# New Evidence on the Healthy Immigrant Effect

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**Abstract**

This paper presents new evidence that immigrants from developing countries have better health than natives upon arrival to their destination. It analyzes a very interesting episode in international migration, namely the exodus of Ecuadorians in the aftermath of the economic collapse in the late 1990s. More than 600,000 Ecuadorians from 1999 to 2005 left their homeland, most relocating in Spain. Using birth certificate data, the paper compares the birth outcomes of immigrant women in Spain not only to that of natives at destination, but to that of natives in Ecuador and immigrants from other nationalities in Spain. These comparisons suggest that the better health at birth of children born to immigrants from Ecuador partly responds to the selection of healthier women into migration.

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# I. Introduction

In migration research questions about the characteristics of those who migrate remain fundamental. To evaluate the costs and benefits of population movements, immigrants are compared to the native population at destination and in the source country along many dimensions (e.g. education, age, risk and entrepreneurial attitudes or health).

The health of immigrants is an issue of concern. Some critical voices argue that migration may represent a burden to the public health system financed mainly by natives at destination. The health of immigrants may also be a relevant factor for their assimilation and integration process. For the sending country, the characteristics of those who leave may as well have repercussions at the aggregate level, for example, in terms of health and inequality.

A widely known and established regularity is that new immigrants to developed countries such as the US, Canada, and Australia enjoy significant health advantages relative to comparable native born individuals in these countries.[1] This is known in the literature as the *healthy immigrant effect* (HIE). The HIE is present among most immigrant groups, even though a vast majority come from developing countries with worse life expectancy indicators. There is also evidence that the health gap does not respond to socioeconomic differences in terms of education and income as most recent immigrants fall behind the native population in these dimensions.

Considerable attention has been directed to the puzzle of the health advantage of immigrants. In an expanding literature at least three alternative explanations have

[1] For the US see Jasso et al. 2004, Abraido-Lanza et al. 1999, Antecol and Bedard 2006, and Giuntella 2012. Chen et al. 1996, Deri 2003, McDonald 2003 and Laroche 2000 have documented a health advantage among immigrants to Canada, while Donovan et al. 1992, Chiswick et al. 2008, and Powles 1990 do so for immigrants to Australia.

sought to account for it. First, their better health may simply be a symptom of the healthier diets, habits and behaviors inherited from the country of origin (*i.e. the cultural hypothesis*). Second, the migration episode may have a direct impact on health as a result of income shocks or other intense changes in life style directly related to the movement (*i.e. the causal or direct effect of migration*). Finally, it may be that only healthy individuals are ready to make their way to a remote and unfamiliar labor market. Consequently, individuals in the upper tail of the health distribution are more likely to migrate (*i.e. the selective migration hypothesis*).[2]

The aim of this paper is to better understand the channels behind the healthy immigrant effect. I study a very interesting episode in international migration, namely the Ecuadorian exodus in the aftermath of the economic collapse of the late 1990s. From 1999 to 2005 more than 600,000 Ecuadorians left their country, and most headed towards Spain rather than the US, the traditional destination for Ecuadorian migration (Bertoli et al. 2011).

The paper employs birth outcomes as a measure of maternal health (i.e. birth weight, low birth weight (less than 2,500 grams), gestational length, preterm birth (less than 38 weeks of gestation) and death within 24 hours of birth). Poor maternal health and risky behaviors during pregnancy have been shown to adversely affect birth outcomes.[3] For example, nutritional deprivation and maternal stress during pregnancy lead to lower birth weight and reduce gestational length (Almond and Mazumder, 2013; Bozzoli and Quintana, 2014; Camacho 2008; and Quintana and

[2]It has also been suggested that the immigrant health advantage could derive from the mandatory health screening that is part of the migration process in some countries. However, some evidence indicates that admission policies are not the principal determinant of the health gap (Laroche, 2000 and Uitenbroek and Verhoeff, 2002).

[3]See Aizer and Currie (2014) for a detailed survey of the literature.

Ródenas, 2014). Smoking also increases the probability of low birth weight (Currie, Neidell and Schmieder, 2009), while participation in supplemental nutritional programs reduces it (Hoynes, Page and Stevens, 2011). Currie and Moretti (2007) also document an important intergenerational correlation in birth outcomes (i.e. low birth weight).

In the empirical analysis I employ administrative birth certificate data for Ecuador and Spain which give coverage to all registered births in both countries. Since 2001 immigrants in Spain, independently of their legal status, have incentive to register to have access to the public health and education system. Thus the data contain information on illegal immigrants that is usually not available. In addition, administrative records not always contain information on years since arrival. Hence the focus on the Ecuadorian exodus represents a relevant contribution as it allows analyzing the determinants of the healthy immigrant effect net of assimilation or acculturation on a large number of recent immigrants.[4]

The paper documents an important advantage in terms of birth outcomes among immigrant women from Ecuador in Spain. These women also show better outcomes than their native counterparts in Ecuador, suggesting that healthier habits and behaviors inherited in the country of origin do not seem to be the only explanation for their health advantage. Finally, Ecuadorian immigrants are compared to those from Romania, another large minority group in Spain. The comparison also reveals an important health advantage in favor of the former group. This last finding is consistent with the theoretical prediction that immigrants from more remote areas are more positively selected to compensate the higher cost of the move (Chiswick, 1999).

[4] As a result of the exodus the Ecuadorian population in Spain increased from 76,000 individuals before 2000 to 457,000 in 2005 (Bertoli et al. 2011).

This is reassured when the comparison is extended to immigrants from Colombia, Bulgaria and China.

The results in this paper may have important implications for the socioeconomic outcomes of immigrants at destination. Birth weight and low birth weight have been shown to be important predictors of health later in life, including the probability of infant mortality (Almond et al. 2005). They are also strongly associated with long term outcomes, such as education, earnings, pregnancy complications and disability claims (Behrman and Rosenzweig 2004; Black, Devereux, and Salvanes 2007; Royer 2009 and Oreopoulos et al 2008).[5] The better health at birth of children born to immigrant mothers could compensate the negative effects of other migration penalties related, for instance, to discrimination or the absence of assimilation (Bosch et al. 2010).

The paper is structured as follows: the next section briefly discusses the literature on the healthy immigrant effect, section III highlights the main features of the international migration episodes in this study; section IV describes the data; section V discusses the empirical methodology; the results and some robustness checks are presented in section VI and section VII concludes.

[5] An important debate in this literature is the existence of nonlinearities in the effect of birth weight. For example, Almond et al. (2005) and Royer (2009) find that the relationship between birth weight and infant mortality is strongest for the lower birth weight births. Behrman and Rosenzweigen (2004) also find that augmenting birth weight among lower birth weight babies, but not among higher birth weight ones, has significant labor market payoffs. In contrast, they also find that increasing birth weight increases adult schooling attainment and adult height for babies at most levels of birth weight. Similarly, Black et al. (2007) find little evidence of significant nonlinearities in earnings, education, height or IQ tests. Finally, Royer (2009) shows that the effect of birth weight on education is strongest in the 2,500+ grams range, while Oreopoulos et al. (2008) find strong effects of birth weight on outcomes such as death between ages 1 and 17, grade completion, and months on social assistance after age 18, even for ranges not considered overtly concerning (for example, birth weights between 2,500 and 3,500 grams).

# II. Literature Review

Alternative explanations have been proposed to account for the health advantage observed among recent immigrants from developing countries. First, healthy diets, habits and behaviors in the home country lead to immigrants who are healthier than the average person in the recipient country. The hypothesis based on cultural differences is put forward in Abraido-Lanza et al. (1999). They argue that the lower mortality of Latinos in the US derive from more favorable health habits (i.e. less alcohol and cigarette consumption which are the major risk factors for cancer and heart diseases, the most common causes of death for both Lations and non-Latino Whites).

A second explanation is that the migration episode has a direct impact on an individual's health due to the resulting income shocks or environmental changes. Evidence on the causal impact of migration is sparse, in the main due to the methodological difficulties involved in estimation. An exception is the work by Stillman et al. (2012) that uses data from a unique survey. They compare the health of migrant children who entered New Zealand through a random ballot, with children in the home country of Tonga whose families were unsuccessful participants in the same ballot process. Their findings indicate that migration increases height and reduces stunting of infants and toddlers, but also increases BMI and obesity among 3 to 5 years old. The authors argue that changes in dietary habits (i.e. increased consumption of meat, fat and milk) rather than the income gains associated to migration explain the findings.

Finally, the better health of recent immigrants could respond to selective migration. There are reasons to suspect that immigrants are different from those who do not migrate. The literature on selection, based on labor market outcomes (wages) and

education, reports a large body of persuasive evidence pointing to positive selection (Chiquiar and Hanson 2005; McKenzie and Rapoport 2007, 2010; Orrenius and Zavodny 2005; Chiswick 1978, 1999, 2007; Belot and Hatton 2008; Grogger and Hanson 2008), though some evidence of negative selection has also been reported for Mexico (Borjas 1987; Fernández-Huertas Moraga 2011). If positive selection in productive skills dominates migration movements, given the strong correlation between income and health, positive selection in health should also be observed. Indeed, if immigrants are selected from the high end of the income distribution in their home countries, they are likely to have access to better diets, to cleaner water and sanitation, less exposure to environmental risks and superior child and maternal health care. Even in the absence of selective migration in skills, positive selection in health is also expected. For example, if immigrants are forward looking (i.e. make current behavioral choices that emphasize future health at the expenses of current time/effort), or if sick individuals are more reluctant to leave the origin to make his or her way in an unfamiliar labor market.[6]

The large and diverse migration wave in Spain since the early 2000s is an interesting case study to analyze the alternative mechanisms behind the healthy immigrant effect. In this paper, the focus is mainly on the two largest recent minority groups: immigrants from Ecuador and Romania. Next I describe their migration experiences.

[6] Evidence of positive selection on health has been documented in Jasso et al. (2004) and Antecol and Bedard (2006).

# III. Two large migration episodes

Between 2000 and 2007 Spain received a remarkable inflow of immigrants – approximately 500,000 per year. The share of the foreign born population shifted from about 3 percent in the late 1990s to more than 10 percent by 2007. The composition of migrants changed over time. While in the 1990s migrants originated mainly from the EU-15 countries, they were rapidly overtaken by South Americans and migrants from the EU enlargement member states. The largest minority groups in Spain during the last decade were: Moroccans, Romanians and Ecuadorians. While the first group had a long tradition in the country, Romanians and Ecuadorians arrived massively only in the early 2000s.[7]

## *The Ecuadorian Exodus*

Ecuador collapsed in 1999 as a result of the economic and financial crisis. This represented an important push factor for about 600,000 people (from a country with a population of 12.7 million) who over a few years (1999-2005) emigrated. A unique feature of this migration episode is that about 80-90 percent of these Ecuadorians went to the US and Spain, to the later roughly 3 times more than the former. Bertoli et al. (2011, 2013) argue that the lower cost of migrating explains the huge exodus towards the lower income country.

The migration policy in Spain was particularly attractive to Ecuadorians. Since 1963 a visa waiver program allowed them to enter as a tourist for a period of up to three months. Those who wished to migrate could simply overstay that time frame and become undocumented workers, and then to legalize their status simply wait for

[7] See Table A1 in the Appendix

one of the frequent amnesties in the early 2000s.[8] The lax Spanish migration policy substantially influenced the location choices of immigrants. According to Bertoli et al. (2011) the Ecuadorian population in Spain increased from 76,000 individuals before 2000 to 457,000 in 2005. They represented 12 percent of immigration flows to Spain between 1999 and 2005.[9]

The liberal visa waiver program was terminated in August 2003. Henceforth Ecuadorian migrants needed a visa to enter any EU member state, so inflows to Spain immediately dropped sharply. The United States subsequently became their main destination (Bertoli et al. 2011).

A salient feature of the Ecuadorian exodus is that most of those who moved in the aftermath of the crisis headed towards Spain. Thus the analysis of birth outcomes in the early 2000s in Spain should be weakly affected by sorting across countries (i.e. migrants choosing their destination conditional on their health status).

### *The Romanian Experience*

Prior to the collapse of the communist regime in 1989, very low number of immigrants were reported. They were mostly political refugees and/or relatively highly educated Romanians of another ethnicity (Jews, Germans and Hungarians). By the mid-1990s a new pattern of labor migration emerged, against the background of a slow pace of economic restructuring that resulted in an acute decline in GDP, high inflation, mass

[8] In the first half of the 2000s in Spain there were three amnesties to illegal immigrants (2001, 2002 and 2005).

[9] The same authors estimate that the Ecuadorian population in the US increased from 272,000 before 2000 to 394,000 in 2005, and represented 1.3 percent of immigration flows in the US during this period.

layoffs, decreasing real wages and rising unemployment.[10]

The migration outflows sharply increased in 2001 when Schengen visa restrictions were lifted, allowing Romanians to freely circulate within the Schengen area. By 2010, Romanian immigrants were the most represented foreign group in both Spain and Italy. These two countries each hosted around 40 percent of Romanian immigrants in Europe, followed by Germany (5.72 percent), the UK (3.78 percent), Austria (2.23 percent), France (2.3 percent), Portugal (1.52 percent), Greece (1.73 percent) and Belgium (1.24 percent) (Andrén and Roman, 2014). It is important to note that while the Roma represented a large fraction of the immigrants in the 1990s, by the early 2000s their percentage had shrunk to that of the population in Romania (i.e. 5 to 10 percent).[11]

The international movements of Romanians can be classified in three groups (Ambrosini et al., 2012). A first one of strictly positive selected immigrants that move to traditional receiving countries such as the US, Canada and Australia. This flow is rather small but persistent and includes a significant share of young people who migrate for educational purposes. A second group of neutral average selected immigrants moved over the 1990s to several continental European countries: Germany, Austria and France. Finally, in the late 1990s and the early 2000s, large flows of Romanian migrants arrived to the Mediterranean countries, mainly Spain and Italy. Initially, those flows were characterized by negative selection but over time the pattern reversed and more skilled and educated Romanians relocated to Spain.[12]

[10] Deindustrialization led to a decrease of almost 3 million jobs in industrial employment that particularly impacted younger and older workers, who were less likely to find new employment opportunities (Voicu 2005).

[11] See Macias (2008).

[12] According to Fernández-Huertas Moraga (2013), between 2000 and 2007 a 5.1 percent of the population in Romania had a college degree, while this number was 9.5 percent among immigrants

# IV. Data

The data in this paper are obtained from the birth certificates registered in Ecuador and Spain. In both countries, registration is the administrative procedure to legalize a vital event.[13] Hence the birth certificate data give coverage to all legalized births in those countries. Since 2001, the Spanish data collect information on immigrants irrespective of their legal status. A change in the law granted all registered individuals access to the public health and education system. This incentivized both legal and illegal immigrants to register their newborns who then appear in the official statistics.[14]

The data for Ecuador and Spain contain information on birth weight and some socioeconomic characteristics of the mother such as age, province of residence, previous fertility and marital status. In Spain, the data also include detailed information on gestational length and death within 24 hours after birth.[15]

Birth weight, the most common indicator of health at birth, is defined as the body weight of a baby measured within an hour of birth. While it may suffer from measurement error, it is immune to the biases inherent in self-reported health questions in other studies. A main problem with reported assessments of one's own health is that it depends on the respondent's reference group. If the group is not stated, comparisons across individuals become difficult (King et al. 2004). This is particularly relevant

in Spain.

[13] In order to register a birth, the parents or the legal representative of the child have to present a document with statistical information on the birth outcome (Informe Estadístico del Nacido Vivo in Ecuador, or Boletín Estadístico del Parto in Spain).

[14] The Spanish data protection policy prevents the police from accessing the local population registry to identify illegal aliens.

[15] Unfortunately the birth certificates do not contain information on prenatal care.

for immigrants whose comparison group may change over the course of assimilation. The use of the prevalence rate of some diseases (i.e. diabetes, cardiovascular and lung diseases) is also subject to legitimate methodological criticism, inasmuch as the lower incidence of such chronic diseases for foreigners may simply result from their less frequent contact with western medical diagnostics.

This paper employs the information available in the birth certificates to measure health at birth. That is, birth weight and low birth weight (less than 2,500 grams), as well as gestational length, preterm birth (less than 38 weeks of gestation), normal term birth (between week 38 and 42 weeks of gestation) and death within 24 hours after birth.

The analysis is restricted to the first half of the 2000s (i.e. 2001-2005). There are two main reasons that justify this constraint. First, because the official statistics do not contain information on years since arrival, it is not possible to account for the effect of acculturation and assimilation on birth outcomes. The inflow of Ecuadorians to Spain started in 1999 and was substantially interrupted after August 2003, when the visa waiver program terminated. Immigrants from Romania started to arrive in large numbers after 2001 when the Schengen visa restrictions were lifted. The inflow slowed down in 2005.[16] Hence restricting the analysis to the first half of the 2000s guarantees that the majority of births to Ecuadorians and Romanians are to recent immigrants. Second, illegal immigrants have incentives to register their children (and thus appear in the official statistics) only after the approval of the new immigration law in 2000.

Table 1 shows the percentage of births in Spain during the 2000s by nationality.

[16] See Table A1 in the Appendix.

The effect of the large immigration inflow is clear. From 2001 to 2008 (the first year of the Spanish economic recession) the number of total births increased from 406,380 to 519,779 of which births to foreign mothers more than doubled, from 8.24 to 20.81 percent. The impact of the Ecuadorian exodus is documented in the fact that the number of births to Ecuadorian mothers doubled between 2001 and 2004 (from 5,649 to 11,092), by 2004 representing 2.44 percent of total births. The table also shows the increase in the birth rate to Romanian immigrants, the largest minority group in Spain in the late 2000s.

Table 2 displays the average of several birth outcomes by nationality over the period 2001-2005 in Spain.[17] Following previous literature I focus on mothers aged 15-49, excluding multiple births and those newborns whose weight was either under 500 or above 9,000 grams.[18] The table indicates that newborns of immigrant mothers are about 70 grams heavier than those of natives. Ranked by foreign nationality, the heaviest babies are born to Ecuadorians (3,295 grams) and then Romanians (3,237 grams), which is inconsistent with the aggregate health statistics in the origin countries (see Table 3). Accordingly, babies born in Romania are heavier than those born in Ecuador (3,196 grams versus 3,093 grams). However, the incidence of low birth weight is higher in Romania than in Ecuador and the birth weight distribution in Romania is more disperse (a standard deviation of 534 grams versus 470 grams). The descriptive statistics do not reveal significant differences in terms of gestational length across groups, although immigrants from Romania show a higher rate of preterm births. Death within 24 hours after birth is the only measure for

[17] The birth certificate data for Spain are made publicly available by the National Statistical Institute (INE).

[18] The descriptive statistics in Table 2 consider only the nationality of the mother. In estimation, I will take into account the nationality of the father.

which immigrants perform worse than natives.

The birth certificate data for Ecuador are summarized in Table 4.[19] The table compares the pregnancy outcomes of natives in Ecuador to that of Ecuadorian immigrants in Spain in the first half of the 2000s.[20] I restrict the analysis to birth weight and low birth weight as information on gestational length is heavily underrerpoted in the Ecuadorian data.[21] Information to construct the death within 24 hours of birth indicator is also not available.

The incidence of nonreported birth weight in the Ecuadorian data was substantial in the early 2000s. This rate was unevenly distributed across different groups. According to Table A2, non reporting between 2001 and 2005 was less than 25 percent among mothers with more than primary education and for births in hospitals. This rate was also much lower in urban than rural areas. Due to the incidence of nonreporting, the information on birth weights collected in the birth certificate data is unlikely to be representative of the whole Ecuadorian population: mothers with more than primary education, and middle/high-income groups living in urban areas are likely to be overrepresented. Given this may obvious be a limitation, the validity of the results is nevertheless reassured when looking closely at the characteristics of migrants. Bertoli (2010) documents that the wave of Ecuadorian migration who relocated in the aftermath of the crisis largely came from the urban areas. These cities were more severely hit due to the suspension of the wage payment to public employees and slash in real wages due to devaluation. In addition, it has been persuasively

[19] These data are available from the Instituto Nacional de Estadística y Censos (INEC) in Ecuador.

[20] Note that the information for Ecuadorian immigrants in Spain is taken from the Spanish birth certificate data.

[21] Only 40 percent of the observations with valid information on birth weight report gestational length.

argued that in the early stage of the migration process it is the middle class that has the means and incentives to migrate (McKenzie and Rapoport 2007). Hence, the group of natives in Ecuador for whom there is valid information on birth weights in the early 2000s is likely to be closer to the immigrants to Spain that the Ecuadorian population as a whole. This factor is a counterbalance and will limit the magnitude of the bias due to differences in the composition of the comparison group. Section VI discusses the implications of this data problem for my results.

The paper employs two additional data sets. The Spanish Labor Force Survey for the years 2001-2005 (Encuesta de Población Activa, EPA) is used to investigate the fertility patterns and socioeconomic characteristics of different ethnic groups. This survey includes household level information on the socioeconomic characteristics of family members, with particular attention to their labor market status. The second data set is the National Immigrant Survey conducted in 2007 by the Statistical Office in Spain (Encuesta Nacional de Inmigrantes, ENI 2007) which analyzes the characteristics of the large inflow of immigrants to Spain. It covers the entire country and all immigrant groups, aiming to capture their demographic and social characteristics as well as their migration itineraries, work and residential histories.

# V. Empirical methodology

The first step in the empirical strategy is to assess the magnitude of the healthy immigrant effect. Hence I estimate the following model:

$$health_i = \alpha + \beta^{HIE} I_{1i} + u_i \tag{1}$$

where the dependent variable, $health_i$, is a birth outcome for individual $i$ (i.e. birth weight, low birth weight, gestational length, preterm birth, normal term birth or death within 24 hours of birth). $I_{1i}$ is an indicator variable that equals 1 if individual $i$ is an immigrant and 0 otherwise. The OLS estimate of $\beta^{HIE}$ in equation (1) is obtained from the comparison of the birth outcomes of natives and those of Ecuadorian immigrants in Spain. It can be interpreted as the healthy immigrant effect.

Differences in birth outcomes between natives and immigrants may result from the healthier habits and behaviors of immigrant mothers acquired in the source country ($\beta^{habits}$), the existence of a causal or direct effect of migration on a mother's health and that of her baby ($\beta^{migration}$) or from the selective migration of healthier women that give birth to healthier children ($\beta^{selection}$). That is:

$$\beta^{HIE} = \beta^{habits} + \beta^{selection} + \beta^{migration}.$$

If healthy habits are common to individuals originating from the same country, the comparison of birth outcomes between immigrants at destination and natives in the source country produces a joint estimate of the effect of selection and of any causal effect of migration.[22] The OLS estimate of this effect can be obtained from:

$$health_i = \alpha + \delta I_{2i} + u_i \tag{2}$$

where $\delta = (\beta^{selection} + \beta^{migration})$ and $I_{2i}$ is equal to 1 if $i$ is an immigrant in Spain and 0 if $i$ is a native in Ecuador.

[22] Note that healthy habits may vary across individuals from the same sending country (e.g. different rates of prenatal care or nutrition). Differences among immigrants and non immigrants in this dimension will be captured by the selection ($\beta^{selection}$) rather than the habits component ($\beta^{habits}$).

Ideally, to disentangle the contribution of selective migration from that of any direct or causal impact of migration, one would compare the health distribution of recent immigrants to their distribution had they not migrated (i.e. counterfactual distribution). This would identify the direct effect of migration (i.e. $\beta^{migration}$). Alternatively, the contribution of selective migration can be assessed by comparing immigrants and natives in the sending country before the movement occurs (i.e. $\beta^{selection}$). However, experimental data that randomizes the decision to migrate and allows estimating counterfactual distributions, or panel data that identifies immigrants before the movement occurs are rather scarce (see McKenzie et al. 2010 or Rubalcava et al. 2008 for exceptions). This paper takes an alternative approach and employs administrative data on birth outcomes to test a prediction of the migration model by Chiswick (1999) regarding the process that determines selection. The model states that the favorable selectivity of immigrants increases with the out-of-pocket (direct) cost of migration. Since the cost increases with distance to destination, immigrants from more remote areas are expected to be more positively selected than those originating from neighboring ones.

The large and diverse migration wave to Spain during the last decade offers an excellent scenario to assess the contribution of selective migration to the healthy immigrant effect. Since the early 2000s immigrants from many diverse origins landed in Spain, mostly attracted by a growing economy and job opportunities, especially in the construction sector. The empirical exercise in the next section will compare the birth outcomes of two of the largest ethnic minorities that have recently arrived in Spain from very different geographical regions: Ecuador and Romania. In the robustness checks the comparison is extended to Colombian, Bulgarian and Chinese

immigrants.

Table 5 summarizes the economic costs of moving to Spain from different countries over the period 1999-2007. This information is collected from the National Immigrant Survey conducted in 2007. The survey interviewed immigrants along many dimensions. They were asked to delineate all the costs associated with their reallocation from their country of origin. These costs were not narrowly restricted to transport expenditures such as air fares or train tickets, but encompassed all types of expenses such as food, accommodation, the cost of obtaining a visa or other legal document, and any other expenses incurred before or during the migration episode. Table 5 shows that the cost of migrating from Ecuador to Spain was 3.5 more than moving from Romania (i.e. 1,609.72 Euros from Ecuador and 464.95 Euros from Romania).

The empirical strategy to identify selection based on distance to destination relies on some strong assumptions. First, the distribution of birth outcomes should be identical across sending countries. Table 3 shows that this is not the case for the countries under study. For example, the average birth weight in Romania is larger than in Ecuador. Hence, even in the absence of positive selection, children born to Romanian immigrants would be heavier than those born to immigrants from Ecuador. The second assumption is that the returns to migration should be homogenous across immigrant groups. Accordingly, immigrants from different source countries should be drawn from the same part of the ability or skill distribution. While this assumption is difficult to test, previous studies have documented that immigrants from Romania belong to the upper tail of the skill/education distribution and that this is not the case for Ecuador.[23] Given the positive association between income (education) and

[23] See Fernández-Huertas Moraga (2013) and Bertoli et al (2011).

health, better birth outcomes should be expected among immigrants from Romania. Finally, one needs to assume that the costs of migrating are solely determined by distance to destination. However, cultural and linguistic barriers are likely to affect both migration costs and returns. In the case of Ecuador, the lower cultural and linguistic barriers may compensate the higher economic cost of the trip, reducing immigrant positive selection. Even if these barriers do not affect selection patterns, immigrants from Romania may have a harder time in understanding instructions from doctors or processing some relevant information.[24] This may negatively affect birth outcomes. The implications of these assumptions for my results will be discussed in the next section.

# VI. Results

## *The Healthy Immigrant Effect*

### a) *Comparison to natives in Spain*

The estimate of the healthy immigrant effect is obtained from the model in equation (1), where the birth outcomes of children born to Ecuadorian mothers in Spain are compared to that of natives in Spain. In terms of birth weight, the estimated coefficient, $\beta^{HIE}$, indicates an advantage in favor of immigrant children of 100.39 grams, with a standard deviation of 2.44.[25]

Natives and immigrants may differ in many dimensions, some having a direct

[24] While the lexical similarity between Romanian and Spanish has been estimated at 71 percent, some immigrants upon arrival my not properly understand the native language.

[25] The estimate is obtained by including as additional controls in equation (1) the gender of the child, an indicator for the month and year of birth, a set of dummies for the mother's age at the date of birth, as well as indicators for the province of residence in Spain.

impact on birth outcomes. Table 6 reports the estimates of the healthy immigrant effect when the model in equation (1) is extended to control for those differences. First, immigrants tend to be positively selected in terms of education and productive skills. The health economics literature has established a strong relationship between parental education and a child's health (Currie 2009). Hence, positive selection in education could lead to better birth outcomes among immigrants. Unfortunately, the Spanish birth certificate data ignored the variable on maternal education prior to 2007. For the years under study I can only control for differences in productive skills by including in the regression the mother's labor market status and an indicator for being employed in a high skilled occupation. Since these variables are not perfect proxies for educational achievement, the estimate of the health gap could still be biased. However, Bertoli et al (2011) find some evidence of negative selection in term of the education of Ecuadorian immigrants to Spain. Thus, the omission of maternal education from equation (1) should produce, if any, a negative bias on the estimated health gap.

Differences in family size may also be relevant for birth outcomes. The child quality investment model (Becker 1981 and Chiswick 1988) predicts that, at any given level of family resources, more children imply smaller levels of investment per child, and thus lower quality. Accordingly, I control for the presence and number of previous children, and a variable that captures the effect of birth spacing. As a robustness test (at the end of this section) I further investigate the implications of differences in the fertility behavior of immigrants.

It has also been documented that parental income affects child's health (Currie and Moretti 2007). The birth certificates do not contain information on family income

or wealth. As a proxy for the level of economic resources I include as additional regressors an indicator for the marital status of the mother and another for being born at a hospital.

The estimate in the first column of Table 6 indicates a weight advantage in favor of immigrants of 117.68 grams, with a standard deviation of 4.91, when the additional controls are included in estimation. The variables capturing the economic situation of the family (being born in a hospital, married, mother's employment status and working in a high skilled occupation) all have a positive effect. The coefficients on the variables related to family size are also positive. There is also evidence of a negative effect due to birth spacing.[26]

The remaining columns examine the presence of the healthy immigrant effect in terms of other birth outcomes: low birth weight (column 2), number of gestational weeks (column 3), preterm birth (column 4), born between week 38 and 42 (column 5), and death within the first 24 hours after birth (column 6). The estimates indicate a statistically significant health advantage in favor of Ecuadorian immigrants in most outcomes: the incidence of low birth weight (i.e. 2.2 percentage points lower probability), gestational length (i.e. 0.038 additional weeks of gestation), the probability of being born between week 38 and 42 (i.e. 1 percentage point higher) and the probability of preterm birth (i.e. 1 percentage point lower). No differences are observed in the probability of dying 24 hours after birth.[27]

[26] I replicate the results in Table 6 but excluding from estimation mixed couples (i.e. babies born to mothers from Ecuador and fathers from Spain, and that born to mothers from Spain and fathers from other nationalities). The main conclusions in Table 6 remain unaffected. The largest difference appear in terms of birth weight: when mixed couples are excluded from estimation the estimated healthy immigrant effect is reduced by 10 grams. The results when mixed couples are excluded from estimation are available upon request form the author.

[27] Differences in birth weight and the probability of low birth weight between natives and immigrants could result from the observed differences in gestational length. To examine this possibility

The results in Table 6 strongly support the view that recent immigrant women from Ecuador in Spain have better birth outcomes than natives. These findings are consistent with the extensive evidence on the healthy immigrant effect that is well documented for Mexican immigrants in the US and other minority groups in Canada and Australia.[28]

### b) *Comparison to natives in Ecuador*

While the previous estimates reveal a clear advantage in terms of birth outcomes in favor of immigrants, they are not informative about the channels behind it. I next estimate the model in equation (2) where the birth outcomes of Ecuadorian mothers in Spain are compared to that of natives in Ecuador. As discussed, this comparison produces a joint estimate of the effect of selection and of any causal effect of migration. Table 7 shows the OLS estimates of equation (2) including as additional controls those common to the birth certificates in the two countries, namely the child's gender, the mother's age, the month and year of birth, those related to fertility histories (i.e. the presence and number of previous children) and whether the child was born at a hospital. The analysis is restricted to the comparisons of birth weights and the

I have re-estimated the birth weight and the low birth weight regressions in column (1) and (2) in Table 6 including as an additional control gestational length. This slightly reduces the size of the healthy immigrant effect (from 117.7 grams to 110.1 grams in the birth weight regression and from -0.022 to -0.019 in the probability of low birth weight). These differences are still significant at any conventional level.

[28] As discussed in Section IV the analysis is restricted to the years 2001-2005 (i.e. pre-crisis period). Fernández-Huertas Moraga (2014) shows that migration flows to Spain were positively selected in terms of productive skills during the booming years, and that, on average, they improved after the crisis. However, for the Ecuadorian case, there is evidence of negative selection in terms of some education measures after the crisis. This suggests that my estimates of the healthy immigrant effect for the period 2001-2005 may be positively biased as a result of the different selection patterns over the business cycle.

incidence of low birth weight.[29]

The estimates indicate that newborns to Ecuadorian immigrants in Spain are 178.68 grams heavier than those born to natives in Ecuador, with a standard deviation of 2.09. The probability of low birth weight is also 2 percentage points lower among immigrants. If healthier practices and behaviors were the only responsible for the advantage of immigrants in Spain, we should not observe differences in birth outcomes when compared to the native population in Ecuador. Hence, the large size of the estimated coefficients in Table 7 indicates that factors other than cultural traits are driving the healthy immigrant effect.

Two issues should be taken into account when analyzing the results in Table 7. First, Ecuador was immersed in a major economic recession in the early 2000s, which may have had a negative effect on birth outcomes. Indeed, Bozzoli and Quintana (2013) document the existence of procyclicality in birth weights for Argentina. Second, a non-negligible fraction of the observations in the Ecuadorian birth certificates do not report information on birth weights in the early 2000s. As discussed, non-reporting is less severe among high-income and more educated mothers. This should tend to bias Ecuadorian babies' weight upwards. Table 8 investigates the implications of these two concerns by comparing the estimates of the birth weight gap on different samples. Column (1) shows the estimated gap between immigrants and natives for the years 2001-2005 as in Table 7, but without including year fixed effects. In column (2) the gap is estimated from comparing the birth weight of immigrants in 2001-2005 to those of natives in 2006-2010, when the Ecuadorian crisis was over and the incidence of non-reporting much lower (see Table A2). Column (3) and (4) repeat

[29] Gestational age is only reported for 40% of the births with valid information on weight and there is no information to construct the death within 24 hours after birth.

the same exercise for the probability of low birth weight. In all the specifications, the weight advantage in favor of immigrants remains statistically significant and of similar magnitude, suggesting that the previous concerns do not have direct relevance for the results.[30]

**c) *Comparison to other immigrant groups***

I next investigate the possibility that selective migration is responsible for the better birth outcomes of immigrant mothers from Ecuador. As discussed, positive selection should increase with distance to destination. This section compares the birth outcomes of two minority groups in Spain, immigrants from Ecuador and Romania, who are similar along many dimensions but their geographical origin. First, the two groups face relatively low cultural and linguistic barriers (i.e. Spanish is the language of Ecuador and Romanian is a Romance language very close to Spanish[31]). Second, the bulk of Ecuadorians and Romanians arrived between 2000 and 2004.[32] Third, the two groups moved to Spain for economic reasons. Ecuadorians came escaping from the economic and financial collapse in 1999, while immigrants from Romania arrived looking for jobs, escaping from the high unemployment rates that followed the massive restructuring of state enterprises in the late 1990s. Finally, Table A3 in the Appendix shows that Romanian and Ecuadorian immigrants to Spain are similar in terms of education and work status. The main difference is observed in terms of fer-

[30] In non-reported additional regressions, I have re-estimated the equations in column (2) and (4) of Table 8 restricting the sample of natives in Ecuador to births occurred in urban areas. Table A2 indicates that over the period 2006-2010 the urban reporting rate is pretty high. The main conclusions in Table 8 remain unaffected when the sample is restricted to urban births in Ecuador. The results are available upon request from the author.

[31] The lexical similarity of Romanian with Spanish has been estimated at 71 percent.

[32] Table A1 in the Appendix indicates that among the Ecuadorian and Romanian immigrants living in Spain in 2007, 72 percent of them arrived between 2000 and 2004.

tility outcomes. Only 45 percent of the Romanian females have children, as opposed to 70 percent of the Ecuadorians, and their average number of kids is 1.33 and 1.67 respectively. The implications of these different fertility behaviors are investigated at the close of this section.

Table 9 presents the estimates of the model that compares the birth outcomes of immigrants from Ecuador and Romania. There is a clear advantage in favor of Ecuadorians. These women give birth to children that are 60 grams heavier than those born to immigrants from Romania, have a smaller probability of low birth weight (2.8 percentage points lower), longer gestational age (0.20 weeks), a higher probability of being born between week 38 and 42 (4.1 percentage points higher), a lower incidence of preterm birth (4 percentage points lower) and a lower probability of death within the 24 hours after birth (0.1 percentage points).[33] These estimates are all statistically significant at any conventional level.[34]

While these results are consistent with the prediction that the positive selection of immigrants increases with distance to destination (Chiswick, 1999), alternative explanations could also account for the better birth outcomes of immigrants from Ecuador. First, cultural and linguistic barriers may affect the costs and returns of migration. Hence the advantage of Ecuadorians could lead to less positively selected immigrants. But even if the selection process is not affected by these barriers, the linguistic disadvantage of Romanians may negatively affect their pregnancy outcomes if they have difficulties in understanding medical instructions or gathering other relevant information. Hence the effect of cultural barriers on the estimates in Table 9

[33]These results are obtained after controlling for differences in socioeconomic characteristics. A similar message is obtained when the models are estimated without including the additional controls.

[34]Note that the health advantage in terms of birth weight is present even if the average birth weight in Romania is higher than in Ecuador (i.e. 3,196 versus 3,098).

is ambiguous. Second, different selection patterns in terms of productive skills could also drive the results. However, the existing evidence suggests that immigrants from Romania are positively selected in terms of education while this is not the case for immigrants from Ecuador (Fernández-Huertas Moraga 2013). Given the positive association between income (education) and health, this would tend to attenuate the health advantage in favor of Ecuadorian immigrants.

Finally, researchers have not been able to identify the causal effect of migration on pregnancy outcomes. The closest evidence is the paper by Stillman et al. (2012) who report evidence regarding the Tongan migrant lottery to explore the effect of migration on child health. They conclude that changes in dietary habits (i.e. larger consumption of meat, fat and milk) rather than income gains are behind the increase in height and BMI of immigrant children. While those changes in nutritional factors would almost certainly have a positive effect on birth weight, there may well be a wide range of countervailing effects that are not identified in Stillman et al. (2012), inasmuch as children in their sample are born before migration occurs. For example, the migration episode may be stressful (i.e. many social, cultural and economic changes are involved) and newcomers may face some post-migration practical living difficulties that may negatively affect birth outcomes.[35] Thus the sign of the direct effect of migration and its possible heterogeneity across immigrant groups is difficult to gauge.

On the whole, the results from the previous comparison indicates a a clear health advantage in favor of immigrant from Ecuador. While the contribution of selective migration can not be precisely estimated, the evidence is consistent with the view

[35] See Camacho 2008; Almond and Mazumder, 2011; and Bozzoli and Quintana, 2013 for evidence of the negative effect of stress and malnutrition on birth outcomes.

that immigrant women from more remote areas are more positively selected and give birth to healthier children upon arrival to destination.

To further explore and verify the prediction that positive selection increases with geographical distance, I extend the comparison to other established ethnic minorities in Spain, namely Colombians and Bulgarians. During the early 2000s Colombian immigrants were the third largest group after Moroccans and Ecuadorians. Bulgarians are a smaller but significant group; in 2004 they represented the eighth most popular non-EU15 immigrant-sending country and the second largest group among Eastern European immigrants in Spain.

Colombian emigration began in the 1960s in search of better economic opportunities. The US was the main destination for this first wave of immigrants. Typically these immigrants were not only well educated, but also highly competent in English. In the case of emigration to Spain, it increased considerably beginning in 1998, largely as a result of the Colombia's economic crisis (1998-1999). Spain's attraction was as a place in which to join the collective immigrant workforce, as well as the critical advantage of the language. A large percentage of Colombian migrants in Spain are women with a medium educational level (see Table A3). Ecuador and Colombia are neighboring countries and Table 5 indicates that the economic cost of migrating from either to Spain is similar.

Large-scale immigration from Romania and Bulgaria coincided with their inclusion in the list of countries exempted from the general visa requirements in early 2002 as a first step towards their membership of the EU. Both countries were by far the poorest of the 27 countries that would be part of the enlarged EU after January 2007, making emigration an attractive means of improving the prospects in life for both

the emigrants themselves and for those staying behind. Table A3 in the Appendix shows that immigrants from Bulgaria and Rumania in Spain are comparable in terms of socioeconomic characteristics. Bulgaria shares its northern border with Romania, hence the economic cost of migrating to Spain is similar and much lower than from Ecuador or Colombia (see Table 5).

Table 10 compares the birth outcomes of the four different immigrant groups. In estimation, the excluded category are immigrants from Ecuador. The comparison to immigrants from Colombia indicates a small, though statistically significant, disadvantage for Colombian immigrants in terms of gestational length. However, this does not translate into other birth outcomes. Indeed, differences between Colombian and Ecuadorian immigrants in terms of birth weight, the probability of low birth weight and that of dying before 24 hours are statistically insignificant. In contrast, children born to immigrants from Romania and Bulgaria are lighter than those born to Ecuadorian immigrants (i.e. 53.61 grams and 34.54 grams respectively).[36] This evidence is also consistent with the idea that immigrants from more remote areas are more favorable selected.

An interesting final comparison is that to immigrants from China. The Chinese community in Spain has a long tradition. As reported in Table A1, more than 50% of the Chinese living in Spain in 2007 had arrived prior to 2000. Despite being a relatively small group, its size has grown sixfold over the last decade and represents the second largest non-EU15 and non-Spanish speaking group after Moroccans. As immigrants from Latin America, individuals originating from China have to afford important travel costs (see Table 5). Moreover these immigrants face large cultural

[36] These differences are statistically significant at any conventional level.

and linguistic barriers that add an additional burden to the cost of migrating. As a result, the Chinese in Spain are expected to be more positively selected than the rest of groups considered.

Table 11 indicates that immigrants from China present a small advantage in terms of the incidence of low birth weight and gestational length when compared to immigrants from Ecuador and Colombia. The advantage becomes larger when the comparison is extended to the EU immigrant groups: the birth outcomes of Romanian and Bulgarian are significantly worse than those of Chinese. Moreover, the disadvantage estimated for the EU immigrants in terms of low birth weight and gestational length almost doubles that estimated when compared to immigrants from Ecuador (see Table 10). Thus immigrants from China seem to be more favorable selected probably to compensate the higher monetary and non-monetary (cultural and linguistic) costs of the movement.

### *Robustness checks*

Immigrants and natives have different fertility rates.[37] If women who decide to have children are different across groups, there may be implications for the previous results. Table 12 investigates differences in fertility between Ecuadorian immigrants and natives in Spain (column 1 and 2) and between Ecuadorian and Romanian immigrants in Spain (column 3 and 4).[38] The analysis is conducted on the sample of women 15 to 49 years old in the Spanish Labor Force Survey for the years 2001 to 2005. The estimated model is:

[37] See evidence in Table A3.

[38] Table A4 in the Appendix explores differences in fertility across all other immigrant groups considered in the paper.

$$infant_i = \beta_0 + \beta_1 I_{1i} + u_i \tag{3}$$

where the dependent variable, $infant_i$, is an indicator for the presence of a child younger than 1 year old. The indicator variable $I_{1i}$ takes value 1 if observation $i$ corresponds to an immigrant from Ecuador and 0 otherwise.[39] The model also includes a set of dummies for the age of the mother, as well as province and year indicators. The estimates in column (1) and (3) reveal differences in the probability of having a child over the period 2001 to 2005 that are statistically significant at any conventional level.

The model in equation (3) is next extended to include a set of observable characteristics that may affect fertility decisions, such as the years since arrival in the country, marital status, number of previous children and an indicator for whether the mother works. The estimates in column (2) and (4) indicate that differences in propensity to have children between 2001 and 2005 disappear after those controls are considered in estimation.[40] This result highlights the importance of controlling for the labor supply and the fertility history of mothers when comparing their birth outcomes. It also indicates that when socioeconomic characteristics are taken into account, there are no significant differences between natives and immigrants from Ecuador and Romania in the probability to have children in the period under analysis.

[39] Note that the excluded category in Table 12, column (1) and (2) are natives in Spain, while in column (3) and (4) are immigrants from Romania.

[40] This is not the case when immigrants from Ecuador and Romania are compared to Chinese immigrants in Table A4. This finding probably reflects the fact that immigrants from China have been longer in Spain, hence their fertility patterns are closer to that of natives.

# VII. Conclusions

This paper presents new empirical evidence on the determinants of the health advantage observed among recent immigrants in developed countries. It focuses on a large migration inflow of Ecuadorians to Spain in the early 2000s. Using the official statistics on births taking place in both countries, it documents an important health advantage for immigrants in terms of birth outcomes (i.e. birth weight, low birth weight and gestational length). The comparison to other recent minorities in Spain suggests that the better outcomes of Ecuadorians partly result from the selection bias of healthier immigrant mothers who give birth to healthier babies.

These findings have at least two important policy implications. First, the health advantage of immigrant children at birth may translate into an advantage in terms of education and earnings that may compensate for some of the disruptive effects associated with migration (i.e. discrimination, lower economic resources or poorer network quality). Second, immigration is not likely to represent a financial burden for the public health system, as long as the health advantage of recent immigrants remains stable over time. An obvious avenue for future research is to examine the evolution of the health advantage uncovered among recent immigrants.

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## Tables

**Table 1:** Births by nationality in Spain

| | | By nationality of the mother (percentage) | | |
|---|---|---|---|---|
| | Total number of births | Immigrant | Ecuadorian | Romanian |
| 2000 | 397,632 | 6.2 | 0.65 | 0.14 |
| 2001 | 406,380 | 8.24 | 1.39 | 0.25 |
| 2002 | 418,846 | 10.55 | 2.01 | 0.50 |
| 2003 | 441,881 | 12.23 | 2.38 | 1.11 |
| 2004 | 454,591 | 13.78 | 2.44 | 1.27 |
| 2005 | 466,371 | 15.07 | 2.13 | 1.48 |
| 2006 | 482,957 | 16.54 | 1.88 | 1.82 |
| 2007 | 492,527 | 18.98 | 1.89 | 2.35 |
| 2008 | 519,779 | 20.81 | 1.84 | 2.62 |
| 2009 | 494,997 | 20.72 | 1.65 | 2.41 |
| 2010 | 486,575 | 20.55 | 1.39 | 2.55 |
| 2011 | 471,999 | 19.51 | 1.13 | 2.46 |

Source: Birth certificate data. National Statistical Office, Spain.

**Table 2:** Birth outcomes by nationality in Spain (2001-2005)

| | Native | Immigrant | Ecuadorian | Romanian | Bulgaria | Colombia | China |
|---|---|---|---|---|---|---|---|
| Birth weight | 3,234.61 (486.19) | 3,305.20 (519.05) | 3,295.46 (507.07) | 3,236.90 (546.33) | 3,251.81 (506.09) | 3,309.13 (510.52) | 3,315.23 (477.99) |
| Low birth weight | 5.5% | 5.08% | 4.85% | 7.10% | 5.22% | 4.72% | 3.81% |
| Gestational length (weeks) | 39.16 (1.73) | 39.17 (1.83) | 39.15 (13.10) | 38.91 (2.08) | 39.16 (1.82) | 39.06 (1.86) | 39.34 (1.58) |
| Preterm birth | 13,88% | 12,91% | 13,10% | 17,67% | 13,13% | 13,98% | 9,90% |
| Death within 24 hours of birth (per 1,000 live births) | 0,6 | 0,8 | 0,7 | 1,7 | 0,6 | 0,5 | 0,4 |
| Nobs | 1,773,102 | 233,518 | 41,984 | 16,865 | 3,176 | 21,056 | 8,388 |

Source: Birth certificate data. National Statistical Office, Spain.
Note: Average over the period 2001 to 2005. Standard deviations in parenthesis. Birth outcomes of mothers 15 to 49, excluding multiple births and newborns whose weight was either under 500 grams or above 9,000 grams.

**Table 3:** Aggregate Health Statistics

| | Spain | Ecuador | Romania |
|---|---|---|---|
| Body mass Index | | | |
| Male | 26.6 | 25 | 24.7 |
| Female | 26 | 26.4 | 24.9 |
| Life Expectancy in years | 83 | 76 | 75 |
| Infant Mortality rate (per 1,000 live births) | 6 | 28 | 23 |
| Child Mortality rate (per 1,000 live births) | 6 | 31.4 | 23.8 |
| Low birth weight probability | 5.5 | 7 | 8 |
| Birth weight | 3,243 (490) | 3,093 (470) | 3,196 (534) |

Source: World Bank, several years between 2000-2005. For Spain and Ecuador information on the birth weight is taken from the birth certificate data employed in the paper for the years 2001 to 2005. There are no birth certificate data for Romania and the descriptive statistics are obtained from a representative sample in the study of Nanu et al. (2006) for the years 2001 to 2004.
Note: *Infant Mortality rate* is the probability of dying between birth and age 1 per 1000 live births. *Child Mortality rate* is the probability of dying before age 5 per 1000 live births.

**Table 4:** Birth outcomes of immigrants in Spain and natives in Ecuador (2001-2005)

| | Immigrants | Natives |
|---|---|---|
| Birth weight | 3,295.46 (507.07) | 3,092.58 (469.94) |
| Low birth weight | 4.85% | 6.56% |
| Nobs | 41,984 | 767,499 |

Source: Birth certificate data, Spain and Ecuador.
Note: Information on birth weights for immigrants is obtained from the birth certificate data in Spain while that for natives comes from the birth certificate data in Ecuador.

**Table 5**: Economic cost of migration in Euros by country of origin

| Year of arrival | Ecuador | Romania | Colombia | Bulgaria | China |
|---|---|---|---|---|---|
| 1999-2007 | 1,591.76€ | 398.22€ | 1,358.98€ | 345.56€ | 1,364.99€ |
| | (1,057.31) | (438.03) | (1,007.90) | (488.28) | (1,716.65) |
| Nobs | 1,062 | 1,154 | 717 | 267 | 36 |

Source: National Immigrant Survey 2007.
Note: Economic cost of migration per person from the country of origin to Spain. It includes transport costs, all types of travel allowances (food, accommodation, etc...), visa and any other type of document, and any other payment related to the migration episode.

**Table 6:** Evidence of the Healthy Immigrant Effect

| | Birth weight | Low birth weight | Gestational length | Preterm birth | Normal term (38-42 weeks) | Death before 24 hours* |
|---|---|---|---|---|---|---|
| Immigrant from Ecuador | 117.679*** [4.914] | -0.022*** [0.002] | 0.038** [0.018] | -0.010*** [0.004] | 0.010*** [0.004] | -0.020 [0.024] |
| Male | 116.841*** [0.716] | -0.011*** [0.000] | -0.060*** [0.003] | 0.010*** [0.001] | -0.010*** [0.001] | 0.014*** [0.004] |
| Born at a hospital | 19.465*** [5.820] | -0.012*** [0.003] | 0.008 [0.023] | -0.016*** [0.004] | 0.017*** [0.004] | -0.077*** [0.029] |
| Presence of previous children | 90.701*** [1.507] | -0.029*** [0.001] | -0.032*** [0.006] | -0.020*** [0.001] | 0.020*** [0.001] | -0.058*** [0.007] |
| Number of previous children | 5.496*** [0.840] | 0.004*** [0.000] | -0.061*** [0.003] | 0.015*** [0.001] | -0.015*** [0.001] | 0.003 [0.004] |
| Married | 40.009*** [0.978] | -0.014*** [0.000] | 0.059*** [0.004] | -0.011*** [0.001] | 0.011*** [0.001] | -0.023*** [0.005] |
| Working | 15.971*** [0.839] | -0.006*** [0.000] | 0.019*** [0.003] | -0.007*** [0.001] | 0.007*** [0.001] | -0.069*** [0.004] |
| Working in a high skilled occupation | 18.451*** [1.016] | -0.008*** [0.000] | -0.005 [0.004] | -0.007*** [0.001] | 0.007*** [0.001] | 0.000 [0.005] |
| Years since last birth | -4.542*** [0.171] | 0.002*** [0.000] | 0.004*** [0.001] | 0.001*** [0.000] | -0.001*** [0.000] | 0.000 [0.000] |
| Age dummies | YES | YES | YES | YES | YES | YES |
| Monthly dummies | YES | YES | YES | YES | YES | YES |
| Province dummies | YES | YES | YES | YES | YES | YES |
| Year dummies | YES | YES | YES | YES | YES | YES |
| Constant | 3,014.335*** [15.714] | 0.110*** [0.007] | 38.829*** [0.059] | 0.174*** [0.011] | 0.821*** [0.011] | 0.001 [0.001] |
| R-squared | 0.029 | 0.005 | 0.009 | 0.006 | 0.006 | 0.000 |
| Observations | 1,791,827 | 1,791,827 | 1,634,306 | 1,634,306 | 1,634,306 | 1,791,827 |

Source: Birth certificate data, Spain.
Note: OLS estimates of the linear model in equation (1). The sample includes children born to native and Ecuadorian immigrant mothers in Spain. Sample period 2001-2005.
(*) The coefficients in the regression "Death before 24 hours" have been multiplied by 100.

**Table 7:** Difference in birth weight of immigrants in Spain and natives in Ecuador

| | Birth weight | Low birth weight |
|---|---|---|
| Immigrant from Ecuador | 178.681***<br>[2.089] | -0.019***<br>[0.001] |
| Male | 67.039***<br>[0.918] | -0.011***<br>[0.001] |
| Being born at a hospital | -54.536***<br>[2.238] | 0.014***<br>[0.001] |
| Presence of previous children | 27.336***<br>[1.328] | -0.010***<br>[0.001] |
| Number of previous children | 11.698***<br>[0.480] | -0.004***<br>[0.000] |
| Age dummies | YES | YES |
| Monthly dummies | YES | YES |
| Year dummies | YES | YES |
| Constant | 3,011.141***<br>[5.263] | 0.075***<br>[0.003] |
| R-squared | 0.026 | 0.003 |
| Observations | 809,483 | 809,483 |

Source: Birth certificate data, Spain and Ecuador.
Note: OLS estimates of the linear model in equation (2). The sample includes children born to native mothers in Ecuador and to Ecuadorian immigrant mothers in Spain. Sample period 2001-2005.

**Table 8**: Difference in birth weight of immigrants in Spain and natives in Ecuador - Robustness checks

| | Birth weight 2001-2005 | Birth weight 2006-2010 | Low birth weight 2001-2005 | Low birth weight 2006-2010 |
|---|---|---|---|---|
| Immigrant from Ecuador | 179.133*** [2.088] | 166.534*** [2.138] | -0.019*** [0.001] | -0.025*** [0.001] |
| Male | 67.143*** [0.918] | 74.081*** [0.826] | -0.011*** [0.001] | -0.012*** [0.000] |
| Being born at a hospital | -55.052*** [2.238] | -62.011*** [2.910] | 0.014*** [0.001] | 0.011*** [0.002] |
| Presence of previous children | 27.142*** [1.328] | 20.778*** [1.217] | -0.010*** [0.001] | -0.009*** [0.001] |
| Number of previous children | 11.760*** [0.481] | 12.563*** [0.459] | -0.004*** [0.000] | -0.003*** [0.000] |
| Age dummies | YES | YES | YES | YES |
| Monthly dummies | YES | YES | YES | YES |
| Constant | 3,023.66*** [5.183] | 3,034.67*** [4.729] | 0.076*** [0.003] | 0.090*** [0.003] |
| R-squared | 0.025 | 0.022 | 0.003 | 0.002 |
| Observations | 809,483 | 1,068,420 | 809,483 | 1,068,420 |

Source: Birth certificate data, Spain and Ecuador.
Note: The estimated models in this table do not contain year fixed effects. This explains the differences with respect to the estimates in Table 7.

**Table 9:** Comparing immigrants from Ecuador and Romania in Spain

| | Birth weight | Low birth weight | Gestational length | Preterm birth | Normal term (38-42 weeks) | Death before 24 hours* |
|---|---|---|---|---|---|---|
| Immigrant from Ecuador | 60.142***<br>[5.471] | -0.028***<br>[0.002] | 0.196***<br>[0.021] | -0.040***<br>[0.004] | 0.041***<br>[0.004] | -0.124***<br>[0.034] |
| Male | 104.773***<br>[4.229] | -0.007***<br>[0.002] | -0.002<br>[0.016] | 0.004<br>[0.003] | -0.004<br>[0.003] | 0.082<br>[0.026] |
| Being born at a hospital | 81.505***<br>[25.630] | -0.032***<br>[0.011] | 0.335***<br>[0.101] | -0.052***<br>[0.018] | 0.050***<br>[0.018] | -0.132<br>[0.160] |
| Presence of previous children | 40.785***<br>[8.815] | -0.010**<br>[0.004] | -0.027<br>[0.034] | -0.005<br>[0.006] | 0.004<br>[0.006] | 0.039<br>[0.055] |
| Number of previous children | 17.251***<br>[3.617] | -0.000<br>[0.002] | 0.009<br>[0.014] | 0.003<br>[0.003] | -0.003<br>[0.003] | -0.022<br>[0.022] |
| Married | 42.159***<br>[4.528] | -0.011***<br>[0.002] | 0.143***<br>[0.017] | -0.021***<br>[0.003] | 0.022***<br>[0.003] | -0.059**<br>[0.028] |
| Working | 10.512**<br>[4.888] | 0.001<br>[0.002] | -0.040**<br>[0.019] | 0.004<br>[0.003] | -0.004<br>[0.003] | -0.069**<br>[0.030] |
| Working in a high skilled occupation | 1.289<br>[13.008] | -0.004<br>[0.006] | 0.015<br>[0.050] | -0.006<br>[0.009] | 0.006<br>[0.009] | -0.013<br>[0.081] |
| Years since the last birth | -0.831<br>[0.919] | 0.001<br>[0.000] | -0.002<br>[0.004] | 0.001<br>[0.001] | -0.001<br>[0.001] | -0.006<br>[0.006] |
| Age dummies | YES | YES | YES | YES | YES | YES |
| Monthly dummies | YES | YES | YES | YES | YES | YES |
| Province dummies | YES | YES | YES | YES | YES | YES |
| Year dummies | YES | YES | YES | YES | YES | YES |
| Constant | 2,873.460***<br>[60.869] | 0.147***<br>[0.027] | 38.037***<br>[0.233] | 0.277***<br>[0.043] | 0.720***<br>[0.043] | 0.000<br>[0.004] |
| Observations | 58,849 | 58,849 | 54,767 | 54,767 | 54,767 | 58,849 |
| R-squared | 0.029 | 0.006 | 0.017 | 0.016 | 0.016 | 0.003 |

Source: Birth certificate data, Spain.
Note: The sample includes children born to Ecuadorian and Romanian mothers in Spain. Sample period 2001-2005.
(*) The coefficients in the regression "Death before 24 hours" have been multiplied by 100

**Table 10:** Comparing different immigrant groups in Spain

| | Birth weight | Low birth weight | Gestational length | Preterm birth | Normal term (38-42 weeks) | Death before 24 hours* |
|---|---|---|---|---|---|---|
| Immigrant from Romania | -53.613*** | 0.027*** | -0.187*** | 0.039*** | -0.039*** | 0.121*** |
| | [5.231] | [0.002] | [0.020] | [0.004] | [0.004] | [0.030] |
| Immigrants from Colombia | 6.782 | -0.002 | -0.045** | 0.008** | -0.008** | -0.025 |
| | [4.615] | [0.002] | [0.018] | [0.003] | [0.003] | [0.027] |
| Immigrants from Bulgaria | -34.543*** | 0.004 | -0.052 | 0.009 | -0.009 | 0.000 |
| | [9.820] | [0.004] | [0.038] | [0.007] | [0.007] | [0.057] |
| Additional controls | YES | YES | YES | YES | YES | YES |
| Constant | 2,983.761*** | 0.108*** | 38.260*** | 0.255*** | 0.744*** | 0.001 |
| | [47.432] | [0.021] | [0.182] | [0.033] | [0.034] | [0.003] |
| Observations | 83,081 | 83,081 | 77,175 | 77,175 | 77,175 | 83,081 |
| R-squared | 0.028 | 0.006 | 0.015 | 0.014 | 0.014 | 0.002 |

Source: Birth certificate data, Spain.
Note: The sample includes children born to Ecuadorian, Colombian, Bulgarian and Romanian immigrant mothers in Spain between 2001 and 2005. The excluded category in estimation are Ecuadorians. Additional controls include: the gender of the child, the set of age dummies for the mother, monthly, province and year dummies, an indicator for being born at the hospital, the presence of previous children, the number of previous children, a variable for the years since the last birth and an indicator for being married, for working and for working in a high skilled occupation.
(*) The coefficients in the regression "Death before 24 hours" have been multiplied by 100.

**Table 11:** Comparing immigrants from China to other immigrant groups in Spain

| | Birth weight | Low birth weight | Gestational length | Preterm birth | Normal term (38-42 weeks) | Death before 24 hours* |
|---|---|---|---|---|---|---|
| Immigrants from Ecuador | 2.482<br>[6.365] | 0.006**<br>[0.003] | -0.176***<br>[0.025] | 0.022***<br>[0.005] | -0.021***<br>[0.005] | 0.022<br>[0.036] |
| Immigrants from Romania | -49.666***<br>[7.157] | 0.033***<br>[0.003] | -0.361***<br>[0.028] | 0.060***<br>[0.005] | -0.060***<br>[0.005] | 0.141***<br>[0.041] |
| Immigrants from Colombia | 8.063<br>[6.806] | 0.005*<br>[0.003] | -0.220***<br>[0.027] | 0.030***<br>[0.005] | -0.029***<br>[0.005] | 0.000<br>[0.039] |
| Immigrants from Bulgaria | -31.707***<br>[10.943] | 0.011**<br>[0.005] | -0.228***<br>[0.042] | 0.031***<br>[0.008] | -0.030***<br>[0.008] | 0.023<br>[0.062] |
| Additional controls | YES | YES | YES | YES | YES | YES |
| Constant | 2,982.477***<br>[45.358] | 0.104***<br>[0.020] | 38.407***<br>[0.174] | 0.227***<br>[0.032] | 0.771***<br>[0.032] | 0.000<br>[0.003] |
| Observations | 91,469 | 91,469 | 84,207 | 84,207 | 84,207 | 91,469 |
| R-squared | 0.028 | 0.006 | 0.016 | 0.015 | 0.015 | 0.002 |

Source: Birth certificate data, Spain.
Note: The sample includes children born to Ecuadorian, Colombian, Bulgarian, Romanian and Chinese immigrant mothers in Spain between 2001 and 2005. The excluded category in estimation are Chinese. Additional controls include: the gender of the child, the set of age dummies for the mother, monthly, province and year dummies, an indicator for being born at the hospital, the presence of previous children, the number of previous children, a variable for the years since the last birth and an indicator for being married, for working and for working in a high skilled occupation.
(*) The coefficients in the regression "Death before 24 hours" have been multiplied by 100.

**Table 12:** Differences in fertility

| Sample | Immigrants from Ecuador and natives in Spain | | Immigrants from Ecuador and Romania in Spain | |
|---|---|---|---|---|
| | Infant | Infant | Infant | Infant |
| Immigrant from Ecuador | 0.013** | -0.005 | 0.036*** | -0.009 |
| | [0.005] | [0.006] | [0.012] | [0.012] |
| Years since migration | | 0.003 | | 0.004 |
| | | [0.002] | | [0.003] |
| Married | | 0.032*** | | -0.018* |
| | | [0.001] | | [0.011] |
| Work | | -0.012*** | | -0.145*** |
| | | [0.001] | | [0.010] |
| Previous children | | 0.063*** | | 0.090*** |
| | | [0.000] | | [0.005] |
| Age dummies | YES | YES | YES | YES |
| Province dummies | YES | YES | YES | YES |
| Year dummies | YES | YES | YES | YES |
| Constant | | 0.480*** | | 0.095 |
| | | [0.081] | | [0.232] |
| R-squared | 0.079 | 0.121 | 0.092 | 0.190 |
| Observations | 436,372 | 436,372 | 4,621 | 4,621 |

Source: Labor Force Survey, Spain.
Note: Estimates from the linear probability model in equation (3). The sample includes immigrant women from Ecuador and natives in Spain. Sample period 2001-2005.

## Appendix

**Table A1:** Year of arrival by country of origin

| | Immigrants | Ecuador | Morocco | Romania | Colombia | Bulgaria | China |
|---|---|---|---|---|---|---|---|
| before 2000 | 45.30 | 23.32 | 60.43 | 6.67 | 27.84 | 12.07 | 50.41 |
| year 2000 | 8.47 | 23.93 | 6.76 | 7.65 | 19.88 | 12.38 | 8.26 |
| year 2001 | 9.89 | 17.51 | 7.84 | 10.72 | 31.81 | 18.58 | 8.26 |
| year 2002 | 8.82 | 18.88 | 5.57 | 17.92 | 3.78 | 16.41 | 7.44 |
| year 2003 | 8.32 | 10.24 | 6.11 | 17.02 | 2.81 | 13.00 | 6.61 |
| year 2004 | 7.45 | 1.68 | 4.92 | 19.04 | 4.95 | 13.93 | 7.44 |
| year 2005 | 6.18 | 2.06 | 5.14 | 10.79 | 4.36 | 8.05 | 5.79 |
| year 2006 | 5.46 | 2.29 | 3.14 | 10.04 | 4.56 | 5.26 | 3.31 |
| Nobs | 15,465 | 1,308 | 1,850 | 1,334 | 1,031 | 323 | 121 |

Source: National Immigrant Survey, 2007
Note: percentage of immigrants living in Spain per year of arrival.

**Table A2:** Missing birth weight information in the Vital Statistics for Ecuador

| | 2001-2005 | | 2006-2010 | |
|---|---|---|---|---|
| | Number of observations | % missing information birth weight | Number of observations | % missing information birth weight |
| **Total:** | 1,270,056 | 39.20% | 1,319,566 | 22.21% |
| **Education:** | | | | |
| No education | 11,130 | 66.27% | 22,929 | 44.04% |
| Primary | 606,080 | 44.66% | 726,234 | 25.13% |
| Higher | 438,754 | 25.49% | 266,560 | 15.18% |
| **Area:** | | | | |
| Urban | 985,657 | 33.64% | 1,049,838 | 17.17% |
| Rural | 253,470 | 57.54% | 236,014 | 41.98% |
| Periphery | 30,929 | 65.80% | 33,714 | 41.03% |
| **Place born:** | | | | |
| Public hospital | 586,866 | 24.24% | 698,508 | 10.23% |
| Private hospital | 353,930 | 17.96% | 403,731 | 6.49% |
| Other (house) | 329,231 | 88.70% | 217,327 | 89.95% |

Source: Birth certificate data, Ecuador.

**Table A3:** Socio-economic characteristics of female natives and immigrants in Spain

| | Native | Ecuador | Romania | Colombia | Bulgaria | China |
|---|---|---|---|---|---|---|
| Age | 38.97<br>[6.67] | 32.61<br>[7.21] | 31.93<br>[7.31] | 34.67<br>[7.31] | 34.89<br>[7.64] | 36.62<br>[7.53] |
| Year of arrival | | 2000<br>[1.99] | 2001<br>[2.33] | 2000<br>[2.95] | 2001<br>[1.98] | 1996<br>[6.13] |
| Education | | | | | | |
| Less than HS | 53.08% | 47.23% | 30.68% | 36.97% | 34.54% | 65.43% |
| HS graduates | 27.38% | 40.54% | 55.22% | 48.10% | 40.51% | 25.93% |
| More than HS | 19.54% | 12.23% | 14.10% | 14.94% | 24.95% | 8.64% |
| Work | 55.61% | 71.34% | 65.12% | 61.81% | 62.47% | 80.25% |
| Low skilled occupation | 61.47% | 97.66% | 96.10% | 89.65% | 95.56% | 76.15% |
| Married | 83.95% | 68.10% | 72.14% | 56.82% | 76.33% | 88.27% |
| % with kids | 63.61% | 69.59% | 45.61% | 60.11% | 45.42% | 61.11% |
| Number of kids | 1.54<br>[0.65] | 1.67<br>[0.84] | 1.33<br>[0.61] | 1.56<br>[0.67] | 1.32<br>[0.47] | 1.77<br>[0.86] |
| Number of observations | 433,560 | 2,812 | 1,809 | 2,705 | 469 | 162 |

Source: Labor Force Survey, Sapin. The sample is restricted to women 16 to 49 years old, who are head of households or the partner. Sample period: 2001-2005

**Table A4:** Differences in fertility across ethnic groups

| | Infant | Infant |
|---|---|---|
| Immigrant from Ecuador | 0.069*** | 0.059** |
| | [0.027] | [0.0266] |
| Immigrants from Romania | 0.025 | 0.053** |
| | [0.028] | [0.027] |
| Immigrants from Colombia | 0.046* | 0.042 |
| | [0.027] | [0.026] |
| Immigrants from Bulgaria | -0.016 | 0.005 |
| | [0.030] | [0.029] |
| Years since migration | | 0.001 |
| | | [0.002] |
| Married | | -0.001 |
| | | [0.008] |
| Work | | -0.012*** |
| | | [0.007] |
| Previous children | | 0.088*** |
| | | [0.004] |
| Age dummies | YES | YES |
| Province dummies | YES | YES |
| Year dummies | YES | YES |
| Constant | -0.072 | -0.095 |
| | [0.234] | [0.222] |
| R-squared | 0.073 | 0.167 |
| Observations | 7,957 | 7,957 |

Source: Labor Force Survey, Spain
Note: Estimates from the linear probability model in equation (3). The sample includes immigrant women from China, Ecuador, Romania, Bulgaria and Colombia . Sample period 2001-2005.