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# Legal versus Illegal U.S. Immigration and Source Country Characteristics*

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## I. Introduction

Both legal and illegal immigration to the United States surged over the last two decades. Between 1971 and 1991, the number of legal immigrants soared from 370,478 to 1,827,167 per year [26].[1] For illegal immigration, a number of studies estimate the volume of both the flow and the stock of migrants. While there is some disagreement regarding these numbers, generally accepted figures on the stock of illegal immigrants give ranges of 2 million to 4 million in 1980, and 3 million to 6 million in 1986 [4; 10]. Empirical studies of population growth conclude that the net population increase due to illegal immigration ranged from 100,000 to 300,000 per annum between 1980 and 1986 [29]. And despite the intent of the Immigration Reform and Control Act (IRCA) of 1986, there is no indication that the yearly flow of illegal immigrants has decreased since the passage of the act [8; 9].

The immigration literature devotes much attention to estimating the size of the illegal immigrant population and to assessing the impact of both legal and illegal immigration on the welfare of the native-born population,[2] and a number of studies address the determinants of the volume of immigration.[3] However, due to lack of reliable data, few empirical studies examine the determinants of illegal immigration flows to the United States.[4] In particular, no empirical study has yet addressed the variation in the volume of illegal immigration across source countries. Such a study is important for a number of reasons.

First, at a conceptual level, the literature uncovers serious contradictions in the way the profession views illegal immigration. For example, the theoretical approaches of Fogel [14] and

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1. The figure for 1991 includes 1,123,162 former illegal immigrants who were legalized as part of the 1986 IRCA (see below). Netting out these leaves 704,005 "regular" immigrant admissions in 1991, roughly doubling the immigrant flow from 1971.

2. Borjas [2] and Chiswick [7] summarize this literature.

3. For example, Borjas [1] examines the empirical relationships between the legal immigration flow and source country characteristics for 41 foreign countries, and Jasso and Rosenzweig [20] examine the relationships between the 1980 stock of foreign-born (which includes both legal and illegal immigrants as well as many non-immigrants such as students) in the United States and source country characteristics for 107 countries.

4. Some studies indirectly approach this issue by examining time series variation in apprehensions at the U.S.-Mexican border [4; 11; 28]. However, Borjas, Freeman, and Lang acknowledge that the number of apprehensions chiefly reflects Border Patrol activity, and therefore serves as a poor indicator of illegal immigration [4, 78].

Ethier [12] have fundamentally different implications regarding the relationship between the volume of illegal immigration and source country earnings. An empirical analysis of the relationship provides a test of these theoretical approaches. Second, an examination of the differential impact of underlying determinants on legal and illegal immigration flows adds to our understanding of international migration flows. Chiswick [6] raises this point, and implicitly calls for a systematic comparison of the impact of determinants when he hypothesizes that illegal immigration is more elastic with respect to migration cost than is legal immigration. Third, a quantitative assessment of the causal relationships between source country characteristics and the volume of illegal immigration is important for purposes of evaluating policies directed at stemming illegal immigration flows.

Based on micro data from the Immigration and Naturalization Service (INS) on legal immigrants as well as on legalization applications that followed the passage of IRCA, this study exploits the variation in legal and illegal immigration flows across seventy source countries to examine the sensitivity of immigration flows to underlying source country characteristics. The study finds that earnings in the source country and the distance from the United States form significant deterrents of both legal and illegal immigration flows. We also find that illegal immigration is more sensitive to such factors than is legal immigration. For example, while the elasticity of legal immigration with respect to source county earnings is close to zero, for illegal immigration the relationship is close to unit elastic.

The study also makes contributions to the recent policy debate regarding the impact of the North America Free Trade Agreement (NAFTA) on U.S. immigration from Mexico. We find that both legal and illegal immigration flows from Mexico are highly responsive to GNP growth in Mexico. For example, a 10 percent increase in Mexico's GNP will reduce legal immigration by 6.3 percent and illegal immigration by perhaps as much as 10.3 percent.

## II. Legal and Illegal U.S. Immigration Flows

To assess the volume of legal and illegal immigration to the United States, this study uses data drawn from both unpublished and published statistics from the U.S. Immigration and Naturalization Service (INS), as well as the public use tapes "Immigrants Admitted into the United States as Legal Permanent Residents (various fiscal years)" also available from the INS. Table I reports the estimates of legal and illegal immigration flows to the United States by continent-of-origin, as well as separately for seventy foreign countries.

For legal immigration flows, we focus on immigrants who arrived in the United States between 1975 and 1980. Unfortunately, published statistics on immigrant admissions between 1975 and 1980 include some immigrants who entered the United States before 1975, and exclude some immigrants who entered within that time-frame but adjusted visa status at a later date.[5] From the published immigration statistics, we therefore net out persons who had entered the United States as non-immigrants or refugees before 1975, and add persons who were admitted as immigrants between 1980 and 1986 but had entered the United States as non-immigrants or refugees between 1975 and 1980. Column 2 of Table I reports the resulting number of legal immigrant arrivals in the United States. In total, roughly 2.6 million legal immigrants entered the United States between

5. For example, in 1982, 47 percent of all immigrants who were admitted had in fact entered the United States at an earlier date [26].

**Table I.** Legal and Illegal U.S. Immigration

| Continent/Country | Legal Immigrant Arrivals 1975–1980 | 1986 IRCA Amnesty Applications: Total | I-687 | I-700 (SAW) | 1977 Population (millions) | Percent Legal Immi-gration | Percent Illegal Immi-gration |
|---|---|---|---|---|---|---|---|
| Total | 2591717 | 2907692 | 1745100 | 1162592 | 4124.0 | 0.0628 | 0.0705 |
| North America | 797604 | 2584772 | 1523976 | 1060796 | 354.0 | 0.2253 | 0.7302 |
| Canada | 66795 | 11572 | 10892 | 680 | 23.3 | 0.2867 | 0.0497 |
| Costa Rica | 7728 | 3657 | 3080 | 577 | 2.1 | 0.3680 | 0.1741 |
| Cuba | 42531 | 673 | 657 | 16 | 9.6 | 0.4430 | 0.0070 |
| Dominican Republic | 80984 | 26688 | 18227 | 8461 | 5.3 | 1.5280 | 0.5035 |
| El Salvador | 22541 | 163494 | 141785 | 21709 | 4.4 | 0.5123 | 3.7158 |
| Guatemala | 15994 | 68718 | 51984 | 16734 | 6.4 | 0.2499 | 1.0737 |
| Haiti | 31598 | 56656 | 15922 | 40734 | 5.4 | 0.5851 | 1.0492 |
| Honduras | 10346 | 17252 | 12980 | 4272 | 3.4 | 0.3043 | 0.5074 |
| Jamaica | 80102 | 18398 | 12967 | 5431 | 2.2 | 3.6410 | 0.8363 |
| Mexico | 328215 | 2178441 | 1219604 | 958837 | 62.3 | 0.5268 | 3.4967 |
| Panama | 14189 | 2169 | 1998 | 171 | 1.8 | 0.7883 | 0.1205 |
| Trinidad and Tobago | 28692 | 4551 | 3083 | 1468 | 1.1 | 2.6084 | 0.4137 |
| South America | 173468 | 97093 | 73404 | 23689 | 230.0 | 0.0754 | 0.0422 |
| Argentina | 14827 | 5858 | 5084 | 774 | 26.4 | 0.0562 | 0.0222 |
| Brazil | 7929 | 5984 | 1738 | 4246 | 113.7 | 0.0070 | 0.0053 |
| Chile | 12486 | 4723 | 4129 | 594 | 10.5 | 0.1189 | 0.0450 |
| Colombia | 46136 | 32892 | 26262 | 6630 | 25.1 | 0.1838 | 0.1310 |
| Ecuador | 26132 | 15574 | 13166 | 2408 | 7.3 | 0.3580 | 0.2133 |
| Peru | 20644 | 18600 | 12579 | 6021 | 16.3 | 0.1267 | 0.1141 |
| Uruguay | 4747 | 2172 | 1821 | 351 | 2.9 | 0.1637 | 0.0749 |
| Asia | 1124026 | 139623 | 79571 | 60052 | 2355.0 | 0.0477 | 0.0059 |
| Bangladesh | 2915 | 6418 | 1325 | 5093 | 83.5 | 0.0035 | 0.0077 |
| China | 81308 | 11068 | 8646 | 2422 | 971.8 | 0.0084 | 0.0011 |
| Hong Kong | 26713 | 2398 | 2143 | 255 | 4.5 | 0.5923 | 0.0532 |
| India | 92900 | 19423 | 3832 | 15591 | 643.0 | 0.0144 | 0.0030 |
| Indonesia | 3952 | 870 | 757 | 113 | 142.0 | 0.0028 | 0.0006 |
| Iran | 62430 | 15102 | 14532 | 570 | 35.4 | 0.1764 | 0.0427 |
| Iraq | 16181 | 1197 | 1138 | 59 | 12.0 | 0.1348 | 0.0100 |
| Israel | 15411 | 2461 | 1587 | 874 | 3.5 | 0.4403 | 0.0703 |
| Japan | 19858 | 1809 | 1586 | 223 | 113.9 | 0.0174 | 0.0016 |
| Korea | 157294 | 10943 | 5755 | 5188 | 37.9 | 0.4150 | 0.0289 |
| Lebanon | 24691 | 2917 | 1596 | 1321 | 2.8 | 0.8818 | 0.1042 |
| Malaysia | 3215 | 780 | 535 | 245 | 13.0 | 0.0247 | 0.0060 |
| Pakistan | 17615 | 19527 | 5224 | 14303 | 79.5 | 0.0222 | 0.0246 |
| Philippines | 197092 | 28560 | 18767 | 9793 | 45.4 | 0.4341 | 0.0629 |
| Singapore | 1567 | 219 | 169 | 50 | 2.3 | 0.0681 | 0.0095 |
| Sri Lanka | 2017 | 562 | 182 | 380 | 14.1 | 0.0143 | 0.0040 |
| Taiwan | 34006 | 4355 | 3659 | 696 | 16.8 | 0.2024 | 0.0259 |
| Thailand | 23903 | 4837 | 4179 | 658 | 44.6 | 0.0536 | 0.0108 |
| Turkey | 9623 | 1346 | 627 | 719 | 42.5 | 0.0226 | 0.0032 |
| Europe | 416490 | 37871 | 33340 | 4531 | 779.2 | 0.0535 | 0.0049 |
| Austria | 2014 | 163 | 145 | 18 | 7.5 | 0.0269 | 0.0022 |
| Belgium | 1985 | 169 | 156 | 13 | 9.8 | 0.0203 | 0.0017 |
| Czechoslovakia | 3824 | 79 | 78 | 1 | 15.0 | 0.0255 | 0.0005 |
| Denmark | 2145 | 99 | 83 | 16 | 5.1 | 0.0421 | 0.0019 |

**Table I.** Continued

| Continent/Country | Legal Immigrant Arrivals 1975–1980 | 1986 IRCA Amnesty Applications: Total | I-687 | I-700 (SAW) | 1977 Population (millions) | | Percent Legal Immigration | Percent Illegal Immigration |
|---|---|---|---|---|---|---|---|---|
| Finland | 1524 | 67 | 67 | 0 | 4.7 | | 0.0324 | 0.0014 |
| France | 8380 | 959 | 837 | 122 | 53.1 | | 0.0158 | 0.0018 |
| Germany | 34586 | 1073 | 997 | 76 | 61.4 | | 0.0563 | 0.0017 |
| Greece | 35686 | 1547 | 1402 | 145 | 9.3 | | 0.3837 | 0.0166 |
| Hungary | 4448 | 282 | 279 | 3 | 10.6 | | 0.0420 | 0.0027 |
| Ireland | 5446 | 1539 | 1398 | 141 | 3.3 | | 0.1650 | 0.0466 |
| Italy | 37006 | 1328 | 1154 | 174 | 56.4 | | 0.0656 | 0.0024 |
| Netherlands | 5333 | 562 | 417 | 145 | 13.9 | | 0.0384 | 0.0040 |
| Norway | 1825 | 85 | 77 | 8 | 4.0 | | 0.0456 | 0.0021 |
| Poland | 22651 | 15625 | 15178 | 447 | 34.6 | | 0.0655 | 0.0452 |
| Portugal | 49293 | 2587 | 1181 | 1406 | 9.7 | | 0.5082 | 0.0267 |
| Romania | 11773 | 110 | 106 | 4 | 21.7 | | 0.0543 | 0.0005 |
| Spain | 9515 | 1203 | 832 | 371 | 36.3 | | 0.0262 | 0.0033 |
| Sweden | 3168 | 195 | 174 | 21 | 8.3 | | 0.0382 | 0.0023 |
| Switzerland | 3210 | 210 | 200 | 10 | 6.3 | | 0.0510 | 0.0033 |
| USSR | 89542 | 91 | 72 | 19 | 259.0 | | 0.0346 | 0.0000 |
| UK | 68008 | 7608 | 7007 | 601 | 55.9 | | 0.1217 | 0.0136 |
| Yugoslavia | 12631 | 2188 | 1436 | 752 | 21.8 | | 0.0579 | 0.0100 |
| Africa | 59710 | 40839 | 30447 | 10392 | 391.0 | | 0.0153 | 0.0104 |
| Egypt | 13748 | 4585 | 1634 | 2951 | 38.8 | | 0.0354 | 0.0118 |
| Kenya | 2792 | 860 | 750 | 110 | 14.6 | | 0.0191 | 0.0059 |
| Morocco | 2234 | 515 | 147 | 368 | 19.2 | | 0.0116 | 0.0027 |
| Sierra Leone | 863 | 1533 | 1431 | 102 | 3.2 | | 0.0270 | 0.0479 |
| South Africa | 8721 | 455 | 408 | 47 | 26.7 | | 0.0327 | 0.0017 |
| Tanzania | 1503 | 390 | 299 | 91 | 16.3 | | 0.0092 | 0.0024 |
| Uganda | 1296 | 573 | 541 | 32 | 12.4 | | 0.0105 | 0.0046 |
| Zambia | 1072 | 145 | 96 | 49 | 5.3 | | 0.0202 | 0.0027 |
| Oceania | 20382 | 7239 | 7239 | 3104 | 20.7 | | 0.0985 | 0.0350 |
| Australia | 7241 | 428 | 409 | 19 | 14.1 | | 0.0514 | 0.0030 |
| New Zealand | 3000 | 366 | 324 | 42 | 3.1 | | 0.0968 | 0.0118 |

1975 and 1980. The majority arrived from Asia and North America (43 percent and 31 percent), with Mexico (13 percent), the Philippines (8 percent), and Korea (6 percent) forming the major source countries.

We use the amnesty applications resulting from the Immigration Reform and Control Act of 1986 as measures of illegal immigration flows to the United States. The act contained two provisions under which illegal immigrants could apply for amnesty, I-687 and I-700. While the I-687 provision required that the illegal immigrant had resided in the United States since before 1982, the I-700 (or SAW for seasonal agricultural worker) provision contained no requirement regarding length of stay in the United States. The SAW provision required instead that the illegal immigrant could document recent employment in U.S. agriculture. Columns 3, 4, and 5 of Table I report the number of amnesty applications processed by the INS as of 9 May 1989. By that date, the INS had processed a total of 2.9 million amnesty applications, of which 60 percent were based on

the I-687 provision and 40 percent on the I-700 (SAW) provision. The majority of the amnesty applicants originated in North America (89 percent), with Mexico (75 percent) again serving as the major source country.

The last two columns of Table I list estimates of the legal and illegal immigration flows as percentages of the source country population. We compute the percentages by dividing the measures of legal and illegal immigration flows (Columns 2 and 3) by the 1977 population of the foreign country. Using this metric, Jamaica becomes the major source country for legal immigrants (3.64 percent), with other large legal immigrant flows originating in Trinidad and Tobago (2.61 percent) and the Dominican Republic (1.53 percent). Similarly, El Salvador (3.72 percent) and Mexico (3.50 percent) are the major source countries of illegal immigrants, with Guatemala (1.07 percent) and Haiti (1.05 percent) also supplying substantial illegal immigrant flows.

The columns reporting legal and illegal immigration as percentages of the source country population document substantial variation in these series across source countries. The empirical analyses below exploit this variation to address the determinants of the size of immigration flows.

## III. The Empirical Model

Economic theory dating back to Hicks [18] points to regional earnings differentials and the cost of migration as the fundamental determinants of the size of migration flows. Empirical studies typically use distance to proxy for migration cost since the distance between origin and destination captures both the monetary and the psychic costs of migration [23; 24]. Our measure of distance is the direct air distance between the capital of the foreign country and the closest U.S. port of New York City; Miami; Brownsville, Texas; or Los Angeles. A standard convention in the immigration literature, we use the natural logarithm of the source country's per-capita GNP as a measure of average earnings at the origin [1; 20].[6]

We estimate the following empirical specification:

$$p_i = \Phi(\beta_1 y_i + \beta_2 d_i + \beta_3 d_i^2 + \beta_4 d_i * y_i + \boldsymbol{\alpha}' \mathbf{x}_i + u_i), \tag{1}$$

where $p_i$ denotes the legal or the illegal immigration rate from country $i$; $y_i$ and $d_i$ denote log per-capita GNP and distance; $\mathbf{x}_i$ denotes a vector of control variables; $u_i$ denotes a random error term; and $\Phi$ denotes the cumulative standard normal distribution function.[7]

The empirical specification is rich in the two regressors log per-capita GNP and distance. For regressions involving legal immigration flows, we expect both $\beta_1$ and $\beta_2$ to be negative since economic theory suggests that migration rates are decreasing with higher mean earnings at the origin and with larger migration costs. A number of empirical studies of both internal and international migration flows have verified these relationships for legal migrants [3; 15; 16; 17].

For illegal immigrants, the theoretical literature contains conflicting predictions regarding the sign of $\beta_1$. Drawing on a standard neoclassical migration framework,[8] Fogel [14] predicts a

6. Data sources are Fitzpatrick and Madlin [13] and U.S. Arms and Disarmament Agency [25].

7. The estimating equation is therefore a grouped probit model, which involves regressing the normit (i.e., the standard normal $z$-value) of the immigration probability on the listed regressors. For details, see Maddala [21]. It is worth noting that because the observed immigration probabilities are close to zero, the probit model is much preferable to the linear probability model in this application.

8. An exposition of this framework is given in Greenwood [15].

negative relationship between the size of the illegal immigration flow and source country earnings as the returns to migration increase with the earnings gap. Conversely, Ethier [12] predicts a positive relationship between source country wages and the number of illegal entrants. In Ethier's model, the difference between the expected wage in the United States and the wage in the source country is determined by the level of enforcement of border policies aimed at stemming illegal entry. Thus the model predicts a positive (negative) relationship between border enforcement (the number of illegal entrants) and the wage gap. Indeed, Ethier concludes ". . . increases in the wage gap . . . will be associated with *decreases* in the actual volume of illegal immigration. A large part of the substantial empirical literature on migration proceeds, by contrast, from the presumption that actual migration ought to be positively correlated with the wage gap" [12, 59].

This contradiction is important. If the volume of illegal immigration indeed increases with higher source country earnings, then the decision rule that guides illegal migration behavior differs fundamentally from that guiding legal migration behavior, and the knowledge that we have accumulated for legal migration behavior does not generalize to illegal migration. While the empirical literature examining time-series variation in apprehensions of illegal immigrants at the U.S.-Mexican border reports a negative association between Mexican wages and the number of apprehensions [11; 28],[9] the relationship has not yet been formally tested in a cross-section sample of illegal immigrants from a number of countries. For illegal immigration flows, estimation of (1) therefore provides a first empirical test of Ethier's proposition.

The specification in (1) also includes distance squared and the cross-product of distance and log per-capita GNP. A priori, we expect positive coefficients on both regressors. Paired with a negative $\beta_2$, a positive $\beta_3$ indicates that distance reduces migration flows at a decreasing rate, and a positive $\beta_4$ indicates that migration cost is a lesser deterrent of migration flows the richer the source country. A simple budget constraint argument motivates such a result. If the cost of migration is large relative to the individual's earnings capacity, higher mean earnings at the origin could have the opposing indirect effect of increasing emigration as more individuals afford to migrate to the United States. The interaction term between the cost of migration (distance) and income controls for this effect.

The empirical specification adds control variables for the political regime and for the language of the source country. The regressors include dummy variables set to unity if the source country has a communist regime and if English is an official language of the source country.[10] While it is unclear what impact communist regimes will have on overall emigration flows from such countries, immigrants from communist countries should be less likely to be illegal immigrants as the United States long has fostered a liberal policy of accepting immigrants from communist countries as political refugees. In regressions involving the volume of illegal immigration, we therefore expect negative coefficients on the communist dummy variable. Other things equal, fluency in English reduces an immigrant's implicit cost of settling in the United States. We therefore expect a positive coefficient on the English dummy variable in both legal and illegal immigration regressions.

In regressions where the illegal immigration flow forms the dependent variable, we also control for the difficulty of obtaining a legal immigrant visa by adding to the regressors the number

9. Note that the finding of a positive relationship between the wage gap and the number of border *apprehensions* does not necessarily reject Ethier's prediction of a negative association between the wage gap and the volume of illegal entrants (who successfully cross the border). However, the literature typically assumes a positive relationship between apprehensions and illegal entries [4; 11].

10. These data are drawn from Wright [30].

**Table II.** Grouped Probit Regressions of Immigration Rates

| Independent Variable | Mean (Std. Dev.) | Legal Immigration (1) | Illegal Immigration: Total (2) | Total (3) | SAW Applicants (4) | SAW Applicants (5) |
|---|---|---|---|---|---|---|
| Constant | | −0.4926 | 0.7151 | 0.5472 | 0.4144 | 0.2146 |
| | | (−0.741) | (1.004) | (0.828) | (0.582) | (0.344) |
| Log (per-capita GNP) | 7.6491 | −0.2612 | −0.4267 | −0.4370 | −0.4593 | −0.4732 |
| | (1.256) | (−2.889) | (−4.402) | (−4.873) | (−4.743) | (−5.592) |
| Distance (1000 miles) | 4.5677 | −0.6339 | −0.7811 | −0.7499 | −0.6184 | −0.5810 |
| | (2.442) | (−4.623) | (−5.315) | (−5.505) | (−4.218) | (−4.529) |
| Distance-Squared | 26.7411 | 0.0140 | 0.0231 | 0.0179 | 0.0155 | 0.0090 |
| | (23.034) | (1.745) | (2.699) | (2.220) | (1.810) | (1.189) |
| Distance × Log (per-cap GNP) | 34.2427 | 0.0538 | 0.0564 | 0.0613 | 0.0449 | 0.0510 |
| | (17.305) | (3.271) | (3.199) | (3.743) | (2.554) | (3.310) |
| Communist Regime | 0.1143 | −0.1302 | −0.4932 | −0.4903 | −0.7359 | −0.7310 |
| | (0.320) | (−0.961) | (−3.397) | (−3.652) | (−5.082) | (−5.780) |
| English | 0.2429 | 0.2341 | 0.1614 | 0.1310 | 0.1314 | 0.0946 |
| | (0.432) | (2.061) | (1.326) | (1.159) | (1.082) | (0.889) |
| Numerically Limited Immigrants (1000s) | 7.9474 | | | 0.0107 | | 0.0133 |
| | (14.520) | | | (3.417) | | (4.504) |
| $R^2$ | | .5065 | .6748 | .7263 | .7073 | .7804 |

Notes: Numbers in parentheses are $t$-ratios. The dependent variables are the normits (standard normal $z$-values) of the immigration probabilities. The regressions have 70 observations, except for the SAW based regressions which have 69 observations.

of numerically restricted immigrant visas that were issued to the source country during 1980 and 1981. The preference system that controls numerically limited immigration places a yearly cap of 20,000 on the number of restricted immigrant visas that may be issued to any given country.[11] The closer a country is to this cap, the longer is the backlog in visa applications and the greater the implicit cost of obtaining an immigrant visa. The likelihood of illegal immigration should therefore increase with the number of numerically restricted visas issued to the source country.

## IV. Empirical Results

Table II reports separately results from grouped probit regressions for legal and illegal immigration flows. In the regressions, the legal and the illegal immigration rates reported in Table I form the dependent variables. The table presents two sets of regression results for the illegal immigration flow—one based on the total number of amnesty applications, and one based on I-700 (SAW) applications only.[12] While the latter measure of illegal immigration applies to agricultural workers

11. A majority of legal immigrants are in fact exempt from these restrictions. For example, in 1982, 56.3 percent of all legal immigrants were exempt from numerical limitations [26].

12. Note that the SAW based regressions have one less observation because no SAW applicants originated in Finland.

only, it has the advantage over the former measure that it does not add a minimum requirement regarding years of residence in the United States. As such the number of SAW applications may supply a better measure of the cross-country variation in illegal immigration since the measure will not be as distorted by potential return migration. Several studies have shown that as many as 20 percent of legal immigrants leave the United States within a few years of arrival [3; 19; 27]. Because a prolonged stay in the United States increases the likelihood of detection, return migration is likely to be equally significant among illegal immigrants.

The table reveals that per-capita GNP and distance from the United States are important deterrents of both legal and illegal immigration flows. Both legal and illegal immigrants are more likely to originate in nearby and poor countries than in distant and rich countries. The empirical evidence therefore contradicts Ethier's proposition that the volume of illegal immigration is positively correlated with source country earnings. Moreover, the coefficients on distance-squared and the interaction term between distance and log per-capita GNP are both positive. Distance impacts migration flows to the United States negatively at a decreasing rate, and distance becomes a less important deterrent of migration the richer the source country. The latter result is consistent with the budget constraint argument that, while fewer persons have an incentive to leave a rich country, more persons could afford to migrate to the United States the richer the source country. In addition to having the expected signs, the coefficients on regressors involving log per-capita GNP or distance (with the occasional exception of distance-squared) are significantly different from zero at the five percent level in every reported specification.

Table II also demonstrates that immigrants from communist countries are much less likely to be illegal immigrants than are immigrants from non-communist countries. From 1970 to 1987, the United States granted 1,294,330 refugees and asylees, mostly from communist countries, lawful permanent resident status [26]. Given such preferential treatment, it is not surprising that the coefficient on the communist dummy variable is negative and significant in the regressions of illegal immigration flows. Based on specification (3) and evaluated at the sample mean, illegal immigrant flows from communist countries are 86 percent less than those from non-communist countries.

As expected, immigrant flows from English speaking countries are larger than those from non-English speaking countries. However, the coefficient on the English language dummy is significantly different from zero at a five percent level only in the legal immigration regression. Evaluated at sample means, legal immigration flows from non-English speaking are 56 percent less, and based on specification (3), illegal immigration flows are 40 percent less than those from English speaking countries.

The table also shows that the volume of illegal immigration increases with the number of restricted visas issued to the source country during 1980–1981. A larger number of restricted visas brings the source country closer to the per-country cap dictated by immigration policy, and therefore increases the difficulty and the implicit cost of obtaining legal visas for potential immigrants from the source country. Given the 20,000 per annum cap and evaluated at sample means, increasing a source country's issues of numerically limited visas by one thousand adds 4.3 percent to the total illegal immigration flow and 5.9 percent to the SAW based illegal flow. Because of potential problems of endogeneity, the table also reports results from regressions that exclude the number-of-restricted-visas variable.[13] However, the table reveals that inclusion of this variable

13. The endogeneity issue arises because the number of restricted visa issues forms a component of the dependent variable in the legal immigration regression and may therefore be correlated with the error term.

**Table III.** Estimated Point Elasticities of Immigration Flows

| | | Illegal Immigration Flow: | |
|---|---|---|---|
| Determinant | Legal Immigration Flow | Total | SAW |
| Per-Capita GNP | −0.0525 | −0.6016 | −1.0199 |
| | (0.1332) | (0.1499) | (0.1661) |
| Distance | −1.4740 | −2.0564 | −2.1026 |
| | (0.3167) | (0.3686) | (0.3840) |

Notes: Numbers in parentheses are estimated standard errors. Elasticities are evaluated at sample means.

has only minor impacts on estimates of other coefficients. Estimation of coefficients of interest therefore appears robust to the endogeneity problem.

Of considerable interest is a comparison of the impact of source country characteristics on legal and illegal immigration flows. Because of the inclusion of non-linear regressors, and because coefficients in probit models are difficult to interpret, we calculated elasticities of the three migration flows with respect to source country GNP and distance from the United States.[14] Table III reports these elasticities evaluated at mean values of the regressors, along with the estimated standard errors.[15]

The elasticities in Table III reveal that legal immigration is rather insensitive to changes in source country GNP. Evaluated at the sample mean, a one percent increase in source country GNP reduces legal immigration by about one-twentieth of a percent. With a large standard error, the estimated elasticity of legal immigration is not significantly different from zero. However, the reduction in illegal immigration is substantial. A one percent increase in source country GNP will reduce illegal immigration by .60 percent according to the regression model based on the total number of amnesty applications, and 1.02 percent according to the regression model based on agricultural workers only. All three immigration flows are more sensitive to distance than to GNP.

14. Elasticities also have the added advantage of being independent of the choice of unit. Here, the time period over which we measure legal immigration is somewhat arbitrary. The regression coefficients (but not the computed elasticities) are sensitive to the underlying choice of time period.

15. We compute the elasticity of the immigration flow with respect to a factor $x$ as

$$\varepsilon_{p,x} = (\partial p/\partial x)\bar{x}/\Phi(\bar{z}) = \phi(\bar{z})(\partial z/\partial x)\bar{x}/\Phi(\bar{z})$$

where $z$ denotes the normit of the immigration probability, $\phi$ denotes the standard normal density function, and $\Phi$ denotes the cumulative standard normal distribution function. For GNP ($g$) and distance ($d$), we compute the partial derivatives as

$$\partial z/\partial g = (\partial z/\partial y)(\partial y/\partial g) = (\hat{\beta}_1 + \hat{\beta}_4\bar{d})/\bar{g}$$

$$\partial z/\partial d = \hat{\beta}_2 + 2\hat{\beta}_3\bar{d} + \hat{\beta}_4\bar{y},$$

where $\bar{y}$ denotes the sample mean of log per-capita GNP. Standard errors are computed from the variance formulae

$$\mathrm{V}(\varepsilon_{p,x}) = [\phi(\bar{z})\bar{x}/\Phi(\bar{z})]^2\,\mathrm{V}(\partial z/\partial x),$$

where, for example,

$$\mathrm{V}(\partial z/\partial g) = [\mathrm{V}(\hat{\beta}_1) + \bar{d}^2\,\mathrm{V}(\hat{\beta}_4) + 2\bar{d}\,\mathrm{COV}(\hat{\beta}_1, \hat{\beta}_4)]/\bar{g}^2.$$

**Table IV.** $t$-statistics from Pairwise Tests of Equality of Legal and Illegal Immigration Elasticities

| Determinant | Illegal Immigration Flow: Total | SAW |
|---|---|---|
| GNP | 2.739 | 4.543 |
| | (4.286) | (6.853) |
| Distance | 1.198 | 1.263 |
| | (2.237) | (2.161) |

Notes: The null hypothesis is $H_0 : \varepsilon_{legal} - \varepsilon_{illegal} = 0$. The $t$-statistics are based on least squares and seemingly unrelated regression (SUR, in parentheses).

Evaluated at sample means, a one percent increase in distance reduces legal immigration by 1.47 percent, and illegal immigration by 2.06 or 2.10 percent depending on specification.

As with the responsiveness to source country GNP, both measures of illegal immigration flows appear to be more elastic with respect to distance between the source country and the United States than is the legal immigration flow. Table IV reports test statistics from pairwise $t$-tests of equality of legal and illegal immigration elasticities. Because least squares estimation ignores cross-equation covariance of regression errors, the table also reports $t$-statistics based on seemingly unrelated regression (SUR) estimation.[16] For GNP elasticities, the tests unambiguously reject the null hypotheses of equality at the one percent significance level. For distance elasticities, the least squares based tests fail to reject the null hypotheses, while the SUR based tests reject the null hypotheses at the five percent significance level. Not surprisingly, the SUR based test statistics exceed the least squares based statistics as the SUR estimation accounts for the large positive cross-equation covariance of regression errors. In sum, the tests support Chiswick's contention that illegal immigration is more sensitive to underlying determinants than is legal immigration [6, 103].

From Table I it is obvious that Mexico is an important source of both legal and illegal immigration to the United States. Both the migration literature and policy discussion have to a large extent focused on immigration from Mexico. In fact, a frequent argument in the recent policy debate regarding the North American Free Trade Agreement (NAFTA) concerned the potential impact of the agreement on illegal immigration from Mexico. The regression models in Table II indirectly provide estimates of the impact of NAFTA on Mexican migration flows to the United States.

Brown, Deardorff, and Stern estimate that NAFTA will lead to a GNP growth in Mexico of four percent per year, implying a five year growth of about 22 percent [5]. Table V lists the estimated reductions in legal and illegal immigration from Mexico resulting from increases in Mexico's GNP. Besides reporting the point elasticities, the table also lists the estimated reductions in immigration flows resulting from discrete increases in GNP. Not surprisingly, immigration from Mexico is more responsive to changes in GNP than is the overall U.S. immigration. According to the estimated point elasticities, a one percent increase in GNP will reduce legal immigration from Mexico by 0.68 percent, and illegal immigration by 0.90 or 1.13 percent depending on the

16. Results from the complete SUR estimation are reported in the appendix. It is worth emphasizing that coefficient estimates are very similar across estimation methods, and that standard errors in general are smaller in the SUR estimation. However, because of substantial cross equation covariances, tests of equality of coefficients across equations are very sensitive to the estimation method.

**Table V.** Estimated Response in U.S. Immigration from Mexico to Increases in Mexico's GNP

| | | Percent Change in Illegal Immigration: | |
|---|---|---|---|
| Increase in GNP | Percent Change in Legal Immigration | Total | SAW |
| Point Elasticity | −0.6800 | −0.9026 | −1.1314 |
| | (0.2405) | (0.1831) | (0.1969) |
| 10% | −6.2969 | −8.3042 | −10.2958 |
| | (2.2918) | (1.7453) | (1.8770) |
| 22% | −12.7349 | −16.6717 | −20.4318 |
| | (4.7815) | (3.6414) | (3.9160) |

Note: Numbers in parentheses are estimated standard errors.

specification. A 10 percent growth in Mexico's GNP will reduce legal immigration by 6.30 percent, and illegal immigration by 8.30 or 10.30 percent.[17] According to these estimates, if NAFTA spurs GNP growth in Mexico, the trade agreement could have a significant impact on lowering both legal and illegal immigration flows to the United States.

## V. Conclusion

This paper presented a first empirical examination of the determinants of illegal immigration flows to the United States. The study uses the legalization applications that followed the passage of the Immigration Reform and Control Act of 1986 to obtain a handle on the variation in the volume of illegal immigration across source countries. The empirical analysis finds that differences in illegal immigration rates are attributable to variation in economic and political characteristics of source countries.

An important contribution of the study is the contrast of determinants of the volume of illegal and legal U.S. immigration. We find that source country earnings and distance from the United States form significant deterrents of both types of immigration flows. The empirical evidence therefore supports the conventional approach of Fogel [14] and rejects theoretical predictions from Ethier's model of illegal immigration [12]. Moreover, the empirical analysis supports Chiswick's contention that illegal immigration is more responsive to underlying determinants than is legal immigration [6].

17. Interestingly, these figures are slightly higher than that we compute from Espenshade [11]. Espenshade bases his study on time-series variation in apprehensions at the U.S.-Mexican border and relates the flow of illegals to the ratio of U.S. to Mexican wages. Using the coefficient from Espenshade's study and a starting wage-ratio of eight [28], we compute a 5.3 percent reduction in illegal immigration associated with a ten percent increase in Mexican wages.

## Appendix

**Table A-I.** Grouped Probit Regressions of Immigration Rates, Pairwise Seemingly Unrelated Regressions

| Independent Variable | Legal Immigration | Total Illegal Immigration | Legal Immigration | SAW Illegal Immigration |
|---|---|---|---|---|
| Constant | −0.4926 | 0.6123 | −0.5256 | 0.2658 |
| | (−0.781) | (0.985) | (−0.826) | (0.454) |
| Log (per-capita GNP) | −0.2612 | −0.4330 | −0.2567 | −0.4696 |
| | (−3.046) | (−5.131) | (−2.996) | (−5.903) |
| Distance (1000 miles) | −0.6339 | −0.7620 | −0.6287 | −0.5906 |
| | (−4.873) | (−5.948) | (−4.798) | (−4.898) |
| Distance-Squared | 0.0140 | 0.0199 | 0.0138 | 0.0107 |
| | (1.839) | (2.638) | (1.806) | (1.501) |
| Distance × Log (per-cap GNP) | 0.0538 | 0.0594 | 0.0533 | 0.0494 |
| | (3.448) | (3.859) | (3.396) | (3.415) |
| Communist Regime | −0.1302 | −0.4915 | −0.1354 | −0.7323 |
| | (−1.013) | (−3.890) | (−1.046) | (−6.157) |
| English | 0.2341 | 0.1428 | 0.2303 | 0.1040 |
| | (2.172) | (1.344) | (2.123) | (1.041) |
| Numerically Limited Immigrants (1000s) | | 0.0066 | | 0.0099 |
| | | (2.592) | | (3.997) |
| $R^2$ | .5065 | .7188 | .5062 | .7758 |
| Error Variance | 0.1099 | 0.1093 | 0.1110 | 0.0957 |
| Error Covariance | 0.0616 | | 0.0511 | |
| Observations | 70 | | 69 | |

Notes: Numbers in parentheses are $t$-ratios. The dependent variables are the normits (standard normal $z$-values) of the immigration probabilities.

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