EMPIRICAL EVIDENCE ON THE EFFECTS OF NAFTA AND DOLLARIZATION ON ILLEGAL IMMIGRATION[1]

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Introduction

Like Western Europe, the North American Free Trade Area (NAFTA) region has made commitments toward economic integration. But, despite the similarity in the overall objective of trade barrier reduction, the pace of integration among Mexico, Canada and the U.S. has been slower. We point to, and elaborate on, three differences in the American and European models to economic integration: the form of trade integration, the extent of labor mobility, and the degree of financial integration.

Indeed, while the European countries have formed a custom's union, the American system is one of a free trade area. Under a custom's union arrangement, countries agree to adopt common trade barriers. In contrast, in a free trade area, as in the NAFTA region, each country maintains its own system of trade restrictions with respect to the rest of the world. As a result, there is a need to verify the country of origin of all goods crossing all national boundaries, which increases transactions costs, limits trade, and, hence, the extent of economic integration.

A second important distinction is with respect to labor mobility. The treaty establishing the European Community, signed in Rome on March 25, 1957, guaranteed the unrestricted labor flows across the national boundaries of the members of the, back then, European Community (Jovanovic, 1997). Not only is this not the case in the Americas but, furthermore, we view the adoption of similar international labor mobility standards as unlikely. Despite the call by President Vicente Fox for greater labor mobility within the region, the position of the U.S. has been to maintain limited labor mobility across national boundaries. With the exception of the 1987 Immigration Reform and Control Act (IRCA) and its one time amnesty provision, no significant steps have been taken to lift restrictions on labor flows within the region.

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Finally, the degree of financial integration attained by the European and American models differs. Europe has embraced, and nearly completed, a process leading to complete monetary integration with full adoption of the Euro as the single Euro area currency. The adoption of a common currency by the European countries sets European integration apart from the North American system. Indeed, in the case of NAFTA, there has been only limited talk of the adoption of a common currency either in the form of dollarization or the creation of a single jointly managed currency.

The intent of this paper is to explore the implications of increased economic integration for illegal immigration from Mexico to the U.S. Though it is conceivable that at some point in the future a custom's union might replace the free trade agreement, it is still unlikely that the region would allow unlimited labor mobility anytime soon. Consequently, we ask: what impact would greater trade integration have on the politically sensitive issue of illegal immigration? Furthermore, since it is conceivable that the NAFTA region might attempt greater financial integration via, for example, dollarization, we also question: what would be the impact of dollarization on the flow of illegal workers across national boundaries? The following analysis addresses these two questions by empirically assessing how increased trade and financial integration affect the incentives of individuals to cross national borders.

Previous Literature

When the NAFTA treaty was being negotiated, economists were asked about the impact on illegal immigration. Diverse opinions were offered. While some argued that NAFTA would increase illegal immigration, others believed that NAFTA would decrease illegal immigration.[2] For the first group, the restructuring of the Mexican economy in response to trade liberalization would raise Mexican unemployment, increasing U.S./Mexican wage differentials, and promoting the incentive to migrate. Another channel by which integration could affect illegal immigration was through the increased volume of trade and traffic between Mexico and the U.S. The increased level of flows across the border would make for more camouflage opportunities for undocumented immigrants. The probability of detection would be lowered, increasing the successfulness of illegal border crossers and, hence, raising the total level of illegal immigration.

However, others believed that illegal immigration would decrease with greater trade. A standard trade model would argue that, given the relative abundance of

[2] See Smith (1997) and Cornelius and Martin (1993) for a review of contrasting arguments.

capital in the U.S. and the relative abundance of labor in Mexico, specialization along the lines of comparative advantage would cause Mexican wages to rise, while U.S. wages would fall. As a result, the incentive for Mexican workers to migrate to the U.S. would thereby fall, reducing the level of illegal immigration. In effect, trade would substitute for migration.

Most economists, however, argued that NAFTA was unlikely to have very much of an effect on illegal immigration. Differing reasons were given for such, including that wage differentials were unlikely to change by much. In accordance with this claim is the work by Markusen and Zahniser (1997), who offer several trade models that suggest that NAFTA does not affect the relative wages of U.S. and of Mexican unskilled labor; thereby eliminating the main channel by which trade integration is supposed to affect migration.

While little has been settled regarding the impact of trade integration on Mexican/U.S. illegal immigration, even less is known about the effects of monetary integration. One attempt to explore this issue has been undertaken by Borjas and Fisher (2001), who try to gauge the impact of dollarization. They conclude that illegal immigration would be more volatile under dollarization.

In this paper, we offer new evidence on the impact of increased trade and monetary integration on illegal immigration by addressing the following questions: What has been the effect of the adoption of a free trade area on the illegal flow of workers across the border? While we consider taking monetary steps toward integration, what evidence can be gathered regarding its likely impact on the level of illegal immigration? How does economic policy, in the form of dollarization and trade integration, influence the flow of persons across the border?

Measuring Illegal Immigration, Trade Integration, and Dollarization

Illegal immigration

In order to empirically assess the impact of differing economic policies on illegal immigration, we need a measure of illegal immigration. How much illegal immigration from Mexico does the United States experience?[3] In answering this question, it is necessary to distinguish between the stock of Mexican illegal immigrants in the U.S. and the flow of illegal immigrants. A common stock measure of illegal immigration can be obtained by subtracting from the number of total Mexican immigrants counted in the

[3] See Bean, Edmonston and Passel (1990) for an overview of the evidence on illegal immigration from Mexico to the U.S.

decennial census the reported number of legal Mexican immigrants. However, this is an inaccurate measure of illegal immigration for a variety of reasons. First, we err when enumerating the "known" quantity of legal immigrants because we lack information on deaths of immigrants and on return migration. Second, we also err in the accounting of immigrants in the decennial census because there likely exists an undercount of immigrants (both illegal and legal). In addition, the relative undercount of legal and illegal immigrants is likely to differ. But even if such a number were accurate, the stock of illegal immigrants in the U.S. at 10-year intervals is of only limited use to us, given the nature of the questions being asked. Indeed, for our purposes, a higher frequency time series that allows us to uncover the effects of trade and monetary integration on illegal international labor flows would be more useful.

In practice, estimates of the flow of illegal immigration into the United States are usually based on the Immigration and Naturalization Service's (INS) series of apprehensions of illegal immigrants. Such a series may serve as a proxy for the changing flow of illegal immigration. We might reason that the greater the number of apprehensions, the greater the number of individuals successfully crossing the border and, hence, the greater the level of illegal immigration. However, several problems remain with such a series, all of which represent only the "tip of the iceberg." First, for each individual apprehended, many more illegal immigrants may be undetected, and we do not know that these relative proportions are constant. Second, there is a considerable number of "commuters" who cross the border on a daily basis. Consequently, an individual may be apprehended several times in one year. Should we, therefore, treat multiple individual apprehensions as several potential illegal immigrants, or simply as one? Finally, the third problem that exists refers to the narrowness of the questions at hand. What would be the impact of trade and monetary integration on illegal immigration of Mexican nationals into the U.S.? Not all INS apprehensions are of *Mexican* nationals. A number are from Central America, Asia, or from other regions of the world. Nonetheless, these apprehension data are probably the best available to discern the flow of undocumented persons of Mexican origin into the U.S. The INS (1999) reports that, in 1998, 1.6 million out of a total of 1.62 million deportable aliens—that is 96 percent—were Mexican nationals.

We adopt the approach of Hanson and Spilimbergo (1999) and use apprehension data to extract information on the flow of Mexican illegal immigration into the U.S. We follow their methodology and note that apprehensions of undocumented immigrants at time t (APP_t) can be expressed as follows:

$$(1)\quad APP_t = P(HOURS_t, M_t) * M(X_t)$$

with P representing the probability of being detained by the INS while crossing the border. This probability of detection is a function of the level of resources the INS devotes to border patrol (HOURS) and the number of undocumented persons (M) attempting the crossing. The number of undocumented persons attempting to cross, in turn, depends on a vector of economic variables that affects migration (X_t). By substituting $M(X_t)$ into $P(HOURS_t, M_t)$, we obtain the following reduced form equation:

$$(2)\ (APP_t = f(HOURS_t, X_t))$$

This equation represents the number of apprehensions while accounting for border patrol resources and other factors (those included in the vector X) that might influence migrants' border crossings. We use monthly apprehensions data and monthly border patrol linewatch hours (Hanson and Spilimbergo, 1999). Since "corrected" apprehensions and M_t are directly correlated to each other, we are, in effect, tracking the level of illegal immigration. Therefore, by estimating equation (2), we can assess the impact of various variables and policy choices on illegal immigration.

To properly specify equation (2), we need to consider the factors that prompt migration (the vector X). Most immigration scholars attempting to explain the level of illegal immigration from Mexico to the U.S. would include as explanatory variables the Mexican real wage and the U.S. real wage. Indeed, Hanson and Spilimbergo (1999) and Borjas and Fisher (2001) control for the Mexican and U.S. real wages in their models of illegal immigration. Increases in the Mexican real wage are thought to deter illegal immigration into the U.S., while increases in the U.S. real wage increase the incentive of Mexican workers to migrate to the U.S. In this paper, we use a monthly index of the average nominal hourly wage of production labor in manufacturing to measure Mexican wages. This series is from Hanson and Spilimbergo. We deflate it using the Mexican CPI (obtained from *IMF Statistics)*. Similarly, we deflated the U.S. manufacturing wage (from Borjas and Fisher) using the U.S. consumer price index (CPI) to obtain a real U.S. wage series.

Another variable that potentially affects the level of illegal immigration is the real exchange rate. The real exchange rate between the peso and the dollar measures the relative cost of living in, and visiting, the U.S. from the perspective of a Mexican resident. There may be some controversy regarding the necessity of controlling for the real exchange rate. But we reason that given the "fluidity" in living arrangements by individuals in the border areas, we need to account for the exchange rate. Many persons (not necessarily attached to the labor market) make frequent border crossings to visit, shop and remain for extended periods of time with family and friends on the other side. Fullerton (2000), for example, finds that real currency move-

ments help explain bridge crossings from Ciudad Juarez, Mexico to El Paso, Texas. To account for these other sources of border crossings, we include the real exchange rate (REAL) in our vector X. As REAL rises — REAL defined as $[E_{peso/\$}$ CPIU.S.]/CPIMEX — the peso experiences real depreciation, making it more costly to travel to the U.S. We hypothesize that real depreciation reduces the number of illegal border crossings from south to north. This is analogous to service and good imports falling (rising) when the local currency depreciates (appreciates).

Trade Integration

Measuring trade integration is much less complicated than measuring illegal immigration. We use two variables to capture trade integration in equation (2): a dichotomous variable and a continuous trade volume variable. We employ a dummy variable to distinguish the pre-NAFTA period from the post-NAFTA period. However, due to the simultaneous passage of NAFTA and "Operation Gatekeeper" in 1994, we cannot infer much about changes in the behavior of illegal immigration from a single level dummy.

To account for the volume of real trade flows between the U.S. and Mexico over time, we use a second variable in our estimation. In particular, real U.S. exports to Mexico are summed to real U.S. imports from Mexico to measure the total volume of Mexico/U.S. trade. Since the NAFTA treaty was to be implemented according to a timetable, a volume of trade variable is anticipated to better measure the growing level of trade integration over time. The nominal trade series were obtained from the OECD's *Statistics of Foreign Trade.*

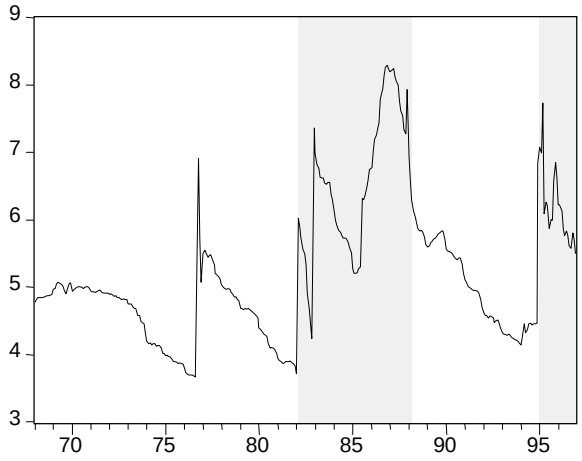
Dollarization

Borjas and Fisher (2001) examine the impact that dollarization in Mexico would have on illegal immigration to the U.S. They assume that illegal immigration takes place to exploit wage differentials and, by comparing the impact of different exchange rate regimes on the Mexican labor market, they assess the impact that dollarization may have on illegal immigration. In particular, Borjas and Fisher compare the elasticity of illegal immigration to wage movements during periods when Mexico had a system of fixed nominal exchange rates in place to periods when Mexico allowed the nominal exchange rate to be market determined. They associate a fixed nominal exchange regime with dollarization and arrive at two conclusions. First, shocks to the labor market would be greater under dollarization. Second, the elas-

ticity of migration to changes in the wage differential would rise with dollarization. That is, the level of illegal immigration would be more responsive to wage differentials. This result, in conjunction with the greater magnitude of shocks that would take place under dollarization, has lead them to conclude that illegal immigration would be more volatile under dollarization.

We use a different approach, and reason, that dollarization implies more than fixing the nominal exchange rate. It means accepting a common monetary policy, which would imply that Mexico's *real* exchange rate (rather than nominal exchange rate) would be stabilized. Of course, dollarization means that the nominal exchange rate is fixed but, more importantly, it implies that Mexican prices, relative to U.S. prices, would tend to converge. Hence, instead of comparing fixed nominal exchange regimes with flexible nominal exchange regimes in order to capture the extent of dollarization, we use variation in the smoothness of the real exchange rate as a proxy for dollarization.

Figure 1. Real peso/dollar exchange rate
(Shaded areas correspond to flexible exchange regime periods).



To back our point that it may be misguided to focus on nominal exchange rate regimes to compare a dollarized economy to a non-dollarized economy, refer to Figure 1. Figure 1 plots the monthly real peso/dollar exchange rate from 1968 through 1996. According to Borjas and Fisher, the periods February 1982 through March 1988 and January 1995 through December 1996 correspond to flexible exchange regime periods. In figure 1, we have shaded the two flexible nominal exchange regime periods 1982:02 to 1988:03 and 1995:01 to 1996:12. Examination of this plot reveals that fixed nominal exchange regime periods do not result in stable real exchange rates and do not

exempt countries from real exchange rate volatility. Instead, we see dramatic movements in the real exchange rate series, both during flexible and during fixed exchange regime periods.

Therefore, we, instead, argue that we can expect dollarization to result in more stable real exchange rates.

We resort to the empirical findings of Abdel-Kader and Balan, 2001, to further strengthen our claim regarding dollarization's impact on the volatility of the real exchange rate. Using a panel of 33 European and Latin American countries, they find that dollarization reduces the volatility of the real exchange rate. They use monthly data from 1995 through 1999, and measure dollarization, and variations in dollarization, using the so called "dollarization ratio": the ratio of foreign currency deposits to M2. The volatility of the real exchange rate is regressed on the dollarization rate. Using a random effects estimator, they find that countries that experience greater levels of dollarization (as measured by the dollarization ratio) experience lower volatility in the real exchange rate.This is true whether, or not, the panel includes as control variables the volatility of the inflation differential to account for other variables or noise that might explain real exchange rate variability. We take this as empirical support for our hypothesis that full dollarization would stabilize the real exchange rate.[4]

As a result, our analysis addresses the question: "what impact will dollarization have on illegal immigration?" We answer this question by measuring how real exchange rate volatility impacts the level of illegal immigration, as proxied by our apprehensions measure.

Data, Estimation, and Results

In order to isolate the impact of progressive economic integration on the illegal immigrant flow, we distinguish between commercial and monetary economic integration by using volume of trade and real exchange-rate volatility, respectively. In particular, we estimate the following equation:

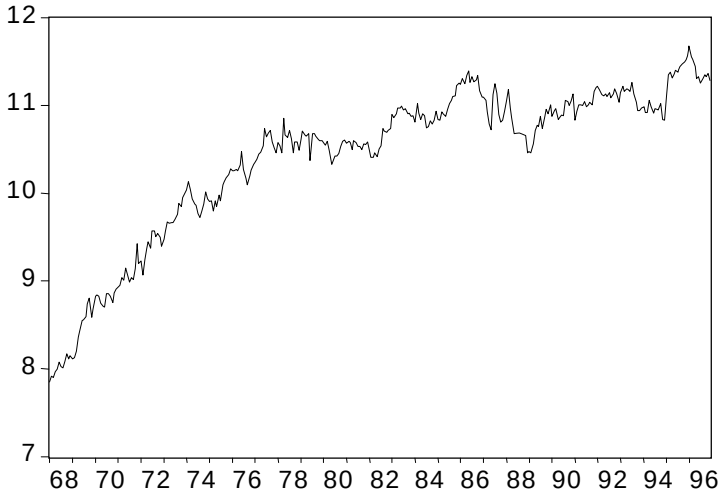
$$(3)\ \text{LAPP} = \alpha + \beta_1 \text{LHOURS} + \beta_2 \text{LRWAGESUS} + \beta_3 \text{LRWAGESMEX} + \beta_4 \text{LREAL} + \beta_5 \text{LRTRADE} + \beta_6 \text{YEAR\_1994} + \beta_7 \text{VOLREAL} + \varepsilon_t$$

The log of monthly apprehensions (LAPP) is posited to depend on the number of hours that the INS devotes to border patrol (LHOURS), the log

[4] The Abdel-Kader and Balan paper is more properly testing the impact of partial dollarization. It is possible that full dollarization could result in a different effect on the real exchange rate than partial dollarization. Also note that this paper does not distinguish between dollarization (adoption of the U.S. dollar by Mexico) and the adoption of a common currency that would be managed *jointly* by treaty members.

of U.S. real wages (LRWAGESUS), and the log of Mexican real wages (LRWAGESMEX). In addition, we recognize that crossings are likely to be highly related to the real exchange rate, which measures the real cost of traveling, purchasing, and visiting in the U.S. We include a level dummy, YEAR_1994, indicating the date of implementation of the North American Free Trade Agreement and of "Operation Gatekeeper." The primary variables of interest, the deflated volume of trade in millions of U.S. dollars (LRTRADE) and the volatility of the real exchange rate (VOLREAL) are also included.

Figure 2. Log of Apprehensions.



The volume of trade is defined as: exports and imports in millions of U.S. dollars, deflated by the U.S. CPI. The volatility of the real exchange rate is obtained by calculating the 12-month moving standard deviation of percentage changes in the monthly real exchange rate. To correct for any seasonal patterns in the data, we seasonally adjust all the series using the X11 procedure in SAS. In addition, prior to estimation, all the variables are transformed into natural logarithms, with the exception of the level dummy and real exchange-rate volatility. Simple descriptive statistics for these series (seasonally adjusted but not logged) are displayed in Table 1.

Time plots of the series are also provided in Figures 1 through 7. Even after smoothing our series, the time plots indicate that our series are trending. Hence, before estimating our model, we test each of the series to determine whether they are stationary or not, and the type of nonstationarity in the latter case. As suggested by (Dickey, Bell and Miller, 1986), we use the formal augmented Dickey Fuller (ADF) unit root tests in order to test for the presence, and

type, of nonstationarity. The test is conducted including a drift term and both with and without a trend.

Table 1. Descriptive Statistic for Seasonally Adjusted Series Sample: 1968: 01, 1996: 12.

Statistics	*APP*	*HOURS*	*RWAGESMEX*	*RWAGESUS*	*REAL*	*RTRADE*	*VOLREAL*
Mean	43,198	182,073.0	2.3996	0.1429	5.2297	39.3248	0.0325
Median	43,314	172,575.1	2.4595	0.1441	4.9772	36.0680	0.0113
Maximum	118,444	387,786.9	3.2288	0.1563	8.3090	115.7240	0.2099
Minimum	2,569	70,629.13	1.7466	0.1297	3.6650	7.4361	0.0002
Std. Dev.	24,783	69,659.43	0.3426	0.0077	1.0420	25.6875	0.0479
Skewness	0.1666	0.6910	-0.2062	-0.2650	0.9741	0.8473	1.9474
Kurtosis	2.4237	3.3998	2.0928	2.0242	3.6193	3.0565	5.3907
Obs.	348	348	348	348	348	348	346

Notes: The real Mexican and U.S. wage series are index numbers derived from different sources and constructed in different ways and hence are not directly comparable to each other.

Figure 3. Log of Border Patrol Hours.

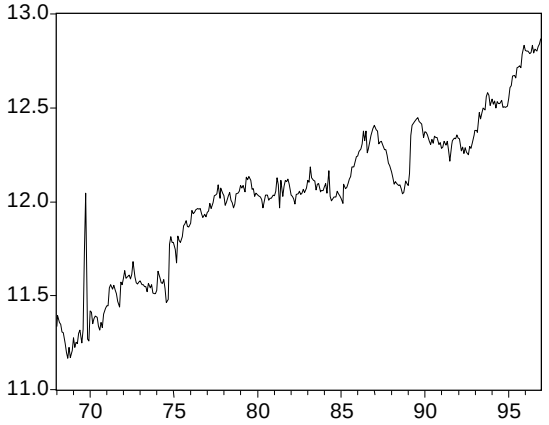


Table 2 contains the results from the unit root tests. The results indicate that, with the exception of exchange-rate volatility (and the dummy variable, of course), all the series are nonstationary. The ADF test results are invariant to the inclusion of a linear trend. The inclusion of a trend in the ADF unit root test allows us to test whether the series is difference or trend stationary. The results from this latter test lead us to accept the null hypothesis of difference stationary processes for each of the nonstationary series. Furthermore, columns 4 and 5 indicate that none of the nonstationary series contains a second unit root. We, therefore, conclude that all the nonstationary series are I(1) processes and require differencing to attain stationarity.

Table 2. Unit Roots Tests.

Series	*ADF statistics for unit root without a trend (no. of lags used in unit root test)*	*ADF statistics for unit root with a trend (no. of lags used in unit root test) root test)*	*ADF statistics for second unit root whitout a trend (no of lags used in unit in unit root test)*	*ADF statistics for second unit root with a trend (no. of lags used*
LAPP	-3.25(6)	-2.80(6)	-7.3946(6)	-7.76(6)
LHOURS	-0.69(2)	-3.10(2)	-14.60(2)	-14.58(2)
LRWAGESMEX	-1.23(12)	-2.08(12)	-4.64(12)	-4.69(12)
LRWAGESUS	-0.72(12)	-2.87(12)	-3.74(12)	-3.85(12)
LREAL	-2.43(2)	-2.58(2)	-11.79(2)	-11.78(2)
VOL	-5.13(10)	-5.20(10)	-4.53(10)	-4.53(10)
LRTRADE	-0.92(11)	-2.92(11)	-4.03(11)	-4.03(11)

Note: The numbers of lags was chosen minimizing the Akaike's AIC criterion. At the 5% level of significance, the critical value for each test with trend is -3.42, the critical value for each test without trend is -2.87. At the 1% level of significance, the critical value for each test with trend is -3.98, the critical value for each test without trend is -3.45. These critical values are taken from Dickey and fuller (1979).

We also examine whether the I(1) series are cointegrated (Pindyck and Rubinfeld, 1997).[5] The cointegration test examines whether there is a stationary linear combination of nonstationary random variables using Johansen's (1991) methodology. The results from the cointegration tests at the 5% and 1% level of significance are reported in Table 3. The test results indicate that our I(1) series are cointegrated. Furthermore, there is one cointegrating vector. Therefore, a long-run equilibrium relationship exists among LAPP, LHOURS, LRWAGESUS, LRWAGESMEX, LREAL, and LRTRADE. Some of the coefficients in the normalized cointegrating equation, such as that of the log of U.S. real wages, do not display the expected positive signs. However, as revealed by the asymptotic standard errors, the coefficients are not significantly different from zero. Finally, since the I(1) series are cointegrated, we need to account for the long-run equilibrium relationship (that was purged with the differencing) by including an error correction term. We thus estimate the following error correction model using the (Engle-Granger, 1987) two-step procedure:

$$(4)\ D(LAPP_t) = \alpha + \beta_1 D(LHOURS_t) + \beta_2 D(LRWAGESUS_t) + \beta_3 D(LRWAGESMEX_t) + \beta_4 D(LREAL_t) + \beta_5 D(LRTRADE_t) + \beta_6 YEAR\_1994 + \beta_7 VOLREAL_t + u_{t-1} + \varepsilon_t,$$

where D denotes first differencing of the series and u_{t-1} stands for the lagged OLS residuals from the estimation of the long-run relationship corresponding

[5] Not accounting for the existence of a long-run relationship between the integrated series could result in a specification error yielding inconsistent estimates.

to the first step regression in the Engle-Granger, 1987, two-step estimation procedure. The OLS residuals were obtained from the regression of LAPP on a constant, LHOURS, LRWAGESUS, LRWAGESMEX, LREAL, and the LRTRADE.

Figure 4. Log of Real US Wages.

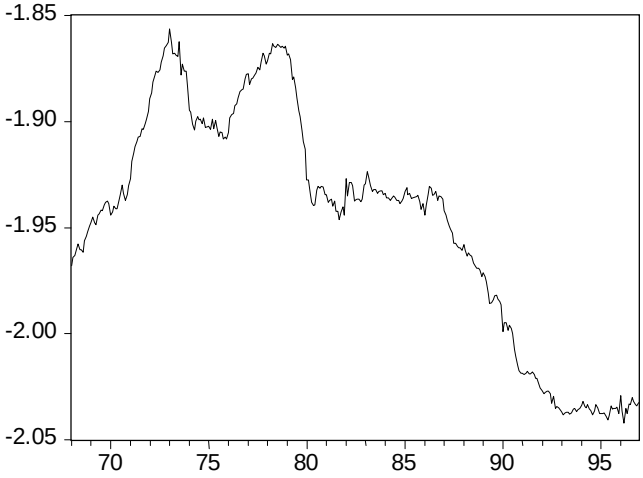


Table 3. Cointegration Tests and Cointegrating equation.

H_0: r	n-r	Likelihood	5% critical ratio	1% critical value	Hypothesized value
no. of CE(s)					
0	6	107.64	94.15	103.18	None*
1	5	63.12	68.52	76.07	At most 1
2	4	34.37	47.21	54.46	At most 2
3	3	17.02	29.68	35.65	At most 3
4	2	5.52	15.41	20.04	At most 4
5	1	0.57	3.76	6.65	At most 5

Normalized cointegrating coefficients: 1 cointegrating equation (standard errors)

LAPP	LHOURS	LRWAGESMEX	LRWAGESUS	LREAL	LRTRADE
1.000	10.8917	-13.0896	-17.7589	-13.8901	-9.96845
	(18.7400)	(21.1990)	(19.5312)	(21.3236)	(14.2556)

Log-likelihood: 3937.73

Notes: r is the number of cointegrating vectors under the null and n is the number of integrated series entering in the test. The **(*) denote rejection of the null hypothesis at the 10% and 5% significance levels respectively. The test is conducted assuming that the series have means and linear trends but the cointegrating equations have only intercepts. Two lags are used since that is the number of lags that minimizes the Akaike's AIC criterion. Critical values are provided by the EVIEWS software package, that uses the cointegration framework and critical values from Johansen (1991). The normalized cointegrating equations all include a constant term.

Table 4. Error Correction Model Results.

Dependent variable: D(LAPP)
Sample (adjusted): 1968:03, 1996:12
Included observations: 346 after adjusting endpoints
White heteroskedasticity-consistent standard errors & covariance

Variable	*Coefficient*	*Std. error*	*t-Statistic*	*Prob.*
Constant	0.0056	0.0059	0.9526	0.3415
D(LHOURS)	0.4324	0.0564	7.6742	0.0000
D(LRWAGESMEX)	-0.1092	0.1196	-0.9129	0.3620
DLR(WAGESUS)	1.1358	1.3907	0.8167	0.4147
D(REAL)	-0.0743	0.0645	-1.1519	0.2502
D(LRTRADE)	-0.0373	0.0616	-0.6056	0.5452
YEAR_1994	-00385	0.0160	-2.4057	0.0167
VOLREAL	0.2160	0.0857	2.5202	0.0122
u_{t-1}	-0.1160	0.0255	-4.5567	0.0000

R-squared	0.1466
Adjusted R-squared	0.1264
F-statistic	7.2375
Prob(F-statistic)	0.0000
Log likelihood	352.0446

The results of estimating equation (4) are presented in Table 4. The coefficient on ut-1 is statistically different from zero, reaffirming the existence of a long-run equilibrium relationship between the six cointegrated variables. As expected, border patrol resources result in an increase in apprehensions. Despite the fact that both the Mexican and the U.S. real wages display the expected signs *(i.e.,* a higher Mexican real wage reduces illegal immigration while a higher U.S. real wage promoted illegal immigration), they do not appear to be significantly different from zero once we control for the remaining factors affecting illegal immigration. Similarly, while a higher real exchange rate *(i.e.,* peso depreciation) is associated with less illegal immigration, the level of the real exchange rate does not appear to significantly prompt illegal immigration. Commercial integration, as measured by the volume of trade, does not appear to significantly lower illegal immigration. However, the passage of YEAR_1994 dummy appears to be statistically different from zero, signaling a reduction in illegal immigration after 1994, even after accounting for any time trends. Since the year dummy might be capturing a variety of events affecting illegal immigration before and after 1994, such as the passage of NAFTA or the

implementation of "Operation Gatekeeper", we interact the level dummy with the volume of trade to capture the effect of trade under NAFTA in an alternative specification included in Table 5. However, trade remains statistically no different from zero in affecting illegal immigration. Finally, the volatility of the real exchange rate appears to contribute to illegal immigration, suggesting that increasing economic integration through dollarization could result in less illegal immigration.

Figure 5. Log of Real Mexican Wages.

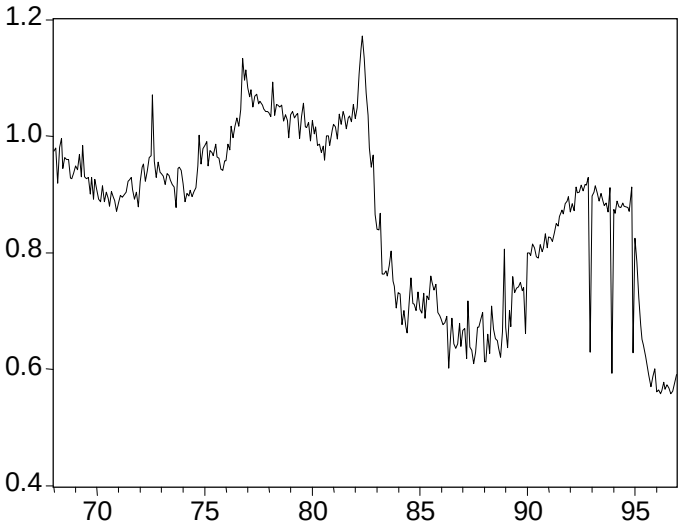


Figure 6. Log Real Trade Volume.

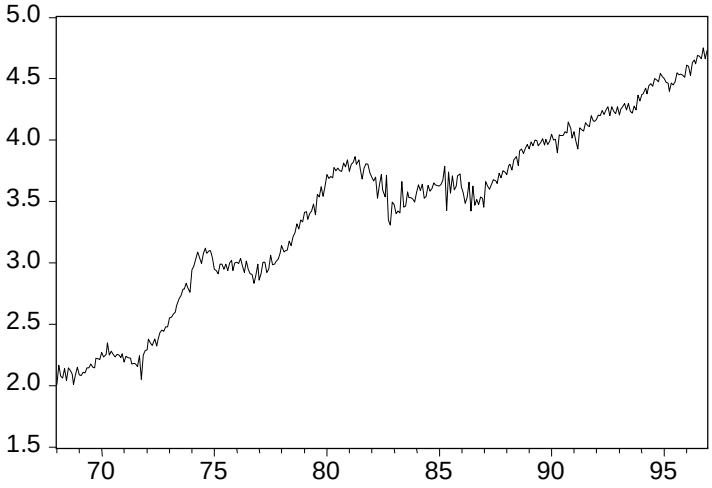
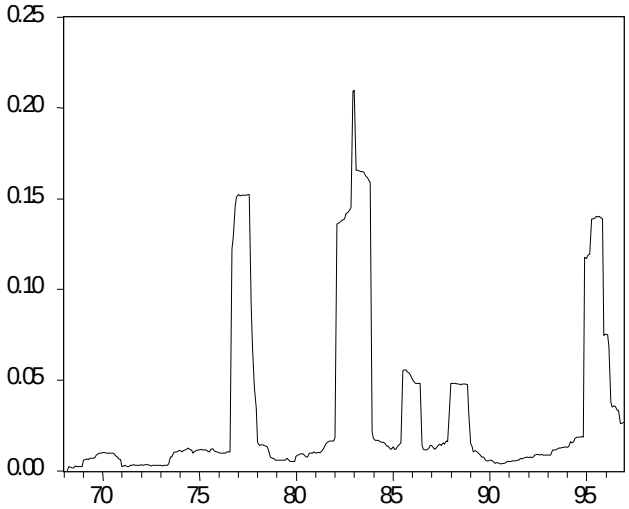


Table 5. Error Correction Model Results with Interaction Term.

Dependent variable: D(LAPP)
Sample (adjusted): 1968:03, 1996:12
Included observations: 346 after adjusting endpoints
White heteroskedasticity-consistent standard errors & covariance

Variable	*Coefficient*	*Std. error*	*t-Statistic*	*Prob.*
Constant	0.0058	0.0059	0.9750	0.3302
D(LHOURS)	0.4272	0.0553	7.7206	0.0000
D(LRWAGESMEX)	-0.0975	0.1204	-0.8100	0.4185
DLR(WAGESUS)	1.3314	1.4114	0.9433	0.3462
D(REAL)	-0.0696	0.0672	-1.0356	0.3011
D(LRTRADE)	-0.0193	0.0620	-0.3114	0.7557
YEAR_1994	-00338	0.0165	-2.0519	0.0410
YEAR_1994* D(LRTRADE)	-0.3846	0.2980	-1.2905	0.1978
VOLREAL	0.2083	0.0854	2.4398	0.0152
u_{t-1}	-0.1151	0.0254	-4.5215	0.0000
R-squared	0.1506			
Adjusted R-squared	0.1278			
F-statistic	6.6177			
Prob(F-statistic)	0.0000			
Log likelihood	352.8472			

Figure 7. Real Exchange Rate Volatility.



Overall, aside from the structural change in illegal immigration before and after 1994, the results indicate that illegal immigration might be effectively lowered through enhanced economic integration in the form of dollarization, as captured by the lower volatility of the real exchange rate.

Concluding Remarks

In this paper, we have attempted to discern the impact that increasing economic integration might have on the flow of illegal immigrants into the U.S. from Mexico. The conclusions derived are based on two major premises: *i)* that the adjusted apprehension data serves as a proxy for illegal immigration into the U.S. from Mexico, and *ii)* that dollarization will result in greater stability in relative prices between Mexico and the U.S. Under these premises, we find evidence of a structural change in the level of immigration before and after 1994, either as a response to the passage of NAFTA, the implementation of "Operation Gatekeeper," both, or even other simultaneous events. In any instance, the results reveal that while commercial integration in the form of increasing trade has not significantly affected illegal immigration, monetary integration in the form of dollarization of the Mexican economy would result in a reduction in the flow of undocumented migrants from Mexico to the U.S., *ceteris paribus*.

Data Appendix[6]

Apprehensions: From (Hanson and Spilimbergo, 1999). Line-watch apprehensions includes apprehensions at the borders and at other international ports of entry.

Linewatch hours: From (Hanson and Spilimbergo, 1999). Number of person hours spent patrolling the border and at other international ports of entry.

Mexican Wage: From (Hanson and Spilimbergo, 1999). Monthly index of average nominal hourly wages in manufacturing.

U.S. wage: From (Borjas and Fisher, 2001). Nominal hourly wages in the manufacturing sector.

Mexican CPI: From IMF, International Financial Statistics. Monthly.

U.S. CPI: From IMF, International Financial Statistics. Monthly.

Nominal Peso/U.S. dollar exchange rate: From IMF, International Financial Statistics. Monthly.

[6] We are grateful to Eric O'N. Fisher for providing is with the following series: Apprehensions, Linewatch hours, Mexican wages, U.S. wages.

U.S. exports to Mexico: From OECD, Statistics of Foreign Trade; in millions of U.S. dollars, monthly.

U.S. Imports from Mexico: From OECD, Statistics of Foreign Trade; in millions of U.S. dollars, monthly.

YEAR_1994: dummy variable taking on the value 0 before 1994 and 1 thereafter.

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