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Immigrant-Trade Links, Transplanted Home Bias and Network Effects

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Macro-level data for the US and 73 trading partners spanning the years 1980 to 2001 is used with a gravity specification to investigate the influence of immigration on bilateral trade. Prior research has identified immigrant stocks as a significant determinant of trade; however, this study indicates that the US immigrant-trade link is driven by immigration from relatively low income countries. A 10% increase in the immigrant stock is found to generate respectively 4.7 and 1.5% increases in domestic imports from and exports to the typical low income home country. The observed link is decomposed into two hypothesized channels – network effects and transplanted home bias. Considerable variation in per-immigrant trade effects is found across home countries: imports from the typical low income home country are estimated to increase by up to $2057 due to transplanted home bias and by as much as $2967 as a result of network effects, while exports rise by up to $910 as a result of networks.

I. Introduction

In recent decades, the US has increasingly opened to the global economy. The sum of imports and exports more than doubled between 1970 and 2001, from 8.1 to 18.5% of US Gross Domestic Product. The ratio of US-owned assets abroad to US GDP increased from 0.16 to 0.61 while foreign-owned US assets relative to US GDP increased from 0.10 to 0.81 (US Bureau of the Census, 1985, 2000, 2003). Increased immigration has coincided with increased trade and capital flows. As integration continues, immigration is expected to remain high on policy agendas.[1] This article, provides a deeper understanding of the immigrant-trade relationship, which may benefit future public policy formulation.[2]

Gould (1994), examining the US, first reports an immigrant-trade link. Head and Ries (1998), Blanes-Cristobal (2002), Girma and Yu (2002), and Bryant *et al*. (2004) report links for Canada, the UK, Spain and New Zealand, respectively. Combes *et al*. (2005) find internal migration increases intra-France trade. Co *et al*. (2004) and Dunlevy (2004) report immigration leads to increased US state exports. I extend the literature by considering heterogeneity in immigrant-trade links across home countries, distilling links into operative channels and estimating proportional, aggregate and per-immigrant trade effects.

[1] The foreign-born population increased from 6.2% of the total population in 1980 to 11.7% in 2001 (US INS, 2003; US Bureau of the Census, 2004).
[2] I follow the US Immigration and Naturalization Service and define an immigrant as a person lawfully admitted for permanent residence in the US (US INS, 2003).

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The Heckscher–Ohlin–Samuelson model, and specifically the Factor Price Equalization Theorem, implies that trade and immigration are substitutes. If economic considerations drive migration, large and persistent earnings differentials between nations may induce migration. However, if trade equalizes factor returns then reduced earnings differentials may discourage emigration.[3] If non-economic factors spur emigration, trade will have a negligible impact. Market imperfections, such as incomplete markets or information asymmetries, provide rationale for immigration and trade to act as complements.

Immigrants may enter the host country with preferences for goods that are unavailable, thus potentially increasing host country imports from the home country. I refer to this channel as 'transplanted home bias'.[4] Also, immigrants may arrive with business contacts or knowledge of political or social obligations required to conduct business in the home country (Globerman, 2001). If such connections reduce transaction costs, both host country exports to and imports from the home country may increase. I refer to this second channel as 'network effects'.[5]

Greater US-home country dissimilarity implies fewer domestically available substitutes and an increased probability that transplanted home bias affects trade. Similarly, assuming high income nations have developed markets and contracting procedures and that low-income nations have less complete markets and weaker contracting and enforcement mechanisms, it is likely immigrants from lower-income nations present opportunities for increased trade.[6] To address the possibility, I stratify the sample by income class (World Bank, 1997).[7] Section II discusses the specification. Section III presents data sources and variables. Section IV presents results while Section V concludes.

II. Empirical Specification

Gould (1994) borrows from Bergstrand (1985), developing a gravity specification where endogenously determined transaction costs decline as immigrants provide the host country with information regarding home country markets. Gould allows for decreasing marginal effects of immigration on trade; however, I follow Girma and Yu (2002) and Head and Ries (1998) by assuming that if effects are decreasing, they diminish over a lengthy horizon – perhaps generations – as immigrant stocks increase and average lengths of stay rise.

Following Gould (1994), Head and Ries (1998), and Girma and Yu (2002), I use a gravity equation where country i (US) imports from country j are defined as follows.[8]

$$\text{IMPORTS}_{ij} = s_{ij} y_j \tag{1}$$

The share of country j output consumed by country i is given by s_{ij} and y_j represents country j GDP. A fully integrated world economy with symmetric differentiated products implies balanced trade between i and j. Helpman (1984) shows that under such conditions $s_{ij} = y_i/y_w$, where y_w is global GDP. Tariffs, transport costs and nontariff barriers are distortionary so that $s_{ij} \neq y_i/y_w$. τ_{ij} is included to account for such barriers.

$$s_{ij} = \frac{(y_i/y_w)}{\tau_{ij}} \tag{2}$$

I assume $\tau_{ij} = \exp^{\Phi_{ij}}$, where Φ_{ij} is a vector of trade-inhibiting factors. Substituting for τ_{ij} in Equation 2,

[3] Absolute Factor Price Equalization (FPE) implies returns equate across nations over the long run; however, relative FPE only dictates the long-run equalization of factor price ratios across nations.

[4] McCallum (1995) reports home bias using 1988 USA-Canada trade data. Intra-provincial trade was found to be 20 times greater than province-state trade. Ceglowski (2002), Wei (1998), Helliwell (1996, 1997) and Engel and Rogers (1996) have also documented positive home bias/border effects.

[5] Rauch and Watson (2002), Rauch and Trindade (2002) and Rauch (1999, 2001) investigate networks finding networks reduce lax contract enforcement and information asymmetries regarding opportunities. Networks may also deter opportunistic behaviour.

[6] The Naturalization Act of 1790 stipulated only free white immigrants may become US citizens. The Chinese Exclusion Act of 1882 banned Chinese immigration, was broadened in 1917 to exclude most Asian immigrants, and created the Asiatic Barred Zone which excluded immigrants from India, Indochina, the East Indies, Polynesia, parts of Russia, Arabia and Afghanistan. The National Origins Act of 1921 established immigrant quotas with the total annual limit equal to 3% of the 1910 US foreign-born population; that is, persons of European descent. Not repealed until 1952, the Immigration Act of 1924 banned Japanese immigration and revised the annual quota down to 2%. From 1924 to 1964, over 94% of visas went to immigrants from Europe, Canada or Oceania (Martin and Midgely, 1999).

[7] The World Bank classified nations as low income if 1995 GNP per capita was $<$ \$765; middle-income if per capita GNP was between \$765 and \$9385; high income if GNP per capita was $>$ \$9 385.

[8] Anderson (1979), Bergstrand (1985), Helpman and Krugman (1985), Davis (1995), Deardorff (1998), Feenstra *et al.* (1999), Haveman and Hummels (2001) and Eaton and Kortum (2001) each present theoretical foundations of the gravity equation as a legitimate model of international trade.

and then Equation 2 into 1 and taking natural logarithms yields

$$\ln \text{ IMPORTS}_{ij} = \ln\left(\frac{y_i y_j}{y_w}\right) + \Phi_{ij} \tag{3}$$

Thus, trade is a function of the total incomes of countries i and j and variables that inhibit trade between the nations. Specifically, the vector Φ_{ij} is constructed as

$$\Phi_{ij} = \left\{\ln \text{ DISTANCE}_{ij},\ \text{MILITARY}_{ij},\ \text{SANCTIONS}_{ij}\right\} \tag{4}$$

A vector of trade-facilitating variables, Γ_{ij}, is added to Equation 3. Γ_{ij} is constructed as

$$\begin{aligned}\Gamma_{ij} = \Big\{&\ln \text{IMMIGRANTS}_{ij},\ \ln \text{GDP per capita}_j,\\ &\Delta \ln \text{EXCHANGE RATE}_{ijt}, \ln \text{FDI\_OUT}_{ij},\\ &\ln \text{FDI\_IN}_{ij}, \text{FTA}_{ij}, \text{LANGUAGE}_{ij}, \text{OPEC}_j\Big\}\end{aligned} \tag{5}$$

IMMIGRANTS_{ijt} represent the immigrant stock from country j. A vector of time dummies, Ω_t, absorbs macroeconomic fluctuations and policy decisions affecting trade. As US GDP is invariant across trading partners within a year, any related trade effects are subsumed into the year dummies. Using Equations 4 and 5, Ω_t, and defining the dependent variable as a vector of trade measures, Equation 3 is rewritten as

$$\ln \text{ TRADE}_{ijt} = \ln\ y_{jt} + \Phi_{ijt} + \Gamma_{ijt} + \Omega_t \tag{6}$$

TRADE_{ijt} includes c.i.f. (cost including freight) imports from and f.o.b. (free on board) exports to country j as well as the sum of imports from and exports to country j.[9]

III. Data and Variable Construction

Macro data for the years 1980 to 2001 is employed.[10] Decennial US censuses provide country-level immigrant stocks at three points in time. I use these values as benchmarks, and incorporate inflow data to estimate immigrant stocks during the intra-census years. For example, immigrant stocks for the years 1981 to 1989 are constructed as

$$\text{IMMIGRANTS}_{ijt} = \text{IMMIGRANTS}_{ij1980} + \sum_{1981}^{t} \text{INFLOW}_{ijt} + \delta_j \tag{7}$$

δ_j is an adjustment factor accounting for return migration, death of immigrants during intra-census years, and amnesties. It is the immigrant stock from country j in the USA given by the 1990 decennial census less the sum of immigrants from country j in the USA in 1980 and the inflow from country j during the years 1981 to 1990 divided by 10:

$$\delta_j = \frac{1}{10}\left[\text{IMMIGRANTS}_{ij1990} - \left[\text{IMMIGRANTS}_{ij1980} + \sum_{t=1981}^{1990} \text{INFLOW}_{ijt}\right]\right] \tag{8}$$

For the years 1991 to 1999, the immigrant stock variable is constructed similarly. The adjustment made to the 2001 portion of the sample is based on the adjustment factor derived when estimating 1991 to 1999 immigrant stocks.

$$\begin{aligned}&\text{IMMIGRANTS}_{ij2001}\\ &\quad = \left(\text{IMMIGRANTS}_{ij2000} + \text{INFLOW}_{ij2001}\right)\\ &\qquad \times \left(1 + \frac{\delta_j}{\text{IMMIGRANTS}_{ij2000}}\right)\end{aligned} \tag{9}$$

The final term in Equation 9, the adjustment percentage, is based on the difference between raw 2000 immigrant values and 2000 benchmark values. Combination of the 1981 to 1989 and 1991 to 1999 estimated immigrant stock values and the 2001 estimated immigrant stock along with use of the benchmark values from 1980, 1990 and 2000 results in a set of immigrant values for each country over the years 1980 to 2001.

FDI stock measures economic integration. Graham and Krugman (1995) report the bulk of US FDI inflows through the mid-1990s were equity acquisitions. Lipsey (1993) reports that, by the end of the 1980s, foreign affiliates accounted for 23% of US exports and more than one-third of imports. I construct two FDI variables. The first, FDI_OUT, is the US FDI stock in country j while the second, FDI_IN, is the country j FDI stock in the US Both are measured relative to country j's GDP.

Prior research employed alternative measures to represent globalization of production. Gould (1994) includes the sum of bilateral FDI when testing for robustness. Head and Ries (1998) use the trading partner's volume of trade divided by GDP to control for the nation's propensity for external trade. I alter Gould's measure to compensate for

[9] The three variables in the TRADE_{ijt} vector are derived using data from Feenstra *et al*. (2002). Each series has been converted from nominal to real values using the US GDP deflator.
[10] Appendix A lists each variable employed, its description and source.

the size of country *j*'s economy and decompose the variable into two separate stocks as US FDI inflows may affect trade differently than US FDI outflows.[11]

Country *j* real GDP measures the economic mass. Higher GDP values signal larger potential export markets for domestic goods and greater output that the USA may import. Real GDP per capita proxies for individual wealth in country *j*. Representing terms of trade changes, the annual change in the US-country *j* exchange rate is included.[12] Capturing trade-generating effects of trade agreements, FTA equals 1 if country *j* is party to a trade agreement with the USA for 6 months during year *t*. LANGUAGE is equal to 1 if English is an official language of country *j*. Common language is often cited as a proxy for cultural similarity (Brainard, 1993, 1997; Engel and Rogers, 1996; Helliwell, 1997; Hutchison, 2002). OPEC controls for US petroleum imports and equals 1 if country *j* was an OPEC member for 6 months in year *t*.

DISTANCE serves to proxy for transport costs. Time-varying import-, export- and trade volume-weighted distances between the 22 busiest US ports (in terms of annual trade volume) and each trading partner's capital city are derived via the 'Great Circle' method. The distance between each capital city-US port pair was weighted by the port's annual share of total trade. The summation of these weighted distances produces the utilized measures. As US military involvement in country *j* may indicate uncertainty exists regarding current and future business opportunities, MILITARY is included as a dummy variable.[13] SANCTIONS is a dummy variable indicating that US-imposed economic sanctions on country *j* were in place during year *t*.[14]

The vector TRADE is regressed on immigrant stock values and other control variables. Addition of an independently and identically distributed error term to Equation 6 yields

$$\begin{aligned}\ln \text{TRADE}_{ijt} = {} & \alpha_0 + \beta_1(\ln \text{IMMIGRANTS}_{ijt}) \\ & + \beta_2(\ln \text{GDP}_{jt}) + \beta_3(\ln \text{GDP per capita}_{jt}) \\ & + \beta_4(\Delta \ln \text{EXCHANGE RATE}_{ijt}) \\ & + \beta_5(\ln \text{DISTANCE}_{ij}) + \beta_6(\text{FTA}_{ijt}) \\ & + \beta_7(\text{FDI\_OUT}_{ijt}) + \beta_8(\text{FDI\_IN}_{ijt}) \\ & + \beta_9(\text{LANGUAGE}_{ij}) \\ & + \beta_{10}(\text{MILITARY}_{ijt}) + \beta_{11}(\text{OPEC}_{it}) \\ & + \beta_{12}(\text{SANCTIONS}_{ijt}) + \beta_\Omega \Omega_t + \varepsilon_{ijt} \quad (10)\end{aligned}$$

Table 1 presents descriptive statistics. The immigrant stock of high income nations is typically higher than that of medium or low income nations.[15] High income countries trade more with the USA than do middle or low income countries. US FDI tends to be highest in medium income nations, while country *j* FDI in the USA is highest for high income nations. US military involvement and economic sanctions are more common occurrences for low income countries. Table 2 lists the countries in the data set.

IV. Econometric Results

Equation 10 is estimated by pooled Ordinary Least Squares. Table 3 presents results.[16] For the full sample, a 10% immigrant stock increase, all else held constant, increases US-country *j* trade volume by 1.66% and imports from and exports to country *j* by 1.3 and 1.13%, respectively. The results are similar to prior research. Head and Ries (1998), using Canadian data for 1980 to 1992, report coefficients of 0.10 and 0.31, respectively, when estimating immigrant effects on Canadian exports and imports. Girma and Yu (2002) employ data for 1981 to 1993, classify

[11] The BEA data does not include specific values, for reasons of protecting firm confidentiality, if FDI is $< \$500\,000$. I have coded these withheld values as the upper limit of \$500 000. This overstates the degree of economic integration between the USA and country *j*. In alternative regressions I set the withheld FDI values equal to \$0. The coefficients on the FDI variables decrease in size and, in some cases, the level of significance; however, the coefficients on the IMMIGRANTS variables are largely unaffected.

[12] Expressed as foreign currency units per US dollar, an increase in the value represents a depreciation of country *j*'s currency indicating an expected increase (decrease) in US imports from (exports to) country *j*.

[13] Appendix B lists US military interventions involving countries represented in this study.

[14] Appendix C lists US-imposed economic sanctions involving countries represented in this study. Hufbauer *et al.* (1997) report sanctions decrease trade flows by a quarter to one-third.

[15] Excluding Mexico from the medium income classification lowers the mean immigrant stock to 159 752.

[16] Time dummies were included in each regression. Due to space constraints, coefficients are not reported.

Table 1. Descriptive statistics – full sample and segmented samples (based on income level)

Variable	Full sample $N = 1{,}599$	High-income countries $N = 506$	Medium-income countries $N = 726$	Low-income countries $N = 367$
Immigrants	241,008	207,761	303,354	164,967
	(638,867)	(256,535)	(905,624)	(241,157)
Export-weighted distance (km)	8,724.36	8,563.70	8,760.36	8,871.86
	(3,503.13)	(3,494.46)	(3,536.06)	(3,451.07)
Import-weighted distance (km)	8,695.31	8,532.83	8,723.21	8,860.96
	(3,518.59)	(3,515.03)	(3,550.89)	(3,460.05)
Volume of trade-weighted distance (km)	8,707.86	8,546.44	8,739.03	8,865.74
	(3,511.39)	(3,505.52)	(3,544.05)	(3,455.67)
Gross domestic product (in $1,000s)	245,397,999	620,138,713	80,698,320	58,106,997
	(634,009,053)	(1,016,529,780)	(120,807,148)	(154,237,208)
Per capita gross domestic product	8,342	22,106	2,838	405
	(10,831)	(9,301)	(2,086)	(201)
Δ exchange rate	0.1635	0.0367	0.2312	0.2045
	(0.4567)	(0.1568)	(0.5041)	(0.5835)
Exports (in $1,000s)	5,564,381	12,667,941	2,996,518	938,358
	(14,695,472)	(21,504,119)	(9,965,725)	(2,718,910)
Imports (in $1,000s)	7,383,510	16,054,013	3,664,623	2,871,850
	(20,960,565)	(31,857,769)	(11,057,769)	(11,376,300)
Volume of trade (in $1,000s)	12,947,891	28,721,954	6,661,140	3,810,200
	(35,189,992)	(52,895,124)	(20,866,176)	(13,999,600)
US direct investment in country j (relative to GDP_j)	0.0483	0.0426	0.0681	0.0177
	(0.1771)	(0.0567)	(0.2566)	(0.0289)
Country j direct investment in U.S. (relative to GDP_j)	0.0166	0.0292	0.0161	0.0003
	(0.0686)	(0.0491)	(0.0921)	(0.0005)
Free trade agreement	0.0230	0.0573	0.0110	0.0
	(0.1501)	(0.2327)	(0.1045)	(0.0)
Common language (English)	0.2055	0.2174	0.1212	0.3529
	(0.4042)	(0.4129)	(0.3266)	(0.4785)
US military action involving country j	0.0249	0.0	0.0275	0.0535
	(0.1559)	(0.0)	(0.1638)	(0.2253)
OECD membership	0.3126	0.8360	0.1088	0.0
	(0.4637)	(0.3707)	(0.3116)	(0.0)
US-imposed economic sanctions	0.1357	0.0079	0.1584	0.2647
	(0.3426)	(0.0886)	(0.3654)	(0.4418)

Standard deviations in parentheses.

Table 2. Countries represented

High-income countries		Medium-income countries		Low-income countries	
Australia	Japan	Argentina	Jordan	Bangladesh	Pakistan
Austria	Korea, Republic of	Bolivia	Malaysia	China	Senegal
Belgium	Netherlands	Brazil	Mexico	Ethiopia	Sierra Leone
Canada	New Zealand	Chile	Morocco	Ghana	Sri Lanka
Cyprus	Norway	Colombia	Panama	Guyana	Tanzania
Denmark	Portugal	Costa Rica	Peru	Haiti	Vietnam
Finland	Singapore	Dominican Rep.	Philippines	Honduras	
France	Spain	Ecuador	Poland	India	
Germany	Sweden	Egypt	Romania	Kenya	
Ireland	Switzerland	El Salvador	South Africa	Nicaragua	
Israel	United Kingdom	Fiji	Syria	Nigeria	
Italy		Greece	Thailand		
		Guatemala	Trinidad and Tobago		
		Hungary	Turkey		
		Indonesia	Uruguay		
		Iran	Venezuela		
		Jamaica			

Table 3. Estimated effects of immigration on trade flows by relative level of per capita income

	High-income countries			Medium-income countries			Low-income countries		
Dependent variable	ln Volume of trade$_{ijt}$	ln Imports$_{ijt}$	ln Exports$_{ijt}$	ln Volume of trade$_{ijt}$	ln Imports$_{ijt}$	ln Exports$_{ijt}$	ln Volume of trade$_{ijt}$	ln Imports$_{ijt}$	ln Exports$_{ijt}$
ln Immigrants$_{ijt}$	0.0406	0.1281#	−0.0428	−0.0153	−0.0874	−0.0732	0.2131**	0.4661**	0.1465**
	(0.0321)	(0.0731)	(0.0303)	(0.0415)	(0.077)	(0.0488)	(0.0752)	(0.1979)	(0.0542)
ln GDP$_{jt}$	0.9071**	0.967**	0.9119**	0.8899**	1.1003**	0.8788**	0.8432**	1.1099**	0.8178**
	(0.0345)	(0.0431)	(0.0315)	(0.0345)	(0.0727)	(0.0505)	(0.0642)	(0.1666)	(0.0486)
ln per capita GDP$_{jt}$	−0.6064**	−0.1432	−0.9642**	−0.3083**	−0.2317**	1.2484**	0.4799**	0.7772**	0.0048
	(0.1193)	(0.155)	(0.1052)	(0.0518)	(0.0891)	(0.1802)	(0.0995)	(0.1798)	(0.0735)
Δ ln Exchange rate$_{ijt}$	−0.065	0.2254	−0.1153	−0.2814**	−0.2848*	−0.4005**	−0.5343**	−1.0399**	−0.4713**
	(0.2532)	(0.281)	(0.2373)	(0.0366)	(0.1353)	(0.0971)	(0.1218)	(0.3975)	(0.1022)
ln Distance$_{ij}$	−0.0085	0.1167	−0.1067	−0.9226**	−1.3836**	−0.4379**	−0.9098**	−1.481**	−1.2134**
	(0.1215)	(0.1293)	(0.1175)	(0.1036)	(0.1802)	(0.0655)	(0.2313)	(0.5665)	(0.1635)
ln FDI_IN$_{ijt}$	0.069**	0.0206	0.0969**	0.0322*	0.0464#	0.0055	0.1191**	0.1672**	0.112**
	(0.0239)	(0.027)	(0.0243)	(0.0155)	(0.0268)	(0.0166)	(0.0273)	(0.0494)	(0.0272)
ln FDI_OUT$_{ijt}$	0.2832**	0.3835**	0.2554**	0.1971**	0.1946**	0.2227**	0.0646**	0.0942*	0.1105**
	(0.0403)	(0.0411)	(0.0443)	(0.0138)	(0.0196)	(0.02)	(0.021)	(0.0442)	(0.019)
FTA$_{ijt}$	1.0702**	1.4287**	0.8175**	0.9608**	0.6325**	0.5189**			
	(0.1087)	(0.1141)	(0.1051)	(0.1295)	(0.1979)	(0.1301)			
Language$_{ij}$	0.0139	−0.0944	0.102	0.6107**	1.2359**	−0.7562**	−0.1743*	0.3472#	−0.2049**
	(0.0881)	(0.1093)	(0.0854)	(0.0941)	(0.1468)	(0.1321)	(0.0818)	(0.1836)	(0.0732)
Military$_{ijt}$				−0.1893	0.1899	−0.0296	−0.9102**	−0.8411#	−0.9985**
				(0.1613)	(0.2436)	(0.2055)	(0.2986)	(0.4451)	(0.2802)
OPEC$_{jt}$				−0.2073	−0.2247	−1.095**	2.1697**	2.649**	0.6259**
				(0.1652)	(0.3165)	(0.1959)	(0.111)	(0.2136)	(0.1153)
Sanctions$_{ijt}$				−0.5147**	−0.8572**	−0.2967**	−0.5674**	−1.0911**	−0.3205**
				(0.0944)	(0.1777)	(0.093)	(0.1017)	(0.198)	(0.0965)
Constant	−0.9384	−9.9213**	3.7336*	4.3394**	2.5652	4.0423**	−1.5823	−3.4613	4.7012**
	(1.7748)	(2.1942)	(1.6444)	(0.981)	(1.6047)	(1.0243)	(1.7289)	(3.8793)	(1.2213)
N	506	506	506	726	726	726	367	367	367
Adjusted R^2	0.8536	0.8378	0.8477	0.7319	0.5676	0.5871	0.8127	0.5575	0.8306

Heteroskedasticity-consistent robust standard errors in parentheses. Statistical significance is indicated as follows. '**', '*', and '#' represent significance from zero at the 1%, 5%, and 10% levels, respectively.

UK trading partners by commonwealth membership, and report immigrant stock coefficients of 0.16 and 0.1 when examining UK exports and imports to noncommonwealth countries. It is posited that commonwealth–UK social/political institution similarities negate potential immigrant-trade effects. Using data for 1970 to 1986, Gould (1994) presents coefficients of 0.02 and 0.01 when considering the immigrant effects on US exports and imports, respectively. The lower coefficients are attributable to difference in specification.

The FDI_OUT coefficients, as expected, are positive and significant. However, while the FDI_IN coefficients are positive, they are of lesser magnitude and significant in only one of the three regressions. The GDP coefficient indicates that the US trades more with larger economies. The Δ EXCHANGE RATE coefficients signal depreciation of country *j*'s currency relative to the dollar reduces exports to country *j* and US-country *j* trade volume. The coefficients on the DISTANCE variables, which proxy for transport costs, are negative and significant. The US is found to trade more with countries they are party to trade agreements with and those for who English is an official language. The two remaining trade-inhibiting variables that proxy for uncertainty as signalled by US military involvement in country *j* and that indicate US imposition of economic sanctions on country *j* are, as expected, negative and generally significant.

Investigating variation in immigrant-trade links, I stratify the sample by per capita GDP. Only immigrants from low income countries significantly increase US-home country trade. Based on the coefficients for the low income country sample, a 10% increase in the immigrant stock increases the volume of trade by 2.13%, imports from country *j* by 4.66% and exports to country *j* by 1.47%. The coefficients on the immigrant stock variables for the high and medium income samples do not indicate trade-increasing effects. This finding is counter to that of Co *et al*. (2004) who, examining 1993 US state exports to 28 nations, report near-identical immigrant stock coefficients for both 'developed' and 'developing' home country samples. As the current sample spans 22 years and includes 73 nations that are classified into three income classifications, the results presented here are arguably more reliable than the referenced prior findings.

Observed links may result from unobservable home country characteristics. If so, then pooled OLS may be an incorrect estimation technique. Similarly, results reported for low and medium income countries may be driven by China and Mexico (home countries of large immigrant populations with whom the US has expanded trade considerably in recent decades) and Vietnam (from which many have emigrated, but with which the USA trades little). Examining robustness, I estimate fixed effect equations (to address possible specification error) and use pooled OLS to estimate Equation 10 with China, Mexico and Vietnam excluded (to address sample selection bias). Following Head and Ries (1998), Equation 10 is estimated using pooled OLS with lagged dependent variables as explanatory variables. Table 4 summarizes the results.[17]

The results of the robustness checks support the findings reported in Table 3. Observed links appear driven by immigration from relatively low income nations. The top panel shows that, for low income nations, coefficients on the immigrant stock variables generally increase in magnitude and significance once allowing for fixed effects. Exclusion of China, Mexico and Vietnam generates similar results. That said, inclusion of lagged dependent variables as explanatory variables reduces significance and coefficients on the immigrant stock variables lower.

To determine the effects of the conjectured channels via which the immigrant-trade link operates requires an assumption regarding interpretation of coefficients. Rauch (2001) states that, 'a reasonable interpretation of the larger import elasticity is that it combines a taste effect and a network effect, while the export elasticity only reflects a network effect'. In Table 3, where coefficients are significant, this is true. Table 5 presents the effects of a hypothetical 10% increase in the country *j* immigrant stock. These values are based on the reported coefficients for the low income sample of countries and on annual trade flow and immigrant stock data for the years 1980 to 2001. For high and medium income countries, effects are set equal to zero as the coefficients were not both significant and positive. For low income countries, on average, a 10% increase in immigrant stock increases US-country *j* trade by $87.6 million.

The immigrant stock coefficient with US exports used as the dependent variable represents pure increases in exports due to networks. Estimated network effects are presented in column (a). Assuming a symmetric network effect with respect to imports and exports, column (b) presents lower bound estimates of increases in US imports. The residual effects column (g) of immigration on US imports can be considered the upper bound transplanted home bias effect. However, assuming

[17] The complete set of estimation results is available upon request from the author.

Table 4. Summary of immigrant stock coefficients, robustness checks

Robustness check: fixed effects estimation			
Sample/Dep. variable	ln Volume of trade$_{ijt}$	ln Imports$_{ijt}$	ln Exports$_{ijt}$
Full sample	0.0583	−0.0073	0.0346
	(0.0423)	(0.0829)	(0.0661)
High-income countries	−0.1078**	−0.0995**	−0.0786*
	(0.0314)	(0.0376)	(0.039)
Medium-income countries	0.218**	−0.0318	0.3551*
	(0.0787)	(0.1396)	(0.1542)
Low-income countries	0.691**	0.8077**	0.0368
	(0.1247)	(0.2925)	(0.1205)
Robustness check: China, Mexico, and Vietnam excluded from data sample			
Sample/Dep. variable	ln Volume of trade$_{ijt}$	ln Imports$_{ijt}$	ln Exports$_{ijt}$
Full sample	0.1926**	0.2384**	0.1346**
	(0.0219)	(0.0369)	(0.0237)
High-income countries	0.0327	0.1171**	−0.0478
	(0.032)	(0.0391)	(0.0302)
Medium-income countries	−0.0527	−0.1197	−0.1183*
	(0.0434)	(0.0791)	(0.0511)
Low-income countries	0.5403**	0.873**	0.3592**
	(0.0407)	(0.0872)	(0.0253)
Robustness check: lagged dependent variable included as additonal explantory variable			
Sample/Dep. variable	ln Volume of trade$_{ijt}$	ln Imports$_{ijt}$	ln Exports$_{ijt}$
Full sample	0.0364*	0.055*	0.065**
	(0.0152)	(0.023)	(0.0188)
High-income countries	0.0115*	0.0195	0.001
	(0.0048)	(0.0602)	(0.0069)
Medium-income countries	0.0327	0.0298	0.0515#
	(0.0264)	(0.0298)	(0.0298)
Low-income countries	0.0616#	0.103#	0.0705*
	(0.0335)	(0.059)	(0.0356)

Heteroskedasticity-consistent robust standard errors in parentheses. Statistical significance is indicated as follows. '**', '*', and '#' represent significance from zero at the 1%, 5%, and 10% levels, respectively.

symmetry with respect to network effects on US imports may be flawed. Immigrants may arrive with home market information previously unknown to US residents that potentially increases US-home country trade, but a time lag may exist during which an immigrant searches for reliable domestic suppliers. If so, network effects would increase US imports proportionally more than US exports. Symmetric effects would then understate the network effect and overstate the transplanted home bias effect on US imports.

Accepting the estimated effects of an immigrant stock increase presented in column (a) as the network effect of immigration on US exports, the decomposition of the increase in US imports requires deriving lower and upper bound values for each channel. At one extreme, the full increase is due to a network effect. This provides an upper bound estimate of the effect on US imports and a corresponding lower bound estimate of transplanted home bias. These estimates are reported in columns (c) and (f), respectively. At the other extreme, applying symmetric effects on US imports from and exports to country j represents an upper bound estimate of the transplanted home bias effect and a lower bound estimate of the network effect on US imports.

A 10% increase in the immigrant stock increases annual US exports to the typical home country by $13.7 million. The average annual network effect on US imports ranges from $13.7 million to $73.9 million. Columns (b) and (c) of Table 5 present these results. Average transplanted home bias effects on US imports are derived as the residual once network effects are accounted for. Estimated lower and upper bound annual increases in US imports equal $0 and $60.1 million, respectively. Estimates are presented in columns (f) and (g), respectively. The

Table 5. Aggregate effects of a 10 percent increase in IMMIGRANTS$_{ijt}$ on US-home country bilateral trade flows

	Business-network opportunities (BNO) effect on					Transplanted home bias (THB) effect on				Total effect (BNO + THB) on
Country	Exports (a)	Imports (lowerbound) (b)	Imports (upperbound) (c)	Volume of trade (lowerbound) (d)	Volume of trade (upperbound) (e)	Imports (lowerbound) (f)	Imports (upperbound) (g)	Volume of trade (lowerbound) (h)	Volume of trade (upperbound) (i)	Volume of trade (j)
Bangladesh	3,449,989	3,449,989	42,393,632	6,899,978	45,843,621	0	38,943,643	0	38,943,643	45,843,621
China	134,642,068	134,642,068	546,670,327	269,284,135	681,312,395	0	412,028,259	0	412,028,259	681,312,395
Ethiopia	1,902,010	1,902,010	2,579,183	3,804,021	4,481,194	0	677,173	0	677,173	4,481,194
Ghana	2,190,302	2,190,302	8,647,763	4,380,604	10,838,065	0	6,457,461	0	6,457,461	10,838,065
Guyana	1,286,374	1,286,374	4,789,635	2,572,748	6,076,009	0	3,503,261	0	3,503,261	6,076,009
Haiti	5,837,626	5,837,626	13,158,643	11,675,251	18,996,268	0	7,321,017	0	7,321,017	18,996,268
Honduras	13,607,427	13,607,427	56,360,003	27,214,854	69,967,430	0	42,752,576	0	42,752,576	69,967,430
India	37,074,032	37,074,032	221,179,454	74,148,064	258,253,486	0	184,105,422	0	184,105,422	258,253,486
Kenya	1,993,883	1,993,883	4,217,635	3,987,765	6,211,518	0	2,223,752	0	2,223,752	6,211,518
Nicaragua	2,449,875	2,449,875	9,420,038	4,899,749	11,869,912	0	6,970,163	0	6,970,163	11,869,912
Nigeria	11,265,620	11,265,620	270,191,098	22,531,241	281,456,718	0	258,925,478	0	258,925,478	281,456,718
Pakistan	12,305,120	12,305,120	31,952,996	24,610,241	44,258,116	0	19,647,875	0	19,647,875	44,258,116
Senegal	827,622	827,622	963,602	1,655,245	1,791,224	0	135,980	0	135,980	1,791,224
Sierra Leone	271,484	271,484	1,583,206	542,968	1,854,690	0	1,311,722	0	1,311,722	1,854,690
Sri Lanka	2,075,304	2,075,304	31,931,437	4,150,609	34,006,741	0	29,856,132	0	29,856,132	34,006,741
Tanzania	652,608	652,608	1,060,291	1,305,215	1,712,898	0	407,683	0	407,683	1,712,898
Vietnam	1,866,608	1,866,608	8,865,851	3,733,217	10,732,460	0	6,999,243	0	6,999,243	10,732,460
Average	13,746,938	13,746,938	73,880,282	27,493,877	87,627,220	0	60,133,344	0	60,133,344	87,627,220

Column (a) is calculated as the average value of country *j*'s annual exports to the U.S. multiplied by the estimated coefficient on the IMMIGRANTS variable (assuming a ten percent increase in the level of the country *j* immigrant stock) when the EXPORTS variable is employed as the dependent variable. Column (b) is equal to the value presented in column (a) following the assumption that an increase in the IMMIGRANTS variable affects U.S. exports to country *j* and U.S. imports from country *j* to an identical extent. Column (c) is calculated as the average value of country *j*'s annual imports from the U.S. multiplied times the estimated coefficient on the IMMIGRANTS variable (assuming a ten percent increase in the level of the country *j* immigrant stock) when the IMPORTS variable is employed as the dependent variable. Column (d) is calculated as the sum of columns (a) and (b). Column (e) is calculated as the sum of columns (a) and (c). Values in Column (f) and in Column (h) are set equal to zero to reflect that, in an extreme scenario, all of the observed increase in U.S. imports from country *j* are the result of the exploitation of business-network opportunities and are not due to transplanted home bias. Column (g) is calculated as the difference between the estimated coefficient on the IMMIGRANTS variable and the percentage increase in the level of U.S. imports from country *j* attributed to the exploitation of business-network opportunities (given a ten percent increase in IMMIGRANTS) and following the assumption that U.S. imports from country *j* and U.S. exports to country *j* are affected to an equal extent. Column (i) is calculated as being equal to column (g). Column (j) is calculated as being equal to column (g) plus column (d), or simply as column (e). Average values are arithmetic means and are not weighted values.

Table 6. Per immigrant effects of a 10 percent increase in IMMIGRANTS$_{ijt}$ on US-home country bilateral trade flows

	Business-network opportunities (BNO) effect on					Transplanted home bias (THB) effect on				Total effect (BNO + THB) on
Country	Exports (a)	Imports (lowerbound) (b)	Imports (upperbound) (c)	Volume of trade (lowerbound) (d)	Volume of trade (upperbound) (e)	Imports (lowerbound) (f)	Imports (upperbound) (g)	Volume of trade (lowerbound) (h)	Volume of trade (upperbound) (i)	Volume of trade (j)
Bangladesh	807	807	9,917	1,614	10,724	0	9,110	0	9,110	10,724
China	2,261	2,261	9,180	4,522	11,442	0	6,919	0	6,919	11,442
Ethiopia	446	446	605	893	1,052	0	159	0	159	1,052
Ghana	763	763	3,012	1,526	3,775	0	2,249	0	2,249	3,775
Guyana	100	100	373	200	473	0	273	0	273	473
Haiti	229	229	517	459	747	0	288	0	288	747
Honduras	1,058	1,058	4,381	2,115	5,438	0	3,323	0	3,323	5,438
India	693	693	4,132	1,385	4,825	0	3,440	0	3,440	4,825
Kenya	1,180	1,180	2,496	2,360	3,675	0	1,316	0	1,316	3,675
Nicaragua	148	148	570	296	718	0	422	0	422	718
Nigeria	1,840	1,840	4,412	3,679	6,252	0	2,572	0	2,572	6,252
Pakistan	1,072	1,072	2,784	2,144	3,856	0	1,712	0	1,712	3,856
Senegal	2,325	2,325	2,707	4,650	5,032	0	382	0	382	5,032
Sierra Leone	292	292	1,702	584	1,994	0	1,410	0	1,410	1,994
Sri Lanka	1,309	1,309	2,015	2,619	3,324	0	706	0	706	3,324
Tanzania	926	926	1,504	1,851	2,430	0	578	0	578	2,430
Vietnam	29	29	136	57	164	0	107	0	107	164
Average	910	910	2,967	1,821	3,878	0	2,057	0	2,057	3,878

Values presented have been constructed as the values presented in Table 5 divided by the numeric equivalent to a ten percent increase in the IMMIGRANTS variable. See Table 5 notes. Average values are non-weighted arithmetic means.

nations with the largest projected annual increases in trade volume with the US are China ($681 million), Nigeria ($281 million) and India ($258 million). Tanzania ($1.7 million), Senegal ($1.8 million) and Sierra Leone ($1.9 million) have the smallest projected increases.

To calculate annual per-immigrant effects, estimated aggregate trade increases presented in Table 5 are employed and numerical values for each nation in terms of a 10% increase in immigrants. I divide the former by the latter and, in Table 6, we see the average immigrant adds $910 to US exports to and between $910 and $2967 to imports from country *j* due to network effects. Each immigrant adds up to $2057 to US imports from country *j* due to transplanted home bias. Thus, the average immigrant adds $3878 to the US-country *j* volume of trade.[18] China ($11 442), Bangladesh ($10 724) and Nigeria ($6252) have the largest per-immigrant effects. Emigration from Vietnam ($164), Guyana ($473) and Nicaragua ($718) increase trade the least.

V. Conclusion

The empirical analysis provides results that buttress and extend prior research. Immigration is a significant determinant of US-home country trade, with network effects and transplanted home bias both displayed. However, contrary to earlier research that either did not consider heterogeneity in immigrant-trade links across home country income classifications or was restricted in its analysis due to data limitations, the observed US immigrant-trade link is found to be driven by immigrants from low income countries. As the data employed spans a lengthier time period and includes more trading partners than prior research, the estimates presented here are taken as more reliable and thus to yield more accurate aggregate and per-immigrant trade effects.

For the typical low income country, a 10% immigrant stock increase leads to 4.66 and 1.47% increases in US imports from and exports to the home country, respectively. Decomposition of the link into operative channels results in lower and upper bound estimates of aggregate and per-immigrant trade effects resulting from hypothetical 10% immigrant stock increases. The average low income home country immigrant increases annual imports from the home country by up to $2057 due to transplanted home bias and by $910 to $2967 due to network effects. The same immigrant adds an additional $910 to annual exports to the home country as a result of network effects.

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[18] These findings are similar to Head and Ries (1998) in which the average Canadian immigrant generates $3000 in exports and $8000 in imports. Wagner, Head and Ries (2002), using an alternative specification, report the average immigrant increases Canadian imports and exports by $944 and $312, respectively.

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Appendix A: Variable listing

Variable	Description	Source(s)
Immigrants_{ijt}	Number of immigrants from country j in the US at time t.	US Census; US INS
$\text{Volume of Trade}_{ijt}$	Volume of trade between the US and country j at time t. Calculated as Volume of $\text{Trade}_{ijt} = (\text{Imports}_{ijt} + \text{Exports}_{ijt})$.	Feenstra *et al*. (2002); US ITC Trade Database
Imports_{ijt}	Imports (c.i.f.) from j to US at time t.	" " " " " " "
Exports_{ijt}	Exports (f.o.b.) to j from US at time t.	" " " " " " "
GDP_{jt}	Gross Domestic Product of country j at time t.	World Development Indicators CD-ROM
$\text{Exchange Rate}_{ijt}$	US-country j exchange rate expressed as units of foreign currency per US dollar at time t.	IMF IFS; Online: www.oanda.com
Distance_{ij}	Distance (in kilometers) between foreign nation's capital city and US	Author's calculations (Great Circle method)
FDI_OUT_{ijt}	Measure of US-owned assets in country j at time t.	US BEA
FDI_IN_{ijt}	Measure of country j-owned assets in the US at time t.	" " " " " " "
$\text{GDP per capita}_{jt}$	Measure of average income in country j during year t.	2003 World Development Indicators CD-ROM
FTA_{ijt}	Dummy variable equal to 1 if the nation is in a Free Trade Agreement (for more than six months in a calendar year) with the US; 0 otherwise.	n.a.
Language_{j}	Dummy variable equal to 1 if the official language of the nation is English; 0 otherwise.	Crystal (1993)
Military_{ijt}	Dummy variable equal to 1 if US military action occurred involving country j during year t; 0 otherwise.	n.a.
OECD_{jt}	Dummy variable equal to 1 if nation is a member of the OECD (for more than six months in a year); 0 otherwise.	Online: www.oecd.org
OPEC_{jt}	Dummy variable equal to 1 if the nation is a member of OPEC (for more than six months in any year); 0 otherwise.	Online: www.opec.org
Sanctions_{ijt}	Dummy variable equal to 1 if sanctions were imposed against country j by the US in year t, 0 otherwise.	Elliot *et al*. (Forthcoming, 2005)

Appendix B: Listing of US military interventions, 1980–2001

Country	Year(s)	Description
Bolivia	1986	Provided logistical support against coca-processing facilities.
El Salvador	1981–92	Demonstrated support for El Salvador during elections, deterred Nicaraguan aggression, advised Salvadoran forces, provided over-flights to aid anti-rebel war.
Haiti	1994–96	Over 20,000 US troops deployed. Returned Aristide regime to power, trained police force and judiciary, assisted the rehabilitation of the civil administration.
Honduras	1983–89	US military conducted maneuvers and built bases near borders.
Iran	1980	Aborted bombing raid to rescue embassy hostages.
Iran	1984; 1987–88	1984: US Air Force jets shot down two Iranian jets over Persian Gulf. 1987–1988: Iraqi-launched missile strike against the USS Stark followed by US claim that Iran had escalated war. US intervened on side of Iraq.
Nicaragua	1981–90	Navy command operation. CIA directed exile invasions, planted harbor mines. Assistance provided to Nicaraguan Resistance. Trade embargo imposed (1985).
Panama	1989–90	27 000 US troops deployed. President Noriega captured, Nationalist government ousted; established US-recognized government.
Philippines	1989	US military evacuated Americans, protected US interests, Marines guarded US embassy, US Air Force patrolled above Manila and rebel air bases.

Appendix C: Listing of US-imposed economic sanctions, 1980–2001

Country	Year(s)	US Foreign policy objective(s)
Argentina	1980–83	Improve of human rights; Adhere to nuclear safeguards.
Bolivia	1980–82	Improve of human rights; Deter drug trafficking.
Brazil	1980–84	Improve of human rights; Adhere to nuclear safeguards.
China	1989–98	Improve human rights; End nuclear proliferation.
Colombia	1996–98	Stop narcotics trade; Improve human rights.
Ecuador	1995–98	End border conflict with Peru.
El Salvador	1980–81; 1987–88; 1990–93	1980–1981 and 1990–1993: Improve human rights. 1987–1988: Reverse amnesty decision.
Ethiopia	1980–92	Settle expropriation claims; Improve human rights.
Guatemala	1993; 1996–98	Restore democracy, oppose coup.
Haiti	1987–94; 1996–98; 2001	Improve human rights; Restore democracy; Stop drug smuggling.
India	1980–82	Adhere to nuclear safeguards.
Indonesia	1991–2001	Improve human rights; End conflict, human rights violations in East Timor.
Iran	1980–81; 1984–2001	1979–1981: Release hostages; Settle expropriation claims. 1984–1997: End war with Iraq; Halt attacks on Gulf shipping; End support for terrorism.
Israel	1980–83	Withdraw from Sinai; Push Palestinian autonomy talks.
Jordan	1990–97	Enforce UN embargo vs. Iraq.
Nicaragua	1981–90; 1992–95	End support for El Salvador rebels; Destabilize Sandinista government; Implement civil control over security forces; Settle expropriation claims.
Nigeria	1993–98	Improve human rights; Establish democracy; Stop flow of narcotics.
Pakistan	1980–2000	Adhere to nuclear safeguards.
Panama	1987–90	Destabilize Noriega regime.
Peru	1991–98	Improve human rights; Establish democracy; End conflict with Ecuador.
Romania	1983–93	Improve human rights; Establish democracy.
S. Africa	1985–91	End apartheid.
Syria	1986–2001	End support of terrorism.
Thailand	1991–92	Restore constitutional regime.
Vietnam	1980–98	Return of members/remains of the US Armed Forces classified as Missing In Action; restrictions on emigration.

Note: These listings are not comprehensive and only present US military interventions and US-imposed economic sanctions during the period 1980 through 2001 involving a trading partner listed in Table 2.