BIRTH RATES AND BORDER CROSSINGS: THE DEMOGRAPHIC PUSH BEHIND EMIGRATION IN THE AMERICAS

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Gordon H. Hanson, UCSD and NBER

Craig McIntosh, UCSD

Abstract. We intersect data on births from the WDI with U.S Census information on country of origin to estimate cohort-specific migration rates to the U.S. for twenty-one countries in the Americas. Using these data, we confirm the theoretical prediction that labor supply should play a driving role in migration, with individuals born into unusually large cohorts having a higher propensity to migrate. We find this effect to be strongest in nearby countries, with a slope that is decreasing and convex in both distance and in the number of countries crossed to reach the U.S. Labor supply-driven migration also interacts in interesting ways with shocks in the sending countries: natural disasters, sudden stops, and high-variability in income per capita all lead to more out-migration when they occur in large cohorts. Our results suggest a strong role for demographic pressure in generating migration in the Americas.

1 INTRODUCTION

Latin America and the Caribbean have among the highest emigration rates in the developing world. In 2000, 3.8% of the region's population was living in high-income countries in North America, Europe, Asia, or the Middle East, compared with emigration rates of 3.0% in the Middle East and North Africa, 2.5% in Eastern Europe and Central Asia, 0.7% in Asia and the Pacific, and 0.6% in Sub-Saharan Africa (see Table 1).[1] While Mexican migration to the US captures most of the attention, it is by no means the only significant flow in the region. There are also sizable flows from the Dominican Republic, El Salvador, and Haiti to the US; Ecuador to Spain; and Jamaica and the Trinidad and Tobago to Canada and the UK (Fajnzylber and Lopez, 2008).

In this paper, we examine the contribution of demographic changes, geographic distance, and economic and political shocks to emigration from Latin America and the Caribbean. What makes the region an interesting case is not just the scale of emigration, but also its concentration. As of 2000, just four countries – Canada, Spain, the US, and the UK – were host to 75.4% of the region's emigrants (see Table 2). The concentration of migration flows to proximate high-income countries (the US) and countries with a shared colonial heritage (Canada, Spain, the UK) greatly simplifies both the measurement and analysis of labor movements.[2]

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[1] All rates are for emigration from developing countries in a particular region to high-income countries. Among developing-country regions, *total* emigration rates are highest in Eastern Europe and Central Asia (as seen in Table 1), largely because of the exodus of individuals (including ethnic Russians) from Former Soviet Union countries to Russia following the breakup of the Soviet Union.

[2] Current and former French and Dutch territories in Latin America and the Caribbean (French Guiana, Guadalupe, Martinique, Netherlands Antilles, and Suriname) have high emigration rates to France and the Netherlands, but are too small to obtain age-specific emigration rates, as is necessary for our analysis. The phenomenon of concentrated regional emigration we identify would also apply to labor flows from North Africa and Turkey to Europe. Unfortunately, age and country-specific stocks of immigrants are difficult to obtain for most European countries for more than one or two years.

Over the last three decades, much of Latin America has experienced a demographic bulge, with large numbers of young people coming of working age and entering the labor force (Birdsall, Kelley, and Sinding, 2001).[3] One would expect this increase in the region's relative labor supply to have put downward pressure on local wages and raised the incentive to emigrate. In some Latin American countries, birth rates have begun to drop sharply (Bongaarts and Watkins, 1996), but in others they are declining only slowly. While fertility rates in Mexico are projected to drop below replacement level by 2020 (Tuiran et al., 2002), they remain substantially above rich country levels in much of Central America and the Andes. Cross-national differences in fertility are useful for isolating the effects of labor supply on emigration and to project which countries are likely to continue produce emigrants in the future.

We utilize cross-time and cross-country variation in birth rates to identify the contribution of changes in labor supply to labor outflows. In related work, Hanson and McIntosh (2009) find that variation in labor supply across Mexican regions can account for nearly one third of regional variation in Mexican emigration rates and Clark, Hatton, and Williamson (2007) find that countries with larger populations of young people have higher rates of legal migration to the US. In this paper, we exploit annual variation in the sizes of birth cohorts in both source and destination countries, which enable us to include an extensive set of nation, time, and age-specific controls in the estimation.

The impact of labor-market shocks on emigration depends on the ease with which a country's population can move abroad. One common means of exodus from Latin America is unauthorized migration, either by entering a destination country illegally or overstaying a temporary entry visa. The long land border between Mexico and the US

[3] Throughout the paper we use Latin America to refer to Latin America and the Caribbean.

and the extended US coastline make it a destination of choice for illegal migrants. If there are adjustment costs in the volume of migration, proximity to destination countries may play a role in mediating the impact of labor market shocks on emigration. We examine whether the elasticity of emigration with respect to labor supply depends on different measures of distance to destination markets. A large number of studies find that the scale of migration depends on distance, colonial relationships, language, and other "gravity" variables.[4] Our contribution is to see whether the responsive of migration to labor-market shocks is also distance dependent.

There is extensive literature on Latin America's susceptibility to macroeconomic shocks and political instability and its implications for the region's growth performance (e.g., Collier et al., 2003; Raddatz, 2007; Edwards, 2008). While there is also abundant research on the relationship between income and international migration, the majority of this work considers the contemporaneous correlation between living standards and labor flows.[5] We examine the contribution of changes in relative income, balance of payments crises, civil and military conflict, and natural disasters to emigration from the region. Our approach is to estimate how shocks at the time a cohort enters the labor market affect initial and subsequent emigration. Since individuals are most mobile when they are young, shocks at time of labor market entry may have long lasting effects.

To preview our results, we find that emigration rates are higher where source-country birth cohorts are larger relative to destination-country birth cohorts. A 10% increase in the relative size of a source-country birth cohort is associated with a 0.5% higher decadal emigration rate. This effect weakens with geographic distance from

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[4] See, e.g., Clark, Hatton, and Williamson (2007) and Mayda (2009).
[5] See Hanson (2009) for a recent review of the literature.

destination markets. Economic and political shocks also affect emigration, with cohorts suffering from natural disasters both migrating at higher levels and displaying a greater sensitivity to labor supply ratios. We also find that other shocks affect emigration.

In section 2, we present a simple dynamic model of migration from a given source country to multiple destinations. In section 3, we describe data on labor supply, migration rates, economic and political shocks, and other variables. In section 4, we present the empirical results. And in section 4, we offer concluding remarks.

2 THEORY

To understand emigration from Latin America, consider a model of three national labor markets that are linked by migration. In each economy, there is one sector of production. Workers from Latin America are differentiated by age but are not otherwise distinguished by their skill.[6] We allow for costs in labor mobility, following models of internal migration in Blanchard and Katz (1992) and Borjas (2006).

In the source country, the national wage for age group i at time t is given by,

$$W_{it} = X_{it}(L_{it})^{\eta}, \tag{1}$$

where W_{it} is the wage, X_{it} is a labor-demand shifter, L_{it} is the population of working-age adults in the country, and $\eta \leq 0$ is the inverse labor-demand elasticity. The supply of labor in the source country is the population of group i that has not emigrated, such that

$$L_{it} = L_{i0} - M_{it} \tag{2}$$

where L_{i0} is the pre-emigration population of group i and M_{it} is the number of individuals in i that have left the country by period t. Putting (1) and (2) together,

[6] We ignore other aspects of skill because in order to measure net migration by age in Latin America we need to track populations by characteristics which are invariant to time.

(3) $$\ln W_{it} = \ln X_{it} + \eta \ln L_{i0} - \eta m_{it},$$

where $m_{it}=M_{it}/L_{i0}$ is the fraction of group *i* that has moved abroad.[7]

An individual in the source country has the option of staying at home or moving to one of two possible destinations, country *A* or country *B*. In the year birth cohort *i* first enters the labor market, the wage in country *c* is given by,

(4) $$W_{i0}^{c} = X_{i0}^{c} (L_{i0}^{c})^{\eta},$$

where X^{c}_{i0} is a labor-demand shifter, L^{c}_{i0} is initial labor supply, and η is the inverse labor-demand elasticity. In later periods, we assume the wage in country *c* is determined by initial labor supply and subsequent innovations to labor demand, imposing the restriction that the impact of immigration on the destination country's wage is neglible. It is straightforward to extend the model to allow for adjustment in destination-country wages; we suppress such adjustment solely to simplify the exposition.[8]

To allow for costs in the mobility of labor between countries, we assume that migration from the source country to destination-country *c* in any period *t* is an increasing function of the lagged difference in wages between the two countries:

(5) $$v_{it}^{c} = \sigma^{c} \left(\ln W_{i,t-1}^{c} - \ln W_{i,t-1} - F^{c} \right),$$

where $v_{it}^{c} = \Delta M_{it}^{c} / L_{i0}$ is the net emigration rate to country *c* for group *i* at time *t*, σ^{c} is the supply elasticity (specific to the destination country), and F^{c} is a wage discount that source-country nationals associate with living in country *c*. As long as σ^{c} is sufficiently small, it will take multiple periods before migration succeeds in raising the source-

[7] We utilize the approximation that, for small values of *X/Y*, $ln(X+Y) \approx lnX + Y/X$.

[8] Allowing for destination-country wage adjustment changes the magnitude of the reduced-form parameters in the emigration equation we derive but does not change their sign. See Hanson and McIntosh (2009).

country wage to destination-country levels.[9] In the empirical analysis, we will assume the magnitude of the labor supply elasticity, σ^c, depends on source and destination-country characteristics, including their distance, whether they share a common language, and whether they have a common colonial heritage.

To solve the model, define the pre-migration effective wage differential between the source country and destination c as,

$$\omega_{i0}^c = \ln W_{i0}^c - \ln W_{i0} - F^c = \eta \ln \ell_{i0}^c + \ln x_{i0}^c - F^c . \tag{6}$$

where $\ln \ell_{i0}^c = \ln L_{i0}^c - \ln L_{i0}$ is initial log relative labor supply and $\ln x_{i0}^c = \ln X_{i0}^c - \ln X_{i0}$ is initial log relative labor demand. The pre-migration wage difference is increasing in the source country's relative labor supply (since $\eta < 0$) and decreasing in the source country's relative labor demand.[10] Using (3), (5), and (6), we solve for the $t = 0$ emigration rate, and then iterate forward, solving for the wage and emigration rate in each period. The emigration rate to country A for age group i in period t can be shown to be,

$$\begin{aligned} v_{it}^A &= \sigma^A \omega_{i0}^A \left(1+\eta\sigma^A\right)^{t-1} + \sigma^A \omega_{i0}^B \left[\left(1+\eta\sigma^B\right)^{t-1} - 1\right] \\ &\quad + \omega_{i0}^B \eta \left(\sigma^A\right)^2 \sum_{s=1}^{t-2} \left[\left(1+\eta\sigma^B\right)^s - 1\right] + \omega_{i0}^B \left[\eta^2 \left(\sigma^A\right)^3 + \left(\eta\sigma^A\right)^2 \sigma^B\right] \sum_{s=1}^{t-3} \left[\left(1+\eta\sigma^B\right)^s - 1\right] \\ &\quad + \omega_{i0}^A \eta \sigma^A \sigma^B \sum_{s=1}^{t-3} \left[\left(1+\eta\sigma^A\right)^s - 1\right] + \omega_{i0}^A \left[\left(\eta\sigma^A\right)^2 \sigma^B + \left(\eta\sigma^B\right)^2 \sigma^A\right] \sum_{s=1}^{t-2} \left[\left(1+\eta\sigma^A\right)^s - 1\right] + \cdots \end{aligned} \tag{7}$$

where there is a continuing series of high-order interactions of the model coefficients up to the power t-1. The expression for country B is analogous. While the expression

[9] For a zero migration disamenity, the condition that migration does not cause wage equalization to occur in one period is that, $\ln W_{i1} = \ln W_{i0} - \eta\sigma^c \left(\ln W_{i0}^c - \ln W_{i0}\right) < \ln W_{i0}^c \Leftrightarrow 0 < 1 + \eta\sigma^c$, which we assume holds.

[10] Here, we assume that labor demand is constant over time such that $X_{it}=X_{i0}$ and $X^*_{it}=X^*_{i0}$. It is straightforward to generalize the model to allow for time-varying labor demand shocks, as shown in Hanson and McIntosh (2009).

appears complicated, the determinants of current emigration from the source country are simply initial wage differences between the source and the two destinations, ω_{i0}^{A} and ω_{i0}^{B}. The large number of terms in (7) comes from the fact that positive emigration occurs only along the transition from an initial period in which there are large international wage differences to a final equilibrium of small wage differences.[11] Migration from the source country to destination *A* today affects migration to *B* tomorrow, which affects migration to *A* in the following period, and so on. Since these higher order effects depend on a minimum of four-way interactions in the labor demand elasticity and labor supply elasticities (which are each less than one in absolute value), they are likely to be very small in practice and we will simplify the expression by dropping them.

To interpret (7), consider each term in the expression. The first term on the right indicates that the current emigration rate to country *A* is higher the larger is the initial wage gap between the source country and destination-country *A*. Note that the emigration rate declines over time (owing to the fact that $1+\eta\sigma^{A}<1$), as the exodus of labor pushes up source-country wages. The second term on the right indicates that the current emigration rate to country *A* is lower the larger is the initial wage gap between the source country and destination-country *B*, as the availability of an alternative location siphons off migrants who would have otherwise gone to *A*. The terms on the second and third lines of (7) are the initial terms in a series of higher order effects, which capture the implications for current migration to country *A* of how past migration to country *A* has affected migration to country *B* and of how past migration to country *B* has affected migration to country *A*. Excluding the higher-order terms and using the approximation

[11] Because of the migration disamenity, international wage differences may not be fully eliminated.

that $(1+x)^t \approx 1+tx$, we can rewrite (7) in much simpler form as

$$v_{it}^A = \sigma^A \omega_{i0}^A \left[1+\eta\sigma^A(t-1)\right] + \eta\sigma^A\sigma^B\omega_{i0}^B(t-1). \tag{8}$$

Plugging in the determinants of the initial wage differential in (6), we obtain,

$$\begin{aligned} v_{it}^A = {} & \ln \ell_{i0}^A \left[\theta^A + \left(\theta^A\right)^2 (t-1)\right] + \left[\ln x_{i0}^A - F^A\right]\left[\sigma^A + \theta^A\sigma^A(t-1)\right] \\ & + \ln \ell_{i0}^B \theta^A\theta^B (t-1) + \left[\ln x_{i0}^A - F^A\right]\theta^A\sigma^B(t-1) \end{aligned} \tag{9}$$

where $\theta^c = \eta\sigma^c < 0$. Equation (9) shows that emigration to country *A* is decreasing (increasing) in the relative size of country *A*'s initial labor supply (demand) and increasing (decreasing) in the initial relative labor supply (demand) of alternative destinations, where the effects of initial conditions diminish as a cohort ages, owing to adjustment in wages in the source country. Since dynamic wage adjustment depends on the square of labor-supply elasticities, in practice its effect on attenuating how initial labor market conditions affect emigration could be quite small.

Equation (9) is missing the effects of past innovations to labor demand in the source and destination countries on current migration flows. Were we to allow innovations to labor demand to affect wages, equation (9) would include a series of distributed lag terms in these innovations (see note 10). In the estimation, we allow for such effects by including measures of labor market shocks that occurred between the time a cohort comes of working age and the current period.

Equation (9) will be the basis for the empirical estimation. For individual birth cohorts in Latin American and Caribbean source countries, we will examine the correlation between the decadal migration rate to a specific destination country and initial relative labor supply, initial relative labor demand, and subsequent innovations to labor demand. Consistent with the theory, we will allow the responsiveness of migration to labor-market shocks to vary across source-destination pairs. By pooling data across cohorts, source countries, destination countries, and time, we are able to include a rich set of fixed effects in the estimation, which helps control for unobserved shocks to migration. The fixed effects also help absorb variation in migration disamenities and migration policy across source and destination pairs.

3 DATA

The data we require for the estimation include measures of labor supply by birth cohort and source country, migration rates for source-destination pairs, and measures of economic shocks for source and destination countries.

We measure labor supply using the number of live births in each country, as reported in World Development Indicators, which begin in 1960. Figure 1 gives the mean number of births by country across the years covered by the analysis, and shows the dominance of Mexico in the total number of births in the region. Assuming that individuals enter the labor force at age 16, the number of individuals born, say, in El Salvador in 1970 would indicate the number of individuals coming of working age in 1986. In using number of births to measure labor supply, we ignore variation across source countries in both mortality rates and labor force participation rates, data on which we cannot obtain by age and year. While cross-country variation in mortality rates is a concern, there are two reasons why it is unlikely to be a serious problem for our analysis. One is that we focus on migration of those of prime migration age, which is 16 to 40. For individuals out of childhood but not yet in middle age, variation in mortality across Latin American countries is likely to be relatively low. More importantly, much of the variation in mortality rates is likely to be absorbed by the country and time dummies we include in the estimation. In a regression of annual mortality rates for nations in Latin America and the Caribbean on country dummies and year dummies, the adjusted R squared is 0.94 for infant mortality, 0.95 for under-5 mortality, and 0.86 for adult mortality. Thus, most of the cross-country variation in mortality can be removed by allowing for country-specific means and time-specific shocks in death rates.

Figure 2 shows the time series of births for countries in Latin America and the Caribbean from 1960 to 2005. Immediately apparent is strong variation in the time pattern of births across countries. In the Andes, births grow steadily between 1960 and 1980 in all countries except Colombia and then flatten out. In Central America, births grow steadily through the mid 1970s in all countries except Costa Rica and then flatten differentially, slowing first in El Salvador, followed by Nicaragua and Honduras and never slowing in Guatemala. By the 1960s, the Southern Cone had already entered an era of slow population growth and births are flat across time in all countries except Paraguay. The Caribbean contains a mix of outcomes, with some countries showing steady growth in births (Bahamas, Belize, Dominican Republic, Haiti), others showing steady declines (Barbados, Cuba, Jamaica, Puerto Rico, St. Vincent), and still others showing a rise early in the sample period followed by a later decline (Guyana, St. Lucia, Trinidad and Tobago, Virgin Islands). Variation in the growth of births across countries produces variation in the growth of labor supply 15 to 20 years hence. It is this variation in birth levels we will exploit to identify the impact of labor supply on emigration.

An important question is whether the factors that produce variation in fertility across countries are correlated with emigration, potentially confounding our empirical analysis. The literature associates national differences in levels and changes in fertility with a large set of determinants (). Because realizations on emigration are observed between 16 and 40 years after the shifts which caused the changes in birth cohort size, we take these changes to be pre-determined for our analysis. We assume that, given country, year, and cohort fixed effects, the most plausible explanation for correlation between country-level birth cohort size and subsequent migration is the cohort size itself. Of course, the size of birth cohorts may summarize more about a country than its labor supply. In section 4, we discuss alternative interpretations of our results.

To calculate bilateral migration rates, we use the number of immigrants by age and gender in the principal destination countries. For the US, we are able to measure age and gender-specific stocks of immigrants from all Latin American and Caribbean countries in 1980, 1990, 2000, and 2005.[12] For Canada, have similar measures for 1981, 1991, and 2001; for Spain, we can obtain immigrant stocks for 2001 only; and for the UK, we can obtain immigrant stocks for 1991 and 2001, but only for select countries.

To gauge the magnitude of emigration from Latin America and the Caribbean, Table 2 reports total emigration rates in 2000 by source country, as well as the fraction of emigrants residing in the US, Canada, Spain, and the UK, using data from Parsons at al. (2007). Evident in Table 2 is variation in the attractiveness of the four principal destinations to emigrants from the region. In the Caribbean and Central America, the share of emigrants going to the four destinations is above 50 percent in all countries, except Nicaragua,[13] and above 70 percent in all other countries that are not former French colonies, except Antigua and Barbuda. In South America, however, the share of emigrants going to the four destinations is above 50 percent for only two countries,

[12] We can measure immigrant stocks for the US in earlier years as well, but this is of no use since our data on births do not begin until 1960 (meaning we cannot measure source-country labor supply before 1976).
[13] Nicaragua sends 43% of its emigrants to neighboring Costa Rica.

Ecuador and Guyana. For Bolivia, Chile, Paraguay, and Uruguay, neighboring Argentina is an important destination; the share of emigrants going to the four destinations plus Argentina is above 60 percent for each of these countries. For Colombia, neighboring Venezuela is an important destination; the share of its emigrants going to the four destinations plus Venezuela is 81.3%. This pattern suggests that in the relatively remote Southern Cone relatively rich neighbors compete for migrants with more distant high-income countries. It is also apparent in Table 2 that Argentina, Brazil, and Venezuela – South America's relatively large and rich countries – have very low emigration rates, in each case less than 2 percent and in Brazil less than 1 percent.

Figures 3 and 4 present two different takes on the temporal process of migration. In Figure 3 we plot cumulative migration rates by age and region from the 2000 census, which demonstrates the differing age trajectories of migration across the different regions of the Americas. As expected, Mexico, Central America, and the Caribbean all have substantially higher migration rates to the U.S. than the Andean or Southern Cone countries. The differences are deeper than this, however, as we see Mexican and Central American migration taking place predominantly at younger ages: from age 27 on, migration is zero or negative in these regions. In the Caribbean, however, we see a more linear relationship between migration and age, with 40-year olds displaying migration rates that are roughly 50% higher than 27-year olds. The upshot of these different age trajectories is that while Mexicans have emigrated at a rate 3-4 percentage points higher than Caribbeans at age 25, by age 40 this difference has been reversed. Figure 4a plots the weighted average migration rates by census year, and shows that the very rapid increases in migration which occurred between 1990 and 2000 had slowed substantially by 2005. Figure 4b shows that the annualized migration rate in the first few years of the new century had fallen to rates similar to those observed during the 1980s.[14]

Equation (9) calls for initial differences in labor demand between source and destination countries, which we measure as the log ratio of source-country per capita GDP to destination-country per capita GDP in the year a cohort first enters the labor market (assumed to be age 16). This is an admittedly crude measure of labor demand and we view the variable as controlling for relative initial conditions in country pairs more broadly. We also control for current-period labor-market shocks, using the 10-year change in relative per capita GDP. We discuss results using other variables, as well.

We measure other economic shocks using data on the incidence of armed conflict from the International Peace Research Institute, Oslo (http://www.prio.no/), data on balance of payments crises (measured as sudden stop episodes) from Cavallo (2007), and data on earthquakes, wind storms, volcanic eruptions, land slides, and wave surges from the International Emergency Event Database (http://www.emdat.be/).

4 RESULTS

4.1 Labor Supply & Labor Demand Ratios.

We begin our empirical analysis of the relationship between labor supply and subsequent emigration to the United States in Table 3. The first battery of results is weighted by birth cohort size (so that they are representative for an individual selected randomly from the pool of birth cohorts considered) and the second battery is unweighted. In all cases the coefficient the log labor supply ratio (sending country over

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[14] These figures are not statements of the population averages as we have a specific set of birth years over which we observe outcomes, and so the age composition of our migrant pool changes across census years.

the US) is positive, implying that those born into relatively large cohorts migrate in larger numbers. Once sending country fixed effects are included, the results are very stable regardless of the additional controls, and suggest that a ten percent increase in the birth cohort ratio will lead to a half a percent per year additional emigration. These estimates are very similar to those from previous work (Hanson & McIntosh 2008) which found decadal migration elasticities of roughly .05 using OLS on Mexican state-level data (since we use annualized migration rates here, we should expect to see coefficients that are one-tenth as large as the decadal estimates). Over the 25-year age span that we measure migration, this marginal effect suggests that labor supply-driven migration will cause roughly 12% of an 'additional' unit of labor supply to emigrate to the U.S.

The larger magnitudes observed using weights, combined with the dominant size of Mexico in the cohort sizes, leads us to question the extent to which these results may be being driven by a specific subset of countries. In order to address this, Table 4 partitions the data and looks for marginal effects on subsets of the countries. We see that, far from being dominated by the Mexican relationship, the strongest effects are found in the Caribbean countries. The effect is highest in those in the middle of the age range we use (that is, 24-32), and falls off sharply with distance from the destination country.

4.2 Distance Analysis.

The sharp dropoff in the marginal effect of cohort size with distance merits more investigation in its own right. A simple way of visualizing the migration-distance link is a scatterplot of mean annualized migration rates over distance; Figure 5 plots this relationship, and there appears to be a clear break at around 3,500 km; the distance that separates Guatemala or Trinidad/Tobago from Panama or Columbia. Within this distance, annualized migration rates drop from around .4% to around .1%. Table 5 gives regression estimates of this relationship. The first three columns examine the raw relationship between annualized migration and distance, and show the decreasing and concave relationship observed in Figure 5. To measure distance, we use three metrics: simple distance, a variable which equals the number of countries crossed in countries that have land crossings, and a dummy variable for the destination being an island.[15]

We also include a dummy for contiguity, which in the data used represents the U.S.-Mexican border. Interestingly, contiguity indicates substantially higher migration when we include a linear and quadratic in distance, but when we enter a variable equal to the number of countries crossed for land-connected source countries the additional effect of contiguity is no longer significant. This suggests that the number of land border crossings enters in some linear fashion, and the Mexico-U.S. border is not qualitatively different from other border crossings in the Americas, except insofar as it represents only a single hurdle to entry into the U.S. We include an interaction between island and distance, testing whether the marginal effect of distance is different by ocean than it is by land. The results indicate that, given the lower overall level of migration from islands to the U.S., migration is less sensitive to distance over water than it is to distance over land.

Columns 4-6 of Table 5 use country fixed effects, thereby removing the mean effect of distance. The labor supply and demand ratios are then interacted with distance, which measures the extent to which the marginal effect of large cohort size on migration

[15] When we include the 'Countries Crossed' variable, which is only non-zero for non-island countries, we also include a dummy for island in order to eliminate the average differences with island countries. 'Countries Crossed' therefore measures the slope in migration generated by the number of border crossings among non-island countries only.

is stronger with distance. All of these metrics indicate that the sensitivity of migration to labor supply is decreasing in distance. This demonstrates the 'gravity' dimension to migration in the Americas, in that spatial distance exerts a strong effect over the manner in which domestic shocks translate into international migration flows.

4.3. Shocks.

Thinking of birth cohort size as a shock to relative labor supply ratios begs the question of how a broader set of shocks may drive migration, and may modulate the effect of labor supply shocks themselves. Our data provides an intuitive way to examine the causal impact of shocks on migration because we have long time series over many countries, and so observe a sufficiently large number of shocks in the data to estimate precise impacts. The five shocks we consider are:

- *Number of Serious Natural Disasters* is the count, over census intervals, of earthquakes over 7.5 Richter, windstorms lasting a week or more, or landslides or volcano eruptions affecting more than 1000 people in sending country.

- *Number of Sudden Stops* is the count, over census intervals, of Sudden Stops 1-4 from Cavallo data, defined as a fall in FA surplus of at least 2 SD from sample mean, with standard deviations calculated four different ways.

- *Civil Conflict* is from CSCW Monadic Armed Conflict data, calculated as a dummy between census intervals indicating any type of conflict (Extra-state, Intra-state, Internal, or Internationalized Internal) in sending country.

- *Log Mean Annual Change in GDP per capita* is calculated over census intervals, using annual data from the WDI for the sending country.

- *Log Standard Deviation Annual Change in GDP per capita* is calculated over census intervals, using annual data from the WDI for the sending country.

The first column of results for each shock in Table 6 gives the uninteracted effect, which measures how migration covaries with these shocks. Here we see strong out-migration effects arising from natural disasters, but the other shocks do not have detectable effects on migration. In the case of civil conflict, if anything, there is less migration out of cohorts suffering from the shock.

The second set of columns for each shock examines how the strength of the migration response to the shock varies with the age of the cohort. Given the country, birth year, and census year fixed effects used, this interaction tracks out the relative contour of migration elasticities over age. Across four of the five indicators we see a consistent pattern, with the sensitivity to shocks increasing with age, but at a decreasing rate. These results imply that over the age range for the analysis (16-40), the raw age migration profile is similar to the profile of sensitivity to shocks: just as migration rates are increasing but concave in age, so is the degree to which shock increase migration. An exception to this rule is the presence of conflict; here we see a disproportionate migration impact on the *young,* an effect that then weakens with age.

Table 7 conducts a similar analysis, but rather than interacting the incidence of shocks with the age of the cohort, the same battery of shocks is interacted with the base conditions of the cohort: log cohort size ratios at birth and log GDP ratios at age 16. Here again we see strong interactive effects. We find that migration is more sensitive to birth cohort size in years where there has been a natural disaster, a 'sudden stop', or in which income per capita has had a high standard deviation. It is also more sensitive to labor supply when income per capita is growing quickly. Again, the conflict variable shows contrarian results, indicating a *lower* sensitivity to cohort size in cohorts experiencing conflict. Looking at the interactions with GDP ratios at age 16, we see an overall pattern consistent with the idea that wealthier cohorts are less sensitive to income shocks (thus responsiveness to natural disasters and SD of GDP pc is lower for cohorts wealthy at 16). Again, the conflict results are reversed from the others, showing that richer cohorts migrate disproportionately *more* when they undergo conflict.

5 CONCLUSION

We intersect data on the size of birth cohorts with questions from the U.S. Census on the country of birth to calculate cohort-specific migration rates from twenty-one countries in the Americas to the U.S. We test theory suggesting that labor supply shocks, in the form of abnormally large or small birth cohorts, should be a driving factor in migration. Our results confirm this theory, indicating that labor supply-driven migration is a substantial contributing factor to migration in the Americas. The effect of labor supply shocks decreases with the distance between the sending and receiving country, is lower for island nations, and is strongest among individuals aged 24-32.

Our fine-grained cohort panel data cover 45 years and a broad set of countries, and therefore provide a good platform for examining how large but relatively rare shocks may contribute to migration. We find that major natural disasters have the clearest effect on driving migration, and that in general sensitivity to shocks follows the same age profile as migration itself; increasing with age after 16 at a decreasing rate. A variety of shocks have stronger effects on migration in large birth cohorts, again demonstrating the importance of demographic pressures in intra-American migration.

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Table 1: Emigration from Developing Countries, 2000

		Emigration to high income countries		Emigration to all countries	
	Population	Emigrants	Emigration rate	Emigrants	Emigration rate
East Asia & Pacific	1,804,027,262	12,315,945	0.0068	16,646,474	0.0092
Europe & Central Asia	444,417,646	11,096,197	0.0250	40,475,642	0.0911
Latin America & Caribbean	513,924,769	19,446,628	0.0378	24,212,595	0.0471
Middle East & North Africa	276,357,816	8,359,017	0.0302	12,914,533	0.0467
South Asia	1,358,784,470	8,794,178	0.0065	23,906,281	0.0176
Sub-Saharan Africa	672,823,767	4,291,261	0.0064	17,434,890	0.0259

High-income countries include Canada and the US; Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, the Netherlands, Norway, Portugal, Spain, Sweden, and Switzerland; Australia, Hong Kong, Korea, New Zealand, Singapore, Taiwan, and Japan; and Kuwait, Qatar, Saudi Arabia, and the United Arab Emiriates. Source: Authors' calculations based on data from Parsons, Skeldon, Walmsley, and Winters (2007).

Table 2: Emigration rates in Latin America and the Caribbean, 2000

Origin Country	Emigration rate	Share of emigrants from US, Can, Spain, UK
Antigua & Barbuda	0.625	0.562
Bahamas	0.124	0.895
Barbados	0.401	0.852
Bermuda	0.404	0.807
Cuba	0.097	0.869
Dominica	0.590	0.626
Dominican Republic	0.111	0.828
Grenada	0.678	0.711
Haiti	0.096	0.643
Jamaica	0.371	0.884
Puerto Rico	0.419	0.902
Saint Kitts & Nevis	0.848	0.547
Saint Lucia	0.327	0.502
Saint Vincent & the Grenadines	0.507	0.644
Trinidad & Tobago	0.258	0.878
U.S. Virgin Islands	0.610	0.865
Mexico	0.105	0.928
Belize	0.214	0.857
Costa Rica	0.030	0.736
El Salvador	0.163	0.871
Guatemala	0.055	0.835
Honduras	0.058	0.822
Nicaragua	0.107	0.448
Panama	0.066	0.820
Argentina	0.017	0.410
Bolivia	0.047	0.188
Brazil	0.006	0.304
Chile	0.036	0.249
Colombia	0.040	0.443
Ecuador	0.058	0.768
Guyana	0.503	0.840
Paraguay	0.079	0.053
Peru	0.029	0.491
Uruguay	0.076	0.233
Venezuela	0.015	0.558
Total	0.051	0.754

The emigration rate is the share of emigrants (as measured by Parsons et al., 2007) in the total population. Very small countries in Latin America and the Caribbean are excluded.

Table 3: Labor Supply & Demand Regressions.

Dependent Variable: Annualized share of cohort migrated	**Regressions Weighted by Birth Cohort Size**				**Unweighted Regressions**			
Log Birth Cohort Size Ratio	0.00028	0.00528	0.0053	0.00531	-0.00012	0.0046	0.00458	0.00448
	(3.15)**	(3.54)**	(4.13)**	(4.59)**	(1.16)	(3.42)**	(3.41)**	(3.39)**
Log GDP pc Ratio at Age 16	0.00179	0.00142	0.00141	0.00139	0.0008	0.00062	0.00061	0.00057
	(12.22)**	(2.37)*	(2.61)**	(2.83)**	(5.20)**	(0.86)	(0.85)	(0.81)
Age at time of census			0.00083	0.00089			0.00038	0.00045
			(7.80)**	(8.47)**			(4.41)**	(5.32)**
Age ^ 2			-0.00001	-0.00002			-0.00001	-0.00001
			(7.81)**	(7.96)**			(4.50)**	(4.53)**
Observations	1449	1449	1449	1449	1449	1449	1449	1449
R-squared	0.28	0.6	0.65	0.67	0.05	0.32	0.32	0.35
Fixed Effects Used:	Birthyear	Country, Birthyear	Country, Birthyear	Country, Census Year, Birthyear	Birthyear	Country, Birthyear	Country, Birthyear	Country, Census Year, Birthyear

* significant at 95%, ** significant at 99%, robust t-statistics in parentheses.

Table 4: Partitioned Regressions.

Dependent Variable: Annualized share of cohort migrated	All	All except Mexico	Mexico & Central America	Caribbean	Southern Cone & Andes	Nearby	Distant	Age 16-23	Age 24-32
		By Region				By Distance		By Age	
Log Birth Cohort Size Ratio	0.00531	0.00601	0.00092	0.00676	0.00093	0.00779	-0.00034	0.0038	0.00797
	(4.59)**	(6.76)**	(0.56)	(2.46)*	(2.03)*	(5.13)**	(0.43)	(2.42)*	(4.31)**
Log GDP pc Ratio at Age 16	0.00139	0.0017	0.00287	0.00058	0.0002	0.00188	-0.00061	0.00051	0.00228
	(2.83)**	(4.76)**	(3.50)**	(0.52)	(0.88)	(2.40)*	(1.12)	(0.74)	(2.63)**
Age at time of census	0.00089	0.00039	0.00153	0.00025	0.0001	0.0015	0.00005	0.00195	0.00438
	(8.47)**	(8.09)**	(10.80)**	(1.67)	(3.79)**	(11.03)**	(0.95)	(1.35)	(1.63)
Age ^ 2	-0.00002	-0.00001	-0.00003	0	0	-0.00003	0	-0.00004	-0.00008
	(7.96)**	(6.73)**	(10.74)**	(1.27)	(3.02)**	(10.21)**	(1.07)	(1.09)	(1.67)
Observations	1449	1375	515	436	498	589	205	631	498
R-squared	0.67	0.53	0.72	0.37	0.4	0.57	0.28	0.7	0.78

All regressions use country, birthyear, and census year fixed effects. Regressions are weighted by the size of the birth cohort.

* significant at 95%, ** significant at 99%, robust t-statistics in parentheses.

Table 5: Distance Effects.

Dependent Variable: Annualized share of cohort migrated	Cross-Country Variation: Distance	Cross-Country Variation: Countries Crossed	Cross-Country Variation: Island Distance	Country Fixed Effects: Distance Inter-actions	Country Fixed Effects: Countries Crossed Inter-actions	Country Fixed Effects: Island Inter-actions
Dyadic distance between	-0.00293		-0.00047			
population centers, '000km	(10.54)**		(12.39)**			
Distance Squared	0.00022					
	(9.40)**					
Dummy for Island	-0.00072	-0.00408	-0.00708			
	(2.52)*	(10.42)**	(5.53)**			
Countries Crossed for non island,		-0.00172				
0 for island		(12.87)**				
Countries Crossed Squared		0.00011				
		(9.60)**				
Contiguous	0.00272	-0.00033	0.00316			
	(11.98)**	(1.08)	(14.38)**			
Island * Distance			0.003			
			(6.15)**			
Log Birth Cohort Size Ratio				0.00721	0.00568	0.00499
				(4.56)**	(4.71)**	(4.21)**
Log GDP pc Ratio at Age 16				0.00186	0.00115	0.00093
				(2.00)*	(1.74)	(1.57)
Log Birth Cohort Ratio * Distance				-0.00057		
				(2.50)*		
Log GDP Ratio * Distance				-0.00014		
				(0.88)		
Log Birth Cohort Ratio					-0.00042	
* Countries Crossed					(3.10)**	
Log GDP Ratio					-0.00005	
* Countries Crossed					(0.46)	
Log Birth Cohort Ratio * Island						-0.00378
						(2.35)*
Log GDP Ratio * Island						-0.00026
						(0.28)
Observations	1449	1449	1449	1449	1449	1449
R-squared	0.55	0.63	0.54	0.68	0.68	0.68

All regressions use birthyear, and census year fixed effects plus linear & quadratic in age.

Regressions weighted by the size of the birth cohort.

* significant at 95%, ** significant at 99%, robust t-statistics in parentheses.

Table 6: Shocks and their Interactions with Age.

Dependent Variable: Annualized share of cohort migrated	# of Serious Natural Disasters		# of Sudden Stops		Civil Conflict		Log Mean Annual Change in GDP p/c:		Log Standard Deviation of Annual Change in GDP p/c:	
Log Birth Cohort Size Ratio	0.00485	0.002345	0.00426	0.003373	0.00518	0.005041	0.00539	0.005898	0.00407	0.003884
	(4.52)**	(2.29)*	(3.73)**	(3.00)**	(4.42)**	(4.36)**	(4.65)**	(5.20)**	(3.53)**	(3.37)**
Log GDP pc Ratio at Age 16	0.00138	0.000817	0.00166	0.001362	0.00139	0.001518	0.00142	0.001295	0.00162	0.001583
	(2.97)**	(1.87)	(3.44)**	(2.90)**	(2.84)**	(3.09)**	(2.88)**	(2.61)**	(3.36)**	(3.27)**
Shock	0.00045	0.000108	0.00022	-0.000496	-0.00034	0.000555	0.00021	-0.000299	-0.00006	-0.000376
	(5.49)**	(1.16)	(1.67)	(2.21)*	(1.67)	(1.91)	(1.64)	(1.02)	(0.60)	(2.29)*
Years since cohort turned 16 * Shock		0.000144		0.000199		-0.000389		0.000283		0.000107
		(8.44)**		(4.09)**		(7.13)**		(3.74)**		(3.72)**
Years since cohort turned 16 ^ 2 * Shock		-0.000007		-0.000008		0.000019		-0.000019		-0.000005
		(8.91)**		(4.01)**		(7.76)**		(4.49)**		(3.82)**
Years since cohort turned 16	0.0004	0.000125	0.00039	0.000274	0.0004	0.000454	0.00041	-0.00181	0.00039	-0.000129
	(8.59)**	(3.53)**	(7.90)**	(5.38)**	(8.07)**	(9.06)**	(8.18)**	(3.13)**	(7.90)**	(1.02)
Years since cohort turned 16 ^ 2	-0.00002	-0.000003	-0.00002	-0.000009	-0.00002	-0.000018	-0.00002	0.000131	-0.00002	0.000009
	(8.41)**	(1.86)	(7.99)**	(4.77)**	(7.98)**	(8.99)**	(7.99)**	(4.08)**	(8.17)**	(1.46)
Observations	1449	1449	1375	1375	1449	1449	1449	1449	1423	1423

All regressions use country, birthyear, and census year fixed effects. Regressions are weighted by the size of the birth cohort. * significant at 95%, ** significant at 99%, robust t-statistics in parentheses.

# of Serious Natural Disasters is the sum, over census intervals, of earthquakes over 7.5 Richter, windstorms lasting a week or more, or landslides or volcano eruptions affecting more than 1000 people in sending country.

# of Sudden Stops is the the sum, over census intervals, of Sudden Stops 1-4 from Cavallo data, defined as a fall in FA surplus of at least 2 SD from sample mean, with standard deviations calculated four different ways.

Civil Conflict is from CSCW Monadic Armed Conflict data, calculated as a dummy between census intervals indicating any type of conflict (Extra-state, Intra-state, Internal, or Internationalized Internal) in sending country.

Log Mean & SD of Change in GDP for sending countries calculated using data on annual GDP per capita from the WDI, over census intervals.

Table 7: Interactions between Shocks and Labor Supply.

Dependent Variable: Annualized share of cohort migrated	# of Serious Natural Disasters	# of Sudden Stops	Civil Conflict	Log Mean Annual Change in GDP per capita:	Log Standard Deviation of Annual Change in GDP per capita:
Log Birth Cohort Size Ratio	0.00322	0.00398	0.00509	0.00165	0.00223
	(3.07)**	(3.68)**	(4.35)**	(1.09)	(1.81)
Log GDP pc Ratio at Age 16	0.00137	0.00149	0.00128	-0.00204	0.0043
	(3.05)**	(3.22)**	(2.55)*	(0.69)	(5.29)**
Shock	0.00022	0.00106	0.00257	0.00314	-0.0006
	(1.07)	(2.42)*	(2.00)*	(2.77)**	(0.88)
Log Birth Cohort Size * Shock	0.00051	0.00027	-0.0005	0.00052	0.00046
	(5.79)**	(2.42)*	(1.44)	(3.18)**	(2.33)*
Log GDP pc Ratio * Shock	-0.00041	0.00023	0.00139	0.00045	-0.00061
	(3.31)**	(1.46)	(2.34)*	(1.18)	(4.12)**
Age at time of census	0.00082	0.00087	0.00089	0.00089	0.0009
	(8.90)**	(8.34)**	(8.46)**	(8.89)**	(8.75)**
Age ^ 2	-0.00001	-0.00002	-0.00002	-0.00002	-0.00002
	(8.49)**	(7.85)**	(8.00)**	(8.50)**	(8.40)**
Observations	1449	1375	1449	1449	1423

All regressions use country, birthyear, and census year fixed effects. Regressions are weighted by the size of the birth cohort. * significant at 95%, ** significant at 99%, robust t-statistics in parentheses.

# of Serious Natural Disasters is the sum, over census intervals, of earthquakes over 7.5 Richter, windstorms lasting a week or more, or landslides or volcano eruptions affecting more than 1000 people in sending country.

# of Sudden Stops is the the sum, over census intervals, of Sudden Stops 1-4 from Cavallo data, defined as a fall in FA surplus of at least 2 SD from sample mean, with standard deviations calculated four different ways.

Civil Conflict is from CSCW Monadic Armed Conflict data, calculated as a dummy between census intervals indicating any type of conflict (Extra-state, Intra-state, Internal, or Internationalized Internal) in sending country.

Log Mean & SD of Change in GDP for sending countries calculated using data on annual GDP per capita from the WDI, over census intervals.

Figure 1: Average Number of Births per Year

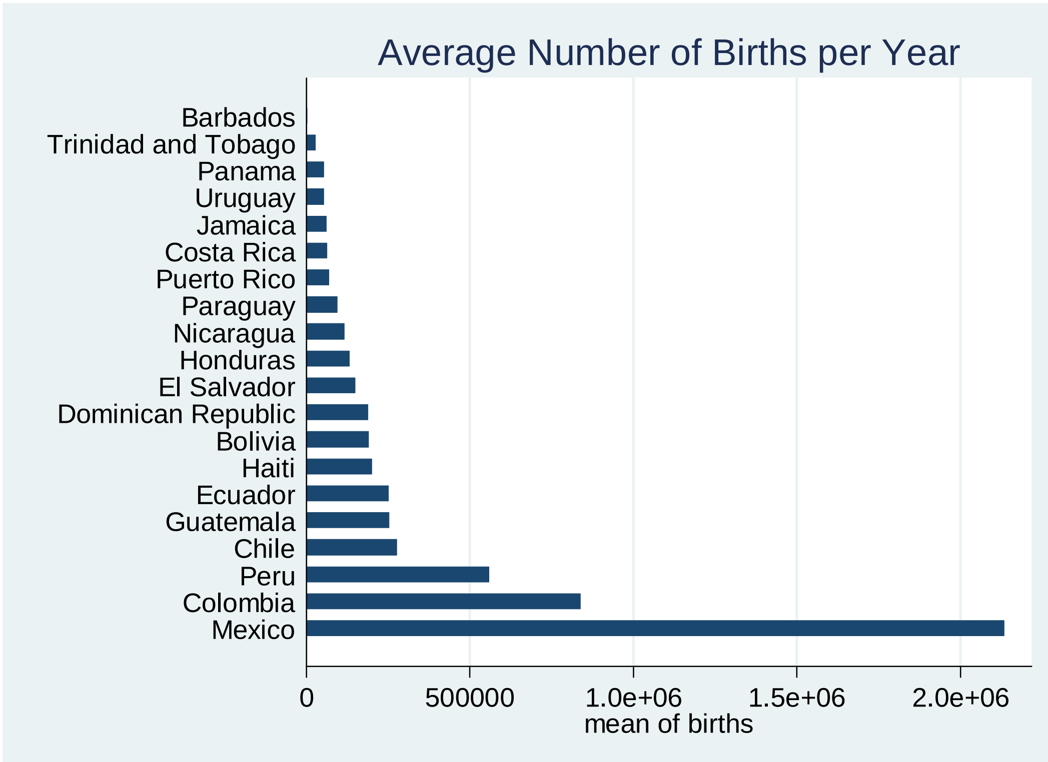
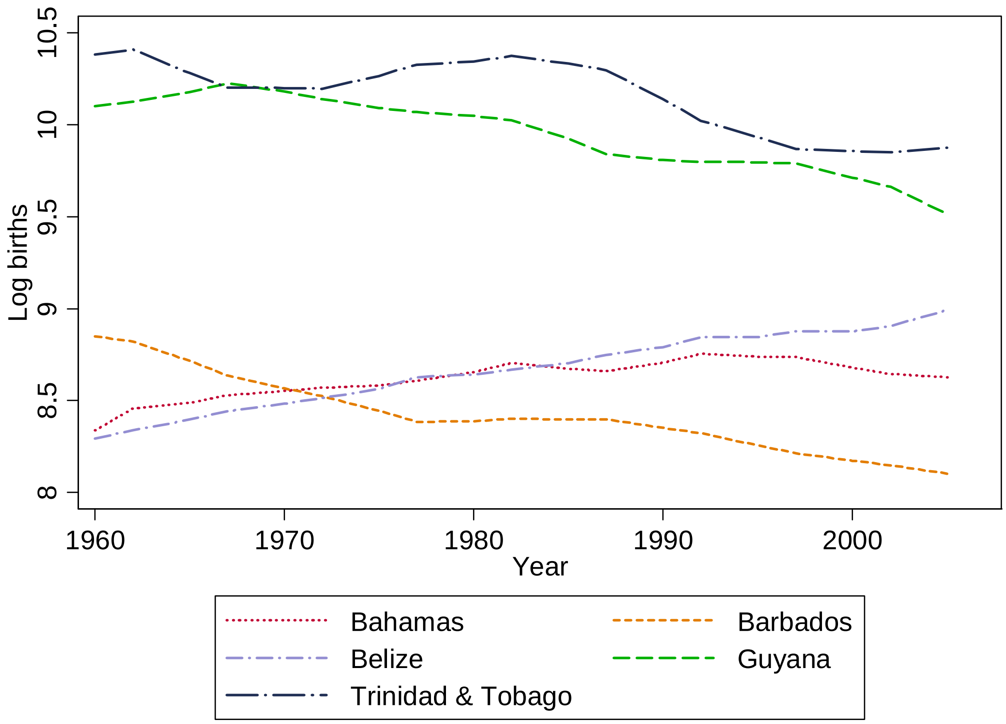
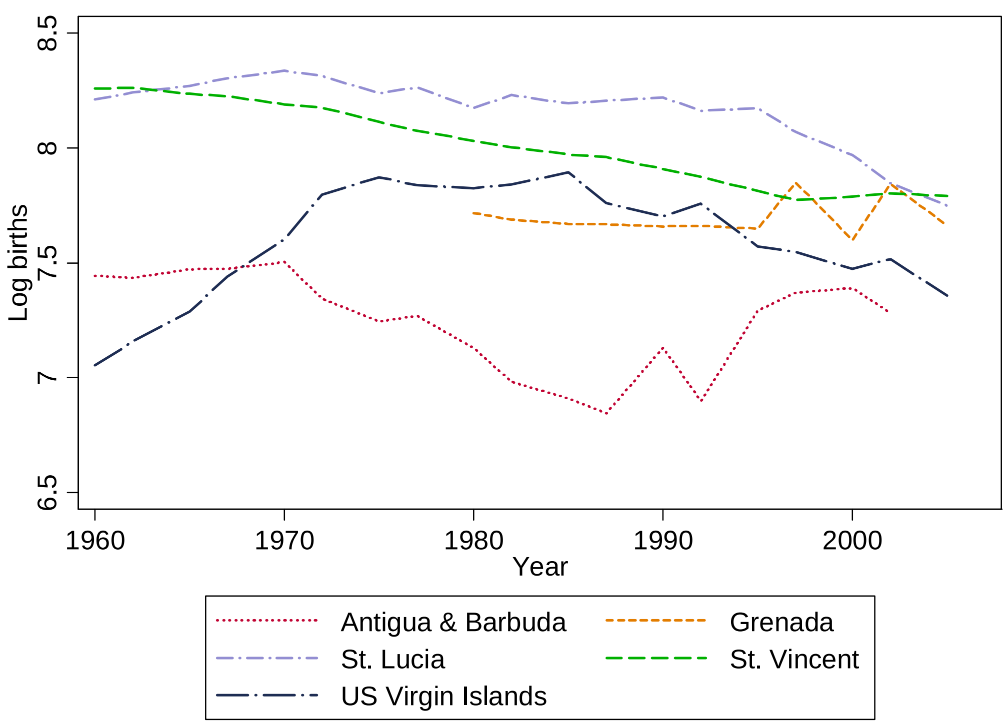


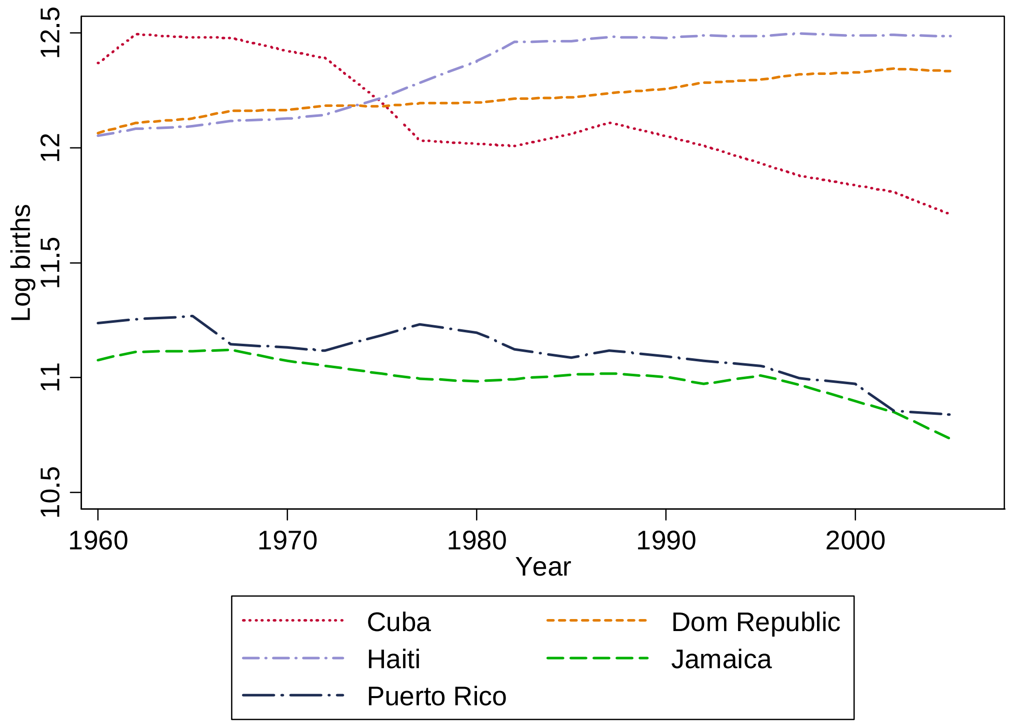
Figure 2: Number of births by country, 1960-2005

(a) Smaller Caribbean Basin Countries

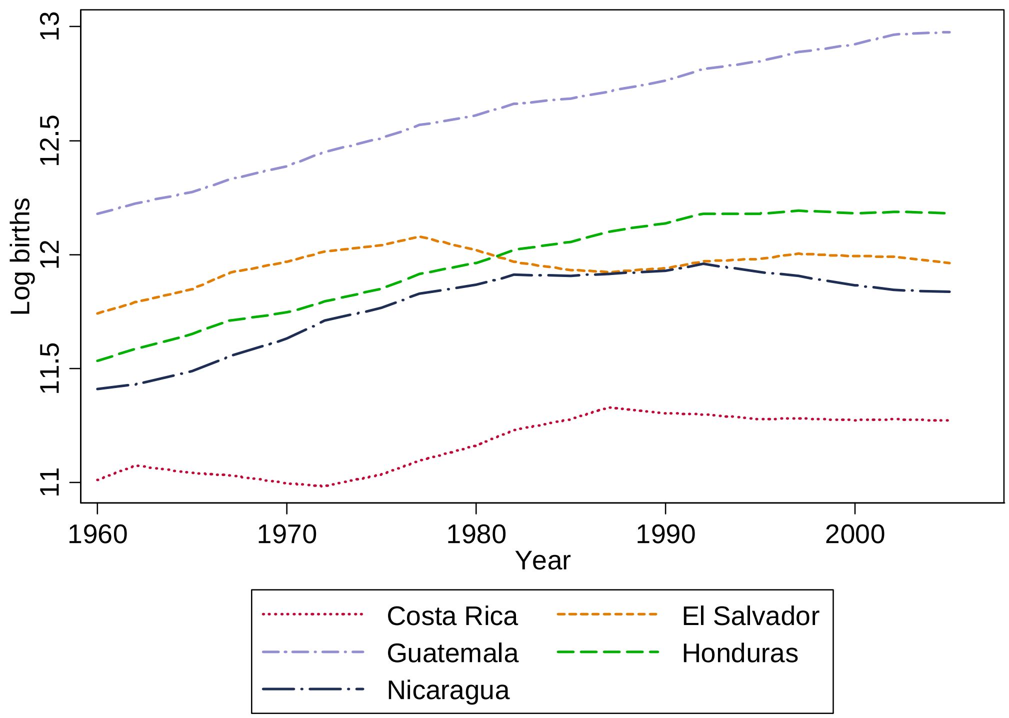




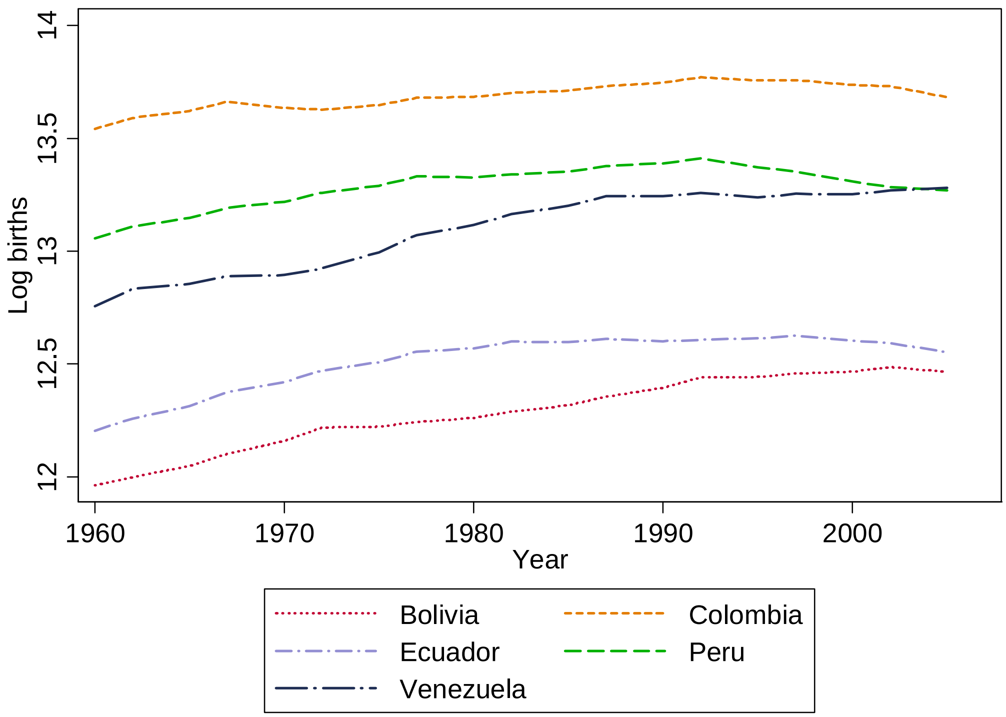
(b) Larger Caribbean Basin Countries



(c) Central America



(d) Andes



(e) Southern Cone

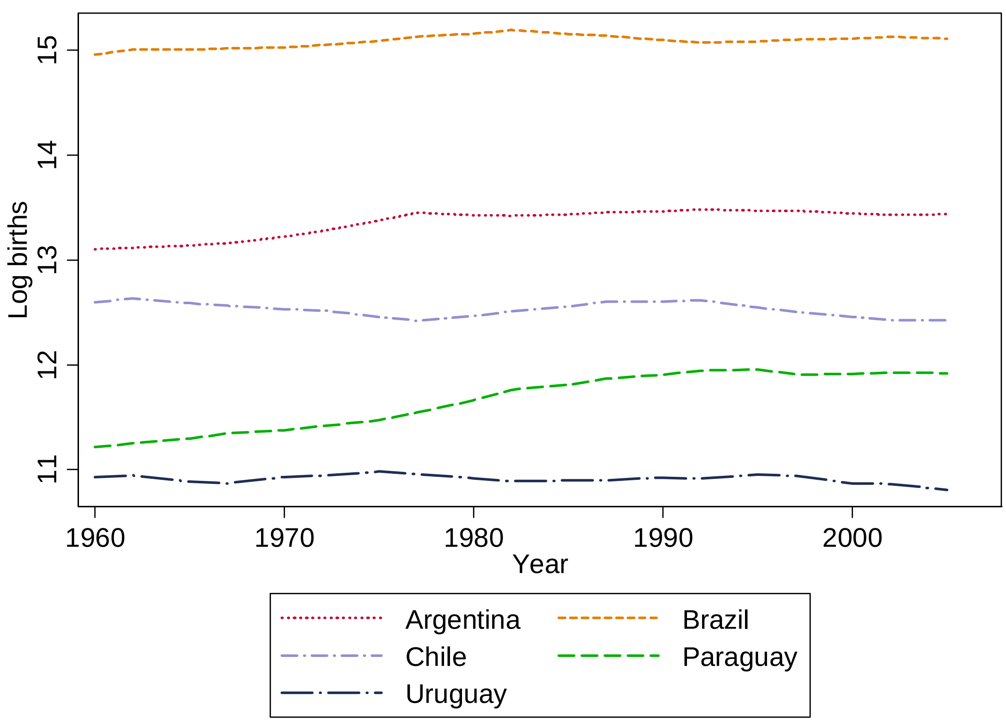


Figure 3: Migration Rates by Age and Region

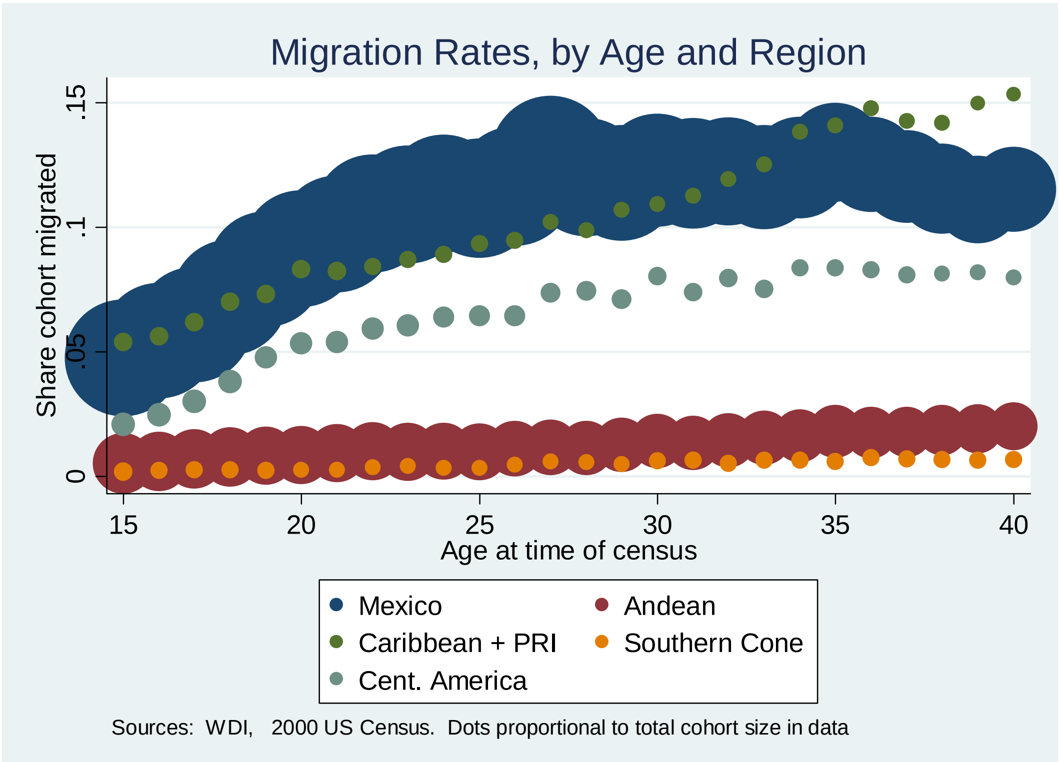


Figure 4a: Cumulative Migration by Census Year & Region

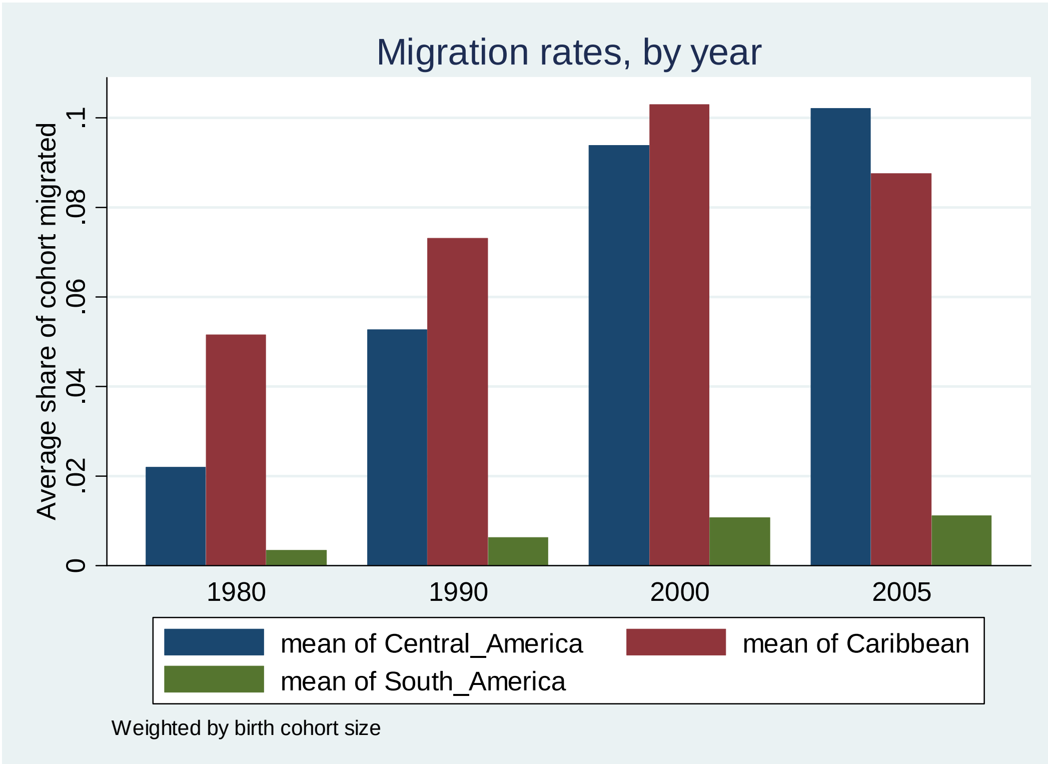


Figure 4b: Annualized Migration Rates by Census Year & Region

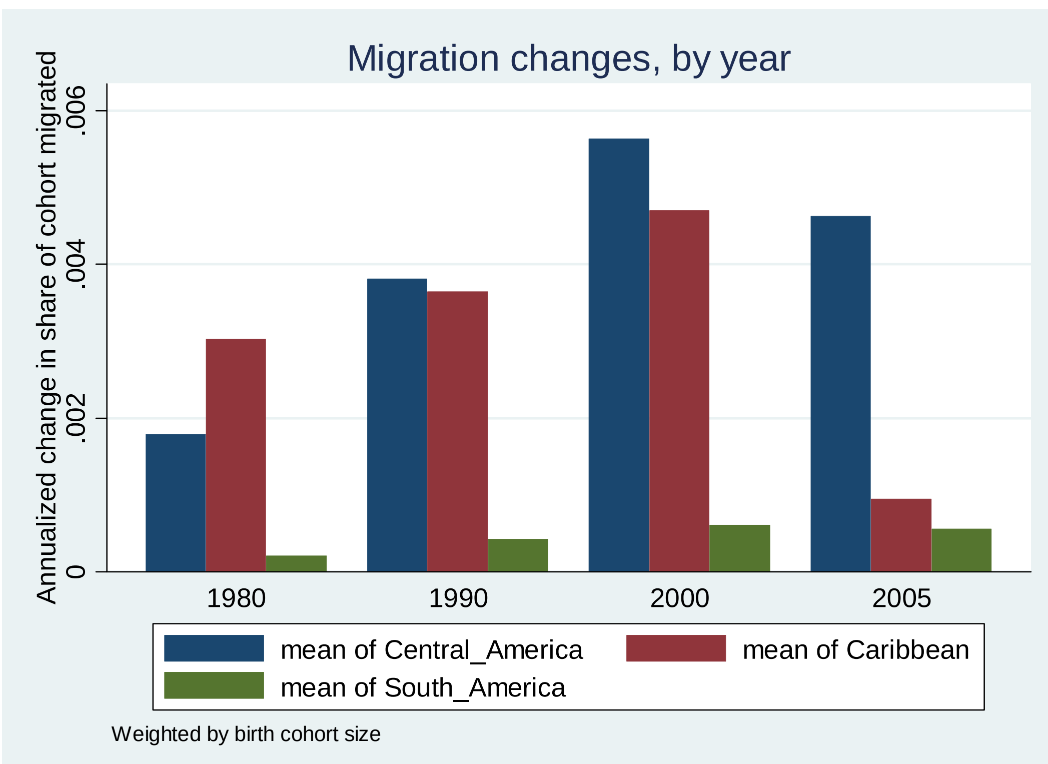


Figure 5: Average Migration by Distance from U.S.