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Policy Reforms and the Gender Dynamics of Rural Mexico-to-U.S. Migration

by

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ABSTRACT

The supply of immigrant workers from Mexico is critical to both agricultural and non-agricultural sectors in the United States. Approximately one half of all Mexican immigrants are females who typically are employed in positions that have minimal legal status requirements, e.g., domestic services and clerical and agricultural jobs. In the past two decades, the United States implemented policy reforms motivated in large part by the desire to curtail Mexico-to-U.S. migration. Despite the large female share and differences in the sector of employment of female and male Mexican immigrants, there has been no effort, to our knowledge, to formally test for gender and employment sector differences in the impact of policy shocks on migrant flows. This paper utilizes data from the 2003 Mexico National Rural Household Survey to econometrically test the effects of U.S. immigration and trade reforms on the gender and employment sector-destination of rural Mexico-to-U.S. migrants. Findings indicate that U.S. immigration and trade policies are both gender and employment-sector specific. Female migration is more sensitive than male migration to immigration reforms and other policy shocks. We also find evidence that past migration by females has little effect on male migration, and vice versa.

The supply of immigrant workers from Mexico is critical to agricultural and non-agricultural sectors in the United States. Although Mexican immigrants constitute only 3.5% of the U.S. labor force, they are concentrated in specific employment sectors: 25% are in the service sector while 29% are involved in production and transportation occupations (Grieco and Ray 2004). Mexico-born persons represented an estimated 77% of the U.S. farm workforce in 1997-98 (U.S. Department of Labor 2000). Approximately one half of all Mexican immigrants are females, many of whom are employed in positions that have minimal legal status requirements, including domestic services and agricultural jobs (Kanaiaupuni 1999).

Despite the large female share and differences in employment sector of female and male immigrants from Mexico, there has been no effort, to our knowledge, to model the gender dynamics of Mexico-to-U.S. migration or to formally test for differences in the impacts of policy reforms by migrants' gender and sector of employment. The present research exploits unique new data from the 2003 Mexico National Rural Household Survey (ENHRUM) to econometrically test the effects of two major U.S. policy reforms, the Immigration Reform and Control Act (IRCA) of 1986 and the North American Free Trade Agreement (NAFTA) of 1994, as well as increased U.S. government expenditures on border enforcement, on the gender and sector composition of immigrant labor supply from rural Mexico to the United States. The effects of these policies have generated lively debate on the overall effectiveness of policies at curtailing Mexico-to-U.S. migration (Cerrutti and Massey 2004; Donato and Patterson 2004; Kossoudji and Ramey 1984; Martin 2004; Massey and Espoinosa 1997; Orrenius 2004). Nevertheless, the gender dynamics of Mexico-to-U.S. migration have not been a focus of past research. The same policy may have differential effects on female and male migration and for the supply of migrant labor to different sectors for reasons given below.

Using retrospective migration life-history data, we estimated separate dynamic econometric models for female and male migration from rural Mexico to farm and nonfarm jobs in the United States between 1980 and 2002. The models were used to test whether the implementation of IRCA, NAFTA, and heightened U.S. border enforcement significantly altered the dynamics of male and female migration to the two sectors. The analysis controls for macroeconomic variables, migration networks, and village characteristics that may influence the decision to migrate.

GENDER AND EMPLOYMENT SECTOR OF MEXICAN IMMIGRANTS

Workers from rural Mexico were recruited under the Bracero program to alleviate U.S. labor shortages created by World War II. From 1942 to 1964 over 4.5 million Mexicans temporally worked in the United States in the agricultural sector under the Bracero Program (Donato and Patterson 2004; Durrand, Massey, and Paredo 1999). The vast majority of Bracero workers were males.[1] Even though the Bracero Program was eventually terminated, the number of immigrants working in U.S. agriculture did not diminish. Between 1964 and 1980 annual legal entry grew by 76% and undocumented entry rose by 42.6% (Durand et al. 1999). By the year 2000, there were more than nine million Mexico-born persons living in the United States, of which 77.5% were not naturalized U.S. citizens (See Table 1). The large non-legalized share of the Mexico-born population in the U.S. highlights the significant effect that U.S. policies potentially

[1] The Bracero Program required housing of workers in barracks, and if provisions were ever made for female barracks, these certainly would have been rare.

could have on Mexican immigrant workers and the sectors in which they are concentrated.

The employment of foreign born workers is more concentrated in the service sector than the employment of native born workers (23.3% versus 14.9%, respectively). However, Latin America-born workers, most of whom are from Mexico, are more likely than other foreign-born workers to be employed in transportation, production, construction and the service sector. Sectors of employment for female immigrants from Latin America are less diverse (see Figures 1 and 2). Forty percent are employed in the service sector, and the rest are concentrated in either construction or farming industries. These statistics provide preliminary evidence that Mexican male immigrants may have more flexible employment options than Mexican female immigrants in response to policy shocks that affect employment in particular sectors. Moreover, the gender stratification of employment may limit the effectiveness of migration networks at transmitting labor market information between male and female migrants, and vice-versa.

U.S. IMMIGRATION POLICIES AND TRADE REFORMS

In the past two decades the United States implemented immigration and trade reforms that either directly or indirectly intended to curb the flow of immigrants. We evaluate two immigration policies: IRCA and increased border control expenditures, and one trade reform: NAFTA. The first two policies obviously targeted immigration; however, NAFTA was motivated in part by the expectation that, in the long run, trade and migration are substitutes.[2] All three policies can discourage migration by increasing migration costs or decreasing economic benefits of migration for migrants and their

[2] Presidents Salinas and Bush (Senior) argued this point to gain support for NAFTA.

households of origin. However, each policy also produces unintended consequences that may counteract or even reverse negative immigration effects (Cerrutti and Massey 2004; Donato and Patterson 2004; Kossoudji and Ramey 1984; Martin 2004). Furthermore, the nature of each policy may have differential influences on male and female migration.

The Immigration Reform and Control Act

In 1986, the U.S. Congress passed the Immigration Reform and Control Act (IRCA), which had three main components aimed at curtailing and controlling immigration (Cerruitti and Massey 2004). First, it imposed sanctions on employers who knowingly hired illegal aliens. These penalties were meant to discourage the hiring of unauthorized immigrants and reduce migration by dampening the employment expectations of migrants. Second, IRCA provided amnesty to illegal aliens who have continually lived in the U.S. since 1982 through the Legally Authorized Worker (LAW) program. To be considered for amnesty illegal aliens had to apply before 1988. Third, the Special Agricultural Worker (SAW) program legalized about 1.2 million of the 1.3 million applicants who submitted evidence of having performed at least 90 days of farm work in 1985-1986 as unauthorized workers (Cerruitti and Massey 2004; Durand et al. 1999).

While employer sanctions intended to decrease the economic incentives for illegal migrants, the LAW and SAW programs may have encouraged migration by family members of newly legalized migrants while also sending a signal to rural Mexicans that future amnesty deals might be forthcoming. Legalization may have decreased circular migration by allowing newly legalized migrants to remain legally in the U.S. year round. If these counteracting effects were greater than the deterrent created by employer sanctions, IRCA may have increased rather than decreased the flow of immigrants from Mexico.

A decrease in circular migration could stimulate new migration for family reunification. Cornelius (1990) argued that female immigration was positively impacted by IRCA as wives and children in Mexico crossed the border to reunite with husbands and fathers in the United States. One study estimated that 300,000 persons per year migrated illegally for family reunification, while another found that a family member legalized by IRCA increased the probability of illegal entry by a factor of seven (Durand et al. 1999). Thus, females may have different migration responses to IRCA than males.

Female immigrants in the U.S. are typically employed in informal sectors with high concentrations of unauthorized migrants who were not given preferential treatment under IRCA (Kossoudji and Ranney 1984). Females in occupations such as domestic services may have been at a disadvantage under LAW amnesty program rules, which required documentation on work history (Donato, Kanaiaupuni, and Stainback 2001). On the other hand, female migrants may have been insulated from the effects of employer sanctions, which were directed primarily at formal-sector employers. A high concentration of females in specific sectors also has implications for the impact of migrant networks on female migration.

Thus, even though IRCA decreased the economic incentives to hire immigrants, its legalization provisions may have had the opposite effect, and there are reasons to expect that the positive and negative influences of IRCA may have played out differently for male and female migrants.

Border Control

The second U.S policy that we evaluate is the increase in enforcement along the U.S.-Mexico border. In 1993, enforcement was increased sharply in high traffic areas, especially along the California and Texas borders (Cerrutti and Massey 2004). Between 1994 and 1999, the number of "line hours" that the border was monitored increased by 300% and the number of border officers increased by 75%. The budget for border enforcement doubled between 1993 and 1997 (See Figure 3; Orrenius 2004) and in the 1990s there were four major border control crackdowns intended to curtail unauthorized immigration along the easiest routes of entry (Cerrutti and Massey 2004).

While the desired effect of border enforcement was to discourage illegal migrants from entering into the U.S., vigilant border enforcement and crackdowns in certain states ultimately discouraged unauthorized immigrants from returning to their home countries. Several studies have suggested that migrants and border patrols partake in a cat and mouse game: the border control catches the migrant at the border and releases him back into Mexico where he will try again to enter the U.S., and likely succeed (Donato and Patterson 2004; Kossoudji 1992).

Increased border enforcement could have two effects on female migrants. First, several studies have shown that women are more risk averse to crossing borders illegally and without documents (Donato and Patterson 2004). Legal documents are generally not available to new migrants from rural Mexico, and smugglers charge high fees for providing their clients with "documented" entry (that is, entry through U.S. immigration check points with falsified documents). Therefore, the increase in border enforcement could disproportionately increase the costs of unauthorized entry for new female labor migrants. However, it also may disproportionately discourage unauthorized female migrants from returning to Mexico (and having to repeat the border entry) once they are in the United States.

North American Free Trade Agreement

NAFTA was only partially motivated by immigration concerns, but it was expected to have far-reaching impacts on migration flows. In the long run, NAFTA was expected to stimulate employment in Mexico's manufacturing and agricultural export sectors, offering local alternatives to migration, by opening up new export markets. Some models predicted that employment in Mexico would rise by 2% because of foreign investment (Martin 2004). However, in the short run NAFTA could displace rural workers as production shifts from importables (e.g., maize) to exportables (e.g., *maquiladora* industries) and labor markets adjust to new market realities. Displacement of workers was also expected to result from a dismantling of agrarian policies and a phase-out of price supports for eleven agricultural field crops as well as from a reduction in credit subsidies offered by the Mexican National Agricultural Bank (BANRURAL; Yunez and Barceinas 2004). Computable general equilibrium (CGE) models predicted that the increase in labor demand generated by exports to the U.S. would be insufficient to absorb displaced agricultural workers (Levy and van Wijnberger 1992; Robinson et al. 1991).

The effects of NAFTA, like immigration policies, may be gender specific. Most farmers and landowners in Mexico are males and policies such as privatization and decreases in price supports thus could disproportionately encourage migration by males. Dismantling of the national agricultural bank could encourage migration by males seeking remittances to overcome credit constraints. The growth of *maquiladoras*, labor-intensive manufacturing operations with a predominantly female workforce, could increase the incidence of internal migration and discourage international migration by women. If women's employment opportunities in traditional agriculture are limited, we would expect NAFTA to have less of a positive short-run impact on female than on male migration to the United States. However, if *maquiladoras* increase employment opportunities for females in Mexico, we would expect NAFTA to decrease female immigration.

In short, all three policies' possible impacts on migration are complex and theoretically ambiguous and can only be determined empirically. In order to isolate the effects of these policies on female and male migration from rural Mexico to the U.S. it is necessary to control for gender-specific migration dynamics for the individual, household, and community variables influencing migration decisions over time, and for other macroeconomic variables that may have affected migration.

Impacts of Migration Networks

Several studies have cited the importance of migration networks in determining the propensity of an individual to migrate (Boyd 1989; Massey et al. 1993; Menjivar 1995; Munshi 2003). Migration networks can be defined as "sets of interpersonal ties that connect migrants, former migrants, and nonmigrants in origin and destination areas through ties of kinship, friendship, and shared community origin" (Massey et al. 1993: 448). These sets of ties can decrease migration costs by providing would-be migrants with critical information about border crossing and employment. Past migrants also may assist in financing the costs of future migrants. Therefore, migration networks can positively influence the probability of migration and also the economic returns from migration (Winters, de Janvry, and Sadoulet 1999).

There are compelling reasons to expect that the effects of networks are gender and sector specific. If the economic value of networks stems from the provision of job information within specific economic sectors, the high sectoral concentration of unauthorized female workers may limit the influence of male migrant networks on female migration, and vice versa. Past studies suggest that women do not receive the same benefits from migration networks as male migrants and may seek out information and assistance only from female migrants (Davis and Winters 2000). If the influence of networks on migration is gender specific, the omission of gender from network measures is likely to result in biased econometric estimates of migration dynamics. We tested for the gender specificity of networks by controlling separately for village stocks of employed male and female migrants in the U.S.

Community Impacts

Community characteristics are also essential in determining the propensity to migrate since many sending areas have a long history of migration. Although the Bracero Program's influence was felt throughout Mexico, it was concentrated in the West-Central states. We would thus expect communities in West-Central Mexico to have different migration rates than other communities. Other community characteristics, including land tenure, agricultural production, and local employment opportunities, all potentially affect migration patterns. We controlled for sending-area characteristics and community level heterogeneity by using fixed effects.

Macro-economic Influences

Macroeconomic shocks have been identified by past studies as influencing Mexico-to-U.S. migration (Massey and Espinosa 1997). The macroeconomic variables that we control for include changes in the peso-dollar exchange rate and shifts in per-capita GDP in both countries. Mexican currency devaluations could encourage migration by increasing the purchasing power of remittances and by adversely affecting expectations of future economic growth in Mexico. An increase in GDP in the U.S. may reflect increased availability of jobs, raising the expected economic benefits for new migrants (Todaro 1969). The impact of an increase in the Mexican GDP is more ambiguous. On one hand, it could indicate employment opportunities at home, which discourage migration. Alternatively, income growth in the home country may enable households to overcome financial constraints on migration, which is costly and risky (Schiff 1996). Our econometric analysis controls explicitly for these macroeconomic variables in order to isolate the impacts of policies on migration flows.

Wage and unemployment rates in both the U.S. and Mexico also could have a role in the propensity to migrate. However, these variables are difficult to obtain for rural Mexico, especially in time-series. Furthermore, wages and unemployment rates are sector-specific, may be affected by trade policies, and may not be exogenous to migration flows. The macroeconomic variables included in our analysis may be viewed as proxies for economic opportunities for rural Mexicans in Mexico and the United States. For example, growth in GDP in either country is likely to accompany a rise in wage employment.

ECONOMETRIC MODEL

The dependent variables $\left(M_{jsgt}\right)$ in our analysis are defined as the percentage of the econometrically active village j labor employed by U.S. sector s (n = non-agricultural, a = agricultural), disaggregated by gender (m = male, f = female) at time t.[3] Villagers were defined as economically active if they were 12 years of age or over. We estimated three dynamic migration models.

First, we estimated a simple model to capture the basic dynamics of migration by males and females to the U.S. agricultural and non-agricultural sectors. Following a standard dynamic modeling approach, the percentage of the male or female village population observed in either agricultural or non-agricultural jobs at time t, M_{jsgt}, was regressed on the same percentage lagged one year $\left(M_{jsgt-1}\right)$ and a time trend (t), controlling for village fixed effects, α_j:

$$M_{jsgt} = \alpha_j + \gamma t + \delta_1 M_{jsgt-1} + \mu_{jt} \quad (1)$$

Equation (1) represents the underlying dynamic structure of employed migration. It is the basis to evaluate the inertia of employed migration. Village fixed effects, α_j, control for community influences on the migration trend, permitting each village to have its own migration trajectory. This makes it possible to isolate the time trend, the influence of migration networks, and inertia in the lagged migration variable.

3 We use the percentage rather than the sum of villagers who migrated because of our concern that the size of village populations in the synthetic cohorts created using retrospective data is biased downward as one goes back in time, as individuals are removed from the population due to death (and thus are not available to be counted in 2003). See Data section, below.

In the second model we added the lagged stock of migration in the same and different employment sectors to evaluate whether networks are gender and employment-sector specific:

$$M_{jsgt} = \alpha_j + \gamma t + \delta_1 M_{jamt-1} + \delta_2 M_{jaft-1} + \delta_3 M_{jnmt-1} + \delta_4 M_{jnft-1} + u'_{jt} \tag{2}$$

We defined networks as the lagged stock of migrants by gender and employment sector because these migrants provided information about jobs, housing, and other key variables.

In the final model we added three policy variables: dummy variables for IRCA (1 for all time periods beginning in 1986, the year of IRCA's implementation) and NAFTA (1 beginning in 1994, 0 before) and the percentage change in border enforcement expenditures between the previous and current year (ΔBE_t). We also included the three macroeconomic variables: the percentage change in the peso-dollar exchange rate between time t-1 and t (ΔER_t) and the US and Mexican GDP $(\Delta USGDP_t, \Delta MGDP_t)$:

$$\begin{aligned} M_{jsgt} &= \alpha_j + \gamma t + \delta_1 M_{jaft-1} + \delta_2 M_{jamt-1} + \delta_3 M_{jnft-1} + \delta_4 M_{jnmt-1} + \\ &\beta_1 IRCA_t + \beta_2 NAFTA_t + \beta_3 \Delta BE_t + \theta_1 \Delta ER_t + \theta_2 \Delta USGDP_t + \\ &\theta_3 \Delta MGDP_t + \mu''_{jt} \end{aligned} \tag{3}$$

While other methods may be used to evaluate the impact of NAFTA and IRCA (e.g., trade flows or changes in real wages in Mexico and the U.S.), these variables are not likely to be exogenous to migration. Policy shocks have an exogenous impact on village migration percentages making it possible to evaluate the long run impact on the rate and dynamics of labor migration.

In all three models the vector of fixed effects, α_j ; δ ; $\beta_k, k = 1,...,3$; and $\theta_l, l = 1,...5$ are parameters to be estimated. u_{jt} , u'_{jt} , and u''_{jt} are stochastic errors. Under the null hypothesis of no policy impacts on migration the coefficients $\beta_k = 0 \ \forall$ k.

Equations (1), (2), and (3) can be estimated using the standard least square dummy variable (LSDV); however, this estimation procedure has a downward bias on δ and is not consistent or efficient for a finite T. To overcome these difficulties we use the instrumental variable General Methods of Moment (IV-GMM) estimation technique proposed by Arellano and Bond (1991). This proposed AB method uses lagged and differenced dependent variables and explanatory variables as instruments to explain endogenous variables in each migration equation, imposing the restriction of no second order autocorrelation. We used the AB second order autocorrelation test to specify the correct number of lags that are required in order to fail to reject the null hypothesis of no second order autocorrelation.

DATA

The data used to estimate the model and evaluate the effects of NAFTA, IRCA, and border controls are from a nationwide rural household survey carried out jointly by the University of California, Davis and El Colegio de Mexico in Mexico City. The Mexico National Rural Household Survey (*Encuesta Nacional a Hogares Rurales de Mexico*, or ENHRUM) provides retrospective data on migration by individuals from a sample of rural households that is both nationally and regionally representative (see http://precesam.colmex.mx). Past studies of Mexican labor supply to the U.S. employment sectors used proxies that included border apprehensions (Torok and Huffman 1986) or data from surveys of small numbers of villages. Surveys typically have not collected migration flows over extended periods of time and thus cannot provide a basis to evaluate whether policies have a long term impact on the dynamics and trends of migration. We hope that our data set will fill this gap in the literature.

The survey was carried out in January and February 2003 in all of Mexico's five census regions.[4] Mexico's national census office, INEGI (*Instituto Nacional de Estadística, Geografía e Informática*), designed the sampling frame to provide a statistically reliable characterization of Mexico's population living in rural areas, defined by the Mexican government as communities with fewer than 2,500 inhabitants. For reasons of cost and tractability, populations with fewer than 500 inhabitants were not included in the survey. The result is a sample of 1,760 households from 80 villages that is representative of more than 80% of the rural Mexican population.

From each household the ENHRUM assembled complete migration histories from 1980 through 2002 for (a) the household head, (b) the spouse of the head, (c) all individuals who lived in the household 3 months or more in 2002, and (d) a random sample of sons and daughters of either the head or his or her spouse who lived outside the household for longer than 3 months in 2002. The migration histories included the state

[4] Mexico is divided into 5 regions, reflecting INEGI's standard regionalization of the country: Central, South-Southeast, West-Central, Northwest, and Northeast. One of these 5 regions, the West-Central, is the focus of Mexico Migration Project (MMP) surveys (Population Studies Center, University of Pennsylvania, Philadelphia (producer and distributor), www.pop.upenn.edu/mexmig/welcome.html). The MMP surveyed a random sample of households within communities, but the sample of MMP communities is not random.

where individuals worked and their employment sector: agriculture or nonagricultural. The data allowed us to calculate the percentage of each village's population that was employed in the U.S. in each year from 1980 through 2002 and also to delineate migrants by U.S. employment sector and gender.

To construct migration histories, individuals were asked to recall employment information from 1980 through 2002. Individuals may be unable to remember their employment history for 22 years; however, when employment is coupled with a life event such as international migration, there is a smaller likelihood that data will be misreported. A study by Smith and Thomas (2003) showed that when respondents were asked to recall information linked to salient events, such as marriage or birth of a child, the number of misreports was insignificant. Also, when asked to recall labor or migration histories, individuals more accurately reported moves that either involved a long distance or an extended stay.

ECONOMETRIC RESULTS

The survey provides information on migration from 80 villages over 23 years (from 1980 to 2002). For each lag of the dependent variable we lose one year of observations. Descriptive statistics show striking differences between male and female migration rates and employment sectors (see Table 2). Village migrants, both males and females, are overwhelmingly employed in the nonagricultural sector. On average, approximately 5% of male villagers, but only 1% of female villagers, are employed in nonagricultural sectors in the United States. Female migrants have a very small presence in the agricultural sector (0.14% of female villagers, on average, were observed in U.S. farm jobs over the 22-year period) while 2% of males are employed in this sector.

The estimated parameters in Equations 1 to 3 for each gender-sector combination, estimated using the AB procedure, are reported in Tables 3 through 6. The magnitude of impacts is revealed more clearly in elasticities. These are presented in Tables 7 and 8. In all of the tables, asterisks and double asterisks indicate statistical significance of coefficients at the .10 and .05 levels, respectively.

Results for Male and Female Migrants in the Agricultural Sector

Table 3 reports estimated coefficients for female migration to U.S. agricultural jobs. The autocorrelation test indicated that with two lags of the dependent variable, second order autocorrelation was not significant at the .05 level. The coefficients of both lagged migration variables were significant and positive, indicating that previous female migration to agricultural jobs significantly affects current migration (see Table 3, Column 1). When the lagged percentages of female villagers in nonfarm jobs and male villagers in farm and nonfarm jobs were included in the analysis (see Table 3, Column 2), only the coefficient on the lagged percentage of female villagers in non-agricultural jobs was significant. It was negative, suggesting competing network effects between nonfarm and farm jobs for female migrants. Other things being equal, a one percentage point increase in the percentage of village female population employed in non-agricultural jobs decreases the future percentage of female villagers in farm jobs by approximately 0.224 percentage points (see Table 7).

The female agricultural migration trend shifts significantly downward, by 0.122 percentage points, after NAFTA's implementation (see Table 3, final column). This finding is consistent with a scenario in which NAFTA released migration pressures and opened up new markets in Mexico, possibly creating internal migration work opportunities for women (e.g., in *maquiladoras*). None of the macroeconomic or other policy variables are statistically significant for female migration to U.S. farm jobs.

For male agricultural migration to the U.S., the autocorrelation test indicated that three lags of the dependent variable were needed (see Table 4). The coefficients on the first two lagged male migration variables were significant and positive, indicating that previous employment of males in agricultural jobs increases future male migration to the same sector. The coefficient on the third lagged male agricultural variable was negative, albeit small, with a coefficient of -.083 (see Table 4). An increase in the percentage of female villagers in U.S. agricultural and non-agricultural jobs was associated with a decrease in the percentage of male villagers in U.S. agriculture (see Table 4, Column 2). That is, the cross-gender network effect is negative for males in agriculture. It is quantitatively small, however. For example, a 1 % increase in the percentage of female villagers employed in the U.S. non-agricultural sector is associated with a 0.054% decrease in the percentage of male villagers in the agricultural sector (See Table 7). This small cross-gender effect is plausible; female migrants working as maids or nannies, for instance, are not likely to provide useful information about employment opportunities for male migrants in agriculture. If agricultural jobs are gender segregated, women working in U.S. agricultural jobs may not be able to provide employment information that is useful to males, either.

When the macroeconomic and policy variables were included, we found that the effects of changes in GDP and in the exchange rate are all significant and positive (see Table 4, Column 3). The finding that US GDP growth is positively associated with immigration is straightforward. A positive effect of Mexican GDP growth is consistent with Schiff (1996) and others who argue that income growth loosen liquidity constraints on future migration. Growth in Mexico's GDP, other things being the same, appears to enable rural households to finance the border crossing and other migration costs for male workers. A positive effect of changes in the exchange rate is consistent with findings reported by Massey and Espinosa (1997). As the peso devalues, the value of a dollar sent home by migrants increases in peso terms.

One policy variable is statistically significant for male agricultural migration: changes in border control expenditures have a positive and significant effect on the percentage of male villagers employed in U.S. agriculture. This finding provides support for previous studies suggesting that increased border control decreased the cyclical return of migrants and encouraged longer U.S. stays. This variable was not significant for female agricultural labor migration, however, suggesting that border controls may be more of a deterrent to female than to male agricultural migrants (or, alternatively, that the border deterrent to return migration may be greater for males, which does not seem likely). Nevertheless, an enforcement dollar spent in 1980 is not the same as one spent in 2000 because border enforcement technology changed significantly during this period. To control for this, we also included an interaction term between the time trend and INS expenditure changes (see Table 4, final column). The sign of the effect of border expenditures does not change when the time interaction is included, but the coefficient increased from 0.615 to 4.761. The interaction term is both significant and negative, but the coefficient is small in absolute value, only 0.23. This finding suggests that border enforcement may be more of a deterrent to migration over time; however, this deterrent to migration is easily outweighed by the deterrent to return. Thus, the net effect of border enforcement on the percentage of village population working in the United States remains positive.

Results for Migrants in the Non-Agricultural Sector

Table 5 presents findings of the econometric analysis of female migration to U.S. nonfarm jobs. The autocorrelation test indicated that three lags of the dependent variable are needed. Our results suggest that neither past male nor female migration to farm jobs significantly affects future migration by females to nonfarm jobs. That is, the farm sector does not significantly compete with the nonfarm sector for male or female migrants. Conversely, past male migration to non-farm jobs does not significantly affect current female migration to non-farm jobs. For female migrants in the non-agricultural sector, networks appear to be stratified by both gender and sector of employment.

Contrary to the results for female migration to the agricultural sector, we found that immigration policies have significant but mixed effects on female migration to the non-agricultural sector (see Table 5, Column 3). Controlling for the underlying dynamics of female migration, both NAFTA and IRCA negatively affect the percentage of female villagers employed in the non-agricultural sector, while changes in border enforcement have a positive effect. The supply of female village labor to the non-agricultural sector decreased when IRCA was implemented in 1986 and again when NAFTA began to be implemented in 1994. The negative effect of NAFTA on female migration to the U.S. nonagricultural sector is similar to that on agricultural labor migration. The negative coefficient on the IRCA dummy variable indicates that female migration to nonfarm jobs was more sensitive to the threat of employer sanctions or less stimulated by amnesty programs than female migration to farm jobs. In contrast to the negative effects of

NAFTA and IRCA, increased border enforcement expenditures have a significant positive influence on female non-farm migration to the U.S. This finding is consistent with the argument that increased border control discouraged return migration while encouraging longer stays by female migrants in the U.S. Among macroeconomic variables, only the percentage change in U.S. GDP was significant in the female nonfarm equation. As expected, an increase in U.S. GDP was associated with an increase in the percentage of female villagers migrating to U.S. nonfarm jobs.

When we control for the interaction between the time trend and changes in border controls, the coefficient on the border control variable not only changes sign but also increases in magnitude. A 1% increase in border control expenditures decreases female nonfarm migration by 1.454. The coefficient on the interaction term is both significant and positive (0.104), but it is small compared to the coefficient on border control. It appears that the initial impact of increased INS border expenditures on female nonagricultural migration is negative; however, over time it is attenuated, perhaps as females acquire more experience crossing the border. This result is consistent with findings from studies suggesting that females are more risk averse to illegally crossing the border.

Network effects for male migration to nonfarm jobs are also sector- and gender-specific (see Table 6). Past migration by males to nonfarm jobs significantly increases future male migration to those jobs. When the other three network variables were included, none were significant (Column 2, Table 6). There was no evidence that females in nonfarm jobs or males or females employed in agriculture constitute a significant assistance network for male migration to the nonagricultural sector.

NAFTA and IRCA decrease participation by males in migration to nonfarm jobs, and changes in border control expenditures have the opposite effect. These results were similar qualitatively to the results for female nonfarm migration. Implementation of NAFTA decreased the percentage of villagers in U.S. nonfarm jobs by 0.401 percentage points for females and by 0.753 points for males. It may be that NAFTA favored expansion of employment in Mexico for males more than for females. While the IRCA effect on male nonfarm migration is negative, it is not statistically significant. The elasticity of the effect of border expenditures is smaller for males than for females, 0.056 versus 0.025, respectively (see Table 8).

When we included the border enforcement-time interaction term (see Table 6, final column) there is no change in the sign of the enforcement effect, but both the enforcement and interaction terms are now statistically insignificant. These findings suggest that migration by males is less sensitive to risky border crossings than female migration.

DISCUSSION

The objective of this paper is to examine gender and sector dynamics of Mexico-to-U.S. migration and to explore whether NAFTA, IRCA, and border enforcement policies impacted the propensity to migrate differently for female and male migrants employed in agricultural and nonagricultural jobs. The effects of these policy shocks on migration are theoretically ambiguous; thus, we opted for an econometric approach using new retrospective migration data from rural Mexico.

Our findings indicate that the impacts of immigration and trade policies on rural Mexico-to-U.S. migration are both gender- and employment sector-specific. NAFTA is associated with a decrease in female migration to both agricultural and nonagricultural jobs in the U.S. but a decrease in male migration only to the U.S. non-agricultural sector. IRCA effects on migration are minimal for males and females to both sectors. Border control expenditures have differential effects on males and females. Our findings are consistent with the hypothesis that females are more sensitive to border control changes than male migrants.

The results of this research present compelling evidence that networks are both gender- and employment sector-specific. Recent studies offer evidence that migration is characterized by a cumulative causation process in which past migrants provide labor market information and other assistance that promotes future migration (Massey et al. 1993; Munshi, 2003). We find econometric evidence that same-gender migration is the most important variable shaping future migration. However, we find that past migration by males is insignificant in explaining female migration to either agricultural or nonagricultural U.S. jobs, and the effect of past female migration on male migration to nonfarm jobs is also insignificant. In some cases network effects are negative. Male participation in agricultural migration is negatively associated with female participation in either agricultural or nonagricultural migration, and past migration by females to the nonagricultural sector discourages future female migration to farm jobs. These findings suggest that the role of networks as determinants of migration needs to be revisited, with particular attention to gender.

REFERENCES

Arellano, M. and S. Bond. 1991. "Some Tests for Specification: Monte Carlo Evidence and an Application to Employment Equations." *The Review of Economic Studies* 58:277-297.

Boyd, M. 1989. "Family and Personal Networks in International Migration: Recent Developments and New Agendas." *International Migration Review* 23:638-70.

Cerrutti, M. and D.S. Massey. 2004. "Trends in Mexican Migration to the United States, 1965-1995." Pp. 17-44 in *Crossing the Border: Research from the Mexican Migration Project*, edited by J. Durand and D.S. Massey. New York: Russell Sage Foundation.

Cornelius, W. 1990. "Mexican Immigrants in California Today," Keynote Presentation to the Conference California Immigrants in a World Perspective, sponsored by the Immigration Research Program UCLA, Los Angeles, April 26-27.

Davis, B. and P. Winters. 2000. "Gender, Networks and Mexico-U.S. Migration." Working Paper, No. 2000-7. Agricultural and Resource Economics, University of New England.

Donato, K.M., S.M. Kanaiaupuni, and M. Stainback. 2001. "The Effects of Migration Household Income, and Gender on Mexican Child Health." Working Paper, No. 2001-10. Center for Demography and Ecology Working Paper, University of Wisconsin-Madison.

Donato, K.M. and E. Patterson. 2004. “Women and Men on the Move: Undocumented Border Crossing.” Pp. 111-130 in *Crossing the Border: Research from the Mexican Migration Project*, edited by Jorge Durand and Douglas S. Massey. New York: Russell Sage Foundation.

Durrand, J., D.S. Massey, and Emilio A. Parrado. 1999. “The New Era of Mexican Migration to the United States.” *The Journal of American History* 86:1-60.

Grieco, E. and B. Ray. 2004. “Mexican Immigrants in the US Labor Force.” *Migration Information Source*, March 1, 2004.

Judson, R.A. and A.L. Owen. 1999. “Estimating Dynamic Panel Data Models: A Guide for Macroeconomists.” *Economics Letters* 65:9-15.

Kanaiaupuni, S.M. 1999. “Reframing the Migration Question: An Empirical Analysis of Men, Women and Gender in Mexico.” Working Paper, No. 99-15. Center for Demography and Ecology, University of Wisconsin-Madison.

Kossoudji, S.A. and S.I. Ramey. 1984. “The Labor Market Experience of Female Migrants: The Case of Temporary Migration to the U.S.” *International Migration Review* 18:1120-1143.

Kossoudji, S.A. 1992. “Playing Cat and Mouse at the U.S.–Mexican Border.” *Demography* 29:159–80.

Levy, S. and S. Wijnbergen. 1992 “Mexican Agriculture in the Free Trade Agreement: Transition Problems in Economic Reform.” Technical Paper, No. 63. Organisation for Economic Co-operation and Development, Development Centre.

Martin, P.L. 2004. “New NAFTA and Mexico-U.S. Migration: The 2004 Policy Options,” *Update, Agricultural and Resource Economics, University of California Giannini Foundation* 8:1-4.

Massey, D.S., J. Arango, G. Hugo, A. Kouaouci, A. Pellegrino, and J.E. Taylor. 1993. “Theories of International Migration: A Review and Appraisal.” *Population and Development Review* 19:431-66.

Massey, D. S. and K.E. Espinosa. 1997. "What's Driving Mexico-U.S. Migration? A Theoretical, Empirical and Policy Analysis." *American Journal of Sociology* 102:939-99.

Menjivar, C. 1995. “Kinship Networks Among Immigrants: Lessons from a Qualitative Comparative Approach.” *International Journal of Comparative Sociology* 36:219-32.

Munshi, K. 2003. “Networks in the Modern Economy: Mexican Migrants in the U.S. Labor Market." *Quarterly Journal of Economics* 18:549-599.

Orrenius, P.M. 2004. “The Effect of Border Enforcement on the Crossing Behavior of Mexican Migrants.” Pp. 281-298 in *Crossing the Border: Research from the Mexican Migration Project*, edited by Jorge Durand and Douglas S. Massey. New York: Russell Sage Foundation.

Robinson, S., M.E. Burfisher, R. Hinojosa-Ojeda and K.E. Thierfelder. 1991. "Agricultural Policies and Migration in a U.S.-Mexico Free Trade Area: A Computable General Equilibrium Analysis." Working Paper, No. 617. Department of Agricultural and Resource Economics, University of California-Berkeley.

Schiff, M. 1996. Trade Policy and International Migration: Substitutes or Complements? Pp. 22-41 in *Development Strategy, Employment and Migration: Insights from Models,* edited by J.E. Taylor. Paris: Organisation for Economic Cooperation and Development (OECD).

Smith, J.P. and D. Thomas. 2003. “Remembrances of Things Past: Test-Retest Reliability of Retrospective Migration Histories.” *Journal of Royal Statistics Society* 166:23-49.

Todaro, M.P. 1969. “A Model of Migration and Urban Unemployment in Less-Developed Countries.” *The American Economic Review* 59:138-48.

Torok, S.J. and W.E. Huffman. 1986. “U.S.-Mexican Trade in Winter Vegetables and Illegal Immigration.” *American Journal of Agricultural Economics* 68:246-260.

United States Department of Labor. 2000. “Findings from the National Agricultural Workers Survey (NAWS) 1997-1998: A Demographic and Employment Profile of United States Farmworkers.” Research Report, No. 8, Washington, DC: U.S. Department of Labor, Office of the Assistant Secretary for Policy, Office of Program Economics.

Winters, P., A. de Janvery, and E. Sadoulet. 1999. “Family and Community Networks in Mexico-U.S. Migration.” Working Paper, No. 99-12. Graduate School of Agricultural and Resource Economics, University of New England.

Yúnez Naude, Antonio y Fernando Barceinas Paredes. 2004. “Agricultural Trade and NAFTA: The Case of Mexico.” Pp. 117-144 in *The First Decade of NAFTA: The Future of Free Trade in North America*, edited by Kevin C. Kennedy. New York: Transnational Publishers, Inc.

Table 1. Mexican Born Population in the United States from 1980-2002[1]

	Number	Percent
2002 Mexican Born Population	9 177 485	100.0
Naturalized U.S. citizen	2 061 790	22.5
Entered 1990 to 2000	309 175	3.4
Entered 1980 to 1989	634 780	6.9
Entered before 1980	1 117 830	12.2
Not a U.S. citizen	7 115 700	77.5
Entered 1990 to 2000	4 134 425	45.0
Entered 1980 to 1989	1 954 105	21.3
Entered before 1980	1 027 170	11.2

[1] This table includes only the foreign-born population; people born in Mexico to a U.S. citizen parent are considered native and are not included in this table.

Source: U.S. Census Bureau, Census 2000 Special Tabulations (STP-159)

Table 2. **Variable Definitions and Means**

Variable	Description	Mean
T	Time Trend	11
Female Ag. Migration	Percentage of Female Villagers Employed in U.S.	0.136
Male Ag. Migration	Percentage of Male Villagers Employed in U.S.	2.035
Female Non. Ag. Migration	Percentage of Female Villagers Employed in U.S.	1.049
Male Non. Ag. Migration	Percentage of f Male Villagers Employed in U.S.	4.989
% Change ER*	% change in Peso-Dollar exchange rate from previous year	0.013
% Change Border Control+	% change in INS border enforcement expenditures in millions of 2000 US$	0.138
NAFTA	Dummy variable = 1 beginning in 1994	0.39
IRCA	Dummy variable = 1 beginning in 1986	0.74
% Change MGDP#	% change Mexico per capita GDP	0.026
% Change US GDP#	% change US per capita GDP	0.03

*Exchange rates were obtained from www.ers.usda.gov/data/exchangerates/
+Border control expenditures were obtained from http://uscis.gov/graphics/index.htm
#GDP were obtained from the Energy Information Administration

Table 3. Female Agricultural Participation in Migration Arellano and Bond GMM Estimation (z statistics in parentheses)

Variables	Model I	Model II	Model III
Female Ag. Migration Lag 1	0.664	0.643	0.644
	(23.35)**	(21.84)**	(21.79)**
Female Ag. Migration Lag 2	0.189	0.175	0.179
	(7.08)**	(6.47)**	(6.60)**
T	-0.009	-0.007	0
	(-4.06)**	(-2.41)**	(0.07)
Male Ag. Migration Lag		0.002	0.003
		(0.3)	(0.33)
Female Non-ag Migration Lag		-0.031	-0.029
		(-2.58)**	(-2.44)**
Male Non-Ag. Migration Lag		0.001	0.001
		(0.27)	(0.17)
NAFTA			-0.122
			(-2.16)**
IRCA			0.065
			(1.27)
% Change MGDP			0.362
			(0.88)
% Change US GDP			-0.649
			(-1.13)
% Change ER			0.108
			(-1.03)
% Change Border Control			-0.071
			(-0.97)
Second Order Autocorrelation	0.1426	0.1714	.1103
Observations	1600	1600	1600
Number of villages	80	80	80

* Significant at 10%; ** Significant at 5%

The Dependent variable is the village percent of females in the agricultural sector

Table 4. Male Agricultural Participation in Migration Arellano and Bond GMM Estimation (z statistics in parentheses)

Variables	Model I	Model II	Model III	Model IV
Male Ag. Migration Lag 1	0.588	0.579	0.588	0.59
	(20.04)**	(19.68)**	(19.89)**	(20.03)**
Male Ag. Migration Lag 2	0.188	0.189	0.187	0.191
	(6.54)**	(6.56)**	(6.45)**	(6.63)**
Male Ag. Migration Lag 3	-0.083	-0.087	-0.087	-0.087
	(-3.42)**	(-3.55)**	(-3.55)**	(-3.55)**
T	0.031	0.034	0.038	0.095
	(3.65)**	(3.22)**	(1.57)	(3.29)**
Female Ag. Migration Lag		-0.588	-0.58	-0.571
		(-4.63)**	(-4.55)**	(-4.49)**
Female Non-ag Migration Lag		-0.096	-0.104	-0.102
		(-2.24)**	(-2.38)**	(-2.35)**
Male Non-Ag. Migration Lag		0.027	0.03	0.032
		(1.44)	(1.55)	(1.7)*
NAFTA			-0.05	-0.369
			(-0.22)	(-1.53)
IRCA			-0.114	-0.067
			(-0.62)	(-0.38)
% Change MGDP			3.789	4.823
			(2.06)**	(2.60)**
% Change US GDP			1.675	4.42
			(0.51)	(1.31)
% Change ER			1.185	1.807
			(2.70)**	(3.83)**
% Change Border Control			0.615	4.761
			(2.09)**	(3.99)**
Time Trend*% Change Border Control				-0.23
				(-3.59)**
Second Order Autocorrelation	0.0764	0.2013	0.2803	0.5878
Observations	1520	1520	1520	1520
Number of villages	80	80	80	80

* Significant at 5%; ** Significant at 1%

The Dependent variable is the village percent of males in the agricultural sector

Table 5. Female Non-Agricultural Participation in Migration Arellano and Bond GMM Estimation
(z statistics in parentheses)

Variables	Model I	Model II	Model III	Model IV
Female Non-Ag. Migration Lag 1	0.577	0.574	0.573	0.575
	(17.36)**	(16.88)**	(16.78)**	(16.86)**
Female Non-Ag. Migration Lag 2	0.135	0.135	0.14	0.136
	(4.25)**	(4.28)**	(4.43)**	(4.28)**
Female Non-Ag. Migration Lag 3	0.082	0.084	0.071	0.068
	(3.05)**	(3.10)**	(2.61)**	(2.52)**
T	0.044	0.049	0.088	0.061
	(7.61)**	(7.60)**	(5.95)**	(3.44)**
Female Ag. Migration Lag		-0.106	-0.1	-0.102
		(-1.42)	(-1.33)	(-1.35)
Male Ag. Migration Lag		-0.003	-0.003	-0.004
		(-0.15)	(-0.13)	(-0.23)
Male Non-Ag. Migration Lag		-0.015	-0.015	-0.016
		(-1.29)	(-1.26)	(-1.32)
NAFTA			-0.401	-0.255
			(-2.90)**	(-1.71)*
IRCA			-0.206	-0.211
			(-1.79)*	(-1.95)*
% Change MGDP			-0.067	-0.604
			(-0.06)	(-0.52)
% Change US GDP			5.181	3.964
			(2.53)**	(1.89)*
% Change ER			0.197	-0.101
			(0.73)	(-0.34)
% Change Border Control			0.423	-1.454
			(2.32)**	(-1.96)**
Time Trend*% Change Border Control				0.104
				(2.62)**
Second Order Autocorrelation	0.4701	0.3105	0.1251	0.2378
Observations	1520	1520	1520	1520
Number of villages	80	80	80	80

* Significant at 5%; ** Significant at 1%

The Dependent variable is the village percent of females in the non-agricultural sector

Table 6. Male Non- Agricultural Participation in Migration Arellano and Bond GMM Estimation (z statistics in parentheses)

Variables	Model I	Model II	Model III	Model IV
Male Non-Ag. Migration Lag 1	0.598	0.597	0.597	0.6
	(18.22)**	(17.89)**	(17.89)**	(17.95)**
Male Non-Ag. Migration Lag 2	0.205	0.205	0.205	0.203
	(6.42)**	(6.40)**	(6.40)**	(6.33)**
Male Non-Ag. Migration Lag 3	0.062	0.065	0.065	0.058
	(2.14)*	(2.23)*	(2.23)**	(1.98)**
T	0.12	0.12	0.12	0.233
	(7.22)**	(6.94)**	(6.94)**	(5.11)**
Female Ag. Migration Lag		-0.04	-0.04	-0.027
		(-0.21)	(-0.21)	(-0.14)
Male Ag. Migration Lag		-0.037	-0.037	-0.027
		(-0.83)	(-0.83)	(-0.6)
Female Non-Ag. Migration Lag		0.013	0.013	-0.011
		(0.22)	(-0.22)	(-0.18)
NAFTA			-0.753	-0.915
			(2.19)**	(2.46)**
IRCA			-0.347	-0.339
			(-1.26)	(-1.29)
% Change MGDP			-1.912	-1.459
			(-0.68)	(-0.51)
% Change US GDP			13.475	14.736
			(2.62)**	(2.81)**
% Change ER			0.987	1.29
			(1.45)	(1.75)*
% Change Border Control			0.889	2.912
			(1.96)*	(-1.57)
Time Trend*% Change Border Control				-0.112
				(-1.13)
Second Order Autocorrelation Test	0.1988	0.2633	0.2457	0.293
Observations	1520	1520	1520	1520
Number of villages	80	80	80	80

* Significant at 10%; ** Significant at 5%

The Dependent variable is the village percent of females in the non-agricultural sector

Table 7. Migration Elasticities with Respect to Networks, by Gender and Sector†

	Equation			
	Female Migration		Male Migration	
Variables	**Ag.**	**Non-Ag**	**Ag.**	**Non-Ag.**
Lagged Female Migration				
Agricultural		-0.013	-0.039**	-0.001
Non-Agricultural	-0.224**		-0.054**	0.003
Lagged Male Migration				
Agricultural	0.045	-0.006		-0.016
Non-Agricultural	0.037	-0.071	0.074	

* significant at 10%; ** significant at 5%

†Numbers represent calculated elasticities at the means of each variable, X: $\frac{\partial M_{jsgt}}{\partial X}\frac{\partial \bar{X}}{\bar{M}_{jsgt}}$

Table 8. Elasticity of Migration With Respect to Policy Shock, by Gender and Sector

	Equation			
	Female Migration		Male Migration	
Policy Change Variable	**Ag.**	**Non-Ag**	**Ag.**	**Non-Ag.**
NAFTA††	-0.122**	-0.401**	-0.050	-0.753**
IRCA††	0.065	-0.206*	-0.114	-0.347
INS Border Enforcement Expenditures†	-0.072	0.056**	0.042**	0.025*

†Numbers represent calculated elasticities at the means of each variable, X: $\frac{\partial M_{jsgt}}{\partial X} \frac{\partial \bar{X}}{\bar{M}_{jsgt}}$

††Numbers represent percentage shift in the migration trend resulting from a discrete change in the policy dummy variable from 0 to 1.

* significant at 10%; ** significant at 5%

Figure 1. Occupations of Male Native, Foreign, and Latin American Born Workers

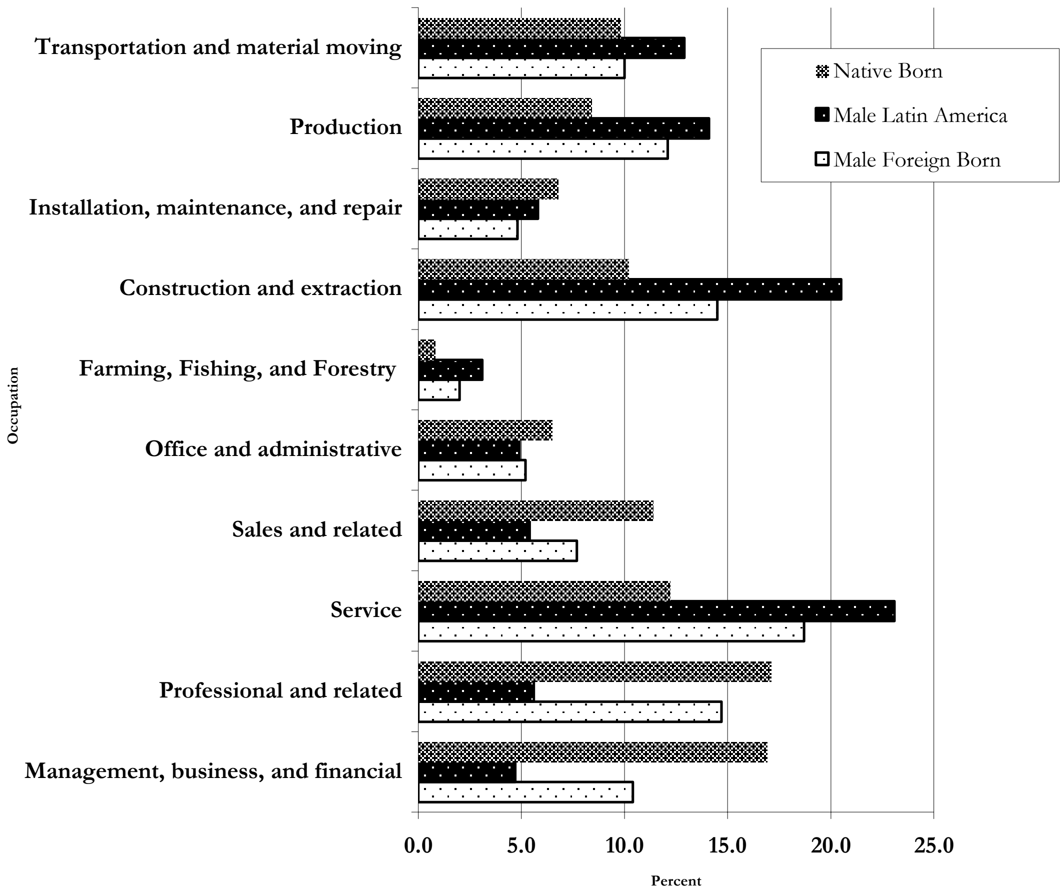

Figure 2. Occupations of Female Foreign and Latin American Born Workers

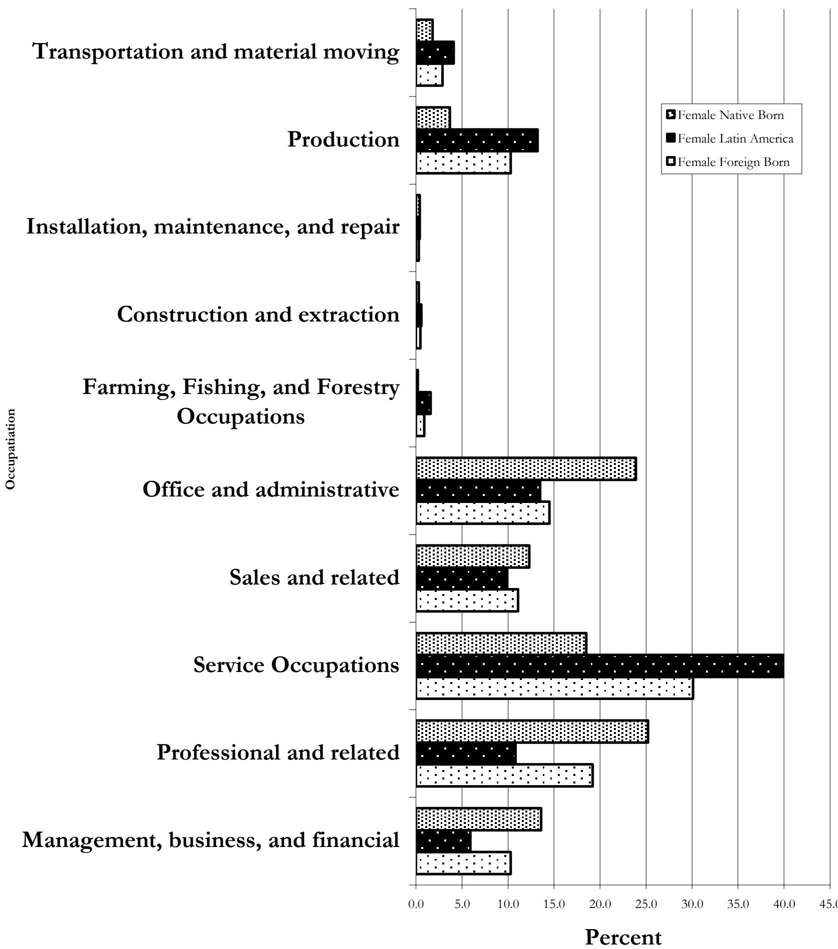

Figure 3: INS Border Control Budget