# Research Paper

## Federal Reserve Bank of Dallas

No. 9102

IMMIGRANT LINKS TO THE HOME COUNTRY:
EMPIRICAL IMPLICATIONS FOR U.S. AND
CANADIAN BILATERAL TRADE FLOWS

by

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March 1991

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expressed in this article are those of the author and should not be attributed
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# Immigrant Links to the Home Country: Empirical Implications for U.S. and Canadian Bilateral Trade Flows

By David M. Gould[*]

This paper examines how immigrant ties to the home country can play a role in creating bilateral trade linkages. Immigrant ties or links refer to knowledge of home-country markets, language, preferences, and personal contacts that have the potential to decrease trading transactions costs. Empirical results for the United States and Canada suggest that immigrant links do play a role in increasing bilateral trade flows.

Over the past two decades, the world has experienced some of the largest increases in the international migration of people since the turn of the century. In the United States, the 1980 census recorded 14 million foreign-born residents, 32 percent of which immigrated between 1970 and 1980. This is one of the highest intercensal increases in foreign-born population in U.S. history, representing 18.6 percent of the increment in population. In Canada, low native fertility rates, combined with new liberal immigration policies, resulted in immigration accounting for 33 percent of the population increase between 1966 and 1975.[1]

Most economic models of immigration treat immigrants as indistinguishable from current residents.[2] In these models, the primary difference between an increase in

[1]Keely and Elwell (1981).

[2]See, for example, Greenwood (1983), Greenwood and McDowell (1985), and Reubens (1983).

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domestic labor as opposed to foreign labor is the treatment of national welfare (that is, Are immigrants included in the host country's welfare?) and the question of whether physical and human capital accompanies foreign labor.[3] This, however, may ignore other important effects of immigration, such as the close ties or links an immigrant community maintains with its home country. These immigrant links to the home country can have trade-enhancing effects for the host and home countries. Immigrant links to the home country include introduction into the host country of the immigrant's language, preferences, knowledge of home-country markets, and home-country contacts.

The question I address in this paper is, Do immigrant links to the home country enhance bilateral trade flows between the home and host countries? This question is important in assessing the economic consequences of immigration as well as understanding the political economy of immigration – that is, who will lobby for immigration liberalizations or restrictions? Furthermore, questions concerning the changing source-country distribution of immigrants can be addressed in this context. Does it make a difference to a host country whether it receives 100,000 immigrants from only one country or from a dozen countries? Should a host country actively promote diversity in its immigration policy or, should it be passive?

Tables 1 and 2 provide some support for the immigrant-link hypothesis by showing that during the 1970s, U.S. and Canadian bilateral trade flows and immigration flows tended to move in the same direction. The tables indicate that as the distribution of immigrants has shifted from traditional European source countries to the nontraditional Latin American and Asian countries, the distribution of bilateral trade flows has shifted in the same direction.

Further evidence suggesting the presence of immigrant links can be found in re-

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[3]See Johnson (1967), Grubel and Scott (1966), Berry and Soligo (1969), and Bhagwati and Rodrigues (1975).

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Table 1 – United States: Distribution of Foreign-Born Persons and Trade, 1970 and
1980 (Percent)

| Region | Immigrant Stock | | Trade | |
|--------|------|------|------|------|
| | 1970 | 1980 | 1970 | 1980 |
| Europe | 54.8 | 34.2 | 32.5 | 24.6 |
| Asia | 9.3 | 17.7 | 22.8 | 32.7 |
| Canada | 7.9 | 6.1 | 24.1 | 15.7 |
| Mexico | 8.0 | 14.3 | 4.2 | 6.1 |
| Latin America* | 8.6 | 12.4 | 10.4 | 10.6 |
| Other | 11.4 | 15.3 | 8.0 | 10.3 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 |

Sources:U.S. Census of the Population, 1970 and 1980,
and the International Monetary Fund Direction of Trade
Statistics.
* Excluding Mexico.

Table 2 – Canada: Distribution of Foreign-Born Persons and Trade, 1966 and 1977
(Percent)

| Region | Immigrant Stock | | Trade | |
|--------|------|------|------|------|
| | 1966 | 1977 | 1966 | 1977 |
| Europe | 87.3 | 69.0 | 18.5 | 11.8 |
| Asia | 3.9 | 11.9 | 5.9 | 8.7 |
| U.S. | 3.8 | 5.6 | 70.6 | 71.4 |
| Latin America | 2.5 | 8.3 | 3.8 | 4.7 |
| Other | 1.9 | 4.2 | 1.2 | 3.4 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 |

Sources: 1986 Canada Census, and the International
Monetary Fund Direction of Trade Statistics.

cent case studies of immigrant networks and immigrant entrepreneurs.[4] These studies show that although entrepreneurial activity may differ between immigrant groups and destination countries, immigrants typically have found trading activities an accessible niche to fill in the labor market.[5] In a survey of Korean immigrants in Los Angeles, Min (1990) found that the most frequent occupation of Korean immigrant entrepreneurs is trading activities (mainly trade in fashion items) with Korea. Min observed, "Korean exports to the U.S. have substantially increased since the early 1970s, when a massive influx of Koreans to the U.S. started. By virtue of the advantages associated with their language and ethnic background, many Korean immigrants have been able to establish import businesses dealing in Korean-imported merchandise"(p. 22).

Although many factors may have contributed to the coincident movements in trade and immigration captured by these tables and observed in case studies, the pattern suggests that immigrants may play a role in determining bilateral trade flows and motivates this study's investigation into the possible trade-enhancing aspects of immigration. In particular, I postulate that immigrant links to the home country can have an important impact on bilateral trade flows between the host and home countries through the introduction into the host country of the immigrant's language, preferences, knowledge of home-country markets, and contacts.

The mechanisms by which immigrant links influence bilateral trade flows may be sorted into two general categories. The first refers to immigrant preference for home-country products, and the other refers to the transactions costs to trade associated with information and trust. The first class of mechanisms suggests that immigrants' consumption of their home-country products will result in a direct increase in the host country's imports of these goods. The second category, a much broader one

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[4]See, for example, Light (1985), Light and Bonacich (1988), and Razin (1990).
[5]Razin (1990).

predicts a direct increase in both export and import flows between the host and home countries through a decrease in transactions costs, associated with obtaining foreign market information and establishing trade relationships.

There are several ways in which immigrant links can decrease the transactions costs to trade associated with foreign market information and developing trust. First, the native language of the immigrants can become known, or used more often, by the residents of the host country. Consequently, this can create a larger group of individuals in the host country, immigrants and nonimmigrants, who are bilingual in the languages of the host and home countries, which diminishes the trading costs due to communication barriers. Second, if products are differentiated across countries and immigrants bring information about their home-country products and preferences, the costs of obtaining this market information in the host country will decrease. Finally, because trade often depends on contracts for delivery and payment, the development of trust through immigrant contacts can decrease the costs associated with negotiating trade contracts and ensuring their enforcement. While trade flows between developed countries may benefit a little from these effects, trade between developed and developing countries would be influenced even more because formal trade contracting is not as well institutionalized in developing countries as it is in developed countries.

The importance of these immigrant information effects, of course, would depend on the initial amount of foreign market information in the host country and the ability of immigrants to relay information and to integrate their communities into the host country.[6] This, in turn, may depend on the educational level of the immigrants, the length of their stay in the host country, and the size of the immigrant community.

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[6]Certainly, immigration is not the only way a host country can obtain foreign market information. Immigration, however, may increase the availability of such information, which would decrease its marginal cost.

This paper presents an empirical investigation into the role immigrant links play in facilitating trade between the United States, Canada, and the home countries of their immigrant populations. Using a panel data set of 47 U.S. and Canadian trading partners, the empirical analysis reveals that immigrant links to the home country have a strong positive impact on exports and imports, with the greatest effects on consumer manufactured exports. These effects tend to increase at a decreasing rate as the size of the immigrant community grows, and they also depend crucially on the types of goods traded.

In the following section, I develop a bilateral trade model that is used as the basis for the empirical work. In this model, immigrants are assumed to decrease the trans-actions costs of trade between the host and home countries by introducing foreign market information and by developing contacts between the host and home countries. This, in turn, results in a decrease in the wedge between the foreign price and the domestic price of traded goods, which increases bilateral trade flows. In Section II, I explore immigrant links to the home country by employing data on U.S. and Cana-dian bilateral trade flows, the type of products that are imported and exported, the size and source-country distribution of the immigrant stocks, and immigrant charac-teristics. Finally, in Section III, I summarize the findings and discuss some policy implications of the analysis.

## I  The Analytical Model

The purpose of this section is to develop an analytical model that will state concisely the mechanisms through which immigrants enhance trade and set the basic framework for the empirical analysis. The model developed is a modification of Bergstrand's (1985) microeconomic foundation of the gravity equation.[7] The essential feature

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[7]The gravity equation as used to estimate bilateral trade flows has proven popular in a variety of international trade applications because it provides an empirically tractable framework. For other

developed here is the introduction of endogenous transactions costs that decline with the introduction of foreign market information supplied by immigrants. The model consists of $N$ countries, each of which produces goods that are differentiated according to the country of destination. Production takes place using a given endowment of labor from its own native population and an immigrant population that comes from a subset of the other $(N-1)$ countries. Producers maximize profits subject to constant elasticity of transformation (CET) technology, and consumers maximize a constant elasticity of substitution (CES) utility function subject to a budget constraint.

## I.A  Supply

Assuming identical technologies across countries, labor is allocated across industries for every country $i$ according to CET joint production surface.[8] In this production surface, labor in country $i$ can be transformed into producing different foreign goods at a constant elasticity, but it cannot be transformed from producing foreign goods to domestic goods at the same constant elasticity.

$$L_i = \left\{ \left[ \left( \sum_{k=1}^{N} X_{ik}^{\phi} \right)^{1/\phi} \right]^{\delta} + X_{ii}^{\delta} \right\}^{1/\delta} \tag{1}$$

$i = 1, \ldots, N$ and, $k \neq i$,

theoretical foundations of the gravity equation, see Anderson (1979), and Helpman and Krugman (1985).

[8]See Bergstrand (1985) and Powell and Gruen (1968).

where

$L_i$      is defined as a single factor of production available to country $i$ (e.g., domestic labor and immigrant labor),

$X_{ik}$      is country $i$'s good supplied to country $k$,

$X_{ii}$      is country $i$'s good supplied to the domestic market,

$\delta = (\eta + 1)/\eta,$      where $\eta$ is the elasticity of transformation between any two goods in country $i$ ($0 \leq \eta \leq \infty$), and

$\phi = (\gamma + 1)/\gamma,$      where $\gamma$ is the CET among exportable goods ($0 \leq \gamma \leq \infty$).

Maximizing profit subject to the CET technology gives $N^2$ first order conditions and generates $N(N-1)$ bilateral exports supply equations

$$
\begin{aligned}
X_{ij}^S &= Y_i P_{ij}^{*\gamma} \left[ \left( \Sigma' P_{ik}^{*\,1+\gamma} \right)^{1/(1+\gamma)} \right]^{-(\gamma-\eta)} \\
&\quad * \left\{ \left[ \left( \Sigma' P_{ik}^{*\,1+\gamma} \right)^{1/(1+\gamma)} \right]^{1+\eta} + P_{ii}^{*1+\eta} \right\}^{-1}
\end{aligned}
\tag{2}
$$

where

$$P_{ik}^* = P_{ik}/(T_{ik}C_{ik}Z_{ik})$$ is the price received for selling $i$'s product in the $k^{th}$ country,

$P_{ik}$     is the price of $i$'s product sold the $k^{th}$ market,

$T_{ik}$     is one plus the ad valorem tariff rate on $i$'s product sold in the $k^{th}$ market,

$C_{ik}$     is a transport cost factor assumed to be a function of distance $(C_{ik} \geq 1)$,

$Z_{ik}$     are the costs associated with gaining foreign market information about country $k$ in country $i$ $(Z_{ik} \geq 1)$,

$Y_i$     is total income paid to labor $(Y_i = W_iL_i)$, where $W_i$ is the wage,

$\Sigma'$     denotes summation over $k = 1,\ldots,N, k \neq i$.

The equation above shows that country $i$'s supply of its differentiated product to the foreign markets depends on its income $(Y_i)$, the price of that product in country $j$ and in the domestic market $(P_{ij}$ and $P_{ii})$, and price of the product in the other foreign markets $(\Sigma' P_{ik}^*)$.

As mentioned in the introduction, the transactions costs to trade $(Z_{ik})$ are assumed to be a function of the foreign market information carried by immigrants. That is,

$$Z_{ik} = f(M_{ik}),$$

where $M_{ik}$ is the number of immigrants from country $k$ in country $i$. $f(\cdot)$ represents the transactions costs related to language, knowledge of foreign markets, and the lack of access to foreign contacts. These transactions costs to trade are assumed to be a

decreasing function of the foreign market information carried by immigrants:

$$\frac{dZ_{ik}}{dM_{ik}} < 0,$$

With complete information across countries and no transportation costs or tariffs, the price of a traded good produced for the domestic market is the same as its price in the foreign market. With incomplete information about the foreign countries, producers of tradable goods find that the actual price they receive for these goods abroad is less than what they can receive at home – the difference being transactions costs. The process by which this information becomes disseminated may be simply through an increase in use of immigrants' home-country language in the host country or, more directly, by immigrants' participation in trading activities and developing trade contacts.

Given the assumptions about the role of immigrants discussed above and assuming that information about the foreign market increases with the flow of immigrants at a decreasing rate, we have

$$\frac{d^2 Z_{ik}}{dM_{ik}^2} > 0.$$

To simplify the following presentation, the functional form of transactions costs that satisfies these conditions is postponed until the empirical model is presented in the next section.

## I.B Demand

Consumers in all countries are assumed to share a constant elasticity of substitution utility function of the form[9]

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[9]This is a form of the Dixit-Stiglitz (1977) utility function in which utility is derived from the variety and quantity of goods available.

$$U_j = \left\{ \left[ \left( \sum_{k=1}^{N} X_{kj}^{\theta} \right)^{1/\theta} \right]^{\psi} + X_{jj}^{\psi} \right\}^{1/\psi} \tag{3}$$

$j = 1, \ldots, N$ and, $k \neq j$, [10]

where

$X_{kj}$      is the country $k$'s good demanded by country $j$,

$X_{jj}$      is the good that is produced and demanded domestically,

$\psi = (\mu - 1)/\mu$      where $\mu$ is the CES between domestic and imported goods in the host country $(0 \leq \mu \leq \infty)$, and

$\theta = (\sigma - 1)/\sigma$      where $\sigma$ is the CES among importable goods $(0 \leq \sigma \leq \infty)$,

Maximizing utility subject to income $(Y_j)$ yields $N + 1$ first-order conditions and $N(N - 1)$ bilateral aggregate import demand equations

$$\begin{aligned} X_{ij}^{D} &= Y_j P_{ij}^{-\sigma} \left[ \left( \Sigma'' P_{kj}^{1-\sigma} \right)^{1/(1-\sigma)} \right]^{\sigma - \mu} \\ &* \left\{ \left[ \left( \Sigma'' P_{kj}^{1-\sigma} \right)^{1/(1-\sigma)} \right]^{1-\mu} + P_{jj}^{1-\mu} \right\}^{-1} \end{aligned} \tag{4}$$

where $\Sigma''$ denotes summation over $k = 1, \ldots, N, k \neq j$.

Equation 4 shows that country $j$'s demand for country $i$'s product $(X_{ij})$ depends on its income $(Y_j)$, the price of country $i$'s product $(P_{ij})$ and its own domestic product $(P_{jj})$ and the price of other foreign products available $(\Sigma'' P_{kj})$.

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[10]Note that the subscript $j$ is used on utility while the $i$ subscript is used for the profit function. The demanders of goods are denoted with the $j$ subscript, while suppliers are denoted with the $i$ subscript.

## I.C   Equilibrium

Solving the complete system of supply and demand equations for $N^2$ equilibrium conditions,

$$X_{ij} = X_{ij}^D = X_{ij}^S \tag{5}$$

yields $2N^2$ solutions for quantities and prices and N solutions for country incomes as functions of the exogenous variables $T_{ij}$, $C_{ij}$, $Z_{ij}$, and $L_i$. However, the system can be simplified quite a bit by assuming that for each country individual bilateral trade flows are small relative to total trade so individual bilateral prices can be taken as given. The small market assumption implies that changes in $X_{ij}$ and $P_{ij}$ that equilibrate demand and supply for traded goods between two countries have a negligible impact on $Y_i$, $Y_j$, $P_{ii}$, $P_{jj}$, $\Sigma' P_{ik}^{1+\gamma}$, and $\Sigma'' P_{kj}^{1-\sigma}$.[11] Consequently, combining equation 2 with equation 4 and equation 5 yields solutions for bilateral prices as well as trade flows and multiplying these solutions together yields the value of aggregate trade flows:

$$
\begin{aligned}
P_{ij}X_{ij} =\ & Y_i^{(\sigma-1)/(\gamma+\sigma)} Y_j^{(\gamma+1)/(\gamma+\sigma)} C_{ij}^{-\sigma(\gamma+1)/(\gamma+\sigma)} T_{ij}^{-\sigma(\gamma+1)/(\gamma+\sigma)} Z_{ij}^{-\sigma(\gamma+1)/(\gamma+\sigma)} \\
* \ & \left( \Sigma' P_{ik}^{*\,1+\gamma} \right)^{-(\sigma-1)(\gamma-\eta)/(1+\gamma)(\gamma+\sigma)} \\
* \ & \left( \Sigma'' P_{kj}^{1-\sigma} \right)^{(\gamma+1)(\sigma-\mu)/(1-\sigma)(\gamma+\sigma)} \\
* \ & \left[ \left( \Sigma' P_{ik}^{*\,1+\gamma} \right)^{(1+\eta)/(1+\gamma)} + P_{ii}^{1+\eta} \right]^{-(\sigma-1)/(\gamma+\sigma)} \\
* \ & \left[ \left( \Sigma'' P_{kj}^{1-\sigma} \right)^{(1-\mu)/(1-\sigma)} + P_{jj}^{1-\mu} \right]^{-(\gamma+1)/(\gamma+\sigma)} , \tag{6}
\end{aligned}
$$

where $P_{ij}X_{ij}$ is the value of aggregate trade flow from country $i$ to country $j$.

The small market assumption yields a reduced-form bilateral trade equation with $Y_i$ and $Y_j$ treated exogenously as well as foreign prices (other than those specifically

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[11]Bergstrand (1985)

between countries $i$ and $j$) and domestic prices.

The value of aggregate trade flow from country $i$ to country $j$ depends on nine terms. In the order of their appearance in the equation they are 1) the income of the exporting country, 2) the income of the importing country, 3) transportation costs, 4) tariffs, 5) transactions costs associated with lack of foreign market information, 6) an export price index for exports to all other countries to which the exporting country exports, 7) an import price index for imports from all other countries from which the importing country imports, 8) an index of domestic prices for the exporting country, and 9) an index of domestic prices for the importing country.

Basically, these nine terms can be sorted into three categories: 1) income in the exporting and importing countries that reflects the potential demand and supply, 2) the wedges between the export and import price of the traded goods due to transportation costs, tariffs, and lack of foreign market information, and 3) price terms reflecting the substitutability between this traded good and the others.

Without an empirical estimation, only four terms in equation 6 can be signed a priori. These terms are the income in the importing country $(Y_j)$, which has a positive effect on trade, and the wedges between the export and import price of the traded goods $(C_{ij}, T_{ij}, \text{ and } Z_{ij})$ which negatively affect the volume of bilateral trade.

The effect of the other terms on bilateral trade flows will depend on the relative magnitudes of the supply and demand elasticities. For example, if the demand elasticity of substitution among imports $(\sigma)$ exceeds one, the exporting country's income and its overall price index will have, respectively, positive and negative effects on trade flows. Additionally, if the supply elasticity of transformation among exports $(\gamma)$ exceeds the overall supply elasticity between exports and domestic goods $(\eta)$, the exporting country's export price index will have a negative effect on trade. The importing country's import price index will have a positive effect on trade if the demand elasticity of substitution among imports exceeds the overall elasticity between

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domestic and imported products ($\mu$). Finally, the importing country's overall price index will have a negative or positive effect on trade depending on whether $\mu$ is less than or greater than one.

With a few modifications, equation 6 will serve as the basis for the empirical analysis of the effects of immigrant information on bilateral trade flows.

## II  Empirical Analysis

Ideally, the most direct way to examine immigrant links would be to measure immigration and foreign market information and then observe directly their relationship with bilateral trade flows. Unfortunately, there is no observable data on the foreign market information carried by immigrants or the transactions costs to trade. However, because there are country-specific data on immigration, immigrant characteristics, and bilateral trade flows, immigrant-link effects may be inferred by analyzing the relationship among these variables. A positive relationship between immigration from a particular country and bilateral trade flows with the same country may suggest that immigrant links to the home country do exist. Whether a positive relationship between immigration and bilateral trade flows can be attributed solely to immigrant links is an important question and depends on other feasible alternative hypotheses that are consistent with the data. In the following paragraphs, I discuss some of these alternative hypotheses and ways of empirically distinguishing the immigrant-link hypothesis.

The traditional factor endowment model of trade can be consistent with the observation of trade flows being complementary with immigration if one assumes at least three factors of production. Furthermore, models that include human capital externalities or industry-specific economies of scale are also consistent with complemen-

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tarity between immigration and trade flows.[12] However, none of these models make predictions for the relationship between immigration and bilateral trade flows once cross-country differences in endowments are controlled for. Consequently, if immigration is empirically found to be complementary to bilateral trade flows, controlling for differences in factor endowments between countries, then this would suggest that a mechanism other than those mentioned above is at least partially responsible for determining bilateral trade flows.

Another alternative hypothesis, is that immigrants have a greater preference for home-country products, which leads to a direct increase in imports of home-country products because of increased consumption. Because both this hypothesis and the immigrant-link hypothesis can imply an increase in bilateral trade flows with immigration, it becomes slightly more difficult to distinguish between them. However, an observational difference between these two hypotheses is that the immigrant preference hypothesis implies an increase in imports, whereas the immigrant-link hypothesis implies a direct increase in exports as well as imports.[13] As a result, in examining the empirical relationship between immigration and bilateral trade flows, several cases can present themselves, reflecting varying degrees of our ability to distinguish between the two hypotheses. If only imports of home-country consumer goods are influenced by immigration, then probably the relevant hypothesis is immigrant preference for home-country products. On the other hand, if only consumer or producer exports are influenced by immigration, then probably the immigrant-link hypothesis is the most relevant one. A combination of effects on exports and imports in consumer and producer products would indicate that both hypotheses may be important to some

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[12]See Leamer (1990), Jovanovic and Rob (1989), Lucus (1988), and Rauch (1989).

[13]Although even in the case of the immigrant preference hypothesis with direct effects on imports, an indirect effect on exports may result as well if trade flows tend to be balanced. However, in a world with functioning capital markets and convertible currencies, the trade account between any two countries does not necessarily have to be balanced in the short or long run.

degree.

The empirical investigation that follows will try to distinguish between these hypotheses by examining the relationship between immigration and bilateral trade flows in both exports and imports and in consumer, producer, and aggregate trade flows. This analysis will begin with the development of the empirical model, and then I will take a preliminary look at the relationships between immigration and trade flows. Finally, I present the empirical estimation of the empirical model.

## II.A Empirical Model

Because the primary focus of this empirical analysis is to examine immigrant-link effects on host-country bilateral trade flows both over time and across countries, it uses time-series as well as cross-sectional information. Given that desired trade flows (as modeled in equation 6) may depart from actual flows over time due to decision, production, or delivery lags, the empirical analysis will approximate these possible dynamic effects by a simple flow-adjustment specification. The flow-adjustment is incorporated into the log transformed empirical model by including a lagged value of logged trade flows as an explanatory variable.

The hypothesis that immigrants provide foreign market information that decreases the transactions costs to trade at a decreasing rate is represented by the following functional form of the stock of immigrants from country $j$ in the host country:

$$Z_{host,j} = Ae^{-\rho(M_{host,j}/(\vartheta + M_{host,j}))}$$

$$\rho > 0, \vartheta > 0, A > 0$$

where, as before, $Z_{host,j}$ represents the transactions costs to trade associated with obtaining foreign market information about country $j$ in the host country. This functional form captures the assumptions that the foreign market information brought

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by immigrants decreases the transactions costs to trade at a decreasing rate. The parameter $\rho$ determines the size of the immigrant information effects on transactions costs, and $A$ is simply a constant. The parameter $\vartheta$ determines the curvature of this function or, in other words, the sensitivity of transactions costs to the size of the immigrant stock. When substituting this functional form for transactions costs back into the reduced-form trade flow (equation 6), the overall effect of immigration on trade is positive. In the trade equation, the exponent on the immigrant information variable, $(M_{host,j}/(\vartheta + M_{host,j}))$, will be $\tilde{\beta} = \rho * \sigma(\gamma + 1)/(\gamma + \sigma) > 0$.

Because $\vartheta$ determines the curvature of the transactions costs function, its value can tell us something about the size of the stock of immigrants at which most of the marginal benefit to an additional immigrant is exhausted. For example, in the estimated trade equation, 90 percent of the immigrant information effects will be exhausted when $e^{\tilde{\beta}(M_{host,j}/(\vartheta + M_{host,j}))} = [.90 * [e^{\tilde{\beta}} - 1] + 1]$, where $e^{\tilde{\beta}}$ is the maximum value of information effects and 1 is the minimum value.[14] Taking logs of this function and solving for $M_{host,j}$ in terms of $\vartheta$, we find $M_{host,j} = \vartheta * (\log[\cdot]/\tilde{\beta})/(1 - (\log[\cdot]/\tilde{\beta}))$, where $\log[\cdot] = \log[.90 * [e^{\tilde{\beta}} - 1] + 1]$. Consequently, this shows the relationship between the size of the immigrant stock $(M_{host,j})$ and the sensitivity parameter $(\vartheta)$ when 90 percent of benefits to the foreign market information are realized.

The effects of the skill level and the length of stay of immigrants are addressed by including measures of the ratio of skilled to unskilled immigrants and the average length of stay of the immigrant stock. If, as the length of stay increases, the ability of immigrants to incorporate their foreign market information into the host country increases, then the length-of-stay variable will be positive. On the other hand, if the foreign market information that immigrants bring becomes obsolete over time, the length-of-stay variable may be negative.

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[14]The constant $A$ disappears from the calculation because it enters multiplicatively on each side of the equality.

In accordance with the analytical model of Section I, bilateral trade flows from country $i$ to $j$ are described as a function of income in the two countries, tariffs, transportation costs, information costs that decrease with the number of immigrants, and a set of price terms that represents a type of price index of import and export prices. Because country-specific data for the price terms are not available, approximations are made that attempt to capture their variation. Thus, $\left( \Sigma' P_{ik}^{1+\gamma} \right)$, which is an index of all of country $i$'s export prices excluding the export prices of goods going to country $j$, is proxied by country $i$'s export unit value index, and $\left( \Sigma'' P_{kj}^{*\,1-\sigma} \right)$, which is an index of all of country $j$'s import prices excluding the import prices of goods coming from country $i$, is proxied by country $j$'s import unit value index. Similarly,

$$\left[ \left( \Sigma' P_{ik}^{1+\gamma} \right)^{(1+\eta)/(1+\gamma)} + P_{ii}^{1+\eta} \right]$$

which is an index of all of country $i$'s prices, is proxied by country $i$'s gross domestic product (GDP) deflator and

$$\left[ \left( \Sigma'' P_{kj}^{*\,1-\sigma} \right)^{(-\mu)/(1-\sigma)} + P_{jj}^{1-\mu} \right],$$

which is an index of all of country $j$'s prices, is proxied by country $j$'s GDP deflator.[15] Besides the differences in tariff rates and transportation costs that were explicitly modeled, there are many country-specific institutional and factor endowment differences that may influence bilateral trade flows. To account for these factors, country-specific dummy variables are included in the estimating equations.

Differences in market size between the host country and its trading partners are controlled for by including the population of the host country and its trading partners multiplicatively in the estimating equations.

Given these preliminaries, the estimated equations describing export flows from the host country to its trading partners takes the nonlinear form

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[15]Bergstrand (1985) makes similar approximations for these price terms.

$$\log EX_{host,j} = \alpha_0 \log EX_{t-1} + \alpha_1 \log Y_{host} + \alpha_2 \log Y_j + \alpha_3 \log POP_{host} + \alpha_4 \log POP_j$$
$$+ \alpha_5 \log P_{host} + \alpha_6 \log P_j + \alpha_7 \log Px_{host} + \alpha_8 \log Pi_j$$
$$+ \alpha_9(M_{host,j}/(\alpha_{10} + M_{host,j}) + \alpha_{11}(SKUK) + \alpha_{12}(STAY)$$
$$+ \alpha_{13}(D_1) + \cdots + \alpha_n(D_n) + \varepsilon, \tag{7}$$

and the estimated import equations take the form

$$\log IM_{j,host} = \beta_0 \log IM_{t-1} + \beta_1 \log Y_{host} + \beta_2 \log Y_j + \beta_3 \log POP_{host} + \beta_4 \log POP_j$$
$$+ \beta_5 \log P_{host} + \beta_6 \log P_j + \beta_7 \log Px_j + \beta_8 \log Pi_{host}$$
$$+ \beta_9(M_{host,j}/(\beta_{10} + M_{host,j}) + \beta_{11}(SKUK) + \beta_{12}(STAY)$$
$$+ \beta_{13}(D_1) + \cdots + \beta_n(D_n) + v, \tag{8}$$

where

| | |
|---|---|
| $EX_{host,j}$ | are exports of goods from the host country to the home country $j$, |
| $IM_{j,host}$ | are imports of goods from the home country $j$ to the host country, |
| $IM_{t-1}$ and $EX_{t-1}$ | are dependent variables lagged one year, |
| $\alpha$ and $\beta$ | are the estimated parameters ($\alpha_{10}$ and $\beta_{10}$ correspond to the immigrant information sensitivity parameters), |
| $Y_{host}$ and $Y_j$ | is the host-country and home-country GDP, |
| $POP_{host}$ and $POP_j$ | is the host-country and home-country population, |
| $P_{host}$ and $P_j$ | is the host-country and home-country GDP deflators, |
| $Px_{host}$ and $Px_j$ | is the host-country and home-country export unit value index, |
| $Pi_{host}$ and $Pi_j$ | is the host-country and home-country import unit value index, |
| $M_{host,j}$ | is the number of immigrants from home country $j$ in the host country, |
| $SKUK_{host,j}$ | is the ratio of skilled to unskilled immigrants from home country $j$ in the host country, |
| $STAY_{host,j}$ | is the average length of stay of the immigrants in the host country, |
| $D_j$ | is the dummy variable for the home country $j$, and |
| $\varepsilon$ and $v$ | are i.i.d. error terms and corr($\varepsilon$,$v$)=0. |

Notice that the lagged dependent variable is included in the estimating equations to account for possible decision, production, and delivery lags. The primary difference between the explanatory variables of equations 7 and 8 are related to the price variables included in each. In the export equation, host-country export unit values and country $j$'s unit import values are included, whereas in the import equation, host-country import unit values and country $j$'s export unit values are included. This specification is indicated by the analytical model in equation 6. Another variable suggested by the analytical model but not included in the estimating equations here is the number of immigrants from the host countries in the home countries (i.e.,

in this empirical analysis the number of U.S. and Canadian immigrants in the home countries). These data are unavailable.

Some notes on the expected signs of the coefficients are in order. As indicated by the analytical model, only two coefficients can be signed a priori and those are 1) the positive effect of the importing country's income on bilateral trade flows (in the export equations this is country $j$'s income ($\alpha_2 > 0$), and in the import equations, this is host-country income ($\beta_1 > 0$)) and 2) the positive effect of the size of the immigrant stock on bilateral trade through the decrease in transactions costs ($\alpha_9 > 0$ and $\beta_9 > 0$).

Although the effects of immigrant characteristics on foreign market information were not explicitly modeled, it is reasonable to expect that as the skilled to unskilled ratio of the immigrants rises, information about the home country will increase ($\alpha_{11}$ and $\beta_{11} > 0$), and as the length of stay of immigrants in the host country increases, information increases ($\alpha_{12}$ and $\beta_{12} > 0$). Home-country and host-country population are not signed a priori because market size can have a negative effect on trade if economies of scale are present or a positive effect if a larger population allows for more specialization through a greater division of labor. Finally, as mentioned in the previous section, the remaining variables have ambiguous effects and are determined by relative magnitudes of the supply and demand elasticities.

## II.B   Data and Preliminary Analysis

In this subsection I describe the data sources for the United States and Canada, and I present some preliminary data analysis. Annual data were collected for forty-seven U.S. and Canadian trading partners between 1970 and 1986. The data were treated as pooled cross-section time-series data, and the inclusion of a country in the data set was based solely on the availability of all data. Table A.1 in the appendix contains

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a list of these countries and the years available for each. Given the wide variety of both developed and developing countries in the sample, I do not expect a systematic bias due to country selection.

Aggregate trade data on exports and imports are constructed from the International Monetary Fund's (IMF) Direction of Trade Statistics. Trade data on consumer and producer manufactured imports and exports are derived from the Organization for Economic Cooperation and Development (OECD) statistics on trade in manufactured goods. All nominal variables are in millions of U.S. dollars.

In constructing the trade data, a problem arises in distinguishing between consumer and producer goods because the ultimate end-use of manufactured imports and exports is unknown. I based the distinction here on a selection from the four-digit International Standard Industrial Classification (ISIC) codes. For example, jewelry and bicycles are classified as consumer goods, while scrap metal, engines, and turbines are classified as producer products. There are goods, however, that do not seem to fit nicely into these two simple categories, such as nonmetallic mineral products and computing and accounting machinery. I attempted to exclude ambiguous categories of goods from the analysis. However, the inability to know the exact end-use of all types of goods may add some degree of error to the analysis.

The 1980 Census and the Immigration and Naturalization Service (INS) public use data on yearly immigration provide annual information on the stock of immigrants in the United States and their skill levels. A source of difficulty in estimating the actual stock of immigrants on a yearly basis is the problem of undercounting due to illegal immigration and overcounting due to emigration. Although the 1980 census includes some illegal immigrants, Greenwood (1983) estimates that more than 2 million immigrants are excluded from the count. Furthermore, I constructed the data after 1980 from yearly INS information that completely excludes illegal immigration. Emigration is accounted for to some degree by comparing the date of arrival reported

in the 1980 census with the INS information on yearly immigration flows.

In the case of Canada, I obtained the stocks of immigrants from the 1986 Canadian census, and I obtained yearly data on immigration from the Canadian Immigration Statistics Planning and Program Management Group of the Department of Manpower and Immigration. In constructing the Canadian immigration data, as in the U.S. case, overcounting due to emigration and undercounting due to illegal immigration could not be corrected.

Skilled workers in the United States are defined as those immigrants whose occupation is classified as professional, technical, and kindred workers, and unskilled workers are those whose occupation is classified as general machine operators, laborers, farm workers, and service workers. The Canadian immigration data were aggregated up from the Canadian Classification of Occupations to be consistent with the U.S. data.

I constructed the average length of stay of the immigrants from dates of entry into the United States and Canada between 1970 and 1986. Consequently, the measure is the average length of stay of the immigrants who arrived between 1970 and 1986. Because decreases in the immigrant stock from return emigration or death could not be estimated, this variable may overestimate the average length of stay for immigrant communities that experienced most of their growth in the earlier part of this period. For the United States and Canada those immigrant communities that tend to have the longer lengths of stay are from European countries whereas those with the shortest lengths of stay are mostly from African, Asian, and Latin American countries.

I extracted data on income, prices and population from the IMF's International Financial Statistics. Income is in millions of U.S. dollars, and prices are export and import unit value indexes that are scaled to equal 100 in 1985.

Because the choice of countries for the analysis was based solely on the availability of data, some important immigration countries may have been excluded from the

analysis. For example, Mexico is excluded from the analysis because data on unit value export and import prices are not available for this country.[16]

Turning attention now to some preliminary data analysis, Table 3 shows the relationship between immigration and bilateral trade flows by controlling for the size of the home and the host countries' world trade and the host countries' immigrant stock. In other words, Table 3 shows the correlation between scaled immigration and scaled bilateral trade, where immigration is scaled by the total host-country immigrant stock, and trade is scaled by what can be thought of as predicted trade based on the host- and home-country shares of world trade. That is,

WIMM= $\text{IMM}_{i,host}/\text{IMM}_{host}$, and
WTRADE = $\text{TRADE}_{i,host}/((\text{TRADE}_{i,W}*\text{TRADE}_{host,W})/\text{TRADE}_W)$,

where

| | |
|---|---|
| $\text{IMM}_{i,host}$ | is the immigrant stock of country $i$ in the host country, |
| $\text{IMM}_{host}$ | is the total immigrant stock of the host country, |
| $\text{TRADE}_{i,host}$ | is the bilateral trade flow between the host country and country $i$, |
| $\text{TRADE}_{i,W}$ | is trade of the home country $i$ with the rest of the world, |
| $\text{TRADE}_{host,W}$ | is trade of the host country with the rest of the world, and |
| $\text{TRADE}_W$ | is world trade. |

In a sense, the variable WTRADE indicates the unexplained movements in trade, and its correlation with WIMM can provide us with some evidence on the existence of immigrant links (immigrant links being the unexplained relationship between bilateral trade and the immigrant stock).

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[16]The exclusion of Mexico, however, may be desirable for the empirical analysis because, although it is an important source of U.S. immigrants, it is a special case in that it shares a border with the United States and has an immigrant stock that is far above all other countries.

Table 3 – Canada and the United States: Correlation Between Scaled Bilateral Trade Flows, Scaled Immigration, and Lagged Immigration

| Share of Imm. Stock | United States | | | Canada | | |
|---|---|---|---|---|---|---|
| | Aggregate WTRADE | Consumer WTRADE | Producer WTRADE | Aggregate WTRADE | Consumer WTRADE | Producer WTRADE |
| Lag 0 years | .317 | .470 | .283 | .657 | .673 | .620 |
| Lag 1 year | .315 | .467 | .282 | .658 | .675 | .622 |
| Lag 5 years | .289 | .446 | .267 | .659 | .677 | .629 |
| Lag 10 years | .256 | .416 | .243 | .675 | .696 | .647 |

Note: all correlations are significant at the .0001 significance level.

Table 3 suggests the presence of immigrant links by showing that the correlation between scaled trade and immigration is positive for all trade categories for both host countries. The relationship between immigrant share and scaled trade tends to be bit stronger in Canada than in the United States. In both countries the correlations appear to be the strongest for scaled consumer trade. In the United States, the highest correlation is 0.470 between immigrant share lagged zero years and scaled consumer goods trade. For Canada, the highest correlation is 0.696 between immigrant share lagged ten years and scaled consumer trade.

## II.C  Regression Analysis

The analysis in this subsection is designed to 1) distinguish the hypothesis of immigrant links against alternative hypotheses, 2) examine the roles that length of stay and the skill level of immigrants play in the immigrant-link effects, and 3) calculate how much bilateral trade an additional immigrant will generate due to immigrant-link effects.

For the first task, I examine the relationship between immigration and bilateral export and import flows for aggregate, consumer, and producer manufactured goods flows. If immigration is found to influence only bilateral exports, then the immi-

grant preference for home-country products hypothesis can be rejected in favor of the immigrant-link hypothesis. On the other hand, if imports are the only flow influenced by immigration, then probably the immigrant preference for home-country products is the most relevant hypothesis. A combination of statistically significant and strong effects on both imports and exports may suggest a combination of these two hypotheses. Second, I examine the role of immigrant characteristics in the immigrant-link hypothesis by including measures of the length of stay and skill level of immigrants in the regression analysis. Finally, I calculate the marginal effects of immigration on bilateral trade flows by using the estimated coefficients from the regression model.

### Immigrant Links

Tables 4 and 5 show the estimation results for the U.S. and Canadian bilateral trade flow equations. Because these estimation equations are nonlinear, I estimate them with the nonlinear least squares regression technique.[17] Tables A.2 and A.3 in the appendix present the estimated country-specific intercepts for each trade equation. All variables are in logs except the immigrant information variable $(M_{host,j}/(\alpha_{10} + M_{host,j}))$, the immigrant skilled/unskilled ratio $SKUK$, and the length-of-stay variable $STAY$, because these variables enter the estimating equations in exponentials.

Directing attention first to the immigrant information variable in U.S. bilateral trade equations, the coefficient on this variable indicates that it has a positive effect on all bilateral trade flows, which is consistent with the immigrant-link hypothesis. For Canada, the coefficients on this variable are also consistent with the immigrant-link hypothesis with the exception of the producer manufactured imports equation.

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[17]I used the NLIN procedure in SAS to estimate the parameters of this model. Starting from good guesses of the parameters I obtained from a double-log approximation of this model, the procedure iteratively finds the value of all parameters that minimizes the SSE of the equation. Sometimes through this methodology a local maximum of the SSE is found rather than a global minimum. As a result, I used different starting values of the parameters to confirm the robustness of the results.

Table 4 – Bilateral Trade Flows Between the United States and Home Countries (Nonlinear Estimation)

| Dependent Variable | Aggregate | | Consumer | | Producer | |
|---|---|---|---|---|---|---|
| | Exports | Imports | Exports | Imports | Exports | Imports |
| Lagged dependent var. | .617 | .467 | .685 | .730 | .523 | .386 |
| | (19.87) | (11.70) | (24.15) | (26.81) | (15.48) | (11.61) |
| Immigrant information var. | 4.263 | 1.042 | 7.948 | 2.235 | 3.459 | .843 |
| | (6.53) | (2.41) | (6.19) | (3.01) | (5.99) | (.17) |
| Information sensitivity par. | 383 | 19746 | 628 | 963 | 208 | 105 |
| | (.97) | (1.23) | (1.29) | (.87) | (.56) | (.68) |
| Immigrant skilled/unskilled | -.031 | -.030 | -.670 | -.052 | -.086 | .157 |
| | (-1.03) | (-.68) | (-1.94) | (-.98) | (-2.18) | (1.99) |
| Immigrant stay | .027 | -.081 | .017 | -.099 | .036 | -.061 |
| | (.67) | (-1.35) | (.37) | (-2.43) | (.67) | (-.59) |
| Home-country GDP | .146 | .053 | .126 | -.153 | .184 | -.056 |
| | (2.56) | (.62) | (1.93) | (-1.59) | (2.48) | (-.38) |
| Home-country population | -.668 | -.996 | -.659 | 1.09 | -.941 | .144 |
| | (-3.16) | (-3.19) | (-2.69) | (.29) | (-3.44) | (.26) |
| U.S. GDP | .694 | 2.107 | .370 | 3.140 | .144 | 2.894 |
| | (1.35) | (2.80) | (.63) | (3.63) | (.21) | (2.19) |
| U.S. population | 2.920 | 1.633 | 6.266 | .109 | 5.650 | 8.927 |
| | (.72) | (.25) | (1.34) | (.29) | (1.06) | (.77) |
| U.S. GDP deflator | -2.405 | -2.735 | -2.666 | -1.962 | -2.104 | -4.211 |
| | (-3.68) | (-3.01) | (-3.59) | (-1.89) | (-2.45) | (-2.65) |
| Home-country GDP deflator | .005 | .027 | .021 | -.018 | .006 | .074 |
| | (.32) | (1.08) | (1.02) | (-.62) | (.28) | (1.61) |
| U.S. export unit | 1.409 | | 1.304 | | 1.608 | |
| value index | (6.45) | | (5.19) | | (5.63) | |
| U.S. import unit | | .227 | | .473 | | .415 |
| value index | | (1.12) | | (2.06) | | (1.17) |
| Home-country export unit | | -.024 | | .001 | | -.086 |
| value index | | (-.46) | | (.01) | | (-.92) |
| Home-country import unit | -1.03 | | -.096 | | -.078 | |
| value index | (-2.76) | | (-2.33) | | (-1.59) | |
| Durbin h-statistic | .947 | -.875* | -.457 | -1.592 | 1.101 | -4.045 |
| Adj. R-square | .998 | .996 | .996 | .993 | .997 | .985 |
| Observations | 713 | 705 | 713 | 706 | 713 | 696 |

Note: t-values are in parentheses.
*Since the h-statistic is not defined for this case, this is the t-value on $u_{t-1}$ in the modified $LM test for autocorrelation. See A.C. Harvey (1981, 274)$

Table 5 – Bilateral Trade Flows Between Canada and Home Countries (Nonlinear Estimation)

| Dependent Variable | Aggregate | | Consumer | | Producer | |
|---|---|---|---|---|---|---|
| | Exports | Imports | Exports | Imports | Exports | Imports |
| Lagged dependent var. | .294 | .331 | .452 | .589 | .444 | .534 |
| | (8.28) | (8.87) | (13.04) | (17.31) | (12.62) | (14.61) |
| Immigrant information var. | 1.232 | 1.148 | 1.952 | .246 | .752 | -.258 |
| | (2.22) | (2.01) | (2.29) | (1.35) | (1.19) | (-.83) |
| Information sensitivity par. | 81 | 93 | 648 | 5098 | 107 | 86 |
| | (.71) | (1.53) | (1.27) | (.26) | (.34) | (.35) |
| Immigrant skilled/unskilled | .303 | -2.16 | 2.345 | -3.216 | .283 | -.708 |
| | (.34) | (-2.08) | (2.22) | (-3.14) | (.26) | (-.39) |
| Immigrant stay | .069 | -.180 | .137 | -.214 | .123 | -.102 |
| | (.95) | (-2.09) | (1.51) | (-2.51) | (1.32) | (-.68) |
| Home-country GDP | .238 | .158 | .302 | -.153 | .453 | -.172 |
| | (2.58) | (1.45) | (2.61) | (-1.44) | (3.82) | (-.91) |
| Home-country population | .013 | .173 | -.500 | .103 | -.048 | -1.901 |
| | (.04) | (.44) | (-1.18) | (.25) | (-.11) | (-2.68) |
| Canadian GDP | -.557 | 2.95 | .912 | 2.500 | -.309 | 3.72 |
| | (.77) | (3.65) | (1.02) | (3.00) | (-.33) | (2.60) |
| Canadian population | -.343 | -.867 | -6.019 | -6.74 | -6.52 | -1.11 |
| | (-.11) | (-.21) | (-2.82) | (-1.62) | (-1.61) | (-.16) |
| Canadian GDP deflator | .173 | -2.19 | -.581 | -2.442 | .238 | -2.947 |
| | (.26) | (-2.67) | (-.69) | (-2.92) | (.27) | (-2.04) |
| Home-country GDP deflator | .026 | .052 | .075 | .024 | -.002 | .069 |
| | (.88) | (1.49) | (1.98) | (.71) | (-.05) | (1.19) |
| Canadian export unit value index | 1.055 | | .571 | | .883 | |
| | (3.45) | | (1.50) | | (2.27) | |
| Canadian import unit value index | | -.285 | | -.788 | | -.683 |
| | | (-.97) | | (-2.69) | | (-1.35) |
| Home-country export unit value index | | .039 | | .011 | | -.056 |
| | | (.56) | | (.16) | | (-.47) |
| Home-country import unit value index | -.125 | | -.021 | | -.093 | |
| | (-2.06) | | (-.29) | | (-1.19) | |
| Durbin h-statistic | -1.285 | .666 | .059 | -1.443 | 1.282 | -3.801 |
| Adj. R-square | .992 | .990 | .986 | .980 | .977 | .961 |
| Observations | 694 | 699 | 690 | 671 | 700 | 642 |

Note: t-values are in parentheses.

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In this equation, the coefficient on the immigrant information variable is negative and insignificant, which casts doubt on the role of any immigrant links in this sector.[18] The smallest coefficients on the immigrant information variable appear in the equations for imports in general and producer goods in particular. Because producer goods tend to be the least differentiated products across countries (e.g., turbine engines and scrap metal), trade flows in these products may not benefit much from country-specific trade information. The immigrant information variable does not appear to be important in the U.S. producer imports equation or in the Canadian consumer imports and producer imports and exports equations.

For the U.S. equations, the coefficients on the immigrant information variable range from 0.843 to 7.948, with the largest effect being in consumer manufactured exports. In the Canadian equation, the coefficients on this variable range from -0.258 to 1.952, with the largest effect also appearing in the consumer manufactured exports equation.

The size of the coefficient on this variable indicates the potential importance of immigrant information to bilateral trade flows. For example, in the United States, comparing Brazil, with an average immigrant stock of 29,258 and an information factor on aggregate exports of 64.7 ($64.7 = e^{4.263*(29,258/(381+29,258))}$), to Italy, with an average immigrant stock of 600,394 and an information factor of 70.8, the estimates indicate that trade with Italy due to immigrant links would be about 9 percent higher than trade with Brazil, all other factors held constant. In comparing Italy to Tanzania, with the lowest immigrant stock in the U.S. sample at 1,301, the effects are even more dramatic. Here, trade due to immigrant-link effects with Italy would

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[18]In the Canadian and U.S. producer imports equations, the Durbin-h test fails to accept the null hypothesis of no autocorrelation at the five percent level, which can result in wrong inferences about the role of immigrant links in these sectors. However, after I corrected for autocorrelation (by including additional lags of the dependent variable in the regression equation) the standard error on the immigrant information variable did not change enough to alter the previous inferences about the insignificance of immigrant-links effects.

be almost twice that of Tanzania.

The estimated immigrant information sensitivity parameter ($\vartheta$) ranges from a value of 81 in the Canadian aggregate exports equation to 19,746 in the U.S. aggregate imports equation.[19] In general, the largest estimates of this parameter appear in the import equations. The larger this parameter is, the smaller is the slope of the immigrant information function and the less sensitive is the immigrant information variable to changes in the immigrant stock. On the other hand, a very small value indicates that the immigrant information function is so sensitive to the size of the immigrant stock that any increase in the stock of immigrants, after an initial small level, does not change information very much. The high standard errors for this parameter variable suggest a wide range of possible values for these parameters. In the maximum likelihood setting, this is indicative of a rather flat peak in the likelihood function in the direction of this parameter.

Estimates for the sensitivity parameters imply that 90 percent of the immigrant information effect will be exhausted at approximately 15,575 immigrants for aggregate U.S. export flows and 309,345 immigrants for U.S. aggregate import flows. In Canada, the range is 1,269 in aggregate exports and 1,408 in aggregate imports.[20] Interestingly, most of these immigrant-link effects, although having a potentially large impact on exports, require a relatively small number of immigrants to exist, while on import flows, a relatively large number of immigrants are required before most of the immigrant-link effects are exhausted. The larger sensitivity parameter in imports, particularly in the U.S. case, may reflect the dominant role of immigrant preference for home-country products, which tends to increase linearly with the flow of immigrants. On the other hand, in the export sector, immigrant information effects may dominate and then tend to expire after a relatively small stock of immigrants is

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[19]This variable was constrained during estimation to be greater than or equal to zero.

[20]As an example of how this number is calculated for U.S. exports, $\tilde{\beta}(M_{host,j}/(383 + M_{host,j})) = \log[(e^{4.26} - 1) * .90 + 1]$ implies $M_{host,j} = 40.66 * 383 = 15,575$.

present. According to this result, there would be fifteen countries in the U.S. sample and four countries in the Canadian sample in which most of the immigrant-link effects in aggregate exports (from the size of the immigrant stock ) are not exhausted and forty-two countries in the U.S. sample and four countries in the Canadian sample in which most of the immigrant-link effects in aggregate imports are not exhausted.[21]

For Canada, the estimated parameters on the immigrant skilled to unskilled ratio are positive for export flows and negative for import flows. For the United States, the estimates on this same ratio are negative for all flows except the producer imports equations. The negative effects of an increase in the skill level on any trade flow appears counterintuitive because one would expect that an increase in skills would also accompany knowledge of foreign markets and an increase in foreign contacts. Two effects, however, may be offsetting each other to different degrees. The first effect is the increase in foreign market information that accompanies skill level, which can have a positive effect both exports and imports. The second effect is the possible propensity for skilled immigrants to create industries in the host country that provide substitute products for home-country goods, which has a negative effect on imports.

The estimated parameters on immigrant stay shows negative values for total import flows and positive values for total export flows for the United States and Canada. Negative and significant values of this variable appear in the aggregate imports and consumer imports equations for Canada and just the consumer imports equation for the United States. The negative relationship on imports and positive relationship on exports suggests a possible time lag in the integration of immigrant links into the host country. On the one hand, as immigrants gain knowledge about the host

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[21] For the United States, these countries in the exports sector are Cyprus, Ethiopia, Iceland, Kenya, Malaysia, Malta, Morocco, New Zealand, Singapore, South Africa, Sri Lanka, Syria, Tanzania, Tunisia, and Zimbabwe. In the imports sector, these countries include all the countries in the sample except Canada, Italy, Philippines, the United Kingdom, and West Germany. For Canada, these countries in the imports and exports sectors are Iceland, Nicaragua, Tunisia, and Zimbabwe.

country over time, they may develop industries in the host country that substitute for products only previously obtained in the home country. On the other hand, their knowledge of both home- and host-country markets and contacts may increase export flows to the home country. The size of the coefficient on this variable ranges from 0.027 to 0.137 in export flows and from -0.214 to -0.061 in import flows. This range, however, indicates that the effects of the length of stay of immigrants on immigrant links is small, particularly for large immigrant communities. For example, in the case of aggregate exports, an immigrant community such as Brazil has an overall information effect of 64.7; however, with an average length of stay of ten years, this effect increases to only about 65 ( i.e., $65 = 64.7 + .027 * 10$). If the average length of stay increased to twenty years, the overall information effect would rise only to around 65.25. So, as far as immigrant links are concerned, the length of stay of immigrants has a statistically significant but small effect.

Parameters estimated for the variables not associated with immigrant information conform, for the most part, to their expectations. The coefficients on the lagged dependent variables fall between zero and one, and the coefficients on income of the importing country (i.e., U.S. and Canadian income in the import equations and country $j$'s income in the export equations) are positive and significant.

The estimated coefficients on the exporting country's income and GDP deflator being positive and negative, respectively, in most trade equations indicate (from the analytical model) that the demand elasticity of substitution among imported goods exceeds one in most equations.[22] Furthermore, the positive coefficients on U.S. and Canadian unit export values indicate that the supply elasticity of transformation among exports is less than the overall elasticity of transformation between domestic and export goods. The same is true for the home-country markets in which the unit

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[22]As before, the exporting country refers to the United States and Canada in the export equations and home country $j$ in the import equations.

export values are positive, with the exception of the U.S. and Canadian producer manufactured product sector and the U.S. aggregate imports sector. The positive coefficient on U.S. import unit values indicates that the demand elasticity of substitution among imports is less then the overall elasticity of substitution, whereas the the opposite seems to be true for Canada. Negative coefficients on the importing country's GDP deflator indicate that the demand elasticity of substitution between domestic and imported goods is less than one.

### The Marginal Effect of Immigrant Links on the Value of Trade

Given the empirical results above, an interesting question is, How much trade does an additional immigrant generate? Tables 6 and 7 show the immigrant stock and the dollar amount of imports and exports that one additional immigrant from each country would generate with their home country. The values shown are short-run effects per year. I calculate the values using the estimates from the aggregate import and export equations in Tables 4 and 5. The partial derivatives of these equations with respect to the immigrant stock are

$$\frac{\partial \log EX_{host,j}}{\partial M_{host,j}} = \frac{\alpha_9 \alpha_{10}}{(\alpha_{10} + M_{host,j})^2} \tag{9}$$

$$\frac{\partial \log IM_{j,host}}{\partial M_{host,j}} = \frac{\beta_9 \beta_{10}}{(\beta_{10} + M_{host,j})^2}. \tag{10}$$

Then the value of aggregate exports and imports generated by an additional immigrant in the last year of the sample is

$$\frac{\partial EX_{host,j}}{\partial M_{host,j}} = \frac{\alpha_9 \alpha_{10}}{(\alpha_{10} + M_{host,j,1986})^2} * EX_{host,j,1986}$$

$$\frac{\partial IM_{j,host}}{\partial M_{host,j}} = \frac{\beta_9 \beta_{10}}{(\beta_{10} + M_{host,j,1986})^2} * IM_{j,host,1986}$$

where

$EX_{host,j,1986}$    are aggregate exports from the host country to the home country $j$ in 1986, and

$IM_{j,host,1986}$    are aggregate imports from the home country $j$ to the host country in 1986.

Using aggregate imports and exports in 1986, the immigrant stock in each host country, and the estimated parameters, I calculate the value of exports and imports each additional immigrant generates.[23]

Notice that because this is the nonlinear model, the largest dollar increases in bilateral trade flows from an additional immigrant are not necessarily from countries that have large immigrant stocks in the United States or Canada. The largest marginal immigrant link effects are from countries with a relatively small immigrant stock and a large potential for trade. For the United States, these calculations suggest that an additional immigrant from Singapore has the largest potential to generate new trade with additional imports at a value of $16,495 per year and exports at a value of $23,682. On the other hand, an additional immigrant from the Philippines would create only about $9 worth of imports per year and $6 worth of exports. For Canada, an additional immigrant from Japan has the largest potential to create trade with $5,847 worth of imports and $4,104 worth of exports per year, while an immigrant from the Philippines would create the least amount of additional trade with $1.10 of imports and $0.40 of exports per year.

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[23]See Fomby, Hill, and Johnson (1984,58) for a discussion of the Delta method which was used to calculate these standard errors.

Table 6 – The United States: Dollar Value Increase in Bilateral Trade From One Additional Immigrant in 1986

| | Immigrant Stock | Imports Est. | Imports t-val. | Exports Est. | Exports t-val |
|---|---|---|---|---|---|
| Australia | 36693 | 3395 | 2.02151 | 6560 | 2.56285 |
| Austria | 112095 | 117 | 1.39360 | 60 | 2.48058 |
| Brazil | 41197 | 6896 | 1.93085 | 3650 | 2.54923 |
| Canada | 793488 | 177 | 1.12673 | 117 | 2.44728 |
| Colombia | 146676 | 153 | 1.31862 | 99 | 2.47138 |
| Cyprus | 6900 | 371 | 1.82092 | 1642 | 3.18962 |
| Denmark | 37197 | 2150 | 2.01070 | 872 | 2.56116 |
| El Salvador | 85422 | 90 | 1.49399 | 94 | 2.49285 |
| Ethiopia | 6640 | 2995 | 1.79601 | 2369 | 3.22468 |
| Finland | 26680 | 2188 | 2.26215 | 845 | 2.61038 |
| France | 112869 | 1341 | 1.39141 | 914 | 2.48031 |
| Greece | 173444 | 23 | 1.28151 | 23 | 2.46679 |
| Hungary | 113841 | 31 | 1.38870 | 12 | 2.47998 |
| Iceland | 4656 | 15921 | 1.59988 | 3860 | 3.65573 |
| India | 276069 | 52 | 1.20696 | 33 | 2.45748 |
| Ireland | 153290 | 72 | 1.30821 | 99 | 2.47009 |
| Israel | 68716 | 852 | 1.59679 | 762 | 2.50546 |
| Italy | 631212 | 46 | 1.13760 | 20 | 2.44868 |
| Japan | 188760 | 3880 | 1.26511 | 1220 | 2.46475 |
| Jordan | 28784 | 21 | 2.20970 | 634 | 2.59753 |
| Kenya | 7299 | 2743 | 1.85860 | 2663 | 3.14148 |
| Malaysia | 14994 | 17412 | 2.35024 | 11884 | 2.75294 |
| Malta | 8359 | 748 | 1.95488 | 521 | 3.03911 |
| Morocco | 8231 | 957 | 1.94359 | 6112 | 3.04986 |
| Netherlands | 88096 | 905 | 1.48115 | 1628 | 2.49128 |
| New Zealand | 12523 | 10703 | 2.25181 | 8590 | 2.82061 |
| Nicaragua | 34320 | 306 | 2.07461 | 337 | 2.57152 |
| Norway | 55489 | 609 | 1.72051 | 488 | 2.52096 |
| Pakistan | 50392 | 222 | 1.78399 | 523 | 2.52916 |
| Philippines | 620286 | 9 | 1.13854 | 6 | 2.44880 |
| S. Africa | 18868 | 10855 | 2.39486 | 5078 | 2.68483 |
| Singapore | 4180 | 16495 | 1.55200 | 23682 | 3.83703 |
| S. Korea | 72489 | 5973 | 1.56983 | 3549 | 2.54982 |
| Spain | 68522 | 1011 | 1.59828 | 895 | 2.50565 |
| Sri Lanka | 6251 | 13896 | 1.75830 | 2445 | 3.28365 |
| Sweden | 72314 | 1425 | 1.57068 | 575 | 2.50224 |
| Switzerland | 38910 | 5647 | 1.97521 | 3132 | 2.55574 |
| Syria | 21216 | 31 | 2.37474 | 206 | 2.65636 |
| Tanzania | 2160 | 8628 | 1.35009 | 15496 | 5.70629 |
| Thailand | 102243 | 289 | 1.42449 | 144 | 2.48436 |
| Trinidad | 68602 | 445 | 1.59766 | 172 | 2.50557 |
| Tunisia | 2784 | 1848 | 1.41194 | 26380 | 4.84112 |
| Turkey | 47182 | 333 | 1.83002 | 897 | 2.53525 |
| U.K. | 601511 | 72 | 1.14023 | 51 | 2.44901 |
| U.S. | n.a. | n.a. | n.a. | n.a. | n.a. |
| W. Germany | 681671 | 91 | 1.13366 | 37 | 2.44817 |
| Yugoslavia | 122573 | 46 | 1.36631 | 61 | 2.47724 |
| Zimbabwe | 3675 | 7257 | 1.50118 | 5282 | 4.09513 |

Note: import and export values are in U.S. dollars.

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Table 7 – Canada: Dollar Value Increase in Bilateral Trade From One Additional Immigrant in 1986

| | Immigrant Stock | Imports Est. | Imports t-val. | Exports Est. | Exports t-val |
|---|---|---|---|---|---|
| Australia | 20446 | 90.0 | 2.04757 | 104.3 | 1.13483 |
| Austria | 7224 | 302.9 | 2.04113 | 66.4 | 1.15447 |
| Brazil | 5501 | 2001.0 | 2.03978 | 1739.7 | 1.16410 |
| Canada | n.a. | n.a. | n.a. | n.a. | n.a. |
| Colombia | 7540 | 161.6 | 2.04136 | 221.3 | 1.15319 |
| Cyprus | 4341 | 2.0 | 2.03876 | 35.8 | 1.17499 |
| Denmark | 4961 | 693.6 | 2.03932 | 302.7 | 1.16852 |
| El Salvador | 8327 | 27.7 | 2.04190 | 16.2 | 1.15042 |
| Ethiopia | 677 | 119.7 | 2.03476 | 2872.5 | 1.48771 |
| Finland | 3789 | 1284.6 | 2.03824 | 380.6 | 1.18256 |
| France | 42644 | 65.5 | 2.05220 | 37.5 | 1.12930 |
| Greece | 40421 | 3.2 | 2.05189 | 2.7 | 1.12958 |
| Hungary | 6591 | 71.4 | 2.04065 | 39.6 | 1.15742 |
| Iceland | 310 | 6210.9 | 2.03428 | 3700.1 | 1.99647 |
| India | 116400 | 0.9 | 2.05669 | 1.7 | 1.12609 |
| Ireland | 11943 | 128.5 | 2.04405 | 42.6 | 1.14243 |
| Israel | 16648 | 35.4 | 2.04621 | 33.7 | 1.13726 |
| Italy | 54616 | 42.2 | 2.05354 | 16.1 | 1.12819 |
| Japan | 9855 | 5847.7 | 2.04288 | 4104.8 | 1.14632 |
| Jordan | 2465 | 19.3 | 2.03688 | 66.8 | 1.21509 |
| Kenya | 10833 | 9.2 | 2.04345 | 10.6 | 1.14431 |
| Malaysia | 8532 | 152.7 | 2.04204 | 102.6 | 1.14978 |
| Malta | 4271 | 13.7 | 2.03870 | 4.6 | 1.17584 |
| Morocco | 5624 | 32.1 | 2.03988 | 366.1 | 1.16322 |
| Netherlands | 22999 | 99.0 | 2.04835 | 127.4 | 1.13365 |
| New Zealand | 7496 | 226.7 | 2.04132 | 183.8 | 1.15336 |
| Nicaragua | 295 | 6133.0 | 2.03422 | 3605.2 | 2.14352 |
| Norway | 1984 | 2989.7 | 2.03635 | 5199.1 | 1.23815 |
| Pakistan | 20741 | 25.6 | 2.04767 | 25.2 | 1.13468 |
| Philippines | 87508 | 1.1 | 2.05567 | 0.4 | 1.12670 |
| S. Africa | 17957 | 77.6 | 2.04671 | 31.7 | 1.13630 |
| Singapore | 2996 | 1430.1 | 2.03745 | 1734.6 | 1.19849 |
| S. Korea | 24673 | 215.9 | 2.04881 | 106.0 | 1.13301 |
| Spain | 7415 | 592.1 | 2.04127 | 165.9 | 1.15368 |
| Sri Lanka | 6878 | 56.1 | 2.04087 | 59.3 | 1.15601 |
| Sweden | 5473 | 1853.6 | 2.03976 | 549.0 | 1.16431 |
| Switzerland | 15450 | 185.8 | 2.04571 | 99.1 | 1.13828 |
| Syria | 3738 | 0.0 | 2.03819 | 57.9 | 1.18338 |
| Tanzania | 10568 | 3.8 | 2.04330 | 17.2 | 1.14482 |
| Thailand | 2269 | 2077.0 | 2.03667 | 1372.5 | 1.22326 |
| Trinidad | 34569 | 1.9 | 2.05096 | 5.8 | 1.13049 |
| Tunisia | 1068 | 545.2 | 2.03526 | 3808.9 | 1.34431 |
| Turkey | 5944 | 59.4 | 2.04014 | 352.4 | 1.16108 |
| U.K. | 298645 | 3.1 | 2.05886 | 2.0 | 1.12496 |
| U.S. | 240391 | 101.0 | 2.05849 | 110.9 | 1.12513 |
| W. Germany | 40901 | 150.5 | 2.05196 | 52.9 | 1.12952 |
| Yugoslavia | 27236 | 3.3 | 2.04946 | 5.2 | 1.13218 |
| Zimbabwe | 1794 | 148.3 | 2.03613 | 142.8 | 1.25083 |

Note: import and export values are in U.S. dollars.

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## III  Conclusion

This paper investigates theoretically and empirically an aspect of immigration that, until now, has received little attention. This study examines the foreign market information that immigrants generate in the host country. This new information in the host country can decrease the transactions costs of trade by making it easier to obtain knowledge of the immigrant's home-country language, market structure, and foreign contacts.

As a basis for the empirical investigation, I developed an analytical model in which goods are differentiated by country of origin and consumers' utility depends on the variety of goods available. By supplying foreign market information, immigrants decrease the transactions costs of trade between the host and home countries. This, in turn, decreases the wedge between the foreign price and the domestic price of traded goods and increases bilateral trade flows.

The results indicate that immigrant information can indeed play an important role in determining bilateral trade flows. The effects of immigrant information seem to be stronger in the exports and imports of consumer manufactured products than in the exports and imports of producer goods. Overall, exports appear to be influenced the most by immigrant links, while imports are influenced the least. The skill level of immigrants appears to play a positive role in Canadian trade but tends to have a negative effect on U.S. trade. These negative effects may be due to immigrants creating industries in the host country that provide substitutes for home-country goods. The length of stay of immigrants tends to play a positive role in exports and a negative role in imports, but the effect is rather small.

The empirical results also indicate that a relatively small immigrant community can exhaust most of the immigrant-link effects in the exports sector, while a relatively large community is required before most of the effects are exhausted in the

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imports sector. This may reflect the dominant role that immigrant preference for home-country products plays in the imports sector, which implies a linear increase in imports as immigration increases.

What does this mean for immigration policy? How should a country conduct its immigration policy, knowing that immigrant links exist? Before the discussion in this paper, the total number of immigrants to be admitted and their skill level were the only economic elements considered as part of immigration policy. Questions concerning the source country of immigrants generally have not been given any economic attention and, in terms of policy, largely have been driven by society's tendency toward xenophobia, as seen in the limitations placed on Asian immigration in the earlier part of this century. Certainly, immigration questions concerning refugees and the preference of admitting family members cannot be addressed in this context, but a policy consistent with maximizing immigrant-link benefits can be implemented.

The analysis suggests that the greatest welfare benefits from immigration could be derived by allowing increased immigration from countries for which the immigrant-link effects are the highest. In other words, a policy prescription from the analysis is to promote diversity in the immigrant stock. This could be done by allowing free immigration from countries that have a high potential for creating trade through immigrant linkages (for example, the United States could admit more immigrants from Singapore because they are a relatively small population in the United States and their home country has a large potential for trade).

This policy prescription would entail significant changes in the way the United States approaches immigration, which may or may not be politically feasible. First, it would mean that future immigration from a particular country would depend on the current levels of its immigrant stock in the United States. This policy already exists de facto in the United States but operates contrary to the immigrant-link hypothesis. In the present system, relatives of U.S. citizens are given preference;

if a country has a high present level of immigration, future immigration will also be high as family members are carried over on a previous immigrant's visa. For immigration policy to be consistent with maximizing the benefits of immigrant links, future immigration from a particular country must increase as the size of the present immigrant population falls. Without modifying the current family preference system, this policy would indicate relaxing the numerical limitations for certain countries with the highest immigrant-link effects.

Several interesting facets of the relationship between immigration and immigrant links remain to be explored. A particularly useful research project would be an examination of differences in the domestic wage response to increases in immigration from different immigrant source countries, addressing the question of whether an increase in the size of immigrant communities with the largest immigrant-link effects have the smallest effects on natives' wages. The results would provide useful information on the ability of a host country to increase immigration without placing a large burden on natives who compete the most with immigrants.

# Appendix

Table A.1
Bilateral Trading Partners and Years Available

|  | United States | Canada |
|---|---|---|
| Australia | 1970-1986 | 1970-1986 |
| Austria | 1970-1986 | 1970-1986 |
| Brazil | 1970-1986 | 1970-1986 |
| Canada | 1970-1986 | – |
| Colombia | 1970-1986 | 1970-1986 |
| Cyprus | 1970-1986 | 1970-1986 |
| Denmark | 1970-1986 | 1970-1986 |
| El Salvador | 1970-1984 | 1970-1984 |
| Ethiopia | 1970-1980 | 1970-1980 |
| Finland | 1970-1986 | 1970-1986 |
| France | 1970-1986 | 1970-1986 |
| Greece | 1970-1986 | 1970-1986 |
| Hungary | 1970-1986 | 1970-1986 |
| Iceland | 1970-1986 | 1970-1986 |
| India | 1970-1986 | 1970-1986 |
| Ireland | 1970-1986 | 1970-1986 |
| Israel | 1970-1986 | 1970-1986 |
| Italy | 1970-1986 | 1970-1986 |
| Japan | 1970-1986 | 1970-1986 |
| Jordan | 1970-1986 | 1982-1986 |
| Kenya | 1970-1985 | 1970-1985 |
| Malaysia | 1970-1986 | 1970-1986 |
| Malta | 1970-1986 | 1970-1986 |
| Morocco | 1970-1985 | 1970-1985 |
| Netherlands | 1970-1986 | 1970-1986 |
| New Zealand | 1970-1986 | 1970-1986 |
| Nicaragua | 1970-1980 | 1970-1980 |
| Norway | 1970-1986 | 1970-1986 |
| Pakistan | 1970-1986 | 1970-1986 |
| Philippines | 1970-1986 | 1970-1986 |
| South Africa | 1970-1986 | 1970-1986 |
| South Korea | 1970-1986 | 1970-1986 |
| Singapore | 1972-1980 | 1972-1980 |
| Spain | 1970-1986 | 1970-1986 |
| Sri Lanka | 1970-1986 | 1970-1986 |
| Sweden | 1970-1986 | 1970-1986 |
| Switzerland | 1970-1986 | 1970-1986 |
| Syria | 1970-1986 | 1970-1986 |
| Tanzania | 1970-1980 | 1970-1980 |
| Thailand | 1970-1986 | 1970-1986 |
| Trinidad | 1970-1985 | 1970-1985 |
| Tunisia | 1970-1986 | 1970-1986 |
| Turkey | 1970-1984 | 1970-1984 |
| U. K. | 1970-1986 | 1970-1986 |
| United States | – | 1970-1986 |
| W. Germany | 1970-1986 | 1970-1986 |
| Yugoslavia | 1970-1983 | 1970-1983 |
| Zimbabwe | 1970-1986 | 1970-1986 |

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| Country | Aggregate | | | | Consumer | | | | Producer | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Exports | | Imports | | Exports | | Imports | | Exports | | Imports | |
| | Est. | t-val. | Est. | t-val. | Est. | t-val. | Est. | t-val. | Est. | t-val. | Est. | t-val. |
| Australia | -33.33 | -1.82 | -36.35 | -1.23 | -46.58 | -2.22 | -3.25 | -0.09 | -43.71 | -1.83 | -90.43 | -1.71 |
| Austria | -34.61 | -1.89 | -38.05 | -1.28 | -47.73 | -2.27 | -3.69 | -0.11 | -45.40 | -1.90 | -91.19 | -1.73 |
| Brazil | -31.97 | -1.75 | -33.91 | -1.14 | -45.28 | -2.16 | -3.39 | -0.10 | -41.85 | -1.75 | -90.27 | -1.71 |
| Canada | -32.33 | -1.77 | -34.73 | -1.17 | -45.48 | -2.17 | -2.46 | -0.07 | -42.70 | -1.78 | -88.63 | -1.68 |
| Colombia | -33.20 | -1.82 | -36.35 | -1.23 | -46.37 | -2.21 | -4.20 | -0.12 | -43.58 | -1.82 | -91.49 | -1.73 |
| Cyprus | -36.27 | -1.98 | -42.00 | -1.41 | -49.22 | -2.34 | -4.84 | -0.14 | -48.15 | -2.01 | -94.81 | -1.79 |
| Denmark | -34.62 | -1.89 | -37.87 | -1.28 | -47.88 | -2.28 | -3.39 | -0.10 | -45.64 | -1.91 | -91.03 | -1.72 |
| El Salvador | -34.59 | -1.89 | -38.47 | -1.30 | -47.66 | -2.27 | -4.26 | -0.12 | -45.58 | -1.90 | -92.46 | -1.75 |
| Ethiopia | -33.54 | -1.84 | -36.55 | -1.23 | -46.62 | -2.22 | -5.03 | -0.15 | -44.08 | -1.84 | -97.76 | -1.85 |
| Finland | -34.87 | -1.90 | -38.22 | -1.29 | -48.00 | -2.29 | -3.89 | -0.11 | -45.85 | -1.91 | -90.84 | -1.72 |
| France | -32.60 | -1.78 | -34.93 | -1.18 | -45.91 | -2.19 | -3.02 | -0.09 | -42.70 | -1.78 | -89.68 | -1.70 |
| Greece | -34.26 | -1.87 | -38.19 | -1.29 | -47.61 | -2.27 | -4.14 | -0.12 | -45.11 | -1.88 | -91.55 | -1.73 |
| Hungary | -34.73 | -1.90 | -38.47 | -1.30 | -47.73 | -2.27 | -4.18 | -0.12 | -45.70 | -1.91 | -92.77 | -1.76 |
| Iceland | -37.00 | -2.02 | -41.19 | -1.39 | -49.68 | -2.36 | -4.24 | -0.12 | -48.99 | -2.04 | -93.33 | -1.76 |
| India | -31.08 | -1.70 | -32.95 | -1.11 | -44.34 | -2.11 | -3.52 | -0.10 | -40.29 | -1.69 | -92.37 | -1.75 |
| Ireland | -34.74 | -1.90 | -38.88 | -1.31 | -48.08 | -2.29 | -3.90 | -0.11 | -45.61 | -1.90 | -91.12 | -1.72 |
| Israel | -34.11 | -1.86 | -37.97 | -1.28 | -47.29 | -2.25 | -3.56 | -0.10 | -45.06 | -1.88 | -90.92 | -1.72 |
| Italy | -32.66 | -1.79 | -35.04 | -1.18 | -46.16 | -2.20 | -3.02 | -0.09 | -42.85 | -1.79 | -89.76 | -1.70 |
| Japan | -31.69 | -1.73 | -33.28 | -1.12 | -45.15 | -2.15 | -2.34 | -0.07 | -41.76 | -1.75 | -88.89 | -1.69 |
| Jordan | -34.73 | -1.90 | -41.05 | -1.38 | -47.97 | -2.28 | -5.75 | -0.17 | -45.99 | -1.92 | -95.19 | -1.80 |
| Kenya | -33.97 | -1.86 | -37.55 | -1.27 | -47.07 | -2.24 | -4.86 | -0.14 | -44.61 | -1.87 | -94.63 | -1.79 |
| Malaysia | -33.37 | -1.82 | -36.15 | -1.22 | -46.21 | -2.20 | -3.19 | -0.09 | -44.05 | -1.84 | -91.73 | -1.74 |
| Malta | -36.90 | -2.01 | -42.52 | -1.43 | -50.05 | -2.38 | -4.80 | -0.14 | -48.80 | -2.03 | -95.11 | -1.79 |
| Morocco | -33.53 | -1.83 | -37.87 | -1.28 | -46.82 | -2.23 | -4.71 | -0.14 | -44.57 | -1.86 | -94.53 | -1.79 |
| Netherlands | -33.19 | -1.81 | -36.60 | -1.23 | -46.67 | -2.22 | -3.35 | -0.10 | -43.75 | -1.83 | -90.04 | -1.71 |
| New Zealand | -34.71 | -1.89 | -38.13 | -1.28 | -47.93 | -2.28 | -3.33 | -0.10 | -45.57 | -1.90 | -91.89 | -1.74 |
| Nicaragua | -35.05 | -1.91 | -39.02 | -1.31 | -48.08 | -2.29 | -4.27 | -0.12 | -46.16 | -1.93 | -93.10 | -1.76 |
| Norway | -34.71 | -1.89 | -38.10 | -1.28 | -47.97 | -2.28 | -3.81 | -0.11 | -45.68 | -1.91 | -91.01 | -1.72 |
| Pakistan | -32.58 | -1.78 | -35.89 | -1.21 | -45.84 | -2.19 | -4.36 | -0.13 | -42.72 | -1.79 | -92.28 | -1.75 |
| Philippines | -32.85 | -1.80 | -35.65 | -1.20 | -45.95 | -2.19 | -3.72 | -0.11 | -43.15 | -1.80 | -92.36 | -1.75 |
| S.Africa | -33.04 | -1.81 | -35.53 | -1.20 | -46.21 | -2.20 | -3.56 | -0.10 | -43.24 | -1.81 | -90.99 | -1.73 |
| S.Korea | -32.68 | -1.75 | -34.87 | -1.26 | -46.68 | -2.24 | -3.66 | -0.06 | -43.72 | -1.79 | -91.33 | -1.79 |
| Singapore | -33.82 | -1.85 | -37.77 | -1.27 | -46.84 | -2.23 | -2.65 | -0.08 | -44.69 | -1.87 | -90.73 | -1.72 |
| Spain | -32.97 | -1.80 | -35.79 | -1.21 | -46.40 | -2.21 | -3.38 | -0.10 | -43.36 | -1.81 | -90.59 | -1.72 |
| Sri Lanka | -34.05 | -1.86 | -37.27 | -1.26 | -47.42 | -2.26 | -4.03 | -0.12 | -45.10 | -1.89 | -94.32 | -1.79 |
| Sweden | -34.11 | -1.86 | -37.17 | -1.25 | -47.31 | -2.25 | -3.21 | -0.09 | -44.79 | -1.87 | -90.26 | -1.71 |
| Switzerland | -34.02 | -1.86 | -37.21 | -1.25 | -47.24 | -2.25 | -3.30 | -0.10 | -44.89 | -1.87 | -90.06 | -1.71 |
| Syria | -34.62 | -1.89 | -39.38 | -1.33 | -47.59 | -2.27 | -5.47 | -0.16 | -45.65 | -1.91 | -94.60 | -1.79 |
| Tanzania | -33.40 | -1.83 | -37.43 | -1.26 | -46.48 | -2.22 | -4.97 | -0.14 | -44.14 | -1.85 | -93.24 | -1.77 |
| Thailand | -33.00 | -1.80 | -35.86 | -1.21 | -46.20 | -2.20 | -3.82 | -0.11 | -43.34 | -1.81 | -92.46 | -1.75 |
| Trinidad | -35.44 | -1.93 | -39.12 | -1.32 | -48.68 | -2.32 | -5.28 | -0.15 | -46.71 | -1.95 | -90.12 | -1.70 |
| Tunisia | -34.13 | -1.87 | -38.89 | -1.31 | -47.45 | -2.26 | -4.87 | -0.14 | -45.26 | -1.89 | -93.67 | -1.77 |
| Turkey | -33.14 | -1.81 | -36.40 | -1.23 | -46.37 | -2.21 | -4.49 | -0.13 | -43.43 | -1.82 | -92.86 | -1.76 |
| U.K. | -32.36 | -1.77 | -34.63 | -1.17 | -45.63 | -2.18 | -3.00 | -0.09 | -42.44 | -1.77 | -89.58 | -1.70 |
| W.Germany | -32.38 | -1.77 | -34.46 | -1.16 | -45.68 | -2.18 | -2.66 | -0.08 | -42.52 | -1.78 | -89.33 | -1.69 |
| Yugoslavia | -33.69 | -1.84 | -36.99 | -1.25 | -47.00 | -2.24 | -3.88 | -0.11 | -44.30 | -1.85 | -91.61 | -1.74 |
| Zimbabwe | -35.08 | -1.92 | -38.62 | -1.30 | -47.97 | -2.29 | -5.50 | -0.16 | -46.11 | -1.93 | -92.12 | -1.74 |

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| Country | Aggregate | | | | Consumer | | | | Producer | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Exports | | Imports | | Exports | | Imports | | Exports | | Imports | |
| | Est. | t-val. | Est. | t-val. | Est. | t-val. | Est. | t-val. | Est. | t-val. | Est. | t-val. |
| Australia | 16.47 | 0.55 | -11.22 | -0.47 | 54.38 | 1.44 | 0.38 | 0.02 | -7.59 | -0.20 | -20.69 | -0.51 |
| Austria | 14.88 | 0.49 | -12.47 | -0.53 | 53.13 | 1.40 | -0.39 | -0.02 | -8.79 | -0.23 | -22.39 | -0.55 |
| Brazil | 16.42 | 0.55 | -12.19 | -0.52 | 55.48 | 1.47 | -0.38 | -0.02 | -7.56 | -0.20 | -16.31 | -0.40 |
| Colombia | 15.86 | 0.53 | -12.77 | -0.54 | 54.72 | 1.45 | -2.20 | -0.09 | -7.39 | -0.19 | -20.86 | -0.51 |
| Cyprus | 14.57 | 0.48 | -15.26 | -0.64 | 51.44 | 1.36 | -3.11 | -0.13 | -8.89 | -0.23 | -30.80 | -0.75 |
| Denmark | 15.30 | 0.51 | -12.19 | -0.51 | 53.11 | 1.40 | -0.22 | -0.01 | -8.57 | -0.22 | -23.15 | -0.57 |
| El Salvador | 15.11 | 0.50 | -13.44 | -0.57 | 53.55 | 1.42 | -2.92 | -0.12 | -7.48 | -0.19 | -26.02 | -0.64 |
| Ethiopia | 14.24 | 0.47 | -15.43 | -0.65 | 52.66 | 1.39 | -5.76 | -0.24 | -8.46 | -0.22 | -21.64 | -0.53 |
| Finland | 15.24 | 0.51 | -12.53 | -0.53 | 53.18 | 1.41 | -0.66 | -0.03 | -8.65 | -0.22 | -23.37 | -0.57 |
| France | 16.13 | 0.54 | -11.22 | -0.48 | 54.40 | 1.44 | 0.70 | 0.03 | -8.00 | -0.21 | -17.22 | -0.42 |
| Greece | 15.30 | 0.51 | -12.83 | -0.54 | 53.83 | 1.42 | -1.32 | -0.06 | -8.06 | -0.21 | -22.64 | -0.56 |
| Hungary | 14.40 | 0.48 | -13.36 | -0.56 | 53.46 | 1.41 | -1.24 | -0.05 | -8.86 | -0.23 | -22.76 | -0.56 |
| Iceland | 14.41 | 0.48 | -14.01 | -0.59 | 52.01 | 1.37 | -2.07 | -0.09 | -8.82 | -0.23 | -30.98 | -0.75 |
| India | 15.76 | 0.53 | -12.94 | -0.55 | 55.15 | 1.47 | -1.19 | -0.05 | -7.63 | -0.20 | -13.89 | -0.34 |
| Ireland | 15.49 | 0.51 | -11.71 | -0.49 | 53.07 | 1.40 | -0.11 | -0.00 | -7.93 | -0.20 | -23.98 | -0.59 |
| Israel | 16.06 | 0.53 | -12.19 | -0.51 | 53.80 | 1.42 | -0.58 | -0.02 | -7.92 | -0.20 | -24.12 | -0.59 |
| Italy | 16.30 | 0.54 | -11.51 | -0.49 | 54.59 | 1.45 | 0.08 | 0.00 | -7.86 | -0.20 | -17.44 | -0.43 |
| Japan | 17.32 | 0.58 | -10.99 | -0.47 | 55.68 | 1.48 | 1.17 | 0.05 | -7.69 | -0.20 | -15.20 | -0.37 |
| Jordan | 14.48 | 0.48 | -15.74 | -0.66 | 52.71 | 1.39 | -3.71 | -0.16 | -8.39 | -0.22 | -23.91 | -0.59 |
| Kenya | 14.84 | 0.49 | -13.51 | -0.57 | 53.53 | 1.42 | -1.07 | -0.05 | -7.72 | -0.20 | -22.27 | -0.55 |
| Malaysia | 15.62 | 0.52 | -12.49 | -0.53 | 54.06 | 1.43 | -2.79 | -0.12 | -7.66 | -0.20 | -32.06 | -0.78 |
| Malta | 14.06 | 0.46 | -14.48 | -0.61 | 51.38 | 1.35 | -2.74 | -0.12 | -9.16 | -0.24 | -24.36 | -0.60 |
| Morocco | 15.12 | 0.50 | -14.52 | -0.61 | 53.33 | 1.41 | -0.04 | -0.00 | -8.44 | -0.22 | -20.54 | -0.50 |
| Netherlands | 16.78 | 0.56 | -11.76 | -0.50 | 54.25 | 1.44 | 0.32 | 0.01 | -7.30 | -0.19 | -24.86 | -0.61 |
| New Zealand | 15.86 | 0.53 | -11.68 | -0.49 | 53.30 | 1.41 | -2.72 | -0.11 | -7.71 | -0.20 | -27.46 | -0.67 |
| Nicaragua | 15.23 | 0.50 | -13.31 | -0.56 | 53.81 | 1.42 | -0.50 | -0.02 | -7.87 | -0.20 | -23.60 | -0.58 |
| Norway | 16.47 | 0.55 | -12.12 | -0.51 | 53.20 | 1.41 | -1.99 | -0.08 | -8.42 | -0.22 | -18.58 | -0.46 |
| Pakistan | 15.57 | 0.52 | -13.68 | -0.58 | 54.75 | 1.45 | -0.73 | -0.03 | -7.53 | -0.20 | -20.13 | -0.49 |
| Philippines | 15.31 | 0.51 | -12.39 | -0.52 | 54.47 | 1.44 | -0.93 | -0.04 | -7.96 | -0.21 | -19.75 | -0.48 |
| S.Africa | 15.69 | 0.52 | -12.01 | -0.51 | 54.68 | 1.45 | -0.08 | -0.00 | -7.82 | -0.20 | -19.07 | -0.47 |
| S.Korea | 16.22 | 0.54 | -11.66 | -0.49 | 55.31 | 1.47 | -0.60 | -0.03 | -7.35 | -0.19 | -25.40 | -0.62 |
| Singapore | 15.93 | 0.53 | -11.96 | -0.50 | 53.42 | 1.41 | -0.39 | -0.02 | -7.23 | -0.19 | -18.91 | -0.46 |
| Spain | 15.50 | 0.52 | -12.48 | -0.53 | 54.08 | 1.43 | -2.43 | -0.10 | -8.25 | -0.21 | -24.66 | -0.60 |
| Sri Lanka | 14.97 | 0.50 | -13.30 | -0.56 | 53.52 | 1.42 | 0.45 | 0.02 | -8.01 | -0.21 | -21.32 | -0.52 |
| Sweden | 15.74 | 0.52 | -11.41 | -0.48 | 53.81 | 1.42 | 0.20 | 0.01 | -8.38 | -0.22 | -21.87 | -0.54 |
| Switzerland | 15.92 | 0.53 | -11.41 | -0.48 | 53.67 | 1.42 | -4.30 | -0.18 | -8.25 | -0.21 | -25.20 | -0.62 |
| Syria | 14.82 | 0.49 | -15.83 | -0.67 | 53.41 | 1.41 | -5.12 | -0.22 | -9.13 | -0.24 | -22.59 | -0.55 |
| Tanzania | 15.20 | 0.51 | -13.93 | -0.59 | 53.91 | 1.43 | -1.47 | -0.06 | -7.30 | -0.19 | -20.11 | -0.49 |
| Thailand | 15.52 | 0.52 | -13.81 | -0.58 | 54.68 | 1.45 | -2.45 | -0.10 | -7.58 | -0.20 | -27.19 | -0.66 |
| Trinidad | 16.16 | 0.53 | -12.33 | -0.52 | 53.65 | 1.41 | -3.36 | -0.14 | -7.41 | -0.19 | -26.23 | -0.64 |
| Tunisia | 15.59 | 0.52 | -14.64 | -0.62 | 52.80 | 1.40 | -1.79 | -0.08 | -7.83 | -0.20 | -21.18 | -0.52 |
| Turkey | 15.26 | 0.51 | -14.16 | -0.60 | 54.85 | 1.45 | 0.72 | 0.03 | -8.34 | -0.22 | -16.75 | -0.41 |
| U.K. | 17.25 | 0.57 | -10.32 | -0.44 | 55.33 | 1.47 | 2.43 | 0.10 | -7.22 | -0.19 | -12.39 | -0.31 |
| U.S. | 18.74 | 0.62 | -8.79 | -0.37 | 57.64 | 1.53 | 0.69 | 0.03 | -6.42 | -0.17 | -18.60 | -0.41 |
| W.Germany | 16.51 | 0.55 | -11.07 | -0.47 | 54.82 | 1.45 | -1.24 | -0.05 | -7.81 | -0.20 | -21.16 | -0.52 |
| Yugoslavia | 15.24 | 0.51 | -13.17 | -0.56 | 54.19 | 1.44 | -3.88 | -0.16 | -8.31 | -0.22 | -25.47 | -0.62 |
| Zimbabwe | 14.06 | 0.47 | -14.44 | -0.61 | 52.79 | 1.40 | -2.34 | -0.13 | -9.57 | -0.25 | -23.12 | -0.34 |

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