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How Localized is the Pro-trade Effect of Immigration? Evidence from Mexico and the United States

Michael Good
Department of Economics, Florida International University

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I estimate the effect that immigrants have on international trade between states of current residence and states of origin. The pro-trade effect of immigrants has been thoroughly examined since the mid-1990s, connecting both destination countries with origin countries and destination sub-national divisions with origin countries, respectively. However, a recent emphasis on the importance of geographic proximity to the immigration-trade link leads me to pose the question of how localized the trade-enhancing effect of immigrants actually may be. In turn, my analysis provides the first results as to the immigrant-trade nexus at the state level for both places of destination and origin, relying on a unique data set allowing the mapping of Mexican-born immigrants' US states of residence to Mexican states of origin. I find that immigrants indeed promote trade between their US states of residence and Mexican states of origin, estimating a statistically significant elasticity of exports to immigration equal to 0.08. This figure is not only qualitatively but also quantitatively important, corresponding to $2467 extra annual exports between respective US and Mexican states associated with each additional immigrant.

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†*Department of Economics, Florida International University, 11200 SW 8th Street, Miami, Florida 33199, USA E-mail: mgood010@fiu.edu*

I. Introduction

Recent studies emphasize the link between immigration and trade, both through theoretical models and empirical evidence. From the seminal works of Gould (1994) and Head and Ries (1998) to more recent articles such as Aleksynska and Peri (2011), Kugler and Rapoport (2011) and Hatzigeorgiou and Lodefalk (2011), all point to the same general conclusion: immigrants do indeed promote international trade between the destination and origin countries. This robust positive relationship between human and goods mobility across studies is especially noteworthy given the variety of approaches employed and the number of countries studied. While most studies use a standard gravity model augmented with an immigration variable as well as various controls for bilateral trade costs, specific methods vary, including pooled cross section or panel data OLS with fixed effects, 2SLS and generalized propensity score. The US and Canada garner the majority of attention in terms of country-specific studies, focusing on immigrants to the destination country and the subsequent trade from the destination country to all other countries; however, studies have also focused on the UK, Spain, Denmark and Bolivia, among others.[1] Furthermore, the geographic unit under examination varies, many measuring links at the country-country level while others narrow the focus to state-country connections.[2]

As to the channels through which immigrants enhance trade, the consensus points to a preference channel and an information channel, normally associated with increased imports and increased imports and exports for the destination country, respectively. Immigrants may bring preferences for specific products with them to the destination region, leading to increased imports from the specific origin regions; on the other hand, immigrants familiar with language, tastes, customs, or the workings of business and law in both the place of origin and destination may pass this information on to firms, thereby lowering the cost associated with entering or increasing presence

[1] For example, see Girma and Yu (2002), Peri and Requena (2010), White (2007), and Erlich and Canavire Bacarreza (2006), respectively.

[2] In order to maintain consistency, I always refer to the geographic unit in terms of destination-origin throughout the paper. For example, I classify a study examining the connection between immigrants living in the United States and their connection with exports from the US (entire country) to countries of immigrants' origins as "country-country."

in a certain foreign market, potentially increasing both imports and exports.

A natural question arises from this consistent body of evidence on the pro-trade effect of immigration: *How localized are the preferences and information that immigrants embody and potentially transmit to firms?* While several previous studies zero in on the state level for the given destination country, to my knowledge no studies examine the immigrant-trade link at the state-state level. Not only does the possibility of localized preferences and information have key implications for firms looking to take advantage of the pro-trade effect, it also makes a contribution to further explaining the actual workings of how immigrants may positively influence trade with their places of origin.[3] This increased trade in turn provides yet another benefit of immigration to those countries and/or states maintaining policies which promote the entry and acceptance of a diverse population of immigrants, potentially especially relevant for states looking to offset or benefit from certain anti-immigrant measures recently adopted in a handful of states in the US, among other countries.[4]

My approach examines empirically the migration-trade nexus, using data linking immigrants' states of origin with current states of residence to determine how localized the information that immigrants transmit to exporting firms actually is. Specifically, this method maps Mexican immigrants' Mexican state of origin to current state of residence in the United States, using data on *matrícula consular* (consulate registration) holders available from the Mexican government.[5] In turn, putting this data in a standard gravity model augmented to include immigration as an additional explanatory variable for exports from US to Mexican states allows for estimation of the pro-trade effect that migrants have at the state-state level for the first time.

[3] See Cohen, Gurun and Malloy (2012) for an analysis of how the ethnic makeup of the population surrounding a firm can point to trade links that will in turn be valuable to the firm.

[4] See Good (2012a) for an analysis of how recent state-level immigration legislation in the US has affected internal migration, specifically the decision as to state of residence after the implementation of laws targeting undocumented immigrants.

[5] The *matrícula consular* is an identification card made available by the Mexican government to citizens residing abroad starting in 1871. The card must be renewed every five years, giving the holder access to opening a bank account, obtaining a driver's license, and other services, depending on the specific country and state of residence. I define state of origin as the last state of permanent residence before immigration occurred from Mexico to the US.

I find that just as in previous studies at the country-country and state-country levels, immigrants indeed have a statistically significant pro-trade effect at the state-state level, promoting exports from US states of residence to Mexican states of origin. The preferred specification reveals an elasticity of exports to immigration of 0.08. This result varies minimally in magnitude and significance across several checks for robustness, providing clear evidence as to the additional benefit of immigration that manifests itself through its nexus with international trade, now evidenced at the relatively localized state-state level.

II. Theory

If the information and knowledge that immigrants embody are indeed differentiated at a localized level, the study of the pro-trade effect of immigration at the state-state level becomes essential. For example, not only does a Mexican immigrant now provide different information to the potential US export market than a Honduran immigrant, a *Veracruzano* (from the Gulf coast state of Veracruz, Mexico) also provides different knowledge than a *Jalicense* (from the Pacific coast state of Jalisco, Mexico). The generally accepted preference and information channels are thoroughly explained in the literature; it is clearly easy to apply both channels to differentiated knowledge not only at the country-country or state-country level, but also at the state-state level.

Revealed preferences and preference absorption

Focusing specifically on exports from places of destination to places of origin, I claim that two additional mechanisms not yet mentioned in the literature are at work in the trade-enhancing effect of immigration - revealed preferences and preference absorption. Although similar in name, what I refer to as revealed preferences is entirely separate from the preference channel which promotes imports from places of origin to destination; on the contrary, revealed preferences has more in common with the information channel in the sense that immigrants reveal information about consumption preferences in the respective localities of origin abroad, thereby lowering the information

cost associated with international trade. Through each and every market transaction completed by an immigrant, certain information as to individual preferences is revealed, requiring no knowledge or effort in passing on the information on the part of the immigrant. If these preferences are shared, even in some part, by persons of similar nationality, state origin, or whatever the geographic (political) unit of focus, information as to preferences of the corresponding demographic in the place of origin are also revealed. For example, a Mexican residing in the US purchasing Thai curry paste produced and sold in the US clearly reveals that he/she has some preference for the product, valuing the paste at at least the price paid. This individual preference can then be interpreted by the seller or producer as a signal of consumption preferences in the origin locality in Mexico, whether or not other individuals of the same origin actually share this preference for Thai curry paste. Just as Kugler and Rapoport (2011) argues that immigrants' participation in the destination country's labor force can reveal information as to profitability of potential foreign direct investment, I argue that immigrants' participation in the goods market can indeed act as an information-revealing mechanism, transmitting valuable knowledge to companies about consumer preferences abroad. Clearly, the actual value of the information revealed is directly related to how homogeneous a particular origin population is in its consumption preferences, pointing again to the importance of a more localized examination of the immigration-trade link, as greater homogeneity of preferences likely exists as the geographic focus becomes ever narrower.

Furthermore, the existence of revealed preferences means that new waves of immigrants remain essential for immigration's promotion of trade, even when a particular immigrant community is well-established in the place of destination. As preferences are clearly dynamic, the communication of these preferences must be dynamic, therefore making the updating of these preferences a necessity for exporters looking to fully capitalize on opportunities in any foreign consumption markets. Updating becomes particularly important when immigrants carry information from countries, states, or communities undergoing a constant, dynamic process of revision of preferences. Posing the question of 'which communities are undergoing the most dynamic processes of prefer-

ence revision?' easily leads to communities that are also undergoing the most dynamic processes of population change - the very high-migration communities that provide the origin side of the origin-destination equation in the study of the pro-trade effect of immigration.

While revealed preferences provides further information as to consumption preferences in the origin localities, overlapping with the already well-established information channel, what I will call preference absorption operates in an entirely different manner, actually creating new demand for international products. Preference absorption occurs as immigrants most likely not only reveal consumption preferences of their origin communities, but affect them as well. As long as immigrants maintain connections with their places of origin and preferences are at least minimally malleable, some preferences for products originating in immigrants' places of residence are transferred to places of origin.[6] An example using the context of this paper, US exports to Mexico, is the prevalence of US-based clothing brands in high-migration Mexican communities. While it is possible that the apparent preference for this particular clothing is solely generated in Mexico, perhaps by local advertising or availability of these products from stores already previously located in Mexico, a much more likely explanation involves a common occurrence in most any high-migration community in Mexico (and probably in the entire world). Immigrants returning to visit places of origin often carry a taste of abroad with them in the form of products such as clothing to family members or friends still residing in origin communities. As this initial transfer of goods takes place, a strong possibility of preference transfer takes place, as those persons never having emigrated "absorb" certain preferences for products originating in the immigrants' places of destination, now resulting in preference absorption, thereby creating a completely new demand for international trade that formerly did not exist. In turn, this new demand results in either heightened interest in frequenting those stores carrying the particular products if they were already established in Mexico, or petitions for further access to the brands via the immigrant who initiated the preference absorption process.

[6]Evidence from Bronnenberg et al. (2012) indirectly confirms this idea; key conclusions include that interstate migrants in the US do indeed display a certain level of preference malleability across different brands in the same product category, especially in consumption categories exhibiting high levels of advertising or social visibility.

Interestingly, just as in the case of revealed preferences, preference absorption permits even immigrants who are relatively low-skilled (low education) and not necessarily well-connected with any kind of business network to potentially enhance trade. Every market transaction can provide at least some level of information in revealing preferences, and the visit of any immigrant to the respective place of origin can result in at least some level of preference absorption.

Aspects of the US-Mexico relationship

The US-Mexico relationship provides an especially interesting and appropriate setting for examining the pro-trade effect of immigration for several reasons. First and foremost is the fact that data is available, permitting the analysis at the state-state level for the first time. Detailed exports data from US to Mexican states are available for all years since 1994, coinciding with the implementation of the North American Free Trade Agreement. Perhaps most noteworthy is the availability of the *matrícula consular* data, uniquely allowing for the connection of Mexican state of origin to US state of residence for each immigrant registered during the period examined.

Additionally, as both the US and Mexico are relatively large, heterogeneous countries, there is clearly wide differentiation within countries as to preferences and the knowledge and information that residents hold about markets, customs, and tastes, all important factors for the theorized channels through which the pro-trade effect operates. For example, an emigrant leaving the southeastern state of Chiapas to reside in the US undoubtedly has much different information than an emigrant leaving the northern state of Sonora, arguably similar to the level of differentiation existing across immigrants of varying nationalities signaled by the previous literature.

Although this differentiation, depending on Mexican state of origin and US state of residence, points unequivocably to the theorized pro-trade effect of immigration at the state-state level, several aspects of the US-Mexico relationship signal that this effect could potentially be minimized relative to the entire range of possible pro-trade effects across all countries (and the respective sub-

national divisions). First, both trade and immigration between the US and Mexico are relatively well-established, neither phenomenon being particularly new in its existence. Herander and Saavedra (2005), among others, find that the existence of a previous large immigrant stock reduces any pro-trade effect of new immigrants. However, the "newness" of immigration from and to particular Mexican and US states, respectively, could potentially offset the fact that the Mexico-US immigration is not novel at the country-country level.[7] Second, Mexican immigration levels to the US are relatively high, especially relevant if beyond a certain level of immigration, further immigrants may not marginally stimulate trade between places of residence and origin. The mean state-state count of *matrículas consulares* for my sample is 2407, with the maximum of 227,032 corresponding to those *Michoacanos* registered in California; 9.81% of the 1488 state-state combinations exhibit immigration numbers surpassing the 4,000-immigrant exhaustion point of Egger, von Ehrlich and Nelson (2012), above which additional immigrants provide zero stimulus for trade.[8] The need for updating mentioned above, however, may raise or eliminate any such kind of exhaustion point suggested by previous findings. Finally, a majority of the Mexican immigrant population in the US is relatively low-skilled and may not participate in any form of business network. These general characteristics are of potential importance given recent findings that being highly-skilled and having access to business networks makes immigrants particularly effective in their promotion of trade.[9]

Given the outlined aspects of the US-Mexico relationship, any pro-trade effect found at the state-state level between states of these neighbor countries can be hypothesized to fall at the lower end of the spectrum of potential worldwide effects across all countries. In turn, the presence of a US-Mexico link between immigration and trade becomes even stronger evidence of the general existence of a pro-trade effect of immigration at the state-state level. However, it is important

[7] Card and Lewis (2007) examines the choice of US states of destination for Mexican immigrants, analyzing changing trends during the 1990s. Hatzigeorgiou and Lodefalk (2011) also highlights the importance of new immigrants in updating information.

[8] The threshold of 4,000 contrasts strongly with the findings of Good (2012b) and those of Serrano and Requena (2012), where every immigrant makes a positive marginal contribution to the pro-trade effect; these vast differences most likely reflect the vastly different data sets under examination in the three articles.

[9] See Felbermayr and Jung (2009) and Aleksynska and Peri (2011) for these respective emphases.

to note that given the lack of previous evidence, it is nearly impossible to hypothesize how the pro-trade effect of immigration at the state-state level may compare in magnitude with that of the country-country or state-country levels already outlined in the literature.

III. Empirical Strategy and Data

In estimating the effect of immigration on international trade between states in the United States and in Mexico, I employ a standard gravity model, the most common empirical strategy for studies examining not only factors affecting trade, but also the potential pro-trade stimulus provided by immigration. Augmenting the standard model with immigration as an additional explanatory variable, however with the novel state-state unit now under the microscope, results in the following specification.

$$lnT_{ij} = \alpha + u_i + m_j + \gamma lnMig_{ij} + \beta_1 lnY_iY_j + \beta_2 lnDist_{ij} + \beta_3 Adj_{ij} + \varepsilon_{ij} \tag{1}$$

T_{ij} measures exports from US state i to Mexican state j in terms of yearly total value, dependent on immigration, size of market (income), distance, and adjacency. Mig_{ij} captures the stock of *matrícula consular* holders in each US state i from each Mexican state of origin j ; Y_i and Y_j are the gross state products of US state i and Mexican state j, respectively, $Dist_{ij}$ represents the distance by land from US state i capital to Mexican state j capital, while Adj_{ij} is a dummy variable taking the value of 1 for adjacent states and that of 0 for states not sharing a border. Given the log transformation, the coefficient of interest γ thus pinpoints the percentage increase (decrease) in yearly exports flowing from a US state to a Mexican state associated with a 1% increase in the stock of immigrants originating from the corresponding Mexican state and registered in the corresponding US state. Additionally, u_i and m_j are US and Mexican state fixed effects, respectively, controlling for the multilateral resistance terms as recommended by Anderson and Van Wincoop (2003). Other variables commonly employed as controls for bilateral trade costs in previous immigration-augmented gravity models, such as trade agreements, language, colonial ties, legal system, currency, and cultural distance, are not relevant in the current setting since these

variables are generally not differentiated within a single country, this being true in the case of the United States and Mexico.[10]

Values of state-state exports are obtained from the US Bureau of Transportation statistics; these statistics cover all exports from the US to Mexico at the state-state level, except for those transported by air or water, providing 90% coverage of total exports between the two nations. Given this coverage, the non-contiguous US states of Alaska and Hawaii are excluded from the analysis; in addition, exports listed as originating in Washington D.C. or destined for Mexico City are excluded from the empirical analysis, both nation's capital cities being included in the Bureau of Transportation statistics. For the preferred specification, trade value is calculated as a simple average for each state-state combination over the five years of 2007 to 2011.[11] As original export data are listed with current dollars as the unit, I use the US CPI-U series to convert all values to 2011 US dollars before taking the averages. Statistics on the number of *matrículas consulares* issued are calculated given the information provided by the *Insitituto de los Mexicanos en el Exterior* (IME). Since holders of the card must specify last state of Mexican residence as well as current state of US residence during the application process, these statistics uniquely allow for the construction of the necessary state-state immigration data. As the identification cards have a renewal period of five years, I sum the available data from 2006 to 2009 in constructing the stock of Mexican immigrants for each state-state combination.[12] I consult the US Bureau of Economic Analysis (BEA) and the Mexican *Instituto Nacional de Estadística y Geografía* (INEGI) statistics for the respective gross state products corresponding to 2010, while distance between capital cities is calculated using the shortest route by land expressed in number of miles.[13] The original data for Mexican gross state

[10]There is a limited amount of heterogeneity for these potential variables, for example with the presence of a number of languages in Mexico, however in the sample at hand this differentiation is so minimal that it does not justify inclusion in the regression equation as an additional control variable.

[11]Section V details modifications to the trade value calculation used to check for sensitivity of the results to these changes.

[12]As of final revisions, complete data is only available for the years 2006 to 2009.

[13]This differs from the standard measure used by similar studies, that of great circle distance, due to the fact that the trade data (and a majority of Mexico-US immigration) is by land. However, if great circle distance is indeed employed as the measure of distance, results change only minimally, with a slight increase in the magnitude of the distance coefficient.

products are listed with the unit of 2003 pesos, therefore I initially convert the values to 2003 US dollars using the average of monthly historical peso-dollar exchange rates from 2003. Finally, just as with the US gross state products originally reported with the unit of 2005 US dollars, I again use the CPI-U series to convert all values to 2011 dollars in order to maintain uniformity with the export values.

As the *matrícular consular* data does not completely cover the population of Mexican origin in the US and could possibly present problems of selection, I closely examine the distribution of Mexican immigrants across the US states of residence in attempting to determine whether this data sufficiently represents the actual distribution of residents of Mexican origin across the US states. As there is no justifiable reason to expect that Mexican state of origin affects selection into obtaining a *matrícula consular*,[14] if the data's distribution is sufficiently close to the actual distribution of Mexican immigrants (irrespective of Mexican state origin) across US states, the use of the *matrícular consular* data can be said to provide a certain level of representativeness for the state-state distribution, thereby minimizing any bias arising from selection problems. This thus allows the use of the 2010 US Census as a benchmark for comparison; I contrast the *matrícular consular* data with that of the Census, in which the number of residents in each US state claiming Mexican origin is detailed. Figure 1 details the distribution of Mexican immigrants in the US for both the *matrícula consular* data and the Census data; the data are expressed as the number of Mexican immigrants in each state divided by the total stock of immigrants from each respective source.[15]

[14] A natural assumption may be that education level is associated with legal immigration status, thereby making it more likely for individuals to obtain a *matrícula consular* if the state of origin corresponds to a low-education Mexican state on average. However, this assumption does not appear to be correct; see page 12, paragraph 2 for a related brief discussion.

[15] This fraction with an upper limit of 1 is then multiplied by 100, resulting in the numbers expressed on the y-axis of Figure 1.

Figure 1. Percentage distribution

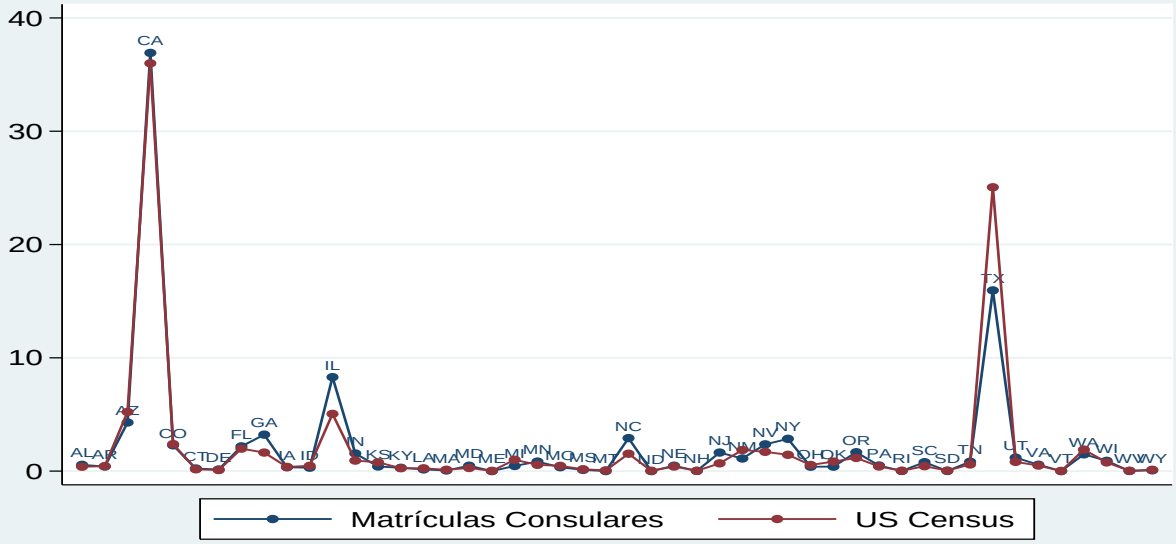


Figure 2. Difference in percentage distribution

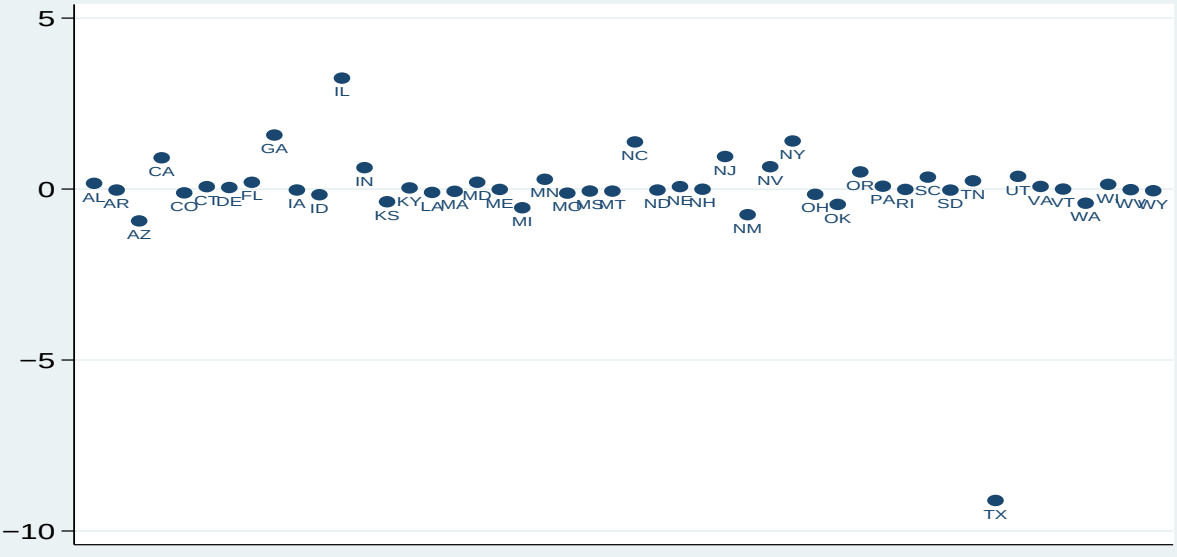
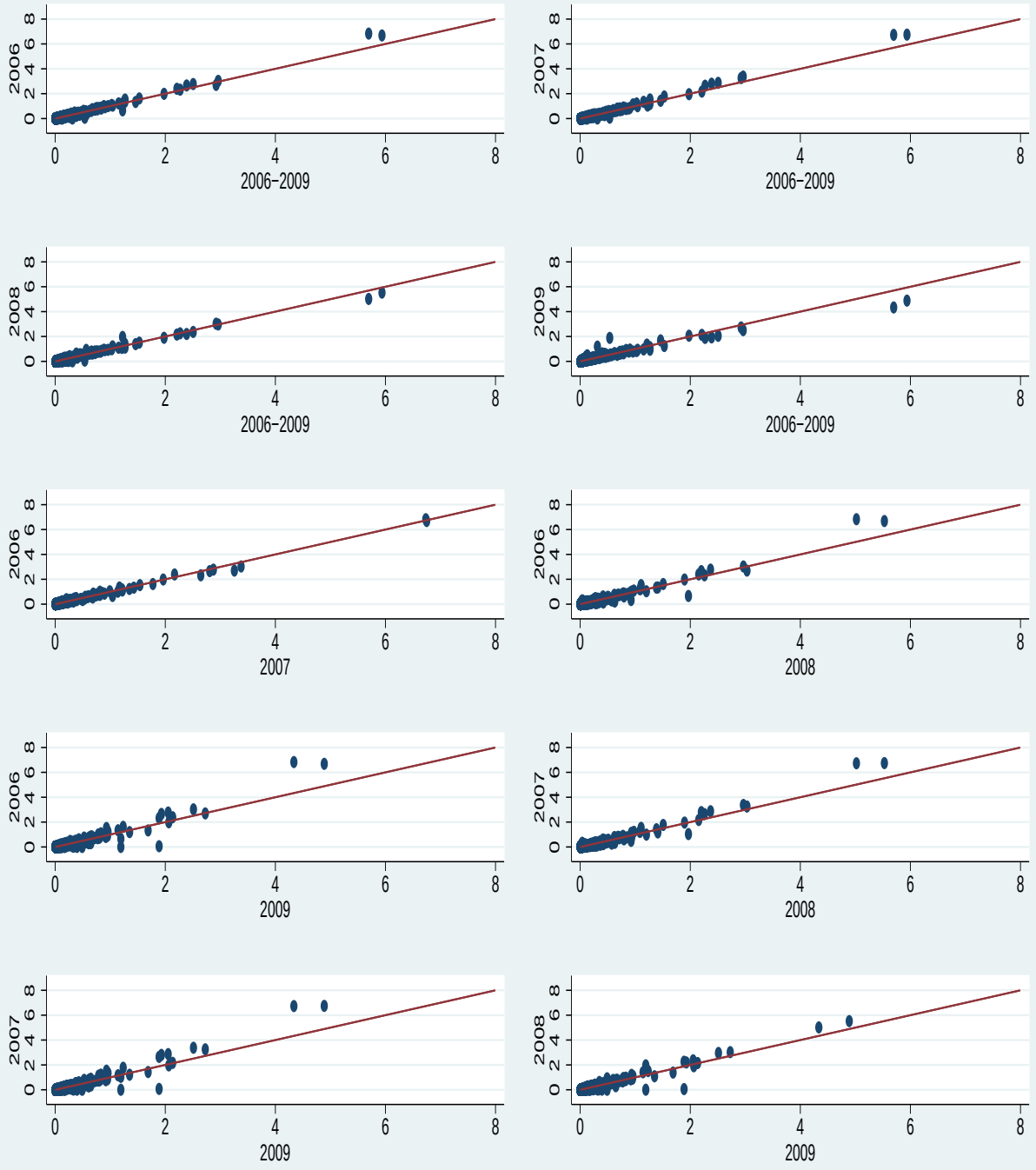


Figure 2 presents the same data, showing the Census 2010 percentage subtracted from the *matrícula consular* percentage. Therefore, if the particular state coordinate lies above the zero line, *matrícula consular* data overestimate the actual percentage share of immigrants; on the contrary, coordinates below the zero line indicate that the actual state share of Mexican immigrants is underestimated by the *matrícular consular* data. As seen in Figure 2, the *matrícula consular* data performs well in representing the actual distribution of Mexican immigrants across US states, with most states' difference coordinates close to zero. Only two states, Texas and Illinois, suffer from differences greater than 3%, while 43 of 48 states' differences in percentages are less than 1%.

It is of further interest to note that the state-state distribution of Mexican immigrants in the US is highly consistent across individual years of *matrícula consular* registrations. Figure 3 highlights the comparison of the state-state distributions of individual years' registrations with the total 2006 to 2009 distribution, as well as comparisons of individual years' distributions. As the alignment of data points on the solid lines with slope of 1 would signal perfect correlation over time, it is clear that the state-state distribution is highly consistent, 2009 data representing the most variation from the rest of the period examined. The top two state-state immigrant groups appearing in the northeast quadrant of each corresponding graph are consistent as well, always immigrants leaving Michoacán and Jalisco to reside in California, these two groups forming more than 6%, 6%, 5% and 4%, respectively, of total annual registrations for the years 2006, 2007, 2008 and 2009.

Figure 3. Correlation of state–state distributions of matrículas consulares

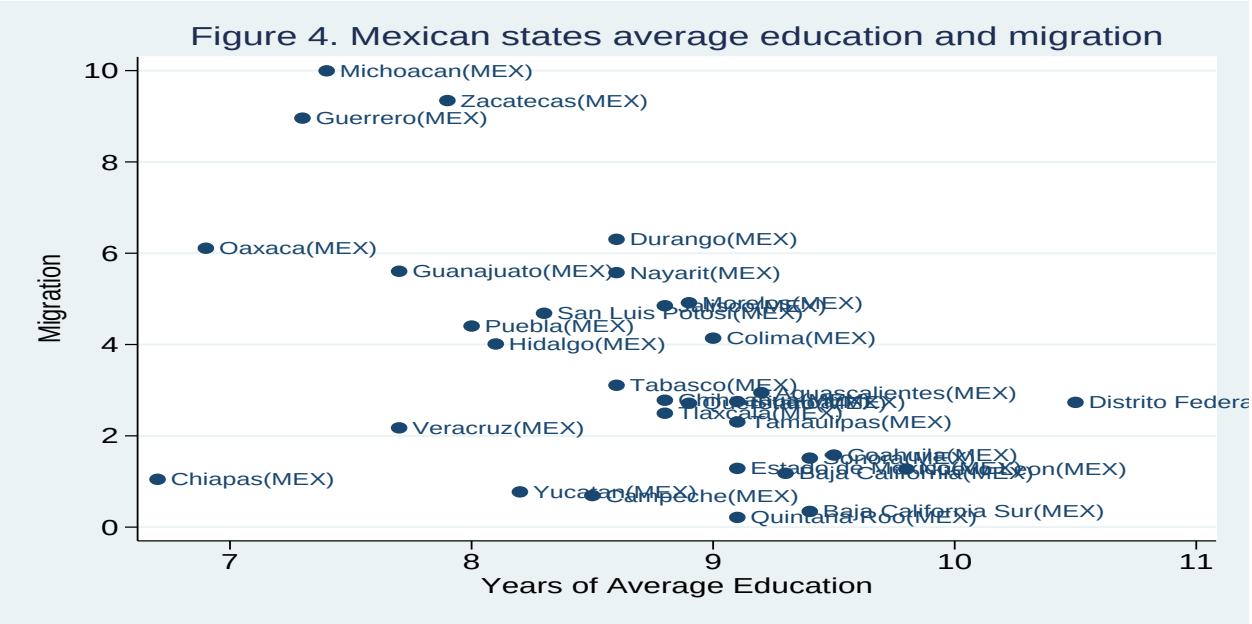


State-state shares are calculated by dividing the number of *matrículas consulares* for each state-state combination by the national total for each corresponding time period; shares are then multiplied by 100, giving the data points representing the corresponding state-state percentages. The number of registrations for each year are: 944,735 in 2006, 906,054 in 2007, 980,809 in 2008 and 991,874 in 2009.

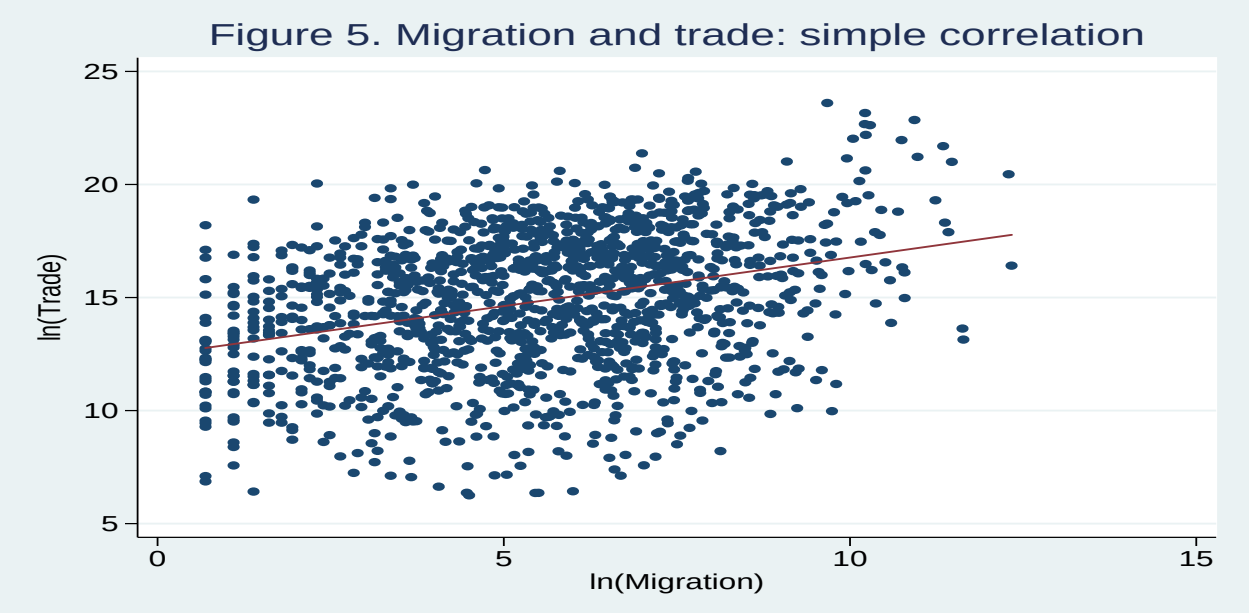
Additionally, one may expect that the number of highly-educated immigrants is underrepresented in the *matrícula consular* data, due to the fact that there is no clear advantage for a documented US resident to hold the identification card. This consideration is especially important given that several studies have emphasized the extra relevance of highly-educated immigrants in promoting trade above and beyond the average immigrant contribution. [16] Given the average education level in Mexican states from INEGI statistics, dispersed over a range of 6.7 to 10.5 years of schooling with a mean of 8.6, a first check of the data indeed shows a negative correlation between Mexican state average education level and the percentage of origin state population registered with the *matrícula consular*.[17] However, this correlation gives no information as to the key question of how education level actually relates to legal immigration status, and in turn to the *matrícula consular*. It is not clear that the expectation of underrepresentation is reasonable, given that the correlation between legal immigration status and education level is anything but definitive for Mexican immigrants in the US. Passel and Cohn (2009) determines that 47% of unauthorized immigrants ages 25 to 64 in the US have completed high school or less, while Caponi and Plesca (2012) argues that documented Mexican immigrants in the US are actually more likely to have a lower education level than undocumented immigrants. Comparing the *matrícula consular* data with other representative data as to education level presents two problems. The IME only reports state-state statistics including education level for 2006 and 2007, thereby providing a smaller sample in representing the overall stock of immigrants; in addition, the best data for comparison, that of the US Current Population Survey, is known to undercount undocumented immigrants. Due to these difficulties and lack of available data, I do not empirically address the issue of state-state distribution by education level. Additional data availability would clearly allow for future exploration of this further rich level of detail.

[16] Felbermayr and Jung (2009) signal the extra importance of highly-educated immigrants for the pro-trade effect, while Aleksynska and Peri (2011) focus on immigrants' participation in business networks, not exclusively on education level of immigrants.

[17] See Figure 4 for a scatter plot of this correlated data.



Migration is measured as the ratio of *matrículas consulares* per Mexican state of origin to the total corresponding state population, then multiplied by 100 to express values as percentages. "Distrito Federal" corresponds to Mexico City.



Migration is measured as the logarithm of *matrículas consulares* from 2006-2009, while trade is measured as the logarithm of the average of annual trade from 2007 to 2011; only values above zero are included.

Appendix A details the number of *matrículas consulares* registered from 2006 to 2009, classified by both US state of residence and Mexican state of origin, while Appendix B focuses on the state-state makeup of Mexican immigration to the three top US destination states, California, Texas, and Illinois, and the corresponding exports from US to Mexico. Appendix B and Figure 5 provide an initial idea of the simple correlation between state-state migration and exports. Without any controls for bilateral trade costs or state fixed effects, the best-fit line displayed in Figure 5 exhibits a slope of 0.44, providing initial evidence of a potential positive relationship between immigration and exports at the state-state level. Table 1 shows the mean, standard deviation, maximum and minimum for variables in both the base and alternative samples.

IV. Results and Discussion

Table 2 displays the results of the OLS regression employing the preferred specification of the augmented gravity equation listed in Equation (1). For the preferred base sample, I exclude exports destined for Mexico City, in order to avoid potential bias caused by the fact that a certain amount of trade is listed under Mexico City simply because a particular company's headquarters is located in the capital city of Mexico. This provides a sample of 1488 observations, a result of all trading pairs of 48 US and 31 Mexican states.

The coefficient estimate of immigrants' effect on state-state exports is indeed positively significant, consistent as additional independent variables controlling for bilateral trade costs are added one at a time; the preferred specification listed in column 4 shows that holding all other factors constant, an increase of 1% in the number of state-state immigrants is associated with a 0.08% increase in state-state exports, with $p < 0.04$. Distance, as expected, is significantly negative, reflecting a 1.67% decrease in state-state exports associated with a 1% increase in distance between the respective capitals of US and Mexican states. States that are adjacent enjoy 1.15% more trade than nonadjacent states, while a 1% increase in combined economy size is associated with a 0.99% increase in state-state exports. All coefficient estimates have the expected positive (negative) relationship with

state-state exports, and are highly significant.

The OLS estimates in turn permit a simple calculation of the magnitude of the pro-trade effect of immigration, highlighting the quantitative importance of the estimated effect. Given a 10% increase in average immigration from a particular Mexican state to a particular US state, the average immigrant stock increases from 2406.97 to 2647.67. Employing the estimated coefficient from column 4 of approximately 0.08, this 10% increase in immigration results in an increase in average state-state exports, settling on the new value of exports equal to $76,839,036. This translates into $2467 extra state-state exports per year associated with the average extra immigrant.[18]

In comparing the estimates and magnitude of the pro-trade effect of immigration to those of the literature, I rely on previous state-country and country-country studies, as this paper is the first to examine the state-state level. Table 3 provides an update of Table 1 from Peri and Requena (2010) in order to include estimates from more recent studies and those of this paper, as well as a comparison of extra annual exports generated per extra immigrant. The elasticity of exports to immigration estimated as 0.08 falls near the lower end of the range of estimates, a reasonable finding given the various factors mentioned in section II.

Additionally, the finding of $2467 extra yearly exports generated by each extra immigrant is extremely similar to those of $2608 and $2717, detailed in White (2007) and Felbermayr and Jung (2009), respectively. While these estimates differ dramatically from that of $24,895 found by Aleksynska and Peri (2011), it is worthwhile to signal that these numbers are not necessarily incompatible. As Aleksynska and Peri (2011) point out, factors such as average number of immigrants in the sample and the specific measure of immigrant stock contribute to these differentiated estimates. My measure based on the *matrícula consular* includes some immigrants who may not be economically active, and does not classify immigrants based on education level, which most likely further attenuates estimates as mentioned in Kugler and Rapoport (2011). However, although these

[18]This figure can be alternatively calculated by multiplying the elasticity of exports to immigration by the ratio of average state-state exports to average immigrant stock.

comparisons provide a useful framework within which the $2467 extra annual exports per immigrant can be viewed, it is essential to not place too much importance on these comparisons, since this paper differs from the literature in examining the state-state level and has no true precedent.

Table 1. Descriptive statistics - preferred and alternative samples

Variable	Base sample $n = 1488$	Base sample plus Mexico City $n = 1536$	Base sample minus Texas and Illinois $n = 1426$
Exports (in USD)	76,245,087.31	85,559,964.29	42,364,468
	(675,756,891)	(693,109,612.5)	(346,638,486.4)
	0/18,532,481,573	*0/18,532,481,573*	*0/11,936,744,226*
Immigrants	2406.97	2489.24	1902.59
	(11,322.63)	(11,439.78)	(10,627.19)
	0/227,032	*0/227,032*	*0/227,032*
Distance (miles)	2077.11	2077.56	2105.75
	(599.59)	(597.34)	(585.22)
	239/3681	*239/3681*	*239/3681*
Adjacency	0.006	0.006	0.004
	(0.077)	(0.076)	(0.059)
	0/1	*0/1*	*0/1*
US GSP (billions USD)	34,392.30	34,392.30	31,232.81
	(39,909.53)	(39,909.53)	(37,118.12)
	2,950.91/218,967.32	*2,950.91/218,967.32*	*2,950.91/218,967.32*
Mex GSP (billions USD)	2,514.13	2,969.87	2,514.13
	(1,975.85)	(3,197.62)	(1,975.85)
	529.45/9,235.81	*529.45/17,097.79*	*529.45/9,235.81*

For each variable, means are listed first, standard deviations are reported in parentheses, while minimum/maximum pairs are reported in italics.

Table 2. Coefficient estimates using the augmented gravity equation (OLS with state-state fixed effects)

Dependent variable: US-Mexico state-state exports, 2007-2011 average				
Independent variable	(1)	(2)	(3)	(4)
Immigration	0.2073*	0.0792**	0.0779**	0.0779**
	(0.0405)	(0.0390)	(0.0392)	(0.0392)
Distance		-1.9994*	-1.6774*	-1.6774*
		(0.3217)	(0.3080)	(0.3080)
Adjacency			1.1455***	1.1455***
			(0.6630)	(0.6630)
Economy size				0.9858*
				(0.1320)
R^2	0.8084	0.8159	0.8167	0.8167
n	1488	1488	1488	1488

Each estimate is from a separate OLS regression with the logarithm of US-Mexico state-state exports in US dollars plus one as the dependent variable, employing the base sample of the 48 contiguous US states and 31 Mexican states. All regressions include state fixed effects, controlling for any existing systematic differences across states that may affect all states' outcomes. Column (1) reports estimates using only immigration as an explanatory variable, column (2) adds distance as an explanatory variable, column (3) adds adjacency and column (4) displays the preferred specification, with economy size as a final additional independent variable. Heteroskedasticity-consistent robust standard errors are reported in parentheses. Reported estimates for immigration, distance and economy size have the following interpretation: a 1% increase of the independent variable value is associated with a coefficient% increase in the value of US-Mexico state-state exports. Reported estimates for adjacency (a dummy variable) have the following interpretation: adjacency of two states is associated with a coefficient% increase in the value of US-Mexico state-state exports relative to nonadjacency. *, ** and *** denote statistical significance at the 1%, 5% and 10% levels, respectively.

Table 3. Comparison of estimates for the elasticity of exports to immigration

Authors	Elasticity of exports to immigration	Extra annual exports generated per extra immigrant	Sample	Specification-Method
My estimates	0.08	$2467	48 US states, 31 Mexican states, 2007-2011	Pooled cross section, OLS with state-state fixed effects
Aleksynska and Peri (2011)	0.25	$24,895	CEPII "square" gravity data set, 5230 observations	Pooled cross section, OLS with country-country fixed effects
Bandyopadhyay, Coughlin and Wall (2008)	0.14	—	50 US states and District of Columbia, 29 countries, 1990, 2000	Panel, OLS with country-time and trading partner pairs fixed effects
Briant, Combes and Lafourcade (2009)	0.10	$6590	94 French departments, 100 countries, 1998-2000	Pooled cross section, OLS, 2SLS with country-department fixed effects
Dunlevy (2006)	0.24-0.47	—	50 US states and District of Columbia, 87 countries, 1990-1992	Pooled cross section, OLS with country-state fixed effects
Felbermayr and Jung (2009)	0.11	$2717	21 "North" countries and 114 "South" countries, 1988-2000	Pooled cross section, OLS, differenced with country-country fixed effects
Peri and Requena (2010)	0.05-0.11	—	50 Spanish provinces, 77 countries, 1993-2008	Panel, OLS, 2SLS with with country-time and trading partner pairs fixed effects
Tadesse and White (2009)	0.04-0.05	$1034-$1267	50 US states and District of Columbia, 75 countries, 2000	OLS with state-country fixed effects
White (2007)	0.11	$2608	US, 73 countries, 1980-2001	Pooled cross section, OLS with country-country fixed effects

Estimates for elasticity are reported according to the preferred model specified by the authors in the corresponding articles, or if not specified, the most appropriate estimates for comparison to those of this paper. My estimates are those corresponding to the preferred base sample. Other articles' estimates are the following: the OLS fixed effects result for Aleksynska and Peri (2011), the benchmark OLS result for Briant, Combes and Lafourcade (2009), the fixed effects result for Bandyopadhyay, Coughlin and Wall (2008), the differenced result for Felbermayr and Jung (2009), the aggregate exports result for Tadesse and White (2009), and the full sample result for White (2007). Figures for column 3 are generated according to the reported elasticities, multiplying the respective elasticity by the ratio of average state-state exports to average state-state stock of immigrants; — denotes that I found neither the corresponding summary statistics nor the estimate of the annual value of extra exports generated per immigrant.

V. Robustness and Sensitivity Checks

As I exclude Mexico City from the preferred specification's sample under concerns of potential bias, I outline a new set of estimates in Table 4, now adding Mexico City to the dataset as a first check for robustness of the obtained results. The magnitude and significance of the pro-trade effect of immigration change minimally, the inclusion of Mexico City slightly increasing the magnitude to 0.09. An additional concern arises from the comparison of the *matrícula consular* data and the US Census data highlighted in section III. Although a high level of representativeness is present, Texas and Illinois clearly are outliers in this respect, reflecting a difference of 9.11% and 3.24% between the data sets, respectively. Especially given the fact that both Texas and Illinois are two of the main destination states in the US for Mexican immigrants, it is important to consider immigration's pro-trade effect excluding the two outliers from the sample as an additional test of robustness. Table 5 highlights the coefficient estimates generated excluding Texas and Illinois, using a sample of 46 US and 31 Mexican states. Compared to the results presented in Table 2, immigration's effect on state-state exports is slightly greater, rising slightly above 0.08, and minimally less significant.

Selection of the average state-state exports over the years 2007 to 2011 as the measure for the dependent variable could be driving the obtained results; if estimates of immigration's pro-trade effect on trade differ greatly across the use of varied individual years of trade data as alternative dependent variables, this would clearly be cause for concern. Use of the average exports measure smoothes out the trade data, potentially leading to an expectation of a wide range of estimates when employing individual years' trade data as the dependent variable. However, the estimates in fact vary only minimally, as reported in Table 6. For each of the three samples, I show immigration's coefficient estimates for the preferred specification, now using exports data from either 2009, 2010 or 2011 as the measure of trade in lieu of the 2007 to 2011 average. Immigration's pro-trade effect remains significant and similar in magnitude across all alternative regressions accounted for. While the use of only 2011 exports data slightly attenuates the coefficient estimates compared to those of

the preferred specification, the elasticity bottoming out at 0.07, the use of either 2009 or 2010 trade data actually increases the pro-trade effect's magnitude, the elasticity peaking at 0.11 for the base sample. Using the same simple method of calculation as in section IV, these figures correspond to an extra $2103 and $3332 of annual exports, respectively, generated by each extra immigrant.

Table 4. Coefficient estimates using the augmented gravity equation (OLS with state-state fixed effects, including Mexico City)

Dependent variable: US-Mexico state-state exports, 2007-2011 average				
Independent variable	(1)	(2)	(3)	(4)
Immigration	0.2083*	0.0879**	0.0860**	0.0860**
	(0.0401)	(0.0388)	(0.0388)	(0.0388)
Distance		-1.8972*	-1.5680*	-1.5680*
		(0.3237)	(0.3115)	(0.3115)
Adjacency			1.2031***	1.2031***
			(0.6607)	(0.6607)
Economy size				0.9631*
				(0.1303)
R^2	0.8207	0.8272	0.8281	0.8281
n	1536	1536	1536	1536

Each estimate is from a separate OLS regression with the logarithm of US-Mexico state-state exports in US dollars plus one as the dependent variable, employing the base sample of the 48 contiguous US states and 31 Mexican states plus Mexico City. All regressions include state fixed effects, controlling for any existing systematic differences across states that may affect all states' outcomes. Column (1) reports estimates using only immigration as an explanatory variable, column (2) adds distance as an explanatory variable, column (3) adds adjacency and column (4) displays the preferred specification, with economy size as a final additional independent variable. Heteroskedasticity-consistent robust standard errors are reported in parentheses. Reported estimates for immigration, distance and economy size have the following interpretation: a 1% increase of the independent variable value is associated with a coefficient% increase in the value of US-Mexico state-state exports. Reported estimates for adjacency (a dummy variable) have the following interpretation: adjacency of two states is associated with a coefficient% increase in the value of US-Mexico state-state exports relative to nonadjacency. *, ** and *** denote statistical significance at the 1%, 5% and 10% levels, respectively.

Table 5. Coefficient estimates using the augmented gravity equation (OLS with state-state fixed effects, excluding Illinois and Texas)

Dependent variable: US-Mexico state-state exports, 2007-2011 average				
Independent variable	(1)	(2)	(3)	(4)
Immigration	0.2012*	0.0772***	0.0804**	0.0804**
	(0.0421)	(0.0400)	(0.0405)	(0.0405)
Distance		-2.0298*	-1.6922*	-1.6922*
		(0.3354)	(0.3220)	(0.3220)
Adjacency			1.4395	1.4395
			(0.9993)	(0.9993)
Economy size				0.9790*
				(0.1341)
R^2	0.7921	0.8002	0.8011	0.8011
n	1426	1426	1426	1426

Each estimate is from a separate OLS regression with the logarithm of US-Mexico state-state exports in US dollars plus one as the dependent variable, employing the base sample of the 48 contiguous US states and 31 Mexican states minus Texas and Illinois. All regressions include state fixed effects, controlling for any existing systematic differences across states that may affect all states' outcomes. Column (1) reports estimates using only immigration as an explanatory variable, column (2) adds distance as an explanatory variable, column (3) adds adjacency and column (4) displays the preferred specification, with economy size as a final additional independent variable. Heteroskedasticity-consistent robust standard errors are reported in parentheses. Reported estimates for immigration, distance and economy size have the following interpretation: a 1% increase of the independent variable value is associated with a coefficient% increase in the value of US-Mexico state-state exports. Reported estimates for adjacency (a dummy variable) have the following interpretation: adjacency of two states is associated with a coefficient% increase in the value of US-Mexico state-state exports relative to nonadjacency. *, ** and *** denote statistical significance at the 1%, 5% and 10% levels, respectively.

Table 6. - Coefficient estimates for γ with alternative dependent variables (OLS with state-state fixed effects)

Dependent variable	Base sample $n = 1488$	Base sample plus Mexico City $n = 1536$	Base sample minus Texas and Illinois $n = 1426$
US-Mexico state-state exports, 2009	0.1052**	0.1163*	0.1115*
	(0.0435)	(0.0435)	(0.0448)
R^2	0.7802	0.7935	0.7620
US-Mexico state-state exports, 2010	0.0985**	0.1074**	0.0993**
	(0.0442)	(0.0437)	(0.0457)
R^2	0.7952	0.8071	0.7781
US-Mexico state-state exports, 2011	0.0664***	0.0732***	0.0702***
	(0.0412)	(0.0420)	(0.0443)
R^2	0.7973	0.8097	0.7798

Heteroskedasticity-consistent robust standard errors are reported in parentheses, while *, ** and *** denote statistical significance at the 1%, 5% and 10% levels, respectively.

Table 7. Coefficient estimates using forwarded exports (OLS with state-state fixed effects)

	(1)	(2)	(3)	(4)	(5)	(6)
Exports measure	2009	2010	2011	2010	2011	2011
Immigration measure	2006-07	2006-07	2006-07	2006-08	2006-08	2006-09
Immigration	0.1177*	0.1108*	0.0722***	0.1072**	0.0682***	0.0664***
	(0.0427)	(0.0435)	(0.0425)	(0.0433)	(0.0418)	(0.0412)
Distance	-1.6838*	-1.8421*	-1.8405*	-1.8503*	-1.8507*	-1.8495*
	(0.3369)	(0.3400)	(0.3310)	(0.3399)	(0.3300)	(0.3324)
Adjacency	1.2049***	0.8646	0.8729	0.8660	0.8742	0.8775
	(0.7229)	(0.6919)	(0.7084)	(0.6935)	(0.7097)	(0.7103)
Economy size	0.9484*	0.9680*	1.0102*	0.9869*	1.0257*	1.0324*
	(0.1429)	(0.1564)	(0.1577)	(0.1534)	(0.1544)	(0.1539)
R^2	0.7805	0.7954	0.7974	0.7954	0.7973	0.7973
n	1488	1488	1488	1488	1488	1488

Each estimate is from a separate OLS regression with the logarithm of US-Mexico state-state exports in US dollars plus one as the dependent variable, employing the base sample of the 48 contiguous US states and 31 Mexican states. All regressions include state fixed effects, controlling for any existing systematic differences across states that may affect all states' outcomes. Heteroskedasticity-consistent robust standard errors are reported in parentheses. Reported estimates for immigration, distance and economy size have the following interpretation: a 1% increase of the independent variable value is associated with a coefficient% increase in the value of US-Mexico state-state exports. Reported estimates for adjacency (a dummy variable) have the following interpretation: adjacency of two states is associated with a coefficient% increase in the value of US-Mexico state-state exports relative to nonadjacency. *, ** and ** denote statistical significance at the 1%, 5% and 10% levels, respectively.

An additional concern is that trade and migration could be determined jointly, leaving forwarding the measure of exports as a clear strategy to alleviate this potential problem. I regress exports for periods $t+2$, $t+3$, and $t+4$, respectively, with the preferred sample and specification, using all possible corresponding measures of immigrant stock (*matrícula consular* stock) to eliminate any possibility of joint determination.[19] This strategy results in six further regressions; Table 7 reports estimation results along with the corresponding exports and immigration measures employed in each additional regression. The estimated effect of immigration's pro-trade effect is consistent across these varied measures, both in magnitude and significance. The elasticity of state-state exports to immigration ranges from 0.07 to 0.12, resulting in a minimum and maximum of $2103 and $3728, respectively, of extra state-state exports per year associated with each extra immigrant. In fact, across all samples, trade measures and immigration measures employed as checks on the original estimates, the minimum amount of exports per year generated by an extra immigrant is $1504, while the maximum amount is $3997.[20]

VI. Conclusion

Immigrants indeed create a significant force in promoting extra trade from US states of residence to Mexican states of origin. This finding is empirically consistent not only in statistical significance, but also in magnitude across all specifications and samples employed in this paper. Using the preferred sample and average exports over the five-year period of 2007 to 2011, the elasticity of state-state exports to immigration is 0.08; this result translates into $2467 extra annual exports per extra immigrant for a particular US-Mexico state-state combination, holding other factors constant. Interestingly, the estimated elasticity and subsequent dollar figure fall in the range of estimates of the immigration-trade link from the previous literature; however, my results contribute the first evidence as to the contribution of immigrants to destination-origin trade at the state-state level. As

[19] As Aleksynska and Peri (2011) mentions, since the immigration measure is a stock accumulated over years, it is probable that it is determined before trade flows; however I forward exports to assure that joint determination is not a factor.

[20] These amounts correspond to $n = 1426$ with 2011 exports as trade measure and $n = 1536$ with 2009 exports as trade measure, respectively.

the very link between immigrants and trade has been theorized to depend on geographic proximity, thus having previously lead to a sub-national focus as to destination, my findings supporting the importance of proximity hopefully will stimulate further empirical study of the immigration-trade nexus at the sub-national level for both places of destination and origin.

Empirical studies employing data sets from countries other than the US and Mexico, as well as data detailing characteristics such as education level and participation in business networks, provide clear avenues for further research at the state-state level, just as they already have at the country-country level. Furthermore, the results not only shed light on how localized immigration's nexus with trade may be, they inevitably connect to the ongoing debate as to the economic costs and benefits of immigration. Without a doubt, the pro-trade effect of immigration cannot be ignored in any careful analysis of the costs and benefits of immigration.

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Appendix A. *Matrículas consulares* registered 2006 to 2009, US states of residence and Mexican states of origin: *total of 3,823,472*

US		Mexico
Alabama 21,316	Oklahoma 14,833	Aguascalientes 34,935
Arizona 161,496	Oregon 62,987	Baja California 37,196
Arkansas 15,616	Pennsylvania 19,054	Baja California Sur 2,192
California 1,418,231	Rhode Island 742	Campeche 5,691
Colorado 85,583	South Carolina 29,817	Chiapas 50,265
Connecticut 8,867	South Dakota 541	Chihuahua 94,690
Delaware 5,353	Tennessee 31,833	Coahuila 43,407
Florida 83,700	Texas 598,615	Colima 26,930
Georgia 124,551	Utah 45,784	Durango 102,954
Idaho 11,356	Vermont 297	Guanajuato 307,505
Illinois 324,667	Virginia 21,667	Guerrero 303,606
Indiana 58,944	Washington 55,748	Hidalgo 106,918
Iowa 12,941	West Virginia 521	Jalisco 356,480
Kansas 15,374	Wisconsin 34,859	Mexico 195,314
Kentucky 11,119	Wyoming 2,818	Mexico City 241,895
Louisiana 5,663		Michoacan 434,873
Maine 198		Morelos 87,357
Maryland 18,402		Nayarit 60,483
Massachusetts 2,197		Nuevo Leon 59,253
Michigan 17,414		Oaxaca 232,283
Minnesota 32,091		Puebla 254,606
Missouri 13,284		Queretaro 49,608
Mississippi 4,091		Quintana Roo 2,828
Montana 127		San Luis Potosi 121,125
Nebraska 18,166		Sinaloa 76,125
New Hampshire 753		Sonora 40,252
New Jersey 62,801		Tabasco 69,563
New Mexico 41,131		Tamaulipas 75,330
New York 110,835		Tlaxcala 29,191
Nevada 90,958		Veracruz 166,234
North Carolina 110,899		Yucatan 15,104
North Dakota 34		Zacatecas 139,279
Ohio 15,198		

Appendix B. Immigration and trade in top US states of Mexican immigrant residence

	California		Texas		Illinois	
Ranking	Immigration	Exports	Immigration	Exports	Immigration	Exports
1	Michoacan	Baja California	Guanajuato	Chihuahua	Michoacan	Mexico City
2	Jalisco	Mexico	San Luis Potosi	Tamaulipas	Guerrero	Nuevo Leon
3	Guerrero	Chihuahua	Tamaulipas	Mexico City	Guanajuato	Mexico
4	Oaxaca	Mexico City	Nuevo Leon	Mexico	Jalisco	Jalisco
5	Mexico City	Jalisco	Michoacan	Coahuila	Mexico City	Coahuila
6	Guanajuato	Sonora	Guerrero	Nuevo Leon	Mexico	San Luis Potosi
7	Puebla	Nuevo Leon	Zacatecas	Guanajuato	Veracruz	Chihuahua
8	Mexico	Sinaloa	Mexico	Jalisco	Durango	Sonora
9	Zacatecas	Tamaulipas	Coahuila	Queretaro	Puebla	Queretaro
10	Sinaloa	Puebla	Mexico City	Aguascalientes	Zacatecas	Baja California
11	Nayarit	Baja California Sur	Veracruz	San Luis Potosi	Morelos	Durango
12	Veracruz	Queretaro	Jalisco	Veracruz	Oaxaca	Tamaulipas
13	Morelos	Guanajuato	Durango	Hidalgo	San Luis Potosi	Guanajuato
14	Hidalgo	Coahuila	Chihuahua	Sonora	Hidalgo	Puebla
15	Baja California	Aguascalientes	Hidalgo	Durango	Tabasco	Aguascalientes
16	Durango	Durango	Puebla	Tabasco	Queretaro	Hidalgo
17	Tabasco	San Luis Potosi	Queretaro	Baja California	Aguascalientes	Veracruz
18	Colima	Quintana Roo	Oaxaca	Puebla	Chihuahua	Quintana Roo
19	Queretaro	Tlaxcala	Morelos	Michoacan	Nuevo Leon	Tlaxcala
20	Chiapas	Veracruz	Aguascalientes	Sinaloa	Tlaxcala	Sinaloa
21	Sonora	Hidalgo	Tabasco	Morelos	Tamaulipas	Morelos
22	Yucatan	Michoacan	Chiapas	Quintana Roo	Coahuila	Michoacan
23	Aguascalientes	Morelos	Tlaxcala	Campeche	Chiapas	Zacatecas
24	Tlaxcala	Yucatan	Sinaloa	Colima	Nayarit	Tabasco
25	Chihuahua	Campeche	Colima	Zacatecas	Sinaloa	Yucatan
26	San Luis Potosi	Nayarit	Nayarit	Tlaxcala	Baja California	Baja California Sur
27	Coahuila	Tabasco	Campeche	Yucatan	Colima	Oaxaca
28	Tamaulipas	Zacatecas	Baja California	Oaxaca	Sonora	Chiapas
29	Nuevo Leon	Chiapas	Yucatan	Chiapas	Campeche	Colima
30	Campeche	Colima	Sonora	Baja California Sur	Yucatan	Guerrero
31	Quintana Roo	Oaxaca	Quintana Roo	Guerrero	Quintana Roo	Campeche
32	Baja California Sur	Guerrero	Baja California Sur	Nayarit	Baja California Sur	Nayarit

States of origin are listed in order of number of *matrículas consulares* in the period of 2006 to 2009 and value of average state-state exports in the period of 2007 to 2011.