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Xinyue (Sarah) Qin April 9, 2021

The Impact of Immigration on U.S. Trade Deficit and Immigrants' Home Bias Effect

By

Xinyue (Sarah) Qin

Jong H. Kim

Adviser

Economics

Jong H. Kim

Adviser

Sue Mialon

Committee Member

Maria Franca Sibau

Committee Member

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Abstract

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This paper investigates the impact of immigration on the United States trade deficit. Immigrants influence bilateral trade through two hypothesized channels - the network effect and the home bias effect. The latter only fosters imports and can potentially aggravate the U.S. trade deficit. By applying panel data for the U.S. and 20 trading partners spanning the years 1986 to 2018 to a gravity model of international trade, the paper reports a significantly positive impact of immigration on the U.S. deficit against immigrant source countries. On average, a 10% increase in the immigration stock is estimated to increase the deficit by $787 million annually. The results indicate a home bias effect operating in the U.S. international trade relations.

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1 Introduction

The post-WWII world experienced the largest wave of migration in human history. The United States attracted more immigrants than did any other country and continues to break its own inflow records. By 2020, immigrants account for 13.7% of the U.S. population, triple of the share (4.8%) in 1970s[1], not including their domestic-born descendants raised in immigrant families. Immigrants' share of total national output was about 14.7% between 2009 and 2011, exceeding its share of the population.[2]

The effects of this non-native influence on domestic economics has long been controversial. In the Heckscher-Ohlin model in the earliest studies, Mundell (1957) argues that international trade and international movements are substitutes, not complements. Thus, immigration's substitutional effect reduces the trade flows between countries. However, more recent scholars challenge

[1]See Pew Research Center estimates based on the U.S. Census Bureau's *Historical Census Statistics on the Foreign-Born Population of the United States: 1850-2000* and Pew Research Center's tabulations of 2010-2018 American Community Survey.

[2]Numbers obtained from EPI analysis of American Community Survey (2009–2011).

the model, suggesting that it fails to accurately capture the true or at least the current relationship between immigration and trade. Since the turn of the century, studies on this topic have reached a consensus on the positive influence of immigration stocks on bilateral trade flows between economies.

Scholarly interests in this topic seems to have waned in the past decade, even though few studies explored immigrants' impact on trade deficits explicitly. As the trade volumes increase, the gap between United States imports and exports has also widened rapidly in the past thirty years. Despite protective tariffs, quotas and various trade barriers, the U.S. trade deficit rose to its highest level of $67.1 billion in 14 years in August 2020, according to the Commerce Department.[3] Interestingly, the nation exhibits high consistency in its largest trading partners and its largest sources of immigrants. Such obvious correlation between immigration stock and trade deficit cannot be explained by a simple economic factor such as productivity growth, inflation, or globalization. Although a confluence of macroeconomic forces may be responsible, it is worth researching whether immigration contributes to trade deficit. The questions that needs to be addressed are: how influential is immigration in the widening U.S. international trade deficit? What is the mechanism behind this influence? Does this effect differ across the immigrants' home countries?

One reasonable hypothesis is that the immigrants' home bias effect on consumption is responsible. Among the two basic mechanisms by which immigration affects trade, one is the facilitation of additional bilateral trade through immigrants' advantages on market information and network; the other is a tendency for immigrants to favor products imported from their home countries. The former exerts a symmetric effect on imports and exports, whereas the latter only increases the import volume to the host country. Sizable trade deficits indicate overwhelming dominance of imports over exports in bilateral trade. Therefore, if the home preference hypothesis holds, immigration boosts imports more than it does exports with the same country, aggravating the host country's trade deficit. Indeed, many previous studies reported an unexpectedly larger in-

[3]See *U.S. International Trade in Goods and Services report, August 2020* published by Bureau of Economic Analysis

fluence on imports than exports. However, few papers attribute the disparity to the preference hypothesis or recognize the impact of the accumulating discrepancy on the host country's trade balance in long run.

In general, verifying the positive effects on trade has limited contribution to the existing studies on trade and immigration. Instead, this study aims to prove that the home preference effect plays a significant role in the United States trade balance by examining its bilateral trade with its largest sources of immigrants from 1986 to 2018. More specifically, immigrants' home bias increases the outflow of domestic capital and widens the trade deficit in the United States. The study also examines trade-related characteristics in bilateral trade and suggests that distance, exchange rates and trade openness are relevant to the scale of the immigrants' impact on trade deficit.

This paper focuses on twenty major immigrant-sending countries and their trade with the United States. The twenty countries are the largest foreign born population origins in 2018, according to the American Community Survey (ACS) of the U.S. Census Bureau.[4] The countries of focus are Mexico, India, China (Mainland), Philippines, El Salvador, Vietnam, Dominican Republic, Korea (Republic of), Guatemala, Canada, Colombia, Jamaica, United Kingdom, Haiti, Honduras, Germany, Brazil, Peru, Ecuador and Poland. The immigrants from these twenty countries make up approximately 70% of the total foreign-born population in United States in 2018 and are representative of the total immigrant community. Therefore, the research will primarily conduct empirical analysis on the immigration from these countries.

The rest of the paper is organized as follows: section II covers major findings and methodologies in previous literature on related topics; section III presents the data and gravity models used to estimate the effect of immigration; section IV demonstrates regression results and tables, conducting empirical analysis and providing answers to research questions; section V summarizes findings and concludes the study.

[4]Cuba's total number of immigrants ranks sevenths in the U.S. However, trade data between the U.S. and Cuba and part of immigration data is missing due to political and military reasons. Therefore, Cuba is excluded. This study extends to include Poland, the 21st country on the list.

2 Literature Review

2.1 Network Effects and Home Bias Effects

The impact of immigration on trade has captured economists' attention since the last century, and a sizeable volume of literature has found evidence of immigrants' positive effects on the bilateral trade flows between the host and home countries. In conventional neoclassical frameworks, such as the Heckscher-Ohlin-Samuelson (HOS) model, international goods trade serves as an alternative to labor migration. Incoming immigrants supplement the labor supply just like the native population does, increasing the domestic production, and the demand for imported goods drops as a result (Mundra 2005). However, empirical evidence suggests the opposite. Gould (1994) pioneered the study by suggesting that immigrants contribute to trade flows via two basic mechanisms. In addition to bringing a preference for home-country products, immigrants also bring with them information and resources that can reduce transaction costs and foster trade. Most studies follow Gould's categorization, analyzing the relationship between immigration and trade through these two channels. White (2007) refers them to the 'transplanted home bias effects' and the 'network effects', respectively.

The network effects refer to the immigrants' natural advantages on lowering various costs in bilateral trade. When market imperfections and information asymmetries exist, immigrant may serve a role in reducing these trade barriers (Rauch 1999). Gould (1994) presents at least three ways by which such a link reduces cost. First, immigrants' bilingual abilities reduce the transaction costs due to communication barriers. Second, knowledge of the home country's legal, social and business practices facilitates long term business development and thus reduces associated costs, something also discussed by Head and Ries (1998) and White (2007). Finally, natural affinity due to association with the home country facilitates negotiating trade contracts and so on. Later, the empirical evidence in Gould's study verifies this hypothesis and indicates that immigration information can reduce trade costs and influence trade flows.

The 'home bias' phenomenon, a more direct mechanism, is the main focus when we consider the immigrants' effect on trade deficit since it potentially exacerbates trade deficit. With the incomes in the host country and preference for home country products, the immigrants simply consume more of those goods and enlarge imports. McCallum (1995) found a surprisingly significant home bias effect using data from Canada in 1988, reporting Canadian provinces trade around twenty times more with each other than they do with the United States of similar proximity. Helliwell (1996) extended McCallum's study by performing robustness check, and reported consistent results. At almost the same time, Wei (1996) found a substantially smaller home bias effect of two and half using the OECD country data. Later, Nitsch (2000) suggested that the home bias among European Union countries is significantly larger than Wei's result, but still lower than McCallum's and Helliwell's estimates on Canadian data. Nitsch estimated that EU countries export approximately seven to ten times more between themselves than to non-EU countries.

Besides the direct individual preference over home country products, we should also expect incidental effects on imports. For example, Egger et al. (2012) argued that 'demonstration effects' would increase the non-immigrants' demand for these goods. Mundra (2005) also suggested that immigrants bring with them unique demand patterns and introduce natives to products from their home countries over time. Furthermore, foreign-born entrepreneurs and their businesses may raise the availability of these goods. Either way, they increase unilateral trade and lower trade balance for the host country. On the other hand, it is worth noting that immigration may impose trade diverting effects that obscure the posited trade enhancing effects (Dunlevy and Hutchinson 1999), especially with the imports. For example, migration may motivate domestic firms to produce relevant substitutes and thus reduce imports from the foreign country (Girma and Yu 2002, Genc et al. 2012).

Gould verified the positive role of immigrant on both way of trade by estimating the effect of immigrant on trade between the United States and 47 countries that were origins of immigrants in 1970s and 1980s. However, the paper indicated that this influence is stronger for imports, contradicting many later studies. Egger et al. (2012) took this as evidence against the preference

theory, but later they summarized that twice as many papers report a greater effect on imports than on exports, which is considered evidence in favor of a strong preference effect operating in international trade.[5] Although rarely discussed explicitly, network effects are usually taken as symmetric in these studis. As a result, the 'residual' effects on imports once the network effects are accounted for are believed to represent the immigrants' net addition to trade deficit due to their home preference. White (2007) observed that a 10% increase in the immigrant stock generates respectively 4.7 and 1.5% increases in domestic imports and exports to the home country, respectively. The imports increase by up to five thousand dollars per-immigrant, while exports rise by less than one thousand as a pure result of network effects.

2.2 Methodology

Borrowed from Bergstrand (1985) by Gould (1994)[6], the gravity equation has become the most successful and popular model for estimating goods trade. Inspired by Newtonian physics, the model measures a gravity-like attraction between two bodies based on their masses and the distance. With respect to international trade, the model states that the volume of trade between two entities is related to their economic size, geographic distance, and other additional variables. In the study of Head and Ries (1998), Lewer (2006) and White (2007), the imports amount M_{ij} of country i from country j is represented as

$$M_{ij} = s_{ij} y_j \tag{1}$$

where y_j is country j's GDP and s_{ij} is country j's share of products consumed by country i. Taking natural logarithms yields

$$\ln(M_{ij}) = \ln(\frac{y_i y_j}{y_w}) \tag{2}$$

[5]See also studies on U.S. immigrant-trade relationship (Dunlevy and Hutchinson, 1999, 2001; Mundra, 2005; White, 2007; Egger et al., 2012) and other studies on regions such as Canada (Head and Ries, 1998), UK (Girma and Yu, 2002), OECD countries (Kimura and Lee, 2006; Lewer, 2006), Spain (Peri and Requena-Silvente, 2007), and Italy (Bratti et al., 2014).

[6]The gravity model of bilateral trade was first introduced by Tinbergen (1962).

Incorporating the vectors of trade-inhibiting factors ϕ_{ijt} and trade-facilitating factors τ_{ijt}, the equation is rewritten as

$$\ln(TRADE_{ijt}) = \ln(y_{it}y_{jt}) + \phi_{ijt} + \tau_{ijt} + \epsilon_{ijt}[7] \tag{3}$$

where $TRADE_{ijt}$ is dyadic trade (imports and exports); ϕ_{ijt} includes variables such as $\ln(Distance_{ij})$, $Military_{ij}$, $Sanction_{ij}$ and τ_{ijt} includes $\ln(Immigrants_{ijt})$, $\ln(ExchangeRate_{ijt})$, FTA_{ij}, $Language_{ij}$ etc.[8] In most studies, trade flows and population statistics are transformed into double logarithms, allowing the economist to interpret the elasticity of immigration's effects easily. This specification (Equation 3) is also attractive for its ability to explain the marginal effects of additional explanatory variables.

Since it contains both country and year information, the form of data of interest is panel data. In his pioneering study, Gould performed regression analysis using a lagged dependent term as one of the explanatory variables, with country-specific dummy variables to account for cross-sectional factors. Later literature extended this framework, many using cross sectional data without accounting for time-related changes. For example, Head and Ries (1998) mainly focused on the trade between Canada and its trading partners in year 1992. Similarly, Lewer (2006) preformed ten separate regressions on OECD trade data from 1991 and 2000 to address the time component. Mundra (2005), however, pointed out the inconsistency in Gould's estimates and the lack of dynamic component after Gould, applying a new semi-parametric (SP) fixed-effect model to handle dynamic panel data and measure the effects of immigration. Genc et al. (2012) corrected for heterogeneity and publication bias using meta-regression models including a weighted least squares (WLS) approach. Egger et al. (2012) utilized generalized propensity scores to identify the impact of migration on imports without imposing strong assumptions about the

[7]The equation is a modification of the gravity models used by Head and Ries (1998), Girma and Yu (2002) and Lewer (2006). For the derivation process, see White (2007). Different from White's model, the time dummy accounting for macroeconomic fluctuations and trade-affecting policy decisions is omitted.

[8]Some works did not include GDP_i since the authors considered the U.S. GDP as invariant within a year and is subsumed into the year dummy. See White (2007). This paper does not include any year dummy, so GDP_i is retained.

relationship. Compared to the advanced panel data handling techniques, White (2007) adopted the most 'brute force' and reproducible method: running regressions on the pooled panel data directly.

3 Data Description and Methodology

3.1 Gravity Model

Borrowing from Gould (1994), Head and Ries (1998), Girma and Yu (2002) and White (2007), I employ the following specification of the gravity model on trade flows as the base equation for regression analysis.

$$\begin{aligned}\ln(TRADE_{ijt}) = &\ln(GDP_{it}GDP_{jt}) + \ln(IMMIGRANTS_{ijt}) + \ln(EXCHANGE_{ijt}) \\ &+ \ln(DISTANCE_{ij}) + FTA_{ij}\end{aligned} \tag{4}$$

In this study, country i will represent the immigration destination, the United States, and country j will represent the twenty immigrant source countries. GDP_{it} and GDP_{jt} are the nominal GDPs of the two countries at time t. $IMMIGRANTS_{ijt}$ represents the estimated immigration stock in country i from country j at time t. $EXCHANGE_{ijt}$ is simply the exchange rate between the US dollar and country j's national currency at time t. FTA_{ij} is a variable capturing the trade-enhancing effects free trade agreements.

The study focuses on the immigrants' effect on aggravating trade deficit. Ideally, the double logarithm form of trade deficit is preferred since logarithmic transformation is able to normalize the data. Therefore, the dynamics between immigrants and trade deficit between the US and

country j at time t are represented as:

$$\begin{aligned}\ln(DEFICIT_{ijt}) =& \ln(GDP_{it}GDP_{jt}) + \ln(IMMIGRANTS_{ijt}) + \ln(EXCHANGE_{ijt}) \\ &+ \ln(DISTANCE_{ij}) + FTA_{ij}\end{aligned} \tag{5}$$

However, the $DEFICIT_{ijt}$ is a negative value and has no corresponding logarithmic form during the years that the U.S. has trade surplus against the home country. The negative values carry with them information on the immigration-trade relationship and cannot be left out. Thus, in the regression analysis performed over the full sample, the untransformed deficit data is used instead of logarithm form. The model estimates a semi-elasticity of trade deficit:

$$\begin{aligned}DEFICIT_{ijt} =& \ln(GDP_{it}GDP_{jt}) + \ln(IMMIGRANTS_{ijt}) + \ln(EXCHANGE_{ijt}) \\ &+ \ln(DISTANCE_{ij}) + FTA_{ij}\end{aligned} \tag{6}$$

Second, imports and exports of the United States are regressed on the same sets of explanatory variables:

$$\begin{aligned}\ln(IMPORTS_{ijt}) =& \ln(GDP_{it}GDP_{jt}) + \ln(IMMIGRANTS_{ijt}) + \ln(EXCHANGE_{ijt}) \\ &+ \ln(DISTANCE_{ij}) + FTA_{ij}\end{aligned} \tag{7}$$

$$\begin{aligned}\ln(EXPORTS_{ijt}) =& \ln(GDP_{it}GDP_{jt}) + \ln(IMMIGRANTS_{ijt}) + \ln(EXCHANGE_{ijt}) \\ &+ \ln(DISTANCE_{ij}) + FTA_{ij}\end{aligned} \tag{8}$$

In order to estimate the effect on trade deficit, the analysis part will adopt White's (2007) method. More specifically, the effect of 1% increase in immigration stock can be calculated as the coefficient on $IMMIGRANTS$ variable, multiplied by the average value of the U.S. exports to country j when $EXPORTS$ is the dependent variable (Equation 8).

$$N(EXPORTS) = \beta_{\ln(IMMIGRANTS)} AVG(EXPORTS)^{9} \tag{9}$$

[9]Since regression models are in double logarithm forms, the β coefficients calculated represent the immigration

The immigrants' impacts on exports can be entirely attributed to the 'network effects', since the home bias effect impacts imports almost exclusively. For the purposes of this study, network effects enhance imports and exports equivalently. Therefore, the estimated immigrants' impacts on imports due to 'network effects' is identical to exports:

$$N(IMPORTS) = N(EXPORTS) \tag{10}$$

The actual total impact on imports (network effects plus transplanted home bias effects) can be derived from Equation 7 as the coefficient on $IMMIGRANTS$ variable multiplied by the average value of the U.S. imports from country j when $IMPORTS$ is the dependent variable. Hence, immigration's contribution to trade deficit due to home bias can be regarded as the discrepancy between the two specifications.

$$H(IMPORTS) = \beta_{IMMIGRANTS} AVG(IMPORTS) - N(EXPORTS) \tag{11}$$

3.2 Immigration Data

The data on the United States' immigrant population from 2006 to 2018 by country of origin is tabulated by the Migration Policy Institute who obtained the data from the U.S. Census Bureau's American Community Survey (ACS). According to the official definition, the term "immigrants" (or "foreign born") refers to people residing in the United States who were not U.S. citizens at birth. For years before 2006, immigration stock data is only available in 1990 and 2000, collected from the Gibson and Lennon (1999) and the U.S. Census Bureau's 2000 Decennial Census, respectively. For the remaining years, annual inflow data are taken from the Yearbook of Immigration Statistics of the Homeland Security. However, immigration stocks data, rather than inflow data, is necessary for measuring the aggregate economic effect of immigration. To obtain the total immigration population at the end of these years (1986 to 1989, 1991 to 1999,

elasticity of trade.

and 2001 to 2005), the cumulative sum of annual inflow data is calculated. Nevertheless, the cumulative sum cannot accurately reflect the stock since deaths and departures constantly incur loss to immigrant communities. Head and Ries (1998) and White (2007), respectively, suggested using a constant attrition rate, or an attrition value, to account for the population loss as a result of departures or deaths. Following White's practice, I use the immigration stocks in 1990, 2000 and 2006 as benchmarks and use inflow data to extrapolate data for the intra-census years between 1986 and 2006. The relationship between the immigration stocks and annual inflow is constructed as

$$IMMIGRANTS_{jt} = IMMIGRANTS_{jbase} + \sum_{base}^{t} INFLOW_{jt} + (t - base)\delta_j \tag{12}$$

where δ_j is an attrition factor used to adjust for the loss in immigration. It is calculated as the difference in the immigrant stocks between the ending benchmark year and the base year, plus total inflow, divided by the number of years in between:

$$\delta_j = \frac{1}{(t - base)}[IMMIGRANTS_{jt} – (IMMIGRANTS_{jbase} + \sum_{base}^{t} INFLOW_{jt})] \tag{13}$$

The estimation of immigrant stocks during the entire time window is shown in Table 1.

3.3 Trade Data

This paper also resorts to the U.S. Census Bureau for the U.S. trade data. The U.S. net trade volume, i.e. trade balance, is calculated as the total value of exported consumer goods less the total value of imported consumer goods in its bilateral trade with country j. A negative trade balance indicates that the U.S. experiences trade deficit with respect to country j during that year. For the purposes of the study, trade deficit is 'flipped' into positive values,

$$\begin{aligned} DEFICIT_{ijt} &= -BALANCE_{ijt} \\ &= EXPORTS_{ijt} – IMPORTS_{ijt} \end{aligned} \tag{14}$$

Table 1: Estimated Immigration Stocks Data

Year		Immigrant Stocks
1986-1989	Attrition Adjustment	$\delta_j = \frac{1}{10}[IMMI_{j2000} - (IMMI_{j1990} + \sum_{1991}^{2000} INFLOW_j)]$
	Immigrant Stock	$IMMI_{jt} = IMMI_{j1990} - \sum_{t}^{1990} INFLOW_j - \delta_j$
1990		Data from Gibson and Lennon (1999)
1991-1999	Attrition Adjustment	$\delta_j = \frac{1}{10}[IMMI_{j2000} - (IMMI_{j1990} + \sum_{1991}^{2000} INFLOW_j)]$
	Immigrant Stock	$IMMI_{jt} = IMMI_{j1990} + \sum_{1991}^{t} INFLOW_j + \delta_j$
2000		Data from 2000 Decennial Census
2001-2005	Attrition Adjustment	$\delta_j = \frac{1}{6}[IMMI_{j2006} - (IMMI_{j2000} + \sum_{2001}^{2006} INFLOW_j)]$
	Immigrant Stock	$IMMI_{jt} = IMMI_{j2000} + \sum_{2001}^{t} INFLOW_j + \delta_j$
2006-2018		Data from American Community Survey

NOTES: Immigrants population estimation from 1986 to 1990 are discounted using the same attrition adjustment value as 1991-2000 since 1986 is chronologically closer to 1990 than to 1980.

As mentioned, the U.S. experiences trade surplus during some years, especially in its trade with most Latin American countries.

3.4 Other Variables

The GDP data of target countries is available at the World Economic Outlook Database of the International Monetary Fund. The product of the two trading countries' GDP will be used in gravity model regressions. The exchange rate data is collected from the International Financial Statistics database of the International Monetary Fund. The distance data is the great circle distance (in kilometers) between the capital city of country j and Washington D.C.[10] All the numerical variables except $DEFICIT$ and FTA are transformed into logarithm form to mitigate heteroskedasticity. Table 2 summarizes all variables and their calculations.

3.5 Descriptive Statistics

Table 3 provides an overview on the statistics of the 20 trading partner countries. The table presents the mean value of variables as well as the mean of their annual changes (i.e. the deltas). The U.S. has received increasing immigration inflows from all of these countries except Germany, which has a negative average inflow. The average immigrant inflows from the other European countries (United Kingdom and Poland) and Canada are significantly smaller than middle- or low-income countries. The total volume of trade increased rapidly for large economic bodies such as Mainland China, Mexico and Canada in the past decades and remained stable for Latin American countries. The aggregate trade deficit grew at a blistering pace in the trade with the former two countries whereas the deficit against Canada dropped. Clearly, the U.S. has surplus against almost all Caribbean and Latin American countries except Ecuador, but the surplus is usually inconspicuous. Despite the increasingly large inflows of immigrants, the U.S. trade surplus with Latin American countries is still climbing.

[10]The great circle distance measures the shortest distance between two locations along the surface of the sphere.

Table 2: Variable Listing

Variables	Description	Formula
$IMMIGRANTS_{ijt}$	Population of immigrant stock from country j at time t	Estimated from stocks of 1990, 2000, 2006 and annual inflow data
$IMPORTS_{ijt}$	Imports from country j to U.S. at time t, in millions of U.S. dollars	
$EXPORTS_{ijt}$	Exports from U.S. to country j at time t, in millions of U.S. dollars	
$TOTAL_{ijt}$	Total volume of bilateral trade between U.S. and country j at time t, in millions of U.S. dollars	$TOTAL_{ijt} = IMPORTS_{ijt} + EXPORTS_{ijt}$
$BALANCE_{ijt}$	U.S. trade balance with country j at time t, in millions of U.S. dollars	$BALANCE_{ijt} = EXPORTS_{ijt} - IMPORTS_{ijt}$
$DEFICIT_{ijt}$	U.S. trade deficit in bilateral trade with country j at time t, in millions of U.S. dollars	$DEFICIT_{ijt} = -BALANCE_{ijt}$
GDP_{it}	Gross Domestic Product of U.S. at time t, in U.S. dollars	
GDP_{jt}	Gross Domestic Product of country j at time t, in U.S. dollars	
$GDP_{it}GDP_{jt}$	Product of U.S. and country j's GDP at time t, in U.S. dollars	$GDP_{it}GDP_{jt} = GDP_{it} * GDP_{jt}$
$EXCHANGE_{ijt}$	Exchange rate between U.S. and country j at time t	
$DISTANCE_{ij}$	Distance between the captial city of U.S. and country j, in kilometers	
FTA_{ij}	Dummy variable, 1 if the coutry j has Free Trade Agreement with U.S.; 0 otherwise	

Table 3: Descriptive Statistics

Country	Distance	FTA	Immigrants	ΔImmigrants	Exchcange Rate	Volume of Trade	ΔVolume of Trade	Trade Balance	ΔBalance
Brazil	6790.56	0	238665.9	13455.94	1.85	36739.03	1816.88	1641.82	381.24
Canada	734.09	1	795840.3	3083.64	1.27	389382.10	15211.99	-30514.84	89.87
China (Mainland)	11144.93	0	913219	47521.82	6.65	244216.22	19751.97	-151700.08	-12695.39
Colombia	3823.93	1	496986.9	18869.15	1633.46	15778.72	789.94	-1360.86	37.10
Dominican Rep.	2372.32	1	677133.8	29594.58	24.36	8028.48	379.79	910.31	379.79
Ecuador	4351.17	0	299830.4	11307.21	2376.01	7006.48	309.51	-1595.48	12.42
El Salvador	3045.94	1	874952.9	36148.09	7.22	3297.08	153.35	255.16	25.19
Germany	6710.6	0	658750.1	-4658.33	1.24	99227.39	4674.31	-33989.37	-1722.33
Guatemala	3002.7	1	560760.5	28034.36	6.35	5419.87	304.03	437.59	73.81
Haiti	2306.94	0	430292.9	17095.73	28.42	1166.48	49.04	258.79	12.64
Honduras	2931.64	1	333767	18912.85	19.35	5594.84	291.01	127.76	29.33
India	12045.09	0	1249350.3	73911.48	40.30	28393.38	2531.41	-8628.58	-619.34
Jamaica	2326.19	0	530776	16231.30	55.81	1992.06	70.09	963.83	63.68
Korea, South	11165.17	1	841664.8	21388.18	1008.25	65202.16	3472.27	-11052.68	-420.51
Mexico	3031.95	1	8677913.1	288069.97	9.06	259149.46	17498.50	-33841.40	-2206.97
Peru	5665.39	1	296532	11507.70	2.35	7049.40	484.79	393.59	72.71
Philippines	13781.6	0	1515635.6	22872.03	42.80	14069.22	538.89	-2036.73	-94.24
Poland	7177.34	0	440021.2	788.36	2.61	3919.15	391.29	-397.58	-80.98
United Kingdom	5897.96	0	671170.4	2436.00	0.63	76716.35	3058.84	-1159.97	285.50
Vietnam	13345.52	0	862713	34407.23	11981.74	15745.44	2262.68	-10245.64	-1518.75

4 Empirical Analysis

4.1 Overall Regression

Table 4 presents the regression outcomes of Equation 6, 7 and 8 estimated in pooled panel data Ordinary Least Squares. This group of regressions is conducted on the full sample data of the twenty countries. As expected, immigration has a visible influence on the U.S. trade deficit. On average, a 1% increase in immigration stock from a country is expected to increase the U.S. trade deficit against this country by 7.6 billion dollars, with all other variables held constant. The imports from and exports to the same country is estimated to increase by 3.03% and 3.18%, respectively. The results of both imports and exports are higher than the 1.30% and 1.13% (for an 10% immigrant stock increase) reported in White's paper (2007) and are significantly larger than the 0.01 and 0.02 presented in Gould's study (1994). On the other hand, the estimations are similar to Dunlevy and Hutchinson's findings (1999) which reported an 2.9% increase in imports. The discrepancy among these papers can be attributed to the difference in model specifications and variable selection. In addition, the trading partner countries incorporated in each study are distinct.

Unexpectedly, the results show that the immigrants exert a similar level of impact on imports and exports despite having significant impact on trade deficit. The coefficient of imports is even smaller than the coefficient of exports. One possible explanation is that the network effects are not necessarily symmetric in both directions of trade flows. Based on the results, the network effects must increase the U.S. exports proportionally more than they do imports if the home preference mechanism is taking effect. Another interpretation is that the volume of the U.S. imports is larger than its exports in most international trade relations. Therefore, when they are multiplied by similar coefficients, the increment in imports is greater than the increment in exports, widening the deficit gap.

In general, the regression results are consistent with most previous studies that claimed a significant effect of immigration on the U.S. total volume of trade. The geographical distance has negative elasticity in all four regressions, indicating that further distance tends to reduce not only the trade volume, but also the trade imbalances. The existence of free trade agreements facilitates bilateral trade by boosting both imports and exports, but appears to not affect deficit, suggesting that whether having a free trade relation does not affect the overall trade balance prominently.

Table 4: Estimated Effects of Immigration on Trade - Full Sample

	$DEFICIT_{ijt}$	$\ln IMPORTS_{ijt}$	$\ln EXPORTS_{ijt}$	$\ln TOTAL_{ijt}$
$\ln IMMIGRANTS_{ijt}$	7.6253**	0.3032***	0.3175***	0.3182***
	(2.3815)	(0.0470)	(0.0367)	(0.0386)
$\ln GDP_{it}GDP_{jt}$	7.6343***	0.7749***	0.6837***	0.7294***
	(0.9380)	(0.0185)	(0.0129)	(0.0152)
$\ln EXCHANGE_{ijt}$	-0.4789	0.0333**	0.0153#	0.0306**
	(0.6293)	(0.0124)	(0.0086)	(0.0102)
$\ln DISTANCE_{ij}$	-1.5151	-0.4300***	-0.7587***	-0.5950***
	(2.9319)	(0.0578)	(0.0402)	(0.0476)
FTA_{ij}	-9.0845	0.5045***	0.3868***	0.3788***
	(4.0294)	(0.0795)	(0.0553)	(0.0654)
N	627	627	627	627
Adjusted R-squared	0.2033	0.8261	0.887	0.8619

NOTES: (1) Robust standard errors are reported in parentheses. '***' denotes $p < 0.001$, '**' denotes $p < 0.01$, '*' denotes $p < 0.05$, '#' denotes $p < 0.1$. (2) To keep the results neat, $DEFICIT_{ijt}$ in this table is measured in billions.

Table 5: Estimated Effects of Immigration on Trade by Continent

	European Countries & Canada			Asian Countries			Latin American Countries		
Dependent Variable	$DEFICIT_{ijt}$	ln $IMPORTS_{ijt}$	ln $EXPORTS_{ijt}$	$DEFICIT_{ijt}$	ln $IMPORTS_{ijt}$	ln $EXPORTS_{ijt}$	$DEFICIT_{ijt}$	ln $IMPORTS_{ijt}$	ln $EXPORTS_{ijt}$
ln $IMMIGRANT_{ijt}$	37.9661**	3.7818***	2.6071***	-93.9931**	-0.4454*	-0.2737	11.7691***	0.6526***	0.4688***
	(12.7050)	(0.3609)	(0.2576)	(28.6925)	(0.2111)	(0.1694)	(1.2414)	(0.0780)	(0.0472)
ln $GDP_{it}GDP_{jt}$	9.8105***	0.7549***	0.6628***	61.1540***	0.8247***	0.7365***	-1.2902#	0.4860***	0.5877***
	(1.2688)	(0.0360)	(0.0257)	(10.6556)	(0.0784)	(0.0629)	(0.7101)	(0.0446)	(0.0270)
ln $EXCHANGE_{ijt}$	-7.8402***	-0.1442**	-0.0507	28.1532***	1.0384***	0.5267***	0.0243	0.0135	-0.0186*
	(1.6056)	(0.0456)	(0.0326)	(6.4433)	(0.0474)	(0.0380)	(0.2131)	(0.0134)	(0.0081)
ln $DISTANCE_{ij}$	227.3044***	0.4874	-3.9210***	-621.1527*	-42.4285***	-22.3603***	12.7258**	0.9789***	-0.2499
	(30.1242)	(0.8556)	(0.6107)	(286.2778)	(2.1061)	(1.6900)	(4.3860)	(0.2757)	(0.1669)
FTA_{ij}	507.0153***	2.5407	-6.6767***	-191.1056***	-5.4051***	-1.9272***	-2.237	0.2918***	-0.0308
	(63.6518)	(1.8078)	(1.2905)	(36.0216)	(0.2650)	(0.2126)	(1.3924)	(0.0875)	(0.0530)
N	130	130	130	122	122	122	295	295	295
Adjusted R^2	0.5532	0.9549	0.9751	0.5692	0.9427	0.9492	0.5086	0.8776	0.9425

NOTES: (1) Robust standard errors are reported in parentheses. '***' denotes $p < 0.001$, '**' denotes $p < 0.01$, '*' denotes $p < 0.05$, '#' denotes $p < 0.1$. (2) To keep the results neat, $DEFICIT_{ijt}$ in this table is measured in billions.

Table 6: Estimated Effects of Immigration on Trade - Individual Countries

	China, Mainland	Germany	India	Mexico	Philippines	South Korea	Vietnam
$\ln IMMIGRANT_{ijt}$	21.3800***	-4.7182**	-0.6115	1.2272*	2.5159	-2.7739*	5.9840*
	(4.8324)	(1.3398)	(0.7381)	(0.5463)	(1.9811)	(1.0838)	(1.3795)
$\ln GDP_{it}GDP_{jt}$	-5.8640***	0.0198	0.5667*	0.8423***	-0.6753	0.9470**	0.4340#
	(1.5081)	(0.2017)	(0.2072)	(0.1749)	(0.4408)	(0.2686)	(0.2350)
$\ln EXCHANGE_{ijt}$	-5.2709*	-0.7662*	1.8449**	-0.622*	-0.1067*	2.1625**	-0.314
	(2.0331)	(0.3740)	(0.6042)	(0.2616)	(0.0479)	(0.6555)	(0.8614)
N	30	30	30	30	30	30	30
Adjusted R-squared	0.8952	0.7988	0.9459	0.891	0.2935	0.6207	0.9704

NOTES: Robust standard errors are reported in parentheses. '***' denotes $p < 0.001$, '**' denotes $p < 0.01$, '*' denotes $p < 0.05$, '#' denotes $p < 0.1$

4.2 Regression by Group

This subsection categorizes the countries based on geographical scope. Table 5 exhibits the regression outcomes for each group. The first group contains all European countries (Germany, Poland and United Kingdom) and Canada, its only trading partner in North America. The immigration from these countries demonstrates its influence not only via their trade surplus against the U.S. but also through the total volume of trade. This is counter to White (2007), who suggested that the immigrant stocks from high- and medium-income countries have no trade-facilitating effects. Nevertheless, this study only includes four countries in this group, reducing its ability to represent all above-medium-income countries compared to White's study. Based on the results, the import elasticity is higher than that export elasticity, which can be seen as evidence of the home bias effects. In trade with this group's countries, free trade agreements seem to contribute to the U.S. deficit level with a large positive coefficient. The positive coefficient on distance indicates that the U.S. exhibits a greater imbalance in its trade with distant European countries compared to the trade with its neighbor, Canada.

According to the columns related to Asian countries (China, India, Philippines, South Korea and Vietnam) in Table 5, the trade volume and deficit are driven mostly by the GDP product,

rather than immigration effects, attributable to the Asian countries' rapid integration into the world in the past decades. The immigration stocks appear to be a less significant variable with a negative sign, possibly due to the inhomogeneity of the countries in this group. Among them, Mainland China and South Korea are East Asian countries, whereas India, Philippines and Vietnam are South- and Southeast-Asian countries. According to Head and Ries (1998), East Asian immigrants exhibit statistically significant influence on trade (import elasticity of 0.74 and export elasticity of 0.29), while the variable for South Asia is insignificant. Moreover, divergence also exists in the income levels of Asian countries in this group. This paper does not stratify countries based on GDP per capita. However, Mainland China, India and Vietnam belong to the low-income group; Philippines belongs to the middle-income; South Korea alone belongs to the high-income group. Only immigrants from low-income countries have a significant effect on trade, according to White (2007). The inhomogeneous nature of the products and immigrants in this group may cause the immigrant stocks to exhibit an opposite effect to the full sample.

Latin American countries include Central American (Dominican Republic, El Salvador, Guatemala, Haiti, Honduras, Jamaica, Mexico) and South American (Ecuador, Brazil, Peru) countries. Distinct from European and Asian countries, most Latin American and Caribbean countries rely heavily on the imports from the United States. As a result, the U.S. imports and exports are relatively balanced, compared with the aforementioned groups. The U.S. trade balance fluctuates around zero in its trade relations with most Latin American countries. Between 2000 and 2013, US sales to Latin America more than doubled (Hornbeck 2014). The U.S. had a moderate deficit against Latin America from 1990s to 2005, after which it usually had a larger volume of sales than purchases. The only exceptions are Ecuador against whom the U.S. always has deficit and Haiti against whom the U.S. always has surplus. Nevertheless, the regression on trade deficit indicates that immigrant stock boosts the deficit level. An 1% increase in Latin American immigrants is estimated to rise the U.S. trade deficit by 11.8 billion, smaller than the effects of European and Canadian immigration. The import and export elasticity coefficients are highly consistent with Head and Ries' estimation (1998) of 0.66 (imports) and 0.36 (exports). As is the case with European countries and Canada, the import elasticity is larger than export elasticity for Latin

American countries. The difference is that this group tends to be indifferent to the distance and trade agreements, possibly due to closer geographical location and lower transportation costs.

4.3 Individual Country Regressions

This subsection performs individual regressions on the immigrant-trade relationship of some highlighted countries. The countries of interest are: 1) Asian countries, because they generate unexpected results when regressed altogether, especially South Korea, which is the only developed Asian country in the previous analysis; 2) Mexico, since it is the origin of the largest immigrant community by the time of research, followed by Asian countries 3) Germany, for it is the only country with negative growth in immigrant population and yet has a large immigrant community, as well as a huge trade surplus against the U.S. In this section, all countries selected have trade surplus against the U.S. during the study's time window. The positive deficit values enable me to adopt double logarithmic equation (Equation 5) and interpret the outcomes as immigration-trade elasticity.

As expected, the immigrants from China have a strong influence on the U.S. trade deficit with the country. However, the negative coefficient on the GDP product indicates potential problems in the regression model. Since China experienced explosive growth over the past several decades as it gained a dominant position in manufacturing, which the U.S. outsourced to East Asia, among other destinations, over a span of several decades beginning with Reaganomics, the U.S. naturally experiences larger and larger trade deficits with China. Hence, the GDP variable may be an incomplete account for China's openness and rapid integration into the world and distorts the outcomes. Mexican immigrants are estimated to have a smaller influence than the Chinese immigrants. Meanwhile, a coefficient of 1.23 indicates Mexican immigrants' strong impact on trade deficit.

The results of India and Philippines are insignificant. Despite large inflows of immigrants from them, it seems that both South- and Southeast-Asian immigrants barely affect their home

country's trade balance with the United States. Furthermore, the two high-income countries - Germany and South Korea - report negative coefficients on immigrant stocks. Wei (1996) and Helliwell (1997, 1998) suggested that richer countries have smaller home bias than do poorer countries, a possible explanation for the inverse effect. The purchases from and sales to richer countries tend to offset each other, demonstrating little home bias effects. This reasonably explains why the Asian group exhibits unexpected influence on the U.S. trade deficit.

4.4 Estimating Immigration Effects

This subsection determines the effects of a hypothetical 10% increase in immigrant stocks from country j using the results from the overall regression. The estimation is based on the assumption that export elasticity only reflects the network effect, and that such effect is symmetric on both directions of trade. The specific estimation rationale is presented in part I of Data and Methodology section (Equation 11). Column (1) is calculated as the coefficient on immigration, with exports as the dependent variable multiplied by the average annual exports to country j. Column (2) is identical to column (1) based on symmetry. Column (3) is computationally similar to column (1): it is the coefficient on immigration with imports as the dependent variable, multiplied by the average annual imports from country j. Column (4) represents the lower boundary of possible home bias effect, and column (5) is the other extreme which attributes the difference between (2) and (3) entirely to the home bias effect. Latin American countries are excluded from the calculations because this section mainly focuses on negative trade balance. Table 7 presents the estimated effects.

On average, a 10% increase in immigrants from the above countries is estimated to increase the U.S. imports from and exports to their home country by 1,999 million and 1,212 million dollars, respectively. Hypothetically, they increase the U.S. trade deficit by about 787 million, an estimate significantly smaller and more reasonable than the one given by the direct regression on $DEFICIT_{ijt}$. However, the quantification of the effect may be flawed in a few ways. First,

Table 7: Aggregate Effects of 10% Increase in $IMMIGRANTS_{ijt}$ on U.S. Trade Deficit

	Network Effects			Home Bias Effects	
	(1) Exports	(2) Imports (lower)	(3) Imports (upper)	(4) Imports (lower)	(5) Imports (upper)
Canada	5697.05	5697.05	6366.27	0	669.21
China (Mainland)	1468.70	1468.70	6002.68	0	4533.98
Germany	1035.66	1035.66	2019.77	0	984.11
India	313.77	313.77	561.31	0	247.54
Korea	859.63	859.63	1156.14	0	296.51
Philippines	191.02	191.02	244.19	0	53.17
Poland	55.91	55.91	65.45	0	9.54
United Kingdom	1199.46	1199.46	1180.72	0	-18.74
Vietnam	87.31	87.31	394.07	0	306.76
Average	1212.06	1212.06	1998.95	0	786.90

Table 8: Per-immigrant Effects of 10% Increase in $IMMIGRANTS_{ijt}$ on U.S. Trade Deficit

	Network Effects			Home Bias Effects	
	(1) Exports	(2) Imports (lower)	(3) Imports (upper)	(4) Imports (lower)	(5) Imports (upper)
Canada	71585.39	71585.39	79994.28	0	8408.90
China (Mainland)	12795.09	12795.09	52294.39	0	39499.29
Germany	15721.59	15721.59	30660.58	0	14938.99
India	2511.45	2511.45	4492.80	0	1981.35
Korea	10213.43	10213.43	13736.32	0	3522.89
Philippines	1260.31	1260.31	1611.14	0	350.83
Poland	1270.51	1270.51	1487.39	0	216.87
United Kingdom	17871.24	17871.24	17591.98	0	-279.26
Vietnam	1012.04	1012.04	4567.75	0	3555.71
Average	14915.67	14915.67	22937.40	0	8021.73

as White (2007) pointed out and verified in section 4(I) of this paper, the network effects do not necessarily affect imports and exports identically. There may exist time lag in the network effect; thus the home bias effects may be overestimated.[11] Second, the average annual imports and exports can be an inaccurate base value for estimation, since it is calculated from a thirty-year time window. With the massive wave of globalization and continuous inflation, the U.S. has witnessed rapid growth in both imports and exports during this period, amplifying the immigrants' influence on trade deficit.

To calculate the per-immigrant effect, the average immigrant stocks data is employed. The aggregate effects from Table 7 are divided by 10% of immigrant population from country j. It is worth noting that the values in the table only represent the effects of the first 10% increase of the population. The marginal effect is expected to decline as the market of foreign products develops and the immigrants' information advantage becomes exhausted. On average, an individual immigrant is estimated to add $8,022 to the deficit annually. This number is considerably higher than White's previous estimation of $2,057. Besides the difference in model specifications, the inclusion of recent data may also lead to elevated numbers. Moreover, countries selected in this subsection are relatively large economic bodies with considerable volumes of imports and exports, generating higher-than-average estimation of home bias effect.

5 Conclusion

This paper investigates the effects of immigration on the United States trade deficit in international trade relations. The paper focuses on twenty trading partner countries that are the largest origins of immigrants for the U.S. and studies their trade volumes with the U.S. from 1986 to 2018. Building on previous work, the paper argues that immigrants affect the U.S. trade balance via two mechanisms: the network effect and the home bias effect. The paper also suggests that the home bias effect is a significant factor in determining the U.S. imports from the home

[11] See White (2007).

country, aggravating its trade deficit with the country.

Employing the popular gravity model of trade, the empirical analysis provides regression results on trade deficit, imports and exports, respectively. The outcomes indicate that immigrant stocks can and do play an important role in determining the U.S. trade balance. In total, a hypothetical 1% immigrant stock increase can lead to a 7.6 billion increase in trade deficit with the corresponding country. Unlike previous studies, this study reports a similar level of immigrant effect on imports and exports at around 3%. Nevertheless, the inflow of immigrants still widens the trade gap with many immigrant origin countries, since the U.S. import from them is usually larger than export in volume. The study also finds evidence of potential asymmetry of the network effects on imports and exports.

In grouped regressions, the immigrants from European and Latin American countries are found to be statistically significant in determining the U.S. trade deficit with their home countries. The inhomogeneous nature of the Asian group may weaken the power of the model and produce insignificant results. Among them, immigration from China exhibits the largest impact on trade balance, while the trade balance with Southeast Asian countries appears to be indifferent to immigrants. Using the coefficients on imports and exports, the paper quantifies the immigrant effect on trade with 9 non-Latin-American countries. On average, 10% increase in immigrant stocks is estimated to increase the U.S. deficit by 787 million U.S. dollar annually.

The study has some limitations, and some facets remain to be improved and further explored. First, using the deficit data as the dependent variable produces a significant result, but apparently overestimates the effect of immigration. In contrast, estimations from the imports and exports models is more reasonable, supported by previous studies which usually reported an effect of tens of millions to thousands of millions. In addition, the regression on deficit has a lower R-squared than the one on imports and exports, suggesting that the gravity equation adopted may not be a fitting model for deficit. Second, pooled panel data technique treats the two dimensions, time and section, in a relatively slipshod way. More advanced panel data methods may produce more accurate results. Last but not least, the sample size studied is rather limited. Although

the immigrants from the twenty countries make up 70% of the total immigrant population, these communities cannot fully represent all immigrants' characteristics. Further research can include a larger range of sample countries and shed light on the actual impact of immigration from each foreign country.

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Appendix A Data Source Listing

Variable	Source
IMMIGRANTS	U.S. Census Bureau's 2006 to 2018 American Community Survey, 2000 Decennial Census, Gibson and Lennon's working paper (See Reference)
IMPORTS, EXPORTS, DEFICIT	U.S. Census Bureau
GDP	International Monetary Fund's World Economic Outlook Database
EXCHANGE	International Monetary Fund's International Financial Statistics database
DISTANCE	Author's calculations using Great Circle method
FTA	n.a.