ij} \beta_{ij})^{1-\sigma}$. Now, if we normalize the within country trade cost terms to one, *i.e.*, $\tau_{ii} = 1$ (which is not necessary, but which simplifies things), and assume symmetry of trade costs, then, using the method from Novy (2008), we can arrive at a clean expression for bilateral trade:

(1.4) $$x_{ij}x_{ji} = \left(\frac{\beta_{ij}\beta_{ji}}{\beta_{ii}\beta_{jj}}\right)^{1-\sigma} \left(\tau_{ji}\right)^{2(1-\sigma)} x_{ii}x_{jj}$$

Hence, bilateral trade is a function of the taste parameters (the betas), trade costs, and the size of both countries' domestic trade. Linder's (1961) hypothesis was that countries which have similar demand structures should trade more with each other, so that one obvious extension of this model would be to make the betas a function of per capita income or the difference in per capita income, both familiar gravity controls (Bergstrand 1989, did something similar). And, indeed, if $\beta_{ij} = \beta_{ii}$ and $\beta_{ji} = \beta_{jj}$, the first term in equation (1.4) cancels. More empirically relevant is the case of home-bias, where $\beta_{ij} > \beta_{ii}$ and $\beta_{ji} > \beta_{jj}$ (remembering that with $\sigma > 1$, $\beta^{(1-\sigma)/\sigma}$ has a negative exponent).

Eaton and Kortum (2002) capture how geography matters for trade, writing that "geographic barriers reflect such myriad impediments as transport costs, tariffs and quotas, delay, and problems with negotiating a deal from afar," to which this paper adds differences in tastes and culture. The evolution of tastes is not merely a random walk, although it is certainly plausible that a substantial component is random. I shall posit that a given region's tastes are persistent, so that the taste parameters today are a function of past consumption.

There are various reasons why tastes might be persistent at the micro level. First is the role that addiction plays for goods such as caffeine, nicotine, and alcohol. Yet aside from these more obviously chemically-addicting goods, a wide variety of other goods and activities are naturally habit forming. A second motivation is "experience goods" – goods which one needs first to consume to gauge the quality. Thirdly, past consumption can reduce the future search costs of finding out when, where, and how to consume a good in the future (Rauch 1999 and Rauch and Trindade 2002 highlight the importance and implications of search for trade). And, due to these search and also negotiating costs, the optimal contract length for some industries might be longer than the time interval for many trade datasets, which is typically one year. Fourth, replacement component parts – such as cell phone rechargers – must be compatible with the original product, meaning that one's past consumption habits can lock in future consumption. A fifth motivation is that some goods take time to learn how to use, and once the fixed cost of learning how to use a good has been paid, it may be rational to be biased in favor of consuming that good again in the future versus other goods which have yet to be learned. Sixth, network externalities can also make changing consumption of a particular good difficult, as collective choice is often not possible (Rauch and Trindade, 2002, discuss network externalities for social goods). These six motivations are by no means exhaustive.

I shall assume the following functional form, which is qualitatively similar to that found in the macro literature: $\beta_{ijt}^{1-\sigma} \equiv c_{ij(t-1)}^{\rho}$, where ρ is less than unity, and where the subscript t denotes the time-period in question.[13] Plugging in the above, iterating, and taking logs yields a simple, tractable, dynamic gravity equation (see appendix for derivation).

(1.5)
$$\ln(x_{ijt}x_{jit}) = \ln(x_{iit}x_{jjt}) + \underbrace{2(1-\sigma)\ln\tau_{jit}}_{CurrentTradeCosts} - \underbrace{\sum_{k=1}^{\infty}\rho^{k}\,2\sigma\ln\tau_{ji(t-k)}}_{PastTradeCosts}$$

This expression is intuitively straightforward – trade today depends on the size of each country's home market, current trade costs, and past trade costs, as current tastes are simply a function of all past trade costs. Hence, had trade costs been zero for all time, the theory predicts that the size of trade between regions i and j should be just as large as the trade within region i and within region j. If, on the other hand, two cultures have a long history of separation, then the theory says that there will be less trade.

If the static gravity equation for trade is analogous to the physics equation for the force between objects due to gravity, then the analogue to equation (1.5) is the equation for velocity due to gravity, which would be a function of both initial velocity and the current force due to gravity. Initial velocity, in turn, would be a function of the forces and gravitational distances which have acted in the past, just as habits are a function of past relative prices. In its reduced form, "dynamic gravity" -- both in the thermodynamics version as well as the economics version -- should be a function of five dimensions: space, time and mass.[14]

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[13] For example, in Carroll, Overland, and Weil (2000), $U(c,h) = \frac{1}{(1-\sigma)}(c/h^{\gamma})^{(1-\sigma)}$, where c is consumption, h is the stock of habit persistence, which evolves according to a weighted average of past consumption (rather than just the previous period's consumption as in my specification), and γ indexes the importance of habits. In their model, this leads to agents in fast-growing countries (such as the Asian Tigers) to want to smooth their consumption growth.

[14] Later in the paper elevation is included in a gravity regression as the third spatial dimension.

How sensitive is equation (1.5) to the assumptions? First note that if we were to change the functional form of habit persistence to $\beta_{ijt}^{1-\sigma} \equiv s_{ij(t-1)}^{\rho}$ where $s_{ij} = p_{ij}c_{ij} / Y_j$, there would be no change in equation (1.5) due to cancellations. While equation (1.5) will certainly not hold for all general functional forms, many other plausible functional forms clearly would carry the same implications, likely with more complication. It is also not realistic to imagine that past consumption is the only determinant of the taste parameters, but rather, one factor among many. Random shocks could easily be added to the model, but would not alter the basic intuition.

And if we were to include the reasonable assumption that agents know that their consumption today will affect their tastes tomorrow (generating an Euler equation from the consumer maximization problem), the major difference with the above would be that bilateral trade would now be a function of both past and future trade costs. At the same time, it is less reasonable to assume that agents know the future history of all trade costs and prices, and there is considerable evidence that agents are myopic, and are often caught by surprise by habit persistence in goods such as cigarettes, or else they would presumably not smoke the first one. Since the implications of such a model are similar to equation (1.5), this extension of the model is left to the unpublished version of the appendix.

Interestingly, none of the six motivations for habit persistence listed above are necessarily independent of the actions of producers, as firms invest heavily in designing food and drugs to be addictive. Firms can also reduce uncertainty over product quality by either giving new products away at first (*viz.*, Red Bull and Coke Zero were both initially distributed free at universities, and the Wall Street Journal is free for many university students, with the hope that these products will become embedded in students' utility functions once they have graduated and their ability to pay increases), or via marketing, which can also alleviate search costs for consumers, and make strange new products seem more familiar. Smart firms will also make expensive component parts which are not compatible with products of other firms or past versions of the same product, such as cell phone rechargers.

Below I shall show that counting these as firms' productivity parameters will lead to precisely the same formulation of dynamic gravity as in equation (1.5) above. This paper argues, in effect, that there is a far greater duality between firm-level market-specific productivity parameters and consumer preferences than has been acknowledged, and that the two, in fact, are indistinguishable *even at a conceptual level* (something akin to the Heisenberg Uncertainty Principle, to keep the physics analogy alive, as we cannot simultaneously measure both). This is due in part to the fact that, for many firms, including, famously, the pharmaceutical industry (Naik *et. al.* 2009), marketing, distribution, and sales costs dwarf that of actual production or R&D costs. That is, the most important "productivity" parameter for a firm such as Coca-cola (whose actual production costs are a bit more than one-third of its revenues)[15] may have nothing to do with physical production itself, but rather with the strength of Coca-cola's name-brand, consumers' familiarity (or addiction) to the product, and the firm's distribution network.

II. Learning-By-Doing in Production

First, assume that each country j maximizes revenue: $\sum_{i=1}^{C} p_{ji} q_{ji}$, where, analogous to the Armington assumption,[16] I assume that what country j sends to country i is different than what it sends to country k or what it consumes at home) subject to the CES output function (also called a constant elasticity of transformation, or CET function).

$$(2.1) \qquad Q_j \geq \left(\sum_{i=1}^{C} \alpha_{ji} q_{ji}^{\left(\frac{\omega+1}{\omega}\right)} \right)^{\left(\frac{\omega}{\omega+1}\right)}, \omega > 0$$

This functional form is motivated by Feenstra's (2007) Zeuthen lectures and Feenstra (2010) and is similar to Bergstrand (1985) and Baier and Bergstrand (1991). Feenstra and Kee (2008) show that this specification is implied by a monopolistic competition model with heterogenous firms and a Pareto distribution for endogenous productivity, as is the case in popular papers such as Helpman, Melitz, and Yeaple (2004), and Chaney (2005).

Maximizing revenue subject to (2.1), and using the definition of exports $x_{ji} = p_{ji} q_{ji}$ and Samuelson (1952) iceberg transport costs, so that $p_{ji} = p_i \tau_{ji}^{-1}$, unilateral exports are:

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[15] From Coca-Cola's Income Statement, available at: http://www.thecoca-colacompany.com/investors/financial_statements.html.

[16] The Armington assumption is that goods produced in different countries are imperfect substitutes, here I assume that goods produced in one location bound for different markets are different.

(2.2) $$x_{ji} = \frac{Y_j\, p_j^{1+\omega}}{\mathrm{P}_j \alpha_{ji}^{\omega} \tau_{ji}^{1+\omega}}$$

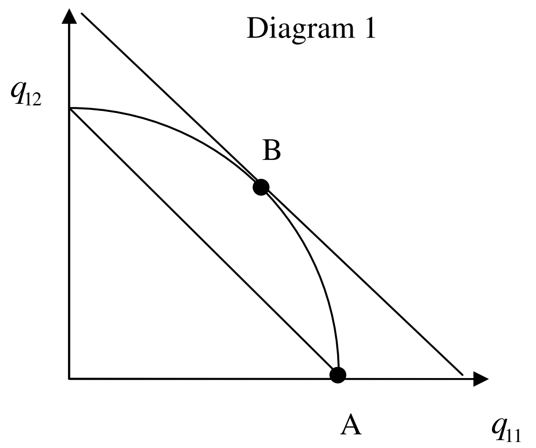
Where $\mathrm{P}_j = \left(\sum_i \left(p_i \tau_{ji}^{-1} \right)^{1+\omega} \alpha_{ji}^{-\omega} \right)^{\frac{\omega}{1+\omega}}$. If within-country trade costs are normalized to unity and trade costs are symmetric, then we can derive another simple gravity equation using the same method as before.

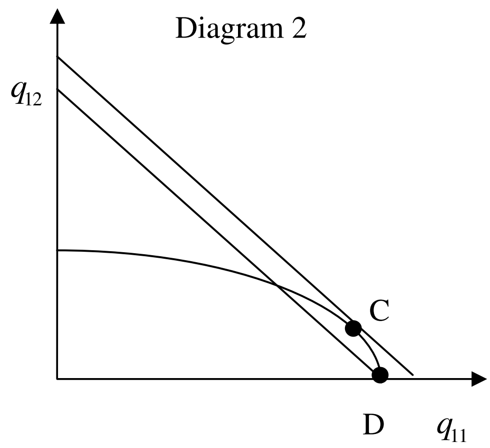
(2.3) $$x_{ij} x_{ji} = \left(\frac{\alpha_{ii} \alpha_{jj}}{\alpha_{ij} \alpha_{ji}} \right)^{\omega} \left(\tau_{ji} \right)^{-2(1+\omega)} x_{ii} x_{jj}$$

Hence, bilateral trade is a function of the market-specific productivity parameters, trade costs, and the size of both countries' home markets. (One extension would be to make the productivity parameters a function of endowments in the spirit of Heckscher-Ohlin.) The idea being that there are substantial fixed costs and learning-by-doing associated both with developing products and with entering specific markets, and so it is easier for a producer to sell to a market which has similar "learning-by-doing" requirements, perhaps due to low transport costs historically.[17]

To fix ideas, consider Diagram 1 below, where, with no trade, region 1 would be forced to produce just for the home market, at point A. If region 1 opens to trade, and if the home and foreign markets are exactly the same, you maximize your own GDP by producing an equal amount for home and abroad at point B. If, however, regions 1 and 2 are dissimilar, then region 1 will produce much more for the home market, as in Diagram 2.

[17] For an interesting reminder of the fixed costs of entering regional markets, see the following fascinating video on the growth of Wal-Mart stores: http://projects.flowingdata.com/walmart/. Wal-Mart's strategy is to enter a market, and then saturate it before moving to the next closest region.





Since q_{11} is the production of all varieties of goods for the home market, then, as in the ubiquitous Melitz (2003) model, a country could increase total productivity by concentrating on producing (and exporting) fewer varieties, thus incurring fewer fixed costs. If the fixed costs for entering a new market were less than the fixed costs for creating generic versions of the product, then $\omega > 0$ is plausible. In the Melitz model, when a country opens up to trade, the marginally productive firms go out of business, and their resources are shifted to more productive uses. For example, in autarky, Japan might produce cars and movies. As both industries have substantial fixed costs, the value of total production would be higher if it focused on cars and imported its movies from Hollywood.

As before, however, the technology parameters are not merely exogenously given, but rather, they reflect learning-by-doing and sunk costs. These include building factories, designing products, acquiring patents and copyrights, and creating distribution chains, sales networks, and brand names through marketing, all of which require detailed knowledge about local markets, tastes, customs, languages, and regulations. Once acquired, these are assets that will continue to make the firm more productive in the future.

Mirroring the motivations for habit persistence on the consumer side, a successful sale one period will naturally yield to the seller information about where, when, how and to whom to make a successful sale in the future (as for the consumer), and could potentially increase the possibility of future sales via "reputation effects". In addition, many products are sold in complementary fashion (an Epsilon printer needs Epsilon ink), meaning that a sale one period can lock in sales in future periods as well. And although it seems more natural to model the effects of addiction or product learning-by-doing on the consumer side, the addiction of consumers to a product could conceivably reduce marketing and distribution costs for firms, an effect which is just as plausibly modeled from a producer's standpoint. Hence, as attempts to disentangle which effect is greater -- habit persistence in consumer tastes or market-specific learning-by-doing -- is unlikely to be a useful line of enquiry.[18]

I posit that the productivity parameters are a function of the past selling history: $\alpha_{ijt}^{-\omega} \equiv q_{ij(t-1)}^{\rho}$ (where ρ is less than unity). Plugging this in above, iterating, and taking logs yields a dynamic gravity equation similar to equation (1.5).

(2.4)
$$\ln(x_{ijt}x_{jit}) = \ln(x_{iit}x_{jjt}) - \underbrace{2(1+\omega)\ln\tau_{jit}}_{CurrentTradeCosts} - \underbrace{\sum_{k=1}^{\infty}\rho^k\omega\ln\tau_{ji(t-k)}}_{PastTradeCosts}$$

This equation implies that any deviation from the frictionless situation where countries produce and consume a fixed amount of each other's products must be a result of either trade costs today, or past trade costs. An extension of this model in which firms know what future costs will look like, and realize that today's sales will affect their future productivity, would carry the additional implication that future trade costs and future market size also matter. Hence, if firms know today that China is likely to be a big, rich market in the future, they might devote resources to entering the Chinese market and establishing a brand name, even though it would not be maximizing revenues at present.

Equation (2.4) is the logical gravity formulation of market-specific learning-by-doing in production, and something similar is implied by the Melitz (2003) model in addition to a host of other models which include market-specific fixed costs of entry, including the Krugman (1980)

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[18] For example, Toyota has a strong brand name in the United States, much stronger than, say, Shanghai Automotive. We could model this from the consumer side, as American consumers would no doubt prefer to buy a car from Toyota than from Shanghai Automotive, all else equal, or we could model this from the producer side, treating the strength of Toyota's brand name in the US as a productive asset. Either way we choose to model it, we would be talking about exactly the same phenomenon.

"home market effect" model, as well as "dynamic returns" and "learning-by-doing" models such as Krugman (1987) and Krugman and Baldwin (1989).

III. Empirics

The point of building a general model featuring habit persistence and learning-by-doing is to show that trade patterns are not only determined by current trade costs, but also by "culture" – which in this context means both relative tastes and the accumulated store of market-specific learning-by-doing.

The hypothesis is that trade depends on three factors: the domestic trade shares in each country, current trade costs, and past trade costs. Most of the variables used to proxy current trade costs -- particularly the geographic variables -- also happen to proxy past trade costs. The heart of the evidence for the model was also the motivation, for this model explains why past colonial status and other typical gravity variables seem to matter so much for trade (past colonial status implies lower historical trade costs), why the gravity equation explains trade in services as well as in goods (the geographic variables proxy culture in addition to shipping costs), and it can explain why one-time changes in trade costs take time to reach maximal impact. The model also provides another rationale for the existence of a "home market effect", as in Krugman (1980), Feenstra *et. al.* (1998) and Hanson and Xiang (2004), and is consistent with the findings of Bergin and Lin (2008), that the gravity variables work predominantly through the extensive margin of trade.

The theory is also supported by the array of evidence offered in Eichengreen and Irwin (1998), and by the aforementioned recent micro studies which show that food consumption is a function of past relative prices -- Logan and Rhode (2009) and Atkin (2009). And the fact that many firms *do* give away new products also lends support to the habit persistence thesis.[19] The

[19] There is also ample evidence from other disciplines, such as political science, where it has been shown with randomized trials that voting may be habit forming (Gerber, Green, and Shachar, 2003). There also seems to be habit persistence in party identification, with Presidential elections determining party identification for the youth in each generation, with persistence lasting decades. Those who came of age during the Great Depression and the Kennedy or Clinton years tend to be Democrats, those during the Eisenhower or Reagan years are still more likely identify as Republicans: http://www.fivethirtyeight.com/2009/05/bush-may-haunt-republicans-for.html.

trade behavior of countries after terms-of-trade shocks, in which the Marshall-Lerner condition tends to be satisfied in the long run but not the short (see Magee, 1973, on the J-curve), also support the theory.[20]

On the producer side, a fascinating recent empirical micro study on by Hirakawa, Muendler, and Rauch (2009) provides evidence for market-specific learning-by-doing in Brazil, and the aforementioned video on the growth of Wal-mart is a reminder that there must be clear market-specific fixed costs of entry. Two recent studies illustrate the intuitive concept that one-time changes in trade costs can have persistent effects. Feyrer (2009) documents that for country pairs affected by the closing of the Suez canal, the maximal impact was reached *seven years* after the closing, after which time it was then re-opened. Nine years after the reopening, trade was still increasing.[21] Berger and Nitsch (2008) find strong evidence that the result of European integration and the adoption of the Euro was a long-term, gradual increase in trade intensity. And Romalis (2004) similarly documents for NAFTA that even for commodities, trade liberalization takes years to reach its full effect. The rest of this section further strengthens the evidence.

III.A. Evidence from Warfare-Induced Trade Shocks

One classic example from economic history is the US Civil War, when Egypt, Brazil and India appropriated the British cotton market (Ellison 1968).[22] Even ten years into the post-war Reconstruction, cotton production in these three countries was still thrice the pre-Civil War level, as these countries had devoted more resources to cotton production, developed higher-yielding varieties and established relationships and distribution networks facilitating exports to Britain.

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[20] There is, of course, a vast literature on the J-curve, with Backus, Kehoe, and Kydland (1994) providing support and with Bahmani-Oskooee (2004) supplying a nice overview. Yet, even if not all research suggests that the Marshall Lerner condition -- that the sum of the export and import elasticity must be greater than one for a devaluation to improve the trade balance -- is satisfied in the long term but not the short, then most research at least appears to support that the Marshall-Lerner conditions are more satisfied in the long-term than the short. It should be noted that J-curve research is made especially difficult by the problem of endogeneity, as countries do not devalue their currencies randomly.

[21] Feyrer authored a Voxeu column on this topic in 2009: http://www.voxeu.org/index.php?q=node/4428.

[22] Cited in Wright (1974) and p. 381 of Atack and Passell (1994). It should be noted that famines in India and booming American production restored US market share temporarily in the late 1870s.

A second example is the history of US versus UK exports to Latin America before and after WWI, as analyzed by Taylor and Glick (2005) and Eichengreen and Irwin (1998). Up until the war restricted financial flows and trade, London dominated New York as a financial center and British exporters of manufactures dominated their American counterparts in world markets. With British commerce halted during the war, New York took over London's role as *the* place to float debentures while American manufacturers appropriated the Latin American market. Total US manufacturing exports increased fivefold during the war.[23] Tafunell (2009) documents that American supremacy in machinery exports to Latin American was never again challenged, as her market share of machinery exports to Latin America were 28.6 percentage points higher in 1925 than it had been in 1913, while the market shares for Great Britain and Germany declined by 39 and 12 percentage points.[24] During the war American manufacturers added capacity, set up supply chains and distribution networks, and familiarized Latin American customers with their products, so that even after the war, British exporters found it difficult to dislodge the Americans, and the UK never again regained its place as the leading exporter to the Americas.[25] Cochrane (2009) documents much the same story in the decline of London and the concomitant rise of New York as a financial center after 1913.[26]

In the graph below on the left, one can see that the UK's total exports to Mexico, Uruguay, Argentina and Brazil were about 30% larger than the US's; after the war, the roles were reversed.[27] What has received less attention is that the very same pattern holds in Asia, and even

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[23] This particular statistic comes from Day (1925), p. 373.

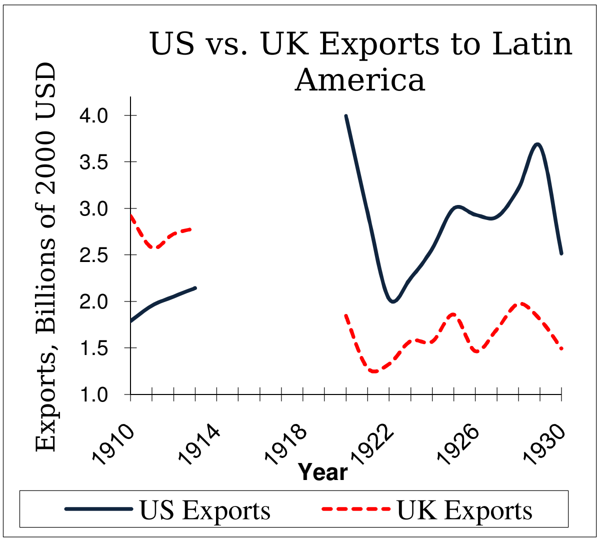
[24] Thus American market share roughly doubled. Statistics from p. 932 of Tafunell (2009).

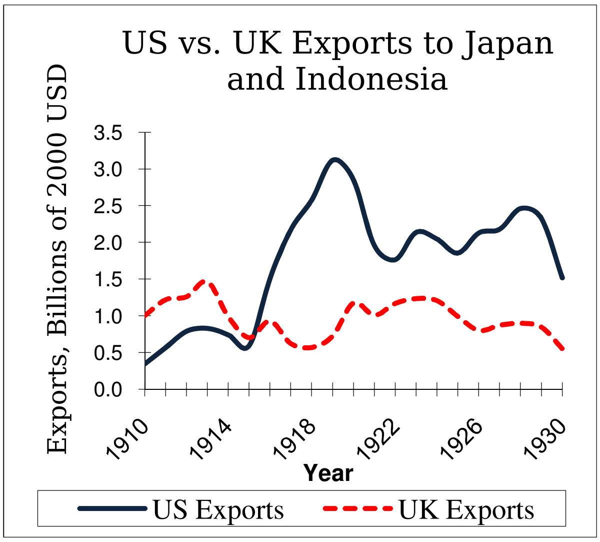
[25] Indeed, thoughts of a war erupting over trade issues were thought to be enough of a possibility that both the US and the UK developed war plans in this period. The Washington Post.

[26] This might be somewhat of an atypical example, as New York likely would have overtaken London eventually as the center of the financial world, but WWI just sped up the process. The same could be said for the US vs. the UK as exporters to Asia and Latin America as well, that WWI just sped up what might have happened eventually anyway, but it is impossible to know the counterfactual.

[27] The same trend holds for each of these countries individually, which can be seen in the Appendix below in the case of Brazil, comparing US vs. UK vs. French exports, in which it can be seen that British exports to Brazil were nearly double the US's before the war, but roughly identical or less after the war, and that French exports were less after the war than before.

with British trade with its own colonial possessions. In the graph on the right, of US vs. UK exports to Japan and Indonesia, it can be seen that before 1914, British exports were twice American exports, but after the war, the roles were reversed.[28]





Another interesting test related to World War I is to ascertain what became of the US-bound exports of countries in several categories -- those countries which fought in the war, such as the UK and Italy, those countries which were neutral, but which had their trade impugned by German U-boats, such as Norway, and finally, those countries whose US exports were largely unaffected, such as Japan. The results are exactly as theory would predict. Japan began the period exporting the least to the US as a percentage of GDP, but with US-European trade severely cut off, especially after 1918, Japanese exports became increasingly important, so that after the war, Japanese exports as a percentage of its own GDP were substantially higher than they had been previously. Neither UK nor Italian exports (as a share of GDP) recovered to pre-war levels. While Norwegian exports did return to their pre-war level as a percentage of Norwegian GDP, this can hardly be considered an impressive feat given that US GDP had increased by about 70% by the end of the 1920s from the prewar period.

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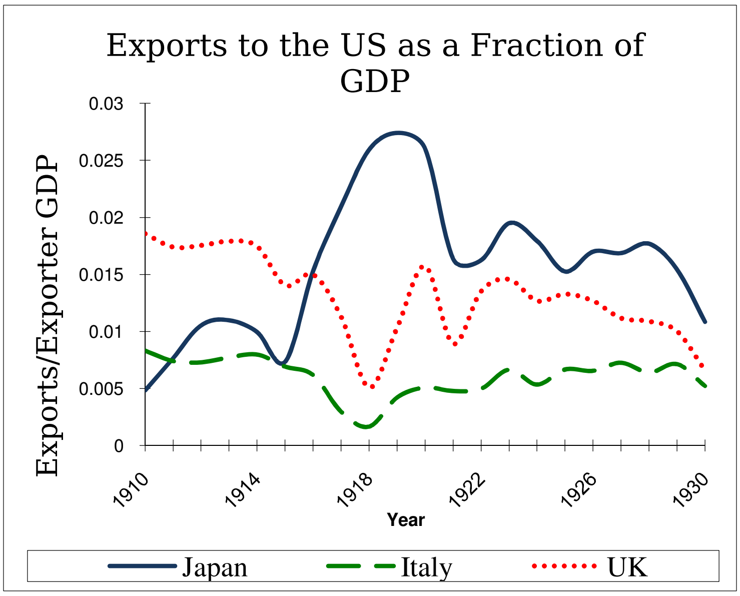
[28] The same trends hold for exports as a share of GDP, as before the war, the UK exported more than three times as much to Latin America, but after the war the UK exported less than twice as much to Latin America as a share of GDP. This graph can be found in the unpublished portion of the Appendix.



Confirming the intuition gained in the graphs above, and the results in Glick and Taylor (2005), below I report the results from a gravity regression with both year and country-pair fixed effects, using dummies for each category of country-pair experiences during WWI. For example, in the first column are the dummies for non-European country pairs, such as Japan and the United States.[29] In 1920, the coefficient of 1.937 tells us that trade was nearly six times what trade was with the baseline group, in this case non-European trade with European non-combatant countries, compared to what it had been in the pre-war period. (Indeed, in the graph above, it can be seen that Japanese-American trade was about five times its pre-war level, even as a fraction of Japanese GDP, while Italian exports to the US fell). This coefficient then declined in 1921 and 1922, before leveling out. Since trade with many European countries declined dramatically during WWI, trade among non-European countries swelled, and after the war ended, this increase in trade persisted. Being true to the philosophy, I have included separate group dummies for each year, so that the sample size is not artificially inflated. The second column contains dummies for European countries which fought in WWI, such as France and Germany. Not

[29] The non-European group includes 13 countries, including Japan, Sri Lanka, Australia, New Zealand, the United States, Canada, Mexico, Uruguay, the Philippines, Argentina, Brazil, India, and Indonesia. The European WWI combatant group includes the UK, Belgium, Germany, France, Austria-Hungary, and Italy. Denmark, Spain, Portugal, Norway, Sweden and the Netherlands were classified as neutral.

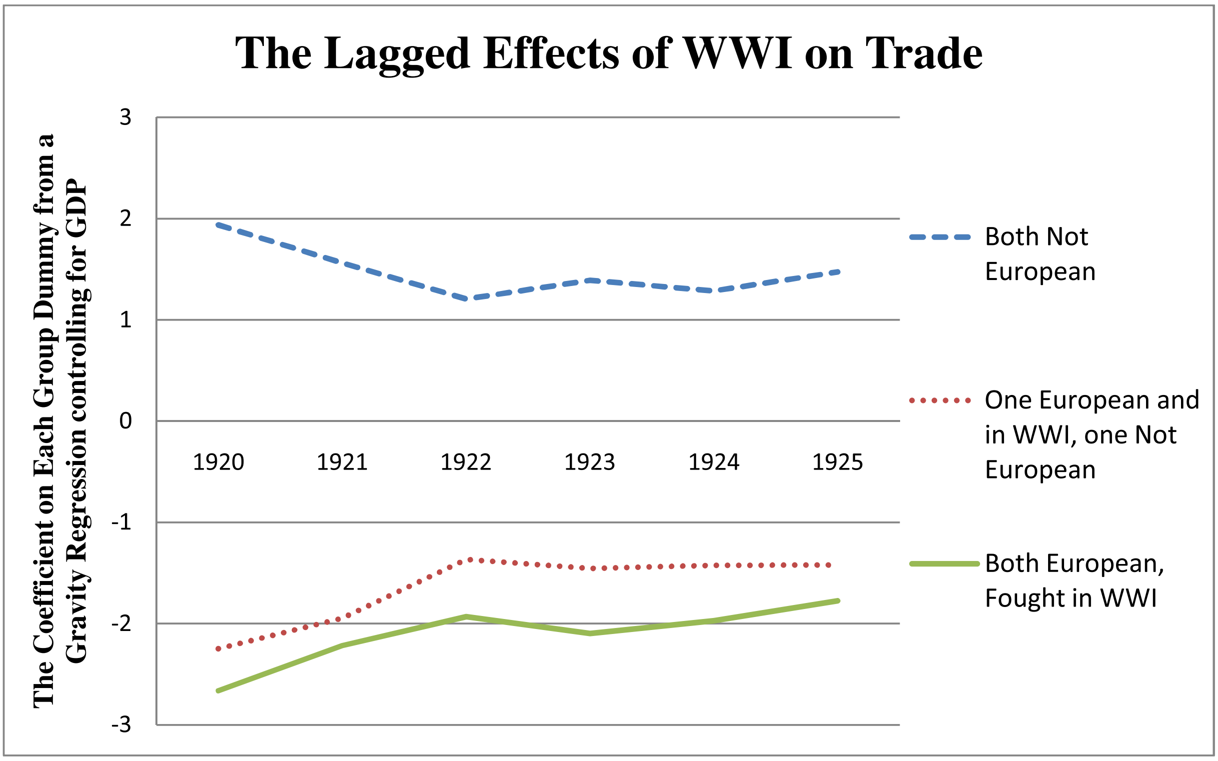
surprisingly, trade in the 1920s was dramatically lower for countries in this category, although it did recover somewhat by 1925. Trade between European countries, such as France, and non-European countries, such as India, was also dramatically hurt by the war but had recovered somewhat by 1925.

Table 3: The Effects of WWI on Trade

Dependent Variable Log Bilateral Trade; Log Domestic GDP & Year Dummies Suppressed

Dummies for Country Pairs with:	Both Not European	Both European, Fought in WWI	One European and in WWI, one Not European
1920	1.937*	-2.664*	-2.247*
	(0.25)	(0.33)	(0.19)
1921	1.564*	-2.218*	-1.948*
	(0.25)	(0.33)	(0.19)
1922	1.206*	-1.932*	-1.365*
	(0.25)	(0.33)	(0.19)
1923	1.392*	-2.098*	-1.456*
	(0.25)	(0.33)	(0.19)
1924	1.285*	-1.973*	-1.425*
	(0.25)	(0.33)	(0.19)
1925	1.475*	-1.774*	-1.423*
	(0.25)	(0.33)	(0.19)

26-Country Sample from Meissner, Jacks, Novy (2008); Includes Country-Pair and Year Fixed Effects. Domestic GDP term suppressed. The sample includes 3789 observations and 149 country-pairs.



III.B. Estimating a "Dynamic" Gravity Equation with Two-Way Regional Clusters

If, instead of iterating *ad-infinum* in equation (3.4), we leave lagged trade in the equation (and simplify the parameters), and add an error term, we would get:

$$\ln(x_{ijt}x_{jit}) = \ln(x_{iit}x_{jjt}) + a\ln\tau_{jit} + \sum_{k=1}^{s}\rho^{k} b\ln\tau_{ji(t-k)} + \rho^{s}\ln\frac{x_{ij(t-s)}x_{ji(t-s)}}{x_{ii(t-s)}x_{jj(t-s)}} + \varepsilon_{ijt} \qquad (3.1)$$

There are two key implications of the dynamic gravity theory for estimation. The first is that the errors from one year to the next will be very correlated, and that this will be true even if the last term in equation (3.1) is included or not, as the middle term, "past trade costs", evolves slowly and is unknown, although it is straightforward to proxy. Hence, I begin estimating gravity using a cross-section instead of as a panel to avoid the problem of correlated standard errors from one year to the next completely. The second, and perhaps more subtle point, is that if we know the trade flows between Sweden and Kenya, then the trade flows between Sweden and Tanzania will provide us somewhat less than completely new information (and the same may be true of trade flows between Norway and Tanzania). This is because the "past trade costs" between Sweden-Kenya and Sweden-Tanzanian trade are likely to be similar, but not known exactly, and hence will show up in the errors, which will then be correlated. For example, the disease environment in Africa made trade with Europe more costly historically, and since the disease environments in Kenya and Tanzania were similar, the errors will then be correlated. Another example is that the EU eliminated tariffs on most goods coming from Sub-Saharan African in 2001, but unless perfect tariff data is included as a regressor, this means that the errors will be potentially be correlated for all Europe-Africa country pairs.

To solve this issue, I have experimented with various methods of clustering, and have invented what I term "Regional Two-Way Clusters," adapted from Cameron *et. al*. (2006), which is a procedure for clustering along multiple dimensions. The Regional Two-Way Cluster defines a cluster in the first direction as the first country in the dyadic pair's trade with 11 different regions of the world, and the second clustering dimension does the same for the second country in each dyadic pair. For example, the Sweden-Tanzania and Sweden-Kenya observations will both be in one cluster, and the Sweden-Denmark and Sweden-Norway observations are in another. This estimator allows the errors within any cluster to be positively correlated, and only requires the much weaker, and much more general assumption that the errors between different clusters are independent -- *i.e.*, the errors for the Sweden-Africa cluster need to be independent of the Sweden-Europe cluster (in fact, the results presented in the appendix imply that there is negative correlation, which suggests that Regional Two-Way Clusters should be used). In generic two-way clusters, as used for gravity estimation in Cameron and Golotvina (2005), Swedish trade with all other countries when Sweden is the first country in the pairing would make only one cluster instead of 11. The problem with this is that if Sweden trades more with Europe, this will likely mean it might trade less with East Asia, in which case the standard errors will be downward biased.

The "Regional Two-Way Cluster" variance estimator proposed has the form (from Cameron et. al., 2006):

(3.2) $$\hat{V}[\hat{\beta}] = (X'X)^{-1}X'(\hat{u}\hat{u}'.*S^{I_r})X'(X'X)^{-1} + (X'X)^{-1}X'(\hat{u}\hat{u}'.*S^{J_r})X'(X'X)^{-1} - (X'X)^{-1}X'(\hat{u}\hat{u}'.*S^{I_r \cap J_r})X'(X'X)^{-1}$$

Where the term S^{I_r} is an $N \times N$ indicator matrix with ij^{th} entry equal to one if the i^{th} and j^{th} observation belong to the same regional cluster $i_r \in \{1,2,\ldots,N*C\}$, and $S^{I_r \cap J_r}$ has ij^{th} entry equal to one only if the i^{th} and j^{th} observation belong to the same regional cluster $i_r \in \{1,2,\ldots,N*C\}$ and the same regional cluster $j_r \in \{1,2,\ldots,N*C\}$, where N is the number of countries, and C is the number of regions.[30] The u's are $N \times 1$ vectors stacked by cluster, with $u = y - X\beta$.

For the results listed below in Table 4, I have used 11 regional clusters, while in the Appendix I have also reported what the standard errors would be for using 8 and 13 regional clusters, both one-way and two-way, and in the Unpublished Appendix I have also reported results for 20 regional clusters. (Given a 72 country sample, there would be little sense in doing more clusters than that.) I have reported results using 11 two-way regional clusters because the 11 region cluster had the highest standard errors, and hence was the most conservative estimation method -- so conservative, in fact, that it killed the significance of several normal gravity variables, such as the log of area and an Africa dummy.

The "One-Way Regional Clusters", reported in the appendix is just a simple cluster in which each regional pairing, *i.e.*, North American trade with Europe, is one cluster. With 11 Regions, this makes 72 clusters. This is the clustering you would want to use if you thought that the correlation in errors between, say, the Sweden-Tanzania and Norway-Kenya pairs is the most important thing to control for. Yet, in general, the standard errors on one-way clustering are not that different from two-way, but since they are frequently smaller, I report the two-way SEs for the main result in the interest of being conservative.[31]

Even under this conservative methodology, the paramount importance of both geography and history for trade is readily apparent in Table 4 below. In the first column, it can be seen that,

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[30] While the total number of potential clusters is N*C, the total number of actual clusters will be less than this, however, as the data was "split" in half so that if there is a US-Tanzania observation, there is no Tanzania-US data point. Also, note that the selector matrix $S^{I_r \cap J_r}$ will have all zeros except for a single "one" in the cross-section case.

[31] Heartbreakingly, clustering killed the statistical significance of the "cricket dummy" which I had planned on using as a cultural proxy, as countries which the UK had colonized for longer periods of time tend to play cricket and still trade more with each other than they do with other UK colonies, only the difference is not statistically significant.

even in 2000, country-pairs which had ever had a colonial relationship traded about *five* times as much as those which did not. Secondly, various geographic variables are highly significant, even when reporting "Two-Way Regional Cluster" errors which tend to be 2-5 times larger than normal White Robust standard errors. Included are geographic variables such as the log of mean elevation, the percentage of each country within 100 kilometers of coasts, and population-weighted distance, which I have found works better than either distance between capitals or distance between geographic centers.[32] Thirdly, the "Linder effect" is large and significant -- countries which have similar real GDP per capita trade more, as do countries which have higher GDP per capita, perhaps because they have better transport infrastructure and institutions which support or promote international trade. The relevance of the Linder term is also support for the model, as Linder's (1961) theory was dynamic in nature -- countries with similar incomes demand similar goods, and thus *learn to produce* similar goods. Indeed, if we were to include the Linder term, the log of absolute difference in per capita GDP lagged 40 years instead of concurrently, it would also be highly significant and have a similar magnitude.

The regressions in Table 4 also include a variable, log migration, from Putterman and Weil's (2008) historical migration dataset, which details the historic origins, circa 1500, of populations in 2000. For example, in 2000, 18.28% of Americans' ancestors lived in the UK in 1500. I have then inserted the log of the sum of the two way bilateral migration flows into the gravity equation, adding one to avoid the log of zero (and have tried other specifications as well), finding that increased migration between two countries is correlated with higher trade flows, although the effect is only significant at 90% (the regional geographic clusters increased the standard errors vs. OLS significantly). When the British migrated to Australia, they brought their tastes with them and continued to trade heavily with Britain despite the dramatically increased distance, in part because Britain had free trade throughout the empire. The correlation between immigration and trade has also been found in numerous less-comprehensive studies of immigrant networks including Rauch and Trindade (2002) for Chinese immigrant networks, Mundra (2005 and 2009), Gould (1994) for immigrant groups in the US, Dunlevy and Hutchinson (1999) for

[32] In the unpublished version of the appendix, I compare four different measures of "distance" for gravity estimation, and find that simple population-weighted distance works the best compared with geographic center, distance between capitals, or CES population-weighted distance.

historical US data, Herander and Saavedra (2005) for US states, White (2007) for the Netherlands, Head and Reis (1998) for Canada and Peri and Requena (2010) for Spain. To my knowledge this study uses more data than any previous work.

The really interesting finding in Table 4, however, is that when we control for trade lagged 40 years, which itself is large and significant, the impact of variables such as former colonial status, the island dummy, the log of population-weighted distance, the bilateral sum of the percentage of each country's population within 100km of a sea-navigable coast, log mean elevation, and the past migration flows on trade are all substantially reduced, indicating that they affect current trade via past trade. Distance matters for trade through its affect on both current and past trade, as controlling for trade in 1965 truncates the impact by a third. The same is true for log migration, which gets cut in half and becomes no longer significant. In all, this regression is direct evidence for the version of dynamic gravity offered versus alternative explanations, such as a static gravity equation Heckscher-Ohlin theory of factor endowments explaining the remarkable persistence of trade.

Colonization only matters for trade today to the extent that colonization affected trade flows in 1965. This is how "dynamic gravity" is a partial answer to the "Distance Puzzle," as for variables such as past migration and colonization, the "past relative trade cost" term are actually still increasing for many former colonial pairs. How could this be? When British people first settled in countries such as Australia and New Zealand, the historical trade costs and cultural differences between these Australasian countries and the homeland was nil (up until the migration), so contemporaneous trade costs were the only thing that would have dampened trade. Over time, those trade costs would begin to affect tastes and production (*i.e.*, they become "past trade costs"), remote Australasian culture (including language) started to diverge from the mother country, and the old trade networks weakened, even as actual trade costs were falling.

In the second column of Table 4 below, the regression model in equation (3.1) is implemented with Regional Two-Way clustered standard errors reported. Hence, if the theory is correct, we should also see that lagged domestic GDP is *negatively* correlated with current trade flows. Interestingly, however, the coefficient on lagged domestic GDP in this specification is not significant, despite the fact that our theory predicted that lagged trade and lagged GDP should enter symmetrically. If we drop the Linder term -- the log of the absolute difference in real GDP per capita -- and the real GDP per capita terms, then lagged GDP will be significant and negative, but the magnitude will still only be significantly less than the coefficient of log trade (see appendix for this version and other robustness checks). Since there is significant correlation between a country's GDP in 2005 and 1965, this implies that, other things equal, trade will be higher today for country pairs which had larger GDPs in 1965, traded more in 1965, and had smaller differences in per capita GDP in 1965.

Table 4: Dynamic Gravity

Two-Way Geographic Clusters, Dependent Variable: Log Bilateral Trade, 2005		
Log Bilateral Trade, 1965		0.608*
		(0.11)
Log Domestic GDP, 2005	1.303*	0.976*
	(0.13)	(0.22)
Log Domestic GDP, 1965		-0.038
		(0.09)
Linder	-0.292**	-0.221+
	(0.14)	(0.12)
Log per capita Real GDP	0.479*	0.300**
	(0.16)	(0.12)
Log Weighted Distance	-2.279*	-1.643*
	(0.21)	(0.20)
Common Language Dummy	0.435**	0.463*
	(0.18)	(0.13)
Landlocked Dummy	-0.914*	-0.847*
	(0.25)	(0.18)
Island Dummy	0.750**	0.339
	(0.34)	(0.35)
Sum of % of Population 100 km from Coast	-1.149*	-0.583+
	(0.377)	(0.34)
Log Mean Elevation	-0.508*	-0.268+
	(0.13)	(0.14)
Common Colonizer Dummy	0.942**	0.478
	(0.44)	(0.33)
Colony Dummy	1.372*	-0.213

	(0.42)	(0.44)
Log Migration	0.340**	0.199+
	(0.16)	(0.12)
Observations	2301	2301

Two-Way Geographic Cluster-Robust Standard errors in parentheses. Countries are the unit of cluster crossed with regions, so the US has separate clusters with 11 different regions of the world. Trade data come from the IMF's IFS, GDP from the WB, Log Migration from Putterman, the geography variables come from CEPII and the colonial variables have been adapted from Rose. The 72 country sample is very full, as less than 10% of the data is missing. Dropping some of the poorer countries in order to balance the data set perfectly only reduces the significance of the Linder term (see the Unpublished Appendix for this version and for the summary statistics). Seven percent of the trade observations are zeros.[33] +significant at 10%; ** significant at 5%; * significant at 1%.

III.C: Long-Run Historical Evidence using Dynamic Gravity

In the historical data in Regression Table 5 below, where the dependent variable is log bilateral trade in 2000, the coefficients on the geographic variables slightly shrink and lose significance once *log bilateral trade in 1870* is included as a control.[34] As more recent years of trade are included as regressors, the coefficient on distance becomes insignificant at the 99%

[33] I have added one to avoid taking the log of zero. Given that a relatively small percentage of the trade observations are zeros, there is scant benefit to doing Tobit in levels, while using a Poisson Psuedo-Maximum Liklihood estimator to estimate gravity equations has been shown to yield biased estimates. These other various models, including simply limiting the sample to positive trade values and the Heckman selection model suggested in gravity estimation by de Groot and Linders (2006) -- who argue that gravity should not be done in Tobit -- are dealt with in the Unpublished Appendix. In the debate about what to do with the zeros it is often lost that with perfect trade data, there would unlikely be any true zeros. This is because, even though there is zero reported trade between, say Vietnam and Bolivia, both nations trade a lot with the United States and with Peru, so it is likely that a small fraction of what Vietnam exports to either the US or Peru ends up in Bolivia. In this case, adding one to zero trade values would be reducing bias due to imperfect data instead of introducing it.

[34] And none of the coefficients of interest are altered much when lagged log domestic GDP is added, to save space this version is included in the Unpublished Appendix. Although there is missing data, with the larger post-war data, there was no benefit to throwing out lots of useful and interesting data in the interest of perfectly balancing the sample, so this is at most a very minor issue. Also, given the geographic diversity of the smaller sample, there is little reason to cluster. Interestingly, doing a two-way cluster on column II actually reduces the standard errors, as the within cluster correlation is actually negative.

confidence level. I would speculate that the reason that the geographic coefficients' size and significance do not drop even more quickly due to the inclusion of more recent lagged values of trade is regional trade liberalization, and perhaps that differentiated-product trade now accounts for a larger proportion of total long-distance trade and is more affected by tastes and culture, counteracting the effect of declining transportation costs. Increased trade in 1870 leads to higher trade in 2000, even controlling for other standard gravity arguments. This implies that lagged trade costs -- history -- is itself a key determinant of trade today, and thus is a probable determinant of the wealth of nations.

Regression Table 5: Dependent Variable Log Trade, Year 2000

Regression:	I	II	III	IV	V
Log Domestic GDP 2000	1.329*	1.257*	1.128*	0.862*	0.392*
	(0.08)	(0.09)	(0.10)	(0.08)	(0.06)
Log Trade 1870		0.097**			
		(0.04)			
Log Trade 1913			0.160*		
			(0.04)		
Log Trade 1960				0.480*	
				(0.05)	
Log Trade 1980					0.782*
					(0.04)
Log Distance	-1.554*	-1.476*	-1.288*	-0.903*	-0.283**
	(0.23)	(0.24)	(0.23)	(0.19)	(0.13)
Border	1.600*	1.293**	1.315**	0.925**	0.384
	(0.57)	(0.59)	(0.56)	(0.46)	(0.30)
Island	0.589**	0.201	0.092	-0.39	-0.183
	(0.29)	(0.35)	(0.31)	(0.25)	(0.15)
Europe	0.902	0.952	0.95	0.939**	0.454
	(0.51)	(0.51)	(0.49)	(0.40)	(0.26)
Observations	149	130	147	149	149
R-squared	0.747	0.75	0.753	0.841	0.935

Standard errors in parentheses; 26 country sample from Jacks, Meissner, Novy (2008)
+ significant at 10%; ** significant at 5%; * significant at 1%

IV. Conclusion and Further Research

Does taking a dynamic specification versus a static specification matter for gravity estimation? In a companion paper, I apply the dynamic gravity specification to the estimate of currency unions on trade and show that, in practice, the dynamic specification can yield dramatically different results.

In this paper, there was also no space to work out the political economy ramifications. One mystery of the political economy of trade is that even though the advantages of trading are clear, opposition to trade has a long history, and is still widespread. While the Stolper-Samuelson Theorem tells us that factors used relatively less abundantly will lose from trade, in this model, since trade necessarily influences culture, a second group of people might also lose out from trade: xenophobic cultural conservatives. Indeed, the original rationale for trade protectionism (as well as its inward-looking foreign policy) in the United States appears to owe as much to nativism as it did to any broad factor, such as labor, losing out, or due to any well-thought-out, Hamiltonian industrial policy. It is also difficult to ignore the fact that the first era of globalization ended with two vigorous world wars centered around identity politics.

New Trade Theory and the New Economic Geography emphasize that real wages are a function of the size of market and of market access -- *e.g.*, Fujita, Krugman, and Venables (1999), Redding and Venables (2000), and Davis and Weinstein (1999, 2003) -- an insight which dates back at least as far as Harris (1954). An implication of this model is that having extensive *cultural* barriers to large markets depresses real wages.[35] Hence, this model implies that part of the reason that Africa is still poor today is that in the past, transport costs to the inland areas of the continent were exorbitantly high due to the disease environment and the lack of transport infrastructure or navigable rivers or inlets. The evidence in Table 5 above suggests that to the extent that these factors adversely affected African trade in 1870, they adversely affect trade today as well.

Although pure shipping costs are probably no longer a critical determinate of inter-regional wage differentials in the United States, the model predicts that real wages in the US

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[35] This is fairly intuitive from the form of the dynamic gravity equation, but a simple look at the unit cost function for the consumer model or the unit revenue function from the producer model shows this clearly -- these are in the Appendix.

north should still be higher than in the US south due to the effects of lagged values of transport costs on learning-by-doing. This model has the potential to explain why the key economic centers of the world are predominantly coastal and river regions (Sachs 1999). In the photograph of the Earth at night in the Unpublished Appendix, it is immediately clear that the areas of the world which are lit up, even today, are those areas which appear to have low transport costs to large markets -- river and coastal regions being especially bright. History, via culture, is very much a critical determinant of trade. And the reverse is also true.

Appendix

I. Derivation of Dynamic Gravity

To derive the gravity equation in Section II, first start with equation (1.3) $x_{ij} = \frac{Y_j \left(p_i \tau_{ij} \beta_{ij}\right)^{1-\sigma}}{P_j}$, and multiply by the same equation for exports from j to i: $x_{ij} x_{ji} = Y_j Y_i \left(\tau_{ij} \beta_{ij} \tau_{ji} \beta_{ji}\right)^{1-\sigma} \frac{\left(p_j p_i\right)^{1-\sigma}}{P_i P_j}$ (A.1), where I have simply re-arranged terms. Now, following Novy (2008), equation (1.3) must hold for all i and j, so that $x_{ii} = \frac{Y_i \left(p_i \tau_{ii} \beta_{ii}\right)^{1-\sigma}}{P_i}$ (A.2), and hence, that $\frac{P_i}{p_i^{1-\sigma}} = \frac{Y_i \left(\tau_{ii} \beta_{ii}\right)^{1-\sigma}}{x_{ii}}$ (A.3), and analogously for country j. Substitute these equations into (A.1), and arrive at: $x_{ij} x_{ji} = \left(\frac{\beta_{ij} \beta_{ji}}{\beta_{ii} \beta_{jj}}\right)^{1-\sigma} \left(\tau_{ji}\right)^{2(1-\sigma)} x_{ii} x_{jj}$ (A.4), after normalizing within-country trade costs to one and assuming trade costs are symmetric -- an assumption made merely to simplify the expression, and which could easily be relaxed. From (A.4), it is straightforward to make the substitution $\beta_{ijt}^{1-\sigma} \equiv s_{ij(t-1)}^{\rho}$ repeatedly, and take the log to arrive at (1.5). In section II, equations (2.2) and (2.3) are derived in precisely the same way.

The unit cost function for the consumer model is:

(A.5) $$c(p_i, \tau_{ij}, \beta_{ij}) = \left(\sum_i (\tau_{ij} p_i \beta_{ij})^{(1-\sigma)} \right)^{1/(1-\sigma)}$$

The unit cost function indicates how cheaply one can derive one unit of utility. It can be easily seen that the cost of one unit of utility increases with trade costs, and also increases with cultural diversity. The interesting implication is that it is bad, in this model, to be different. The betas depend upon past trade costs, so that past trade costs make it more expensive to consume a unit of utility today. The unit revenue function from the producer model carries the same implication.

II. Data Appendix

To ensure that this remarkable stability in trade patterns is not merely a product of having a narrow data set, I have repeated the exercise below in Table II using a much larger postwar sample from the IMF's Direction of Trade Statistics (DOTS). Trade in the larger IMF sample from 1955 and 1969 to 2000 is even more persistent with the larger IMF data set. To put the relative sizes of the R-squared from regressing the log of the product of lagged bilateral trade on log bilateral trade in 2000 in perspective, comparing Column V to Column I of Table II, *trade in 1955 is a better predictor of trade for year 2000 than GDP in 2000*.

Appendix Table 1: Dependent Variable, Log Trade 2000

	I	II	III	IV		V
Regressor: Log Trade in	1955	1969	1980	1995	vs.	Log GDP 2000
Coefficient	1.292*	1.221*	0.947*	0.992*		0.837*
(Std. Error)	(0.06)	(0.06)	(0.06)	(0.06)		(0.06)
Observations	2852	6415	7478	9425		5340
R-squared	**0.597**	**0.692**	**0.775**	**0.93**		**0.499**
Corr. with trade in 2000	0.76	0.84	0.88	0.97		0.58

* significant at 1%; Trade data from IMF DOTS, GDP from the World Bank.

In Appendix Table 2, I have included the correlation coefficients for the log product of bilateral trade over GDP for every decade going back to 1870. Interestingly, trade flows today are much more stable than they have ever been.

Appendix Table 2: Correlation Coefficient Matrix of the Log of Bilateral Trade over GDP

	2000	1995	1980	1969	1955	1928	1910	1890	1870
2000	1								
1995	.99	1							
1980	.95	.96	1						
1969	.88	.90	.96	1					
1955	.70	.72	.80	.87	1				
1928	.59	.60	.65	.70	.82	1			
1910	.53	.54	.58	.61	.72	.87	1		
1890	.54	.55	.61	.63	.69	.71	.85	1	
1870	.45	.45	.52	.56	.60	.59	.76	.82	1

Sample of 26 countries trade from Jacks, Meissner, Novy (2008); pre WWI gdp data are rough estimates from Maddison.

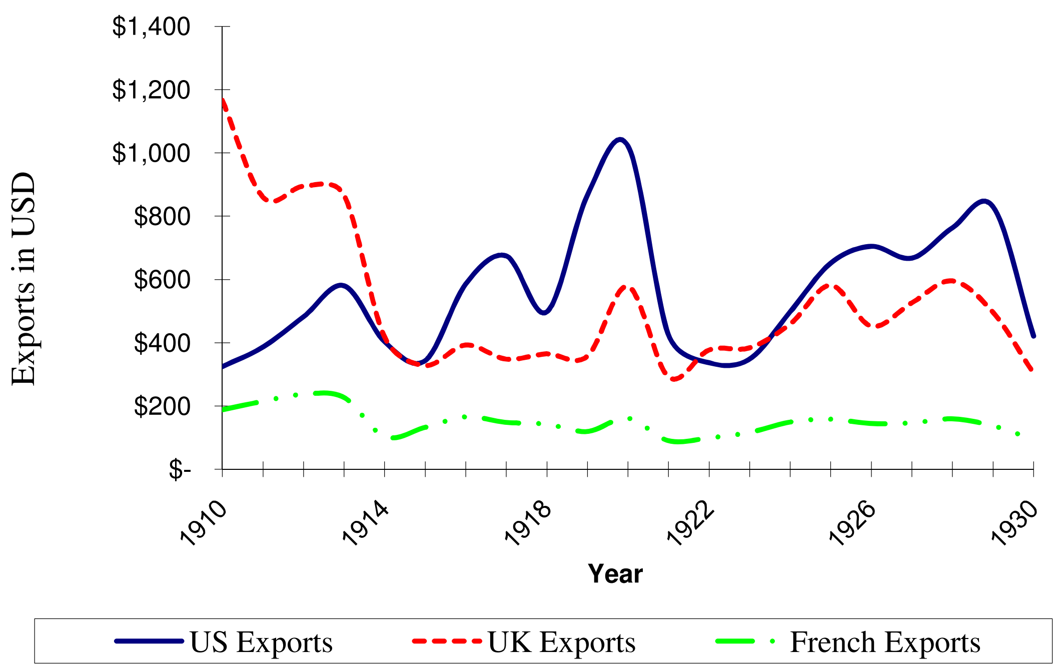
Appendix Table 3: Investigating Various Clustering Strategies

	Robust	FGLS	One-Way Clusters	Two-Way Clusters
Log of Bilateral Domestic GDP	1.303*			
	(0.027)	(0.025)		(0.10)
(8 Regional Clusters)			(0.071)	(0.096)
(11 Regional Clusters)			(0.068)	(0.127)
(13 Regional Clusters)			(0.060)	(0.109)
Linder: Log Difference	-0.292*			
in GDP per capita	(0.038)	(0.038)		(0.09)
(8 Regional Clusters)			(0.103)	(0.096)
(11 Regional Clusters)			(0.102)	(0.138)
(13 Regional Clusters)			(0.094)	(0.138)
Common Language Dummy	0.435*			
	(0.122)	(0.121)		(0.27)
(8 Regional Clusters)			(0.218)	(0.213)

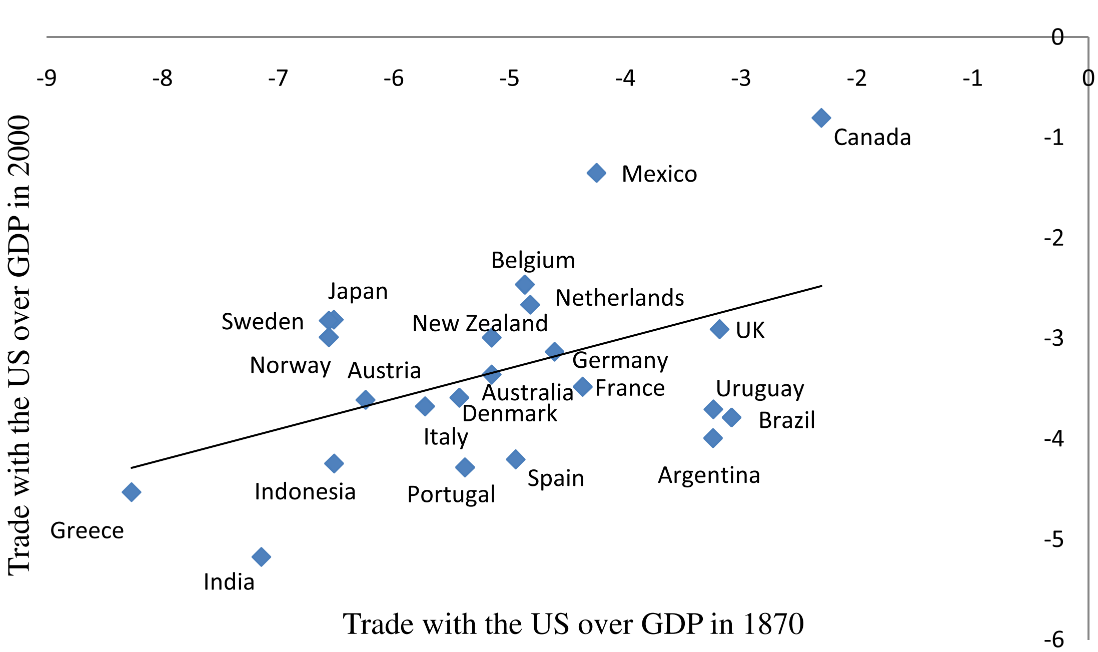
(11 Regional Clusters)			(0.238)	(0.182)
(13 Regional Clusters)			(0.238)	(0.190)
Colonial Dummy	1.372*			
	(0.331)	(0.343)		(0.34)
(8 Regional Clusters)			(0.342)	(0.322)
(11 Regional Clusters)			(0.309)	(0.418)
(13 Regional Clusters)			(0.316)	(0.436)
Log Migration	0.340*			
	(0.080)	(0.097)		(0.11)
(8 Regional Clusters)			(0.103)	(0.115)
(11 Regional Clusters)			(0.116)	(0.158)
(13 Regional Clusters)			(0.111)	(0.142)

Observations: 2301, R-squared = .811; This is the same regression as reported in Table 4, only with various SEs reported, and some results suppressed to save space (such as GDP per capita, the Island, Common Colonizer, and Landlocked Dummies). See Unpublished Appendix for more complete results. In the column "Two-Way Clusters" the first errors reported are just "normal" two-way clusters of the variety found in Cameron *et. al*., where one dimension of the cluster is each of the first country in each dyadic pair and all of its trading partners, while for the Regional clusters, the first country's trade with each of its trading partners is broken up into eight regional clusters -- *e.g.*, South America, Europe, North America. The "one-way" clusters create a single cluster for each possible trade combination among the regions of the world, for example, all North American trade with South America enters into a single cluster, and all South American trade with other South American countries are in a separate cluster. The Migration data comes from Putterman, the GDP data come from the World Bank, the trade data comes from the IMF, the colonial data from Rose, and the geographic data come from CEPII.

Appendix Figure 1: US vs. UK vs. French Exports to Brazil



Appendix Figure 2: The Correlation of Trade Patterns Across Centuries



REFERENCES:

Allen, Robert C. 2004. "Mr. Lockyer Meets the Index Number Problem: The Standard of Living in Canton and London in 1704." Working Paper.

Anderson, James E. 1979. "A Theoretical Foundation for the Gravity Equation." A*merican Economic Review*, 69: 106-16.

Anderson, James E., and Eric van Wincoop. 2003. "Gravity with Gravitas: A Solution to the Border Problem." *American Economic Review,* 93: 170-192.

Atack, Jeremy, and Peter Passell. 1994. *A New Economic View of American History: From Colonial Times to 1940*. W.W. Norton & Company, Inc.

Atkin, David. 2009. "Trade, Tastes, and Nutrition in India." Working Paper.

Backus, D. K., P.J. Kehoe, and F.E. Kydland. 1994. "Dynamics of the Trade Balance and the Terms of Trade: The J-Curve?" *American Economic Review,* 84: 84-103.

Bahmani-Oskooee, Mohsen, and Artatrana Ratha. 2004. "The J-Curve: A Literature Review." *Applied Economics,* 36(13): 1377-98.

Baldwin, Richard, and Paul Krugman. 1989. "Persistent Trade Effects of Large Exchange Rate Shocks." *The Quarterly Journal of Economics*, 104(4): 635-654.

Baier, Scott L., and Jeffrey H. Bergstrand. 2001. "The Growth of World Trade: Tariffs, Transport Costs, and Income Similarity." *Journal of International Economics,* 53: 1-27.

Berger, Helge, and Volker Nitsch. 2008. "Zooming Out: The Trade Effect of the Euro in Historical Perspective." Publications of Darmstadt Technical University, Institute of Economics (VWL) 34447.

Bergin, Paul, and Ching Yi Lin. 2008. "Exchange Rate Regimes and the Extensive Margin of Trade." NBER Working Paper 14126.

Bergstrand, Jeffrey H. 1985. "The Gravity Equation in International Trade: Some Microeconomic Foundations and Empirical Evidence." *The Review of Economics and Statistics*, 67(3): 474-481.

Bergstrand, Jeffrey H. 1989. "The Generalized Gravity Equation, Monopolistic Competition, and the Factor-Proportions Theory in International Trade," *The Review of Economics and Statistics,* 71(1): 143-153.

Berthelon, Matias, and Caroline Freund. 2008. "On the Conservation of Distance in International Trade." *Journal of International Economics,* 75: 310-320.

Bowles, Samuel. 1998. "Endogenous Preferences: The Cultural Consequences of Markets and other Economic Institutions." *Journal of Economic Literature*, 36: 75-111.

Cameron, A. Colin, Jonah B. Gelbach, and Douglas L. Miller. 2006. "Robust Inference with Multi-Way Clustering." NBER Technical Working Paper T0327.

Cameron, A. Colin, and Natalia Golotvina. 2005. "Estimation of Country-Pair Data Models Controlling for Clustered Errors: with International Trade Applications." Working Paper.

Carroll, Christopher D., Jody Overland, and David N. Weil. 2000. "Saving and Growth With Habit Formation." *The American Economic Review*, 90(3): 341-355.

Carrère, C., and Maurice Schiff. 2005. "On the Geography of Trade: Distance is Alive and Well." *Revue Economique*, 56 (6), 1249–1274.

Cho, Gue Dae, Min Kyoung Kim, and Won W. Koo. 2003. "Determining Bilateral Trade Patterns Using a Dynamic Gravity Equation." *Agribusiness and Applied Economics Report*, 525.

Combes, P.P., M. Lafourcade, and T. Mayer. 2005. "The Trade-Creating Effects of Business and Social Networks: Evidence from France." *Journal of International Economics,* 66(1): 1-29.

Cochrane, Sarah. 2009. "Assessing the Impact of WWI on the City of London." University of Oxford Working Paper Series 456.

Davis, D.R., and D.E. Weinstein. 1999. "Economic Geography and Regional Production Structure: An Empirical Investigation." *European Economic Review*, 43: 379-407.

Davis, D.R., and D.E. Weinstein. 2003. "Market Access, Economic Geography and Comparative Advantage: An Empirical Assessment." *Journal of International Economics,* 59: 1-24.

Day, Clive. 1925. *History of Commerce of the United States*. Longmans, Green and Co. New York.

de Groot, Henri L.F., and Gert-Jan M. Linders. 2006. "Estimation of the Gravity Equation in the Presence of Zero Flows." Tinbergen Institute Discussion Papers.

de Nardis, Sergio, Roberta De Santis, and Claudio Vicarelli. 2009. "The Euro's Effects on Trade in a Dynamic Setting." *The European Journal of Comparative Economics,* 5(1): 73-85.

Dunlevy, J. A., and W. K. Hutchinson. 1999. "The Impact of Immigration on American Import Trade in the Late Nineteenth and early Twentieth Century." *The Journal of Economic History,* 59.4: 1043-62.

Eaton, Jonathan, and Samuel Kortum. 2002. "Technology, Geography, and Trade." *Econometrica* 70(5): 1741-1779.

Eichengreen, Barry, and Douglas A. Irwin. 1998. "The Role of History in Bilateral Trade Flows." published in Jeffrey Frankel (ed.). *The Regionalization of the World Economy*. University of Chicago Press.

Ellison, Thomas. 1968. *The Cotton Trade of Great Britain*. New York: Augustus Kelley.

Feenstra, Robert C. 1998. "Integration of Trade and Disintegration of Production in the Global Economy." *Journal of Economic Perspectives*.

Feenstra, Robert C., **James A. Markusen and Andrew K. Rose.** 1998. "Understanding the Home Market Effect and the Gravity Equation: The Role of Differentiating Goods." NBER Working Paper 6804.

Feenstra, Robert C. 2004. Advanced International Trade: Theory and Evidence. Princeton University Press.

Feenstra, Robert C. 2007. Notes from Zeuthen Lectures.

Feenstra, Robert C., and Hiau Looi Kee. 2008. "Export Variety and Country Productivity: Estimating the Monopolistic Competition Model with Endogenous Productivity." *Journal of International Economics*, 74(2): 500-518.

Feenstra, Robert C. 2010. "Measuring the Gains From Trade Under Monopolistic Competition." *Canadian Journal of Economics*, 43(1): 1-28.

Feyrer, James. 2009. "Distance, Trade, and Income -- The 1967 to 1975 Closing of the Suez Canal as a Natural Experiment." NBER Working paper #15557.

Fujita, M., Paul Krugman, and Anthony Venables. 1999. *The Spatial Economy: Cities, Regions, and International Trade*. MIT Press, Cambridge.

Fratianni, Michele, and Heejoon Kang. "International Trade, OECD Membership, and Religion." *Open Economies Review,* 17: 493-508, 2006.

French, Gary L., Usman A. Qureshi, and Joel W. Sailors. 1980. "Linder's Trade Thesis: A Further Examination." *Southern Economic Journal*, 46(3): 933-936.

Gerber, Alan, Donald P. Green, and Ron Shachar. 2003. "Voting May Be Habit Forming: Evidence From a Randomized Field Experiment." *American Journal of Political Science*, 47(3): 540-550.

Glick, Reuven, and Alan Taylor. Forthcoming. "Collateral Damage: Trade Disruption and the Economic Impact of War." *Review of Economics and Statistics*.

Gould, David M. 1994. "Immigrant Ties to Home Country: Empirical Implications for U.S. Bilateral Trade Flows." *The Review of Economics and Statistics*, 76(2): 302-316.

Gruber, Jonathan. 2004. "A Present Value Test of Habits and the Current Account. " *Journal of Monetary Economics*, 51(7): 1495-1507.

Hanson, Gordon H., and Chong Xiang. 2004. "The Home-Market Effect and Bilateral Trade Patterns." *American Economic Review*, 94(4): 1108-29.

Harris, Chauncy D. 1954. "The Market as a Factor in the Localization of Industry in the United States." Annals of the Association of American Geographers, 44: 315-348.

Head, K., and J. Reis. 1998. "Immigration and Trade Creation: Econometric Evidence from Canada." *Canadian Journal of Economics* (31.1): 47-62.

Hirakawa, Oana T., Mark Muendler, and James E. Rauch. 2009. "Employee Spinoffs and Other Entrants: Stylized Facts from Brazil." NBER Working paper 15638.

Helpman, Elhanan, and Paul Krugman. 1985. *Market Structure and International Trade: Increasing Returns, Imperfect Competition, and the International Economy*. The Massachusetts Institute of Technology. 38-39.

Helpman, Elhanan, Marc Melitz and Stephen Yeaple. 2004. "Exports vs. FDI with Heterogeneous Firms." *American Economic Review*, 300-316.

Herander, Mark G., and Luz A. Saavedra. 2005. "Exports and the Structure of Immigrant-Based Networks: The Role of Geographical Proximity." *The Review of Economics and Statistics,* 87:2: 323-335.

Jacks, David S. 2009. "On the Death of Distance and Borders: Evidence From the Nineteenth Century." *Economics Letters,* 105: 230-233.

Jacks, David S., Christopher M. Meissner and Dennis Novy. 2008. "Trade Booms, Trade Busts, and Trade Costs." Working paper.

Kimura, Fukunari, and Lee, Hyun-Hoon. 2006. "The Gravity Equation in International Trade in Services." *Review of World Economics*. 142(1): 92-121.

Krugman, Paul. 1979. "Increasing Returns, Monopolistic Competition, and International Trade." *Journal of International Economics*, 9(4): 469-79.

Krugman, Paul. 1980. "Scale Economies, Product Differentiation, and the Pattern of Trade." *American Economic Review*, 70(5): 950-59.

Krugman, Paul. 1987. "The Narrow Moving Band, the Dutch Disease, and the Competitive Consequences of Mrs. Thatcher: Notes on Trade in the Presence of Dynamic Scale Economies." *Journal of Development Economics,* 27: 41-55.

Logan, Trevon D., and Paul W. Rhode. 2008. “Moveable Feasts: A New Approach to Endogenizing Tastes.” Working Paper.

Linder, Staffan Burenstam. 1961. *An Essay on Trade and Transformation.* Almqvist & Wiksell/Stockholm, John Wiley & Sons, New York.

Magee, S.P. 1973. “Currency Contracts, Pass Through and Devaluation.” Brookings Papers on Economic Activity, 1:303-25.

Markusen, James R. 1986. “Explaining the Volume of Trade: An Eclectic Approach.” *American Economic Review,* 76(5): 1002-1011.

Mundra, K. 2005. “Immigration and International trade: a Semiparametric Empirical Investigation.” *The Journal of International Trade and Economic Development,* 14(1): 65-91.

Mundra, K. 2009. “Immigrant-Based Networks and the U.S. Bilateral Trade: Role of Immigrant Occupation.” Working paper.

Mill, J.S. 1848. *Principles of Political Economy*. In: Robson, J.M. (Ed.), Collected Works of John Stuart Mill, vol. III. University of Toronto Press. 918– 919.

Naik, Narayan Y., and Michael J. Moore. 1996. “Habit Formation and Intertemporal Substitution in Individual Food Consumption.” *Review of Economics and Statistics*, 78(2): 321-328.

Naik, Prasad, Dan Weiss, and Ram Weiss. 2009. “The 'Big Pharma' Dilemma: Develop New Drugs or Promote Existing Ones?” Nature Reviews Drug Discovery.

Novy, Dennis. 2009. “Gravity Redux: Measuring International Trade Costs with Panel Data.” 19 June, 2009. Warwick Economic Research Papers 861.

Peri, Giovanni, and Francisco Requena. 2010. “The Trade Creation Effect of Immigrants: Testing the Theory on the Remarkable Case of Spain. ” *Canadian Journal of Economics*.

Putterman, Louis, and David Weil. 2008. “Post 1500 Population Flows and the Long Run Determinants of Economic Growth and Inequality.” Working paper.

Rauch, James E. 1999. “Networks Versus Markets in International Trade.” *Journal of International Economics* 48: 7-35.

Rauch, James E., and Vitor Trindade. 2002. “Ethnic Chinese Networks in International Trade.” *Review of Economics and Statistics*. 84(1): 116-130.

Rauch, James E., and Vitor Trindade 2004. “Neckties in the Tropics: A Model of International Trade and Cultural Diversity.” Working paper.

Redding, Stephen, and Anthony J. Venables. 2000. “Economic Geography and International Inequality."

Rodrick, Dani. 2008. “The Real Exchange Rate and Economic Growth.” Working paper.

Romalis, John. 2007. “NAFTA's and CUSFTA's Impact on International Trade." *Review of Economics and Statistics*.

Rose, Andrew K. 2000. “One Money, One Market: Estimating the Effects of Common Currencies on Trade.” Economic Policy. 30: 7-45.

Sachs, Jeffrey. 2000. “Tropical Underdevelopment.” CID Working Paper No. 57.

Samuelson, Paul. 1952. “The Transfer Problem and the Transport Costs: Analysis of Effects of Trade Impediments.” *Economic Journal.*

Tafunell, Xavier. 2009. "Capital Formation in Machinery in Latin America, 1890-1930." *Journal of Economic History*, 69(4): 928-950.

Viner, Jacob. 1959. "Relative Abundance of the Factors and International Trade." *Festschrift to Bertil Ohlin: Ekonomi, Politik, Samhalle*. Stockholm. 279-293.
Wright, Gavin. 1974. "Cotton Consumption and the Post Bellum Recovery of the American South." *Journal of Economic History,* 34: 611.