

Effects of Bilateral Trade on Migration Flows: the case of the United States

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**Tenth Annual Conference on Global Economic Analysis
West Lafayette, IN U.S.A.
June 2007**

Abstract

The factor price equalization theorem has inspired many theoretical and empirical papers on the relationship between trade and factor mobility. This paper uses a gravity equation to empirically test the effect of bilateral trade on a subset of international permanent legal migration from 175 countries into the United States. Cross-section and panel estimations are provided as exploratory tools. The results show that bilateral trade flows do not significantly explain migration flows, while the traditional determinants do.

Key words: international migration flows, bilateral trade flows, gravity model.
JEL Classification Numbers: F16, F22

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1. Introduction

Migration creates economic distortions in both the receiving country (i.e., United States) and the source country (i.e., Mexico). In the United States, one main concern is the extent to which immigrants depress wages and lead to unemployment of native workers. Borjas et al. (1997) argue that immigration has had a negative impact on the wages of the least skilled U.S. workers.¹ In Mexico however, migration abroad has helped ease the country's adjustment to the rapid growth in its working-age population and to macroeconomic shocks (i.e., reduce social spending in favor of foreign debt servicing); though not without disrupting the families and communities whose members have moved to the United States (Hanson, 2006). Additionally, there is the positive effect of remittances on the labor exporting country (Funkhouser, 1995). Recently, a World Bank report (2004) found that in Latin American countries, 70 percent of foreign direct investments were the result of remittances, and remittances were 500 percent larger than Official Development Assistance to the region.

In the U.S., the current migration policy aims to control the flow of both legal and illegal migration. Legal immigrants are foreign born that legally reside in the U.S. but are not citizens; they hold worker visas or green cards. Figure 1 shows the total number of green cards that have been issued for the period of 1996 to 2005. The level of legal immigration can be determined from the number of visas and green cards issued. The U.S. assigns quotas on these visas and green cards based on different criteria (i.e., type of visa, country of origin, and world limit) which change infrequently over time. Figure 1 also shows the number of green cards that have been issued that are restricted (i.e., subject to the numerical limits) categorized by the sponsor

¹ High school dropouts and those in the bottom 20 percent of the wage distribution.

which could be family, employment, or the diversity program². In addition, Figure 1 shows the number of green cards issued to those unrestricted (i.e., not subject to quota), this includes the immediate relatives of U.S. citizens, refugees and asylum seekers. From Figure 1, notice that restricted and unrestricted issued green cards have similar pattern over time. In addition, the decline number of green cards acceptance in 2003 may be a lagged reflection of the attacks of September 2001.

INSERT FIGURE 1 HERE

In the Wall Street Journal, a recent article gave an estimate of the stock of illegal immigrants in the United States at 12 million people (Jordan and Buerlein, 2007). According to Pew Hispanic Center, 75 to 80% of these illegal immigrants are Hispanics. Illegal immigration is controlled through border enforcement. Monitoring the hiring practices of employers is also within the scope of migration policies, but is not implemented as much as the other two measures (i.e., visas and border enforcement). In this paper, we focus on the legal permanent resident flows that are not subject to quota. The reason for not taking total legal migrants is that it can be argued that having a quota restricts the possible effects of trade on total legal migration, undermining the analysis. However, as we saw from Figure 1, both restricted and unrestricted flows follow the same pattern over time, therefore our results could also relate to the case of restricted and total legal immigrants. Estimates of illegal migrants exist but not for the years selected in this study. Illegal migration is also not considered because of poor data quality in total migration and by region of origin. The high number of Mexican illegal immigrants would certainly skew the results –towards ease of entry.

² The diversity program is an annual lottery run by the U.S. Department of State, which offers up to 55,000 permanent resident visas each year to randomly selected applicants from eligible countries.

Some policy makers in the United States argue that more trade reduces migration and advocate free trade agreements (FTA) as a tool to reduce migration. The reason for this is that more trade, achieved by free trade agreements for instance, would tend to equalize the prices of commodities across participating countries. Through the equalization of commodity prices, payments to factors such as labor would tend to equalize as well. Samuelson's (1948, 1949) theorem of Factor Price Equalization (FPE) explains how, in the absence of factor mobility, international trade homogenizes factor prices through commodity price equalization under certain conditions.³ If wages were truly converging and migration was driven by wages, then there would appear to be no reason for migration to occur (Massey and Espinosa, 1997). Under this neoclassical model, where a cost-benefit analysis is considered to drive migration, an individual would decide to migrate if the expected discounted difference in the stream of income between the new and old location exceeds moving costs.

The goal of this paper is to empirically test the effect of trade on migration flows. The United States is selected to analyze this phenomenon for three reasons. First, the U.S. is the largest importer of migrants worldwide. Second, the U.S. has actively pursued free trade agreements with other countries in the Americas, particularly with Mexico, the main source of migrants to the U.S. (Mexico is the most important source country for U.S. immigration, accounting for 34% of total immigrant arrivals since 1990). Third, the U.S. provides reliable and available data.

We expect to find significant effect between trade and migration. Additionally, we would like to determine if the trade relationship with migration is one of complement or substitute to test the hypothesis that trade can be used as an instrument to reduce or control

³ Production factors are qualitatively the same between countries; the production functions are also the same; no transport costs or import taxes.

migration. Trade and migration would be substitutes if more trade, achieved by say free trade agreements, reduces labor migration. Alternatively, more migration could reduce trade, instead of the good reaching the consumer, the consumer mobilizes to the market where the good is being traded. Complementarity between trade and migration occurs when more trade increases migration. Increasing trade may require citizens of the home country to migrate to a foreign country to strengthen their trade links. The results of this research will be of interest to policy makers in both Europe and the United States where increasing migration is a political concern, and to labor exporting countries who wish to stop the outward flow of migration.

In the next section, we review the literature of the economic determinants of international migration and previous studies linking trade to migration. Section 3 describes the model and the data used in this study. In section 4, we present our estimation results. The last section we provide a summary and some concluding remarks for future work.

2. Literature Review

The migration literature is extensive, in part because it spans a number of different disciplines (i.e., anthropology, demography, economics, sociology, regional science, and political science), and most agree that people move because of expected improvement elsewhere, where improvement might include higher wages, better employment, health, education, etc. For a review of contemporary theories of international migration, see Massey et al. (1993). The focus of this literature review is on the economic studies of migration.

From an economic point of view, migration occurs because of spatial differences in the supply and demand of labor. For example, labor-importing regions demand extra labor due to aging population, while labor-exporting regions have an excess supply of labor due to high birth rates. These spatial differences are reflected in the wage differentials between these countries.

The wage differential encourages workers from low-wage countries to move to high-wage countries.

This literature review is divided in two sections. The first section covers studies that focus on the general determinants of migration; and the second section reviews the theoretical and empirical papers that have focused on the relationship between trade and migration.

2.1 Determinants of Migration

In his seminal work, Ravenstein (1885) developed what he called the “laws for migration”. The main contribution attributed to him is that distance is a deterrent to migration (i.e., migration decreases as distance increases).

Another important early contribution to this literature is Lee’s (1966) “push-pull” migration model. Lee’s behavioral model considers migration to be a decision problem for the individuals migrating. Both push and pull forces are considered in determining whether to migrate. Push determinants are the factors that drive people to leave their countries (i.e., lack of stable employment, low wages, increasing population, etc).

Pull factors attract people to their new countries (i.e., higher wages, better working conditions, family, friends, etc). Due to aging population and declining birth rate, developed countries, such as Japan, offer higher wages attracting qualified migrants from other continents to meet Japanese labor needs (Massey et al., 1993).

Both forces (push and pull) are intrinsic characteristics of the origin and destination locations of migrants. Borjas et al. (1997) argue that Mexican illegal immigrants’ are responding more to the wage differential⁴ between the U.S. and Mexico, than to U.S. labor market

⁴ Lewis, 1954; Sjaastad, 1962; Todaro, 1969; Harris and Todaro, 1970; and Haans, 1999) base the decision to migrate on the wage differential, in this case between host and home country.

developments alone, because unskilled real wages in the United States have fallen in recent years.

Haan (1999) argues that migration is a result of individuals acting rationally according to economic interest. He emphasizes that throughout history, in most if not all societies, migration has been the norm rather than exception, particularly in Europe before industrialization⁵.

Contrary to the individualistic view of the migration decision, Stark and Bloom (1985) consider the choice to migrate a household decision. When the household decides to let one of its members migrate, it is because it expects higher income for the household as a whole –as the migrant is expected to earn more in the host country and send remittances back to the home country.

In addition to the above-mentioned reasons for people to move, there are also factors that perpetuate international migration, particularly along certain migration corridors. One factor is social networks between migrants abroad, former migrants (returnees) and non-migrants (stayers) in the country of origin. Social networks facilitate the “recruitment” and adaptation of new migrants in the host country by providing or helping migrants find job opportunities (Balan, 1992; Wilpert, 1992; and Waldorf, 1996). The possible factors that trigger and/or maintain migration are summarized in Table 1.

INSERT TABLE 1 HERE

2.2 Trade as Determinant of Migration

Theoretical Analysis

According to classical trade theory, free factor mobility across regions causes relative prices to equalize. Further developments in trade theory have shown that free mobility of commodities in

⁵ He also recognizes several countries in Africa with high degree of labor mobility.

international trade also causes factor price equalization across regions (Samuelson, 1948). This result has inspired many theoretical and empirical papers on the relationship between trade and factor mobility.

Two seminal papers must be considered when reviewing the literature on the relationship between factor mobility and international trade. Mundell (1957), who pioneered this topic, found that international trade on commodities serves as a substitute for factor movement under certain assumptions. Conversely, Markusen (1983) argues that by relaxing some of Mundell's assumptions the relationship between international trade of commodities and factor movement becomes complementary.

There are two fundamental differences between Mundell and Markusen's initial assumptions about the two countries (A and B) considered.

- a) Mundell assumes that countries have identical technologies, while Markusen assumes that country A has superior technology for the production of one of the goods.
- b) Mundell also assumes asymmetry in the relative endowments between countries, while Markusen assumes identical relative factor endowments across countries.

Further developments in this literature accept the possibility of having two different relationships between trade and factor mobility depending on the assumptions. Wong (1986) uses a general equilibrium model where international differences in endowments, preferences or technologies are possible. Wong assumes that only capital is mobile and further that capital moves without its owners who repatriate the income earned on capital abroad. Wong compared

the volume of trade and capital movement during three situations: autarky in trade with free capital mobility, and free trade with and without capital mobility.

Wong defines substitution between capital and trade flows if and only if the following two conditions hold. First, capital movement diminishes the volume of trade, i.e. the volume of trade under free trade with capital mobility is smaller than that under free trade without capital mobility. Second, trade diminishes capital flow, i.e. the amount of capital transferred under free trade with capital mobility is smaller than that under autarky in trade with free capital mobility.

On the other hand, Wong explains that complementarity occurs if capital and trade flows augment each other. Capital flows augment trade if and only if the volume of trade under free trade with capital mobility is greater than under free trade without capital mobility. Trade flows augment capital flows if and only if the amount of capital transfer under free trade with capital mobility is greater than under autarky in trade with free capital mobility.

Similarly, Neary (1995) developed a model where goods and capital trade are substitutes under the assumption that capital is used in the import-competing sector, while Markusen (1983) argued that capital and goods trade are complements when capital is used in the export-competing sector. In addition, Neary explains how, under the assumption of capital being used in the import-competing sector, a tariff on the manufactures creates an incentive for a capital inflow to the home country because a tariff would increase home prices relative to world prices and this would attract foreign investors.

In a recent World Bank working paper, Schiff (2006) generalizes Markusen's complementarity results between trade and factor movement. Recall that Markusen obtained his results by eliminating barriers to factor movement in the absence of trade protection. Schiff considers an initial tariff and finds that the relationship between factors and commodity trade

could be either that of complements or substitutes, depending on the initial tariff rate and the magnitude of the change. Schiff argues that the magnitude of the tariff rate could offset the technological change effect on factor prices. His results show that with high protection, substitutability holds; while low protection levels result in complementarity. Moreover, for large changes in the protection rates, Schiff argued that either substitutability or complementarity could occur.

The above summary shows that at a theoretical level, there is no definite answer on the relationship between commodity trade and factor mobility. The nature of the assumptions seems to be driving the results.

Empirical Analysis

Following the theoretical developments, two empirical studies attempt to solve the dilemma but stumble on no clear pattern of the relationship between trade and factor movement. Collins et al. (1997) analyze historical data and find mostly neutral, statistically insignificant, results.

Goldberg and Klein (1999), studying more recent data, conclude that there is evidence of both complementarity and substitutability type of relationship between trade and factor movement.

Collins, O'Rourke, and Williamson (1997), studied the historical link between factor mobility and trade. The authors focused on Austria, Canada, United States, Denmark, France, Germany, Italy, Norway, Sweden, and the United Kingdom between 1870 and 1940. They considered changes over decade-averaged panel data and over fifteen to twenty-year periods to describe the trade versus factor movement relation in their analysis. Collins et al. regressed real trade values on absolute real values of factor flows (capital and migration), tariffs, and transportation costs.

Their coefficients on the factor mobility variables were classified as complementary to trade if the coefficient is positive and significant, substitute if it is negative and significant, and neutral if the coefficient is not significant irrespective of its sign. The dominant result under their time series long swings was neutral the coefficients were mostly non-significant. Their results of the panel data estimation also provided limited support for complementarity between capital flows and trade, and insignificant ambiguous results for labor flows. Even when complementarity was significant, Collins et al. considered the economic link to be weak because of the low estimated coefficients. In addition, the authors noted that policy makers in the U.S. never treated its immigration policy as if they considered trade to substitute migration.

Goldberg and Klein (1999) developed a theoretical model and investigated empirically the relationship between international trade and foreign direct investment. The authors assume foreign direct investment (FDI) as a proxy for mobile capital. Sector level trade (manufacturing, other manufacturing, and non-manufacturing sectors) between South American countries and the U.S. is considered. One of the implications of their theoretical model is that the effects of capital inflows in a sector depend on whether the sector was originally a net importer or net exporter. If the sector were a net exporter, inflows of capital would increase trade. However, if the sector were a net importer, inflows of capital would decrease trade. The empirical results of the Goldberg and Klein study provide justification to the theoretical debate of the trade versus factor mobility relation. Using cross-country and time-series data, the authors were not able to establish strong or systematic linkages between trade and capital.

In the next section, we will combine traditional determinants of migration (i.e., gross domestic product and population) with trade to build a modified gravity model. We use cross-section and panel data estimations to help analyze the trade-migration relationship. The gravity

model has been widely used in the social sciences for its simplicity and intuition. Bilateral trade flows are well described by the gravity equation (Feenstra et al. 2001), and migration flows have also taken advantage of the gravity structure (Plane, 1984). In 2000, Karemera et al. (2004) studied international migration into North America⁶ using a gravity model, they use the same migration data that is used here but they focus on a previous decade (1976-1986) and for seventy countries.

This study differs from Karemera et al. in that it uses the gravity model to explore the effect of trade on migration. In addition, the focus here is on a more recent data (i.e., years 1996 to 2005) and corresponds to a larger number of countries (i.e., 175). Therefore, we increase the scope and update previous studies.

With respect to Collins et al., our study is different in that we want to explain the effect of trade on migration, while they focused on the effect of migration on trade. Our specification poses its challenges such as endogeneity, which we deal using instrumental variable. Details on the instrumental variable specification are provided in the following section.

3. Methodology and Data

A modified gravity model⁷ of migration is adopted to explain the determinants of migration flows. The gravity model is one of the so-called Spatial Interaction Models. In these models, the main assumption is that flows are a function of the attributes of the source country, the attributes of the host country, and the distance between the source and host countries. We consider the following model:

⁶ They defined North America as the United States and Canada.

⁷ Commonly used among trade economist. It is inspired on Isaac Newtons' law of gravity. The force of gravity between two objects is proportional to the product of the masses of the two objects divided by the square of the distance between them.

$$Mig_{it} = \frac{Trade_{it}^{\beta_1} * USpop_t^{\beta_2} * Pop_{it}^{\beta_3} * USinc_t^{\beta_4} * Inc_{it}^{\beta_5}}{Dist_i^{\beta_6}} \quad (1)$$

where, *Mig* is migration from the country *i* into the United States in time *t*; *Trade* is measured as the openness index, this is the sum of exports and imports to and from the United States divided by country *i*'s GDP over time *t*. Population is another explanatory considered, *Pop* for country *i* and *USpop* for the United States, both at time *t*. Per capita Gross Domestic Product is used as the income variable, *USinc* for the U.S. and *Inc* for country *i*, the two at time *t*. Finally, *Dist* is the distance between country *i* and the US.

In logarithm form, the linear equation of our U.S. migration modified gravity model that we would estimate is the following:

$$\ln Mig_{it} = \beta_0 + \beta_1 \ln Trade_{it} + \beta_2 \ln USpop_t + \beta_3 \ln Pop_{it} + \beta_4 \ln USinc_t + \beta_5 \ln Inc_{it} - \beta_6 \ln Dist_i + \varepsilon \quad (2)$$

where we have added a constant and an error term. The parameters β_i represent elasticities of these variables with respect to migration.

It is expected that home population and host income have a positive on migration. A high home population increases the pressure for a potential migrant to compete in the home market pushing them out, while a high income in the foreign countries would attract them to relocate where there are higher incomes. Distance and home income are expected to have a deterrent effect on migration. Following previous literature, countries that are far apart would have lower migration than if they were at a closer distance while countries with high incomes offer fewer incentives to potential migrants.

The trade effect on migration is uncertain and determining the effect is part of the main purpose for this study. A positive relationship would indicate that trade and migration are complements, while a negative one would indicate that they are substitutes.

Several empirical papers point out that the presence of an immigrant population is associated with an increase in trade between the host and country of origin. This is attributed to superior knowledge of products and/or preferential access to market opportunities or increasing imports by migrants, see Markusen (1983), Gould (1994), Dunlevy et al. (1999), Head and Ries (1998), and Girma et al. (2006). However, the hypothesis of this study is that more trade reduces migration. Theoretically, this poses an endogeneity problem⁸. In order to control for this problem the instrumental variable technique is used, for which we use trade costs⁹. It is assumed that trade costs only affect trade and not migration and therefore it is a suitable instrument.

The data to be used in this analysis is time series data over 175 countries in the Americas, Europe, Asia, Africa and Oceania for the period of 1996 to 2005. The list of countries included in the present study is shown in Table 2.

INSERT TABLE 2 HERE

Annual migration data from these countries into the United States corresponds to the aggregate of permanent immigrants to the U.S. that are not subject to numerical quotas. We use green card holders as a proxy for permanent migration into the United States. The U.S. Office of Immigration Statistics website has annual data that identifies the country of birth of the green card holder. The U.S. International Trade Commission reports bilateral trade and trade costs in its Online Trade Database. Population and GDP per capita come from the World Bank Development Indicators. Distances were collected from the Centre D'études Prospectives et D'informations Internationales (CEPII), the measurement consists on geodesic distances calculated following the great circle formula. This formula uses latitudes and longitudes of the

⁸ The presence of endogeneity was confirmed empirically using Wu-Hausman F test and Durbin-Wu-Hausman chi square test reported in STATA.

⁹ Trade costs include transportation, duties, and other port fees.

most important cities/agglomerations (in terms of population). The variables considered in this study are displayed in Table 3.

INSERT TABLE 3 HERE

The instrumental variable (IV) for trade is based on U.S. import trade costs. Trade costs are defined to have two components, the dollar value of the duties charged and the other transportation costs that pertain to goods. We compute a transportation cost index by adding the dollar value of the duties charged¹⁰ with the aggregate cost¹¹ of all freight, insurance, and other charges (excluding U.S. import duties) and then dividing the result by total imports. We use this transportation cost index as an independent variable along with the other explanatory variables to estimate *Trade*. The predicted values of *Trade* are then used to avoid the endogeneity problem; this procedure is also called the two-stage least square estimator (2SLS).¹²

4. Estimation Results

The nature of the data for this study, cross-sectional time-series, allows us to use three possible ways to estimate the regression, a pooled regression, fixed effects, and random effects. We will first analyze the cross-section estimation of the last four years and then we will use the panel data that we have constructed to deepen our analysis.

In Table 4, we present the results of the cross-section estimation for the years of 2002 to 2005. Stata automatically dropped the U.S. population and income variables because in our model specification, for a given year their value is the same over the cross-section. The included variables are displayed with three asterisks when the variable is significant at the 99%, two asterisks at the 95%, and one asterisk at the 90% confidence. The white test is reported at the

¹⁰ “Calculated Duties” in the USITC online data base.

¹¹ “Import Charges” in the USITC online data base.

¹² This procedure is automatically performed in Stata by using the *ivreg* and *xtivreg* commands for cross-section and panel estimations respectively.

bottom of Table 4. We use this test to determine if heteroskedasticity is present in our cross-section estimation. The results of the White test were not significant and therefore, we fail to reject the null hypothesis, the disturbances are homoskedastic for all 4 years' results. R^2 was not reported for our estimations.¹³

INSERT TABLE 4 HERE

From Table 4 we see that over the four years presented, the trade index, the population, and the distance variables have not changed its sign. Moreover, distance and population variables have the expected sign but are not always significant. A country with increasing population would increase its migration flow to the U.S., similarly the farther apart the countries are with respect to migration, the lower the migration flows to the U.S. would be.

The sign of the trade index variable would indicate that the relationship of this variable with respect to migration flows is that of substitution. More trade between the U.S. and the partner country would decrease migration flows from the partner country to the U.S. but the variable is not significant in any of the cross section estimations. The income variable has a positive sign over the years presented in Table 4 except for 2004 but in all years is non-significant. At first, these results were puzzling because a higher income in the home country should not encourage migration flows to the U.S. This may reflect the fact that our data represent a subset of legal migrants, to whom higher income may not be the main reason to migrate, family reunion could be more important. If the income variable was positive and significant, the effect of income could reflect their ability to cover migration costs. Then the positive relationship shows that lower income implies lower migration simply because they cannot afford the relocation expenses. In contrast, higher income would encourage migration

¹³ According to Sribneyet al. 2005, Stata's ivreg command suppresses the printing of an R^2 on 2SLS/IV if the R^2 is negative. Sribneyet et al. explain that the R^2 has no statistical meaning in the context of 2SLS/IV.

because the migration costs can be covered. This may not be the case with illegal migrants where higher incomes at home might reduce illegal migration.

Next, we consider the panel data set that we have constructed and run three different procedures, the pooled regression, fixed effects, and random effects. In this section, both the U.S. population and income were considered in the model. However, we identify a high degree of correlation between these two variables, therefore the inclusion of both would carry redundant information. We include only the U.S. population due to its higher significance in preliminary results. This variable now has a wider meaning for our results; a high population will be also identified with high income, or higher economic opportunities (i.e., job opportunities).

In the pooled regression, no distinction per country is assumed, see results in Table 5. Noticing the presence of heteroskedasticity we proceed to use dummy variables to fix this problem. Continent and high-low dummies did not successfully reduced heteroskedasticity. Dummy variables where countries are classified in high, medium, and low level of migration successfully reduced heteroskedasticity. The countries in the medium category are the countries that are one standard deviation away from the mean. Dummy1 and Dummy2 signal countries with high and low migration with respect to countries with medium migration. We observe that the sign of our estimates are consistent to what we found before in the cross-section estimation except for the intercept. The U.S. population, now included, has a positive sign, which means that a higher U.S. population would encourage migration flows into the U.S. This is what we would expect especially since this variable also represent U.S. income variable. Note that U.S. population is significant along with other countries' population and distance. The dummy variables are also significant and of the right sign.

INSERT TABLE 5 HERE

The second column of Table 5 presents the fixed effects results. These are country fixed effects. Fixed effects controls for the unobserved country-specific characteristics that vary across labor exporting countries but not over time. You should note that the distance variable has been dropped because this is invariant over time. There is no switch in the sign of the variables with the exception of the trade index variable. The trade index variable switched its sign indicating a complementarity behavior with respect to migration. The significance of U.S. population and other countries' population also increased.

Finally, the last column in Table 5 shows the random effects results. Random effects assume that country has specific characteristics but allows them to change over time. The distance variable is now present and significant. There is consistency in the sign with respect to the fixed effects estimates.

There are statistical tests that let the data determine which of these three methods should be used. The first test is an F test that compares the fixed effects model against the pooled regression effects. The result of this test is also presented at the bottom of Table 5, which indicate that fixed effects are present. The test to select between random and fixed effects is the Hausman test, this test is also reported in the bottom of Table 5 and it rejects the null hypothesis that states that random effects would be consistently estimated. Based on these two tests, fixed effects estimation is the correct way to estimate the regression. This means that country-specific characteristics, captured by the fixed effects assumptions, are relevant to explain migration into the U.S. These characteristics are exclusive to each labor exporting countries and do not change over time.

The fixed effects estimation shows that the trade index has a positive effect on migration, which indicates a complementarity behavior but it is not significant. The coefficient of U.S.

population is positive and significant. An increase in the U.S. population would positively affect migration flows. Remember that we use U.S. population variable as a proxy to represents more opportunities for new comers (i.e., bigger economy) and higher income.¹⁴ In the case of own country's population, this is also positive but insignificant. This is considered a push factor in the literature because the bigger the population in a small economy means that there would be more competition for each individual, motivating them to look for better opportunities abroad.

As was discussed before, the income variable for the U.S. was dropped because it was highly correlated to the U.S. population. The estimate for the income variable of the home countries is non-significant but positive. As we discussed in the cross-section estimation section, this is not what we would have expected, the migration measure that we have as our dependant variable represents people with no legal obstacle to migrate if they can afford it. Therefore, the possible barrier they face may be their ability to pay the costs of migration (i.e., green card application fee, airplane ticket, house rent, etc). An increase in income that allows the payment of those migration costs explains the positive effect on migration flows.

5. Summary and Conclusions

In trade theory, the relationship between trade and migration depends on the assumptions made. The objective of this study is to empirically test the effects of trade as an alternative policy to manage migration.

Previous studies focus on the effect that migration has on trade, this study is interested in the effect that trade has on immigration. This posed a challenge to the aim of this paper. In order to correctly deal with this distinguishing fact, an instrumental variable was defined using

¹⁴ U.S. income variable was dropped to avoid collinearity because it was highly correlated with U.S. population.

trade costs. It is assumed that trade costs only affect trade between countries and do not affect migration.

We construct a data set of one hundred and seventy five countries (regions) over the span of ten years (1996-2005). We conduct cross-section and panel data estimations of a modified gravity model for migration to analyze the effects of trade on migration. The results showed bilateral trade between the U.S. and its partners have no significance in determining migration flows between these countries and the U.S. in contrast with the traditional determinants of migration, which are highly significant. Furthermore, the relationship between migration and bilateral trade for the U.S. and its partners was negative in the cross-section estimation but positive in the panel estimation. Therefore, we cannot establish the relationship of migration and trade as complements or substitutes.

One limitation of this study is that it focuses on a subset of migrants: the permanent legal migrants not subject to numerical quotas, while most of the public discussion is on illegal migration. Unfortunately, data on illegal migrants by home country and over time is not available. Additionally, the reason for not taking the total legal migrants was that if these quotas were binding (as they probably are), therefore the effect of trade on total legal migration could not be determined. However, we can relate our results to the restricted and total legal migrants because as we saw from Figure 1, over time both flows follow the same pattern as the unrestricted legal immigrant flow.

Another limitation of the study is that we consider trade as an index that positively accounts for exports and imports. This assumes that the effect of imports and exports on migration goes in the same direction, but in a small economy dependant on trade, exports and imports might have opposite effects on migration. Increase exports would improve the labor

market conditions in a small export dependant economy pushing up wages and/or employment, reducing the incentive to migrate, while increases in imports could undermine the productive sector in that country creating downward pressure in wages and/or employment, increasing the incentive to migrate. In this study, we created a trade index because we notice that in our data, a country's exports and imports with the U.S. are highly correlated with each other, including both would result in redundant information. There is also the endogeneity problem that we discussed before, and if we consider both exports and imports, we would have needed an additional instrument. We would like to address these issues in future research and we are open to suggestions.

Finally, one of the reasons we chose the United States to be the receiving country in this study was because the U.S. remains one of the most attractive destination for migrants. Future research would focus on collecting global bilateral migration data and using GTAP bilateral trade data to examine the effect of trade on migration with a larger set of countries.

References

- Balan, J (1992) "The role of migration policies and social networks in the development of a migration system in the Southern Cone," in M. Kritz, L.L. Lim, and H. Zlotnik (eds), *International migration systems: a global approach*, Oxford: Clarendon Press.
- Borjas, R. Freeman and L. Katz. 1997. "How much do immigration and trade effect labor market outcomes?" BPEA, p.1-90.
- Collins, W., K. O'Rourke, and J. Williamson (1997) "Were Trade and Factor Mobility Substitutes in History?" <http://www.nber.org/papers/W6059/>. National Bureau of Economic Research.
- Dunlevy, J.A. and William K. Hutchinson. 1999. "The Impact of Immigration on American Import Trade in the Late Nineteenth and Early Twentieth Centuries." *The Journal of Economic History*, Vol.59, No.4, 1043-1062.
- Feenstra R., James Markusen, and Andrew Rose, 2001, "Using the Gravity Equation to Differentiate among Alternative Theories of Trade", *The Canadian Journal of Economics*, 34: 30-447.
- Funkhouser Edward (1995) "Remittances from International Migration: A Comparison of El Salvador and Nicaragua." *The Review of Economics and Statistics*, Vol. 77, No.1, 137-146.
- Girma S. and Zhihao Yu. "The Link between Immigration and Trade: Evidence from the U. K." Forthcoming in *Weltwirtschaftliches Archiv*
- Gould, D. M. 1994. "Immigrant Links to the Home Country: Empirical Implications for U.S. Bilateral Trade Flows," *The review of Economics and Statistics*, Vol. 76, No.2, 302-316.
- Greenwood, M. and J. McDowell. 1986. "The Factor Market Consequences of U.S. Immigration" *Journal of Economic Literature*, Vol. 24, 1738-1772.
- Goldberg, Linda and Michael Klein (1999) "International Trade and Factor Mobility: An Empirical Investigation." <http://www.nber.org/papers/W7196>. National Bureau of Economic Research.
- Haan, Arjan (1999) "Livelihoods and Poverty: The Role of Migration –A Critical Review of the Migration Literature." *The Journal of Development Studies*, Vol. 36, No. 2, 1-47.
- Hanson, Gordon. 2006. "Illegal Migration from Mexico to the United States." NBER Website. <<http://papers.nber.org/papers/W12141>>.
- Head, K. and John Ries. 1998. "Immigration and Trade Creation: Econometric Evidence from Canada." *The Canadian Journal of Economics*, Vol. 31, No. 1, 47-62.

Jordan, M. and Valerie Bauerlein (2007) Bank of America Casts Wider Net for Hispanics. The Wall Street Journal, pp. A1, A23.

Karemera, D., Victor Iwuagwu, and Bob Davis, 2000, "A Gravity Model Analysis of International Migration to North America", *Applied Economics*, 32:1745-1755.

Lee, E. 1966. "A theory of migration". *Demography*, Vol. 3, 47-57.

Markusen, James R. 1983. "Factor Movements and Commodity Trade as Complements." *Journal of International Economics*. 14 (3-4), 341-356.

Massey, D. and Kristin Espinosa. 1997. "What is Driving Mexico-U.S. Migration? A Theoretical, Empirical, and Policy Analysis," *American Journal of Sociology*, Vol. 102, No. 4, 939-999.

Massey, et al. 1993. "Theories of international migration: A review and appraisal," *Population and Development Review* 19: 431-466.

Mundell, Robert (1957) "International Trade and Factor Mobility." *American Economic Review* 47(3): 321-335.

Neary, J. Peter (1995) "Factor Mobility and International Trade." *The Canadian Journal of Economics*, Vol. 28, Special Issue: Essay in International Economics in Honour of Douglas Purvis, S4-S23.

Plane, D., 1984, "Migration Space: Doubly Constrained Gravity Model Mapping of Relative Interstate Separation", *Annals of the Association of American Geographers*, 74: 244-256.

Ravenstein, E., 1885, "The Laws of Migration", *Journal of the Statistical Society*, 46: 167-235.

Samuelson, Paul A. 1948. "International Trade and the Equalisation of Factor Prices," *Economic Journal* 58, 163-184.

Schiff, Maurice (2006) "Substitution in Markusen's Classic Trade and Factor Movement Complementarity Models." World Bank Policy Research Working Paper 3974.

Stark, Oded and David Bloom (1985) "The New Economics of Labor Migration." *The American Economic Review*, Vol. 75, No. 2, Papers and Proceedings of the Ninety-Seventh Annual Meeting of the American Economic Association, 173-178.

Sribney, W., Vince Wiggins, and David Drukker. "FAQ: For two-stage least-squares (2SLS/IV/ivreg) estimates, why is the R-squared statistic not printed in some cases?", StataCorp, Retrieved on April 21, 2007 from < <http://www.stata.com/support/faqs/stat/2sls.html>>

U.S. Department of Commerce, International Trade Administration, Manufacturing and Services, Office of Trade and Industry Information. Retrieved on March 1st, 2006 from:

<http://tse.export.gov/MapFrameset.aspx?MapPage=NTDMapDisplay.aspx&UniqueURL=a4n51tij0x4tk0u3lsg04z55-2006-3-2-21-1-5>

U.S. Office of Immigration Statistics website. Retrieved on March 1st, 2006 from:
<http://uscis.gov/graphics/shared/statistics/index.htm>

Waldorf, Brigitte (1996) "The Internal Dynamic of International Migration Systems,"
Environment and Planning A, Vol. 28, 631-650.

Wilpert, C. (1992) "The Use of Social Networks in Turkish Migration to Germany," in M. Kritz,
L.L. Lim, and H. Zlotnik (eds), *International migration systems: a global approach*, Oxford:
Clarendon Press.

Wong, Kar-yiu (1986) "Are International Trade and Factor Mobility Substitutes?" *Journal of
International Economics* Vol. 21, 25-43.

World Bank (2004) "Close to Home: The Development Impact of Remittances in Latin
America" <http://web.worldbank.org/>

World Bank, "World Development Indicators" Online database. Retrieved on March 1st, 2006
from: <http://devdata.worldbank.org/dataonline/>

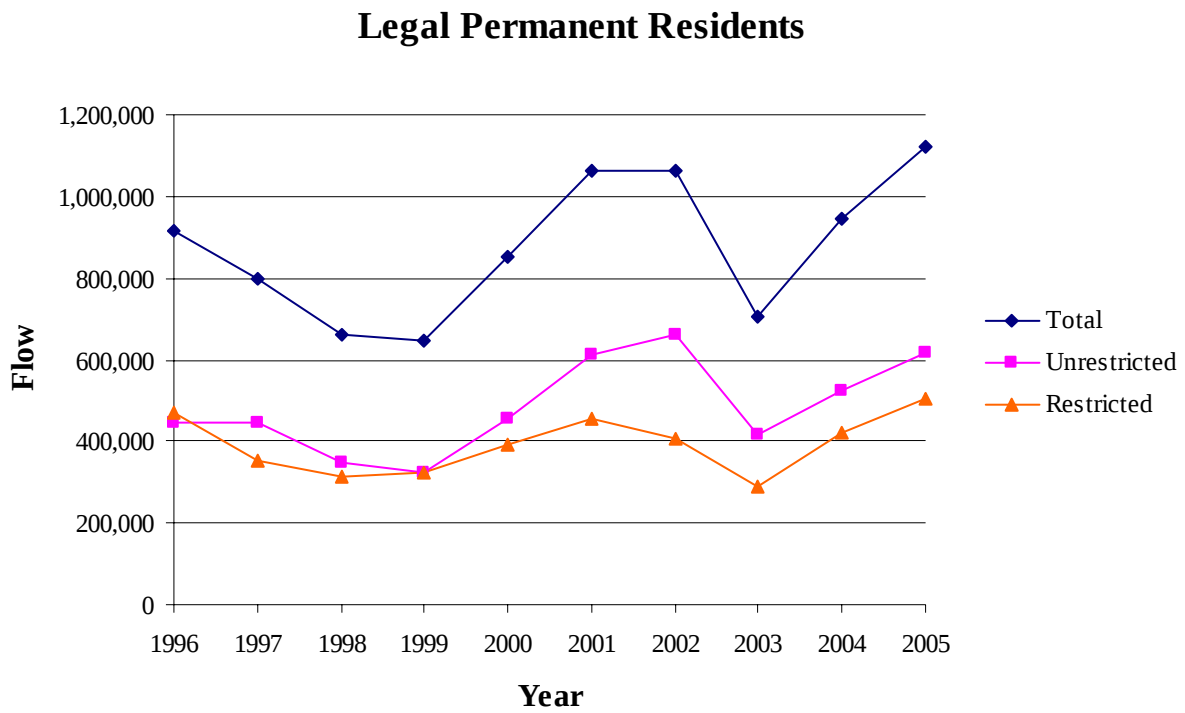


Figure 1. U.S. Legal Permanent Residents (U.S. Office of Immigration Statistics)

Table 1. Economic Factors of Migration

Push factors	Pull factors	Distance	Social Networks
High unemployment	Low unemployment	High transportation cost	Job and wage information
High population	High demand for workers	Border share	Assistance to new migrants (e.g., housing, move)
Low income (i.e., individual and household.)	High income (i.e., individual and household.)	Different language	Established communities with similar culture
Low wages	High wages		
Economic crisis	Economic stability		

Table 2. List of countries included in the migration flow analysis

Continents	Countries
North America	Canada, Mexico
Central America and the Caribbean	Antigua and Barbuda, Bahamas, Barbados, Belice, Costa Rica, Dominica, Dominican Rep, El Salvador, Grenada, Guatemala, Haiti, Honduras, Jamaica, Nicaragua, Panama, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Trinidad and Tobago
South America	Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Guyana, Paraguay, Peru, Suriname, Uruguay, Venezuela
Europe	Albania, Austria, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Macedonia, Malta, Moldova, Netherlands, Norway, Poland, Portugal, Romania, Serbia and Montenegro, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom
Asia	Armenia, Azerbaijan, Bahrain, Bangladesh, Bhutan, Cambodia, China, Georgia, Hong Kong, India, Indonesia, Iran, Israel, Japan, Jordan, Kazakhstan, Korea, Kuwait, Kyrgyz Republic, Lao People's, Lebanon, Macao, Malaysia, Maldives, Mongolia, Nepal, Oman, Pakistan, Philippines, Qatar, Russia, Saudi Arabia, Singapore, Sri Lanka, Syrian Arab, Tajikistan, Thailand, Turkmenistan, United Arab Emir, Uzbekistan, Vietnam, Yemen
Africa	Algeria, Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Rep, Chad, Comoros, Congo, Ivory Coast, Djibouti, Egypt, Equatorial Guinea, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Libya, Madagascar, Malawi, Mali, Mauritania, Mauritius, Morocco, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, South Africa, Sudan, Swaziland, Tanzania, Togo, Tunisia, Uganda, Zambia, Zimbabwe
Oceania	Australia, Fiji, Kiribati, Marshall Islands, Micronesia, Sts. New Caledonia, New Zealand, Papua New Guinea, Samoa, Solomon Is., Tonga, Vanuatu

Table 3. Main variables in this study

Variables	Definition	Expected Sign	Source
DEPENDENT:			
Migration _{it}	Migration from country i to U.S. at time t		(1)
EXPLANATORY:			
Trade _{it}	Trade index between country i and US in time t	+/-	(2)
USincome _t	US GDP per capita at time t	+	(3)
Income _{it}	GDP per capita in country i at time t	-	(3)
USpopulation _t	US population at time t	+	(3)
Population _{it}	Population in country i at time t	+	(3)
Distance _i	Distance between country i and U.S.	-	(4)

Source: (1) U.S. Department of Homeland Security, (2)U.S. International Trade Commission, (3)World Development Indicators, (4) Jon Haveman's Website.

Table 4. Cross-section Instrumental Variable Estimation Results

	Coefficients			
Variable\ Year	2005	2004	2003	2002
Trade index	-7.57	-4.77	-0.70	-2.89
Income	0.19	-0.06	0.07	0.46
Population	0.22	0.37	0.70 ***	0.52
Distance	-7.83	-5.32	-2.39 ***	-3.77 *
Constant	49.12	34.53	13.72 **	19.64 *
White Test	7.91	5.51	5.36	7.57

Table 5. Panel Data Instrumental Variable Estimation Results

	Pooled Regression	Fixed Effects	Random Effects
Trade index	-0.90	0.11	0.08
US population	2.47 *	4.24 ***	5.12 ***
Income	0.09	0.21	0.09
Population	0.23 *	1.19 ***	0.71 ***
Distance	-1.32 ***	(dropped)	-1.51 ***
Constant	-36.59	-96.04 ***	-91.69 ***
Dummy1	2.69 ***	0.56 ***	0.57 ***
Dummy2	-3.05 ***	-1.07 ***	-1.10 ***
R ²	0.55	0.35	0.35
Ho: no fixed effects and no intercept			F-test = 31.53 ***
Ho: random effects would be consistent and efficient			H-test = 57.39 ***