

Are Sunday Babies Doomed for Life?

Measuring the Sunday-Born Earnings Gap in Ecuador¹

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Abstract

Sunday birth rates in Ecuador have sharply declined, and the drop is larger among young cohorts in urban areas. These trends are attributed to an increase in cesarean births, which are generally scheduled during regular hospital hours. Multiple rounds of Health Surveys confirm that mothers with higher levels of education and socioeconomic status are more likely to give birth via cesarean and less likely to give birth on Sunday. Using administrative birth and earnings records we find that this selection process is strong enough to create an earnings differential between individuals born on Sunday and individuals born on other days. For instance, after controlling for age, education, gender and marital status, workers born on Sunday earn 2 percent less than comparable workers born on other days of the week. The Sunday-born earnings gap is larger for young cohorts in Quito and Guayaquil, precisely the same cohorts and urban locations where the decline in Sunday birth rates is largest.

Keywords: Sunday baby, weekend births, earnings regression, earnings gap, developing country, Ecuador

JEL Codes: H26, H32, O12

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1. Introduction

Parents often choose the day when their children are born. Tax policy incentives and important days in pop culture such as New Year's Eve, Valentine's Day, Halloween, and the Millennium can influence the timing of births.² The medical and economics literatures have also documented between 20 and 30 percent fewer Sunday births relative to births on other days of the week. Declining Sunday births are explained by increasing cesarean and induced labor births, which are generally scheduled during regular hospital hours.³

The typical woman giving birth on a Sunday may be different from the typical woman giving birth on a weekday. Evidence from developed countries shows that weekday deliveries are more common amongst women who are educated, married, white, and have access to private prenatal care (Dickert-Conlin and Elder 2010; Hamilton and Restrepo 2006). Mothers who plan cesarean or induced labor are more likely to give birth during the week and have generally had access to regular medical care. The differences between women giving birth on Sunday and women giving birth on other days may be even stronger in developing countries, where access to medical care is less equal (Peters et al. 2008).

Should one expect the day of birth to be associated with a child's labor market outcomes during adulthood? A long and growing literature on intergenerational mobility shows that there is a strong association between parents' and children's outcomes (for a recent and comprehensive review of this literature see Black and

² See for example Dickert-Conlin and Chandra (1999), Gans and Leigh (2007), Neugart and Ohlsson (2009) and Levy et al. (2011).

³ For evidence on declining Sunday births, see MacFarlane (1978; 1979), Hendry (1981), Mathers (1983), Ytterstad and Brenn (1997), Gould et al. (2003), Luo et al. (2004), Hamilton and Restrepo (2006; 2003), Goodman et al. (2005), and Young (2011). For evidence linking declining Sunday births to cesareans, see Mangold (1981), Rindfuss et al. (1976; 1979), Lerchl (2005), and Lerchl and Reinhard (2008). As far as we know evidence about declining Sunday births in developing countries is available only for Chile (McEwan and Shapiro 2008), Brazil (Barros et al. 2011), and Argentina (Berlinski et al. 2008).

Devereux 2011). If Sunday babies are born into households of lower socioeconomic status, they may also have lower socioeconomic endowments throughout their lives. It has also been documented that Sunday babies have higher rates of stillbirths and neonatal mortality (Mangold 1981; Mathers 1983; Luo et al 2004), and studies have linked characteristics at birth to future cognitive deficits (Currie 2000). Hence, particularly in developing countries, one would expect that individuals born on a Sunday may be at a disadvantage and perform worst than their counterparts born on other days. To the best of our knowledge, there has been no attempt in the literature to test these hypotheses and measure the association between day of birth and labor market outcomes. The lack of evidence is not surprising given that few datasets combine information on the exact day-of-birth and outcomes during adulthood. In this study we combine rich administrative databases from Ecuador to explore these issues.

Using the universe of records of vital statistics from Ecuador's Civil Registry, we first show that the share of Sunday births has notably declined during the past 40 years and is particularly low for young cohorts in urban areas (Quito and Guayaquil). For instance, the share of babies born on Sunday in Guayaquil has declined from about 14% to 10% between 1960 and 2008. The sharp decline in Sunday birth rates is similar to that observed in developed countries. Three rounds of Ecuador's reproductive health survey are then used to analyze the relationship between a) cesarean deliveries and day of birth, and b) mother's demographic characteristics and access to medical care. Our findings suggest that, as expected, cesarean rates are disproportionately low on Sunday and access to obstetric medical care increases with mothers' education.

Finally, we combine Civil Registry data with individuals' tax records. The combined data include annual earnings of all wage earners in the Ecuadorian formal sector between 2005 and 2010 (over 1.1 million employees per year, on average) as

well as many of their demographic characteristics. Estimates from conventional log-earnings equations suggest that workers born on a Sunday earn as much as 2 percent less than their counterparts, after controlling for age, marital status, gender and education. The Sunday-earnings-gap is even larger among young cohorts in Quito and Guayaquil (3 percent), precisely those cohorts and locations experiencing the sharpest declines in Sunday birth rates.

This paper contributes to the literature in at least the following ways. First, we assess the magnitude and trends of Sunday birth rates in the context of a developing country, and to the best of our knowledge, we are the first to show that the decline in Sunday births is larger in urban areas. Second, we corroborate previous findings in the literature and show that the day of birth depends on the delivery method and on the mothers' demographic characteristics. Third, we are the first to measure the association between the day of birth and children's labor market outcomes later in life. We provide robust empirical evidence about the *Sunday-born earnings gap* adding to a literature that has long studied the existence of earnings gaps between groups and regions.⁴ In sum, our results suggest that the exact timing of birth may be driven to a certain extent by selection processes that are strong enough to create an earnings differential later in life.

The remainder of the paper is organized as follows. Section 2 describes the data and presents summary statistics. Section 3 explores the trends and determinants of Sunday births in Ecuador. Section 4 estimates the Sunday-born earnings gap, and finally the last section concludes.

⁴ For example, previous papers have documented the existence of an earnings gap between races (Neal and Johnson 1996; Heckman 1998), between genders (Oaxaca 1973; Groshen 1991), between educational types (James et al. 1989), and between sexual orientations (Badgett 1995; Black 2003).

2. Data

The paper relies on data from three different sources: (1) birth records from Ecuador's National Civil Registry; (2) information about the type of birth (i.e. vaginal vs. cesarean delivery) and mother's socioeconomic characteristics from multiple rounds of Ecuador's Reproductive Health Survey; and (3) earnings data from Ecuador's Tax Authority.

Birth records were obtained from the National Civil Registry (*Registro Civil*)⁵. The Civil Registry dataset contains information about the exact date of birth of the universe of (registered) individuals, who were alive as of January 2009.⁶ The civil registry collects information on births, including the exact date and place of birth. In addition, it also collects basic demographic information such as gender, marital status, citizenship, and educational attainment. Educational attainment is updated when an individual brings proof of schooling completion (for example, a high school diploma or college degree). While this variable is a noisy measure of education, most individuals have incentives to update their current educational attainment because this information is displayed in the Ecuadorian national identity card ("cédula de identidad"). Civil registry education estimates are thus less reliable for younger cohorts.

We also use three rounds of Ecuador's Reproductive Health Survey (*Encuesta Demográfica y de Salud Materna e Infantil; ENDEMAIN*).⁷ Data collection took place in 1989, 1999, and 2004. All rounds of the survey cover information on socioeconomic characteristics of women, fertility, family planning, obstetric

⁵ The civil registry is the system by which a government records the vital events of its citizens and residents. For instance, in the US vital records such as birth certificates, death certificates, and marriage certificates are maintained by the Office of Vital Statistics in each individual state.

⁶ Not all individuals are registered in the Civil Registry. According to the 2010 Population Census, Ecuador's population was close to 14.4 million in 2010. Civil Registry data, on the other hand, contain about 12.5 million birth records.

⁷ Data is available from the Global Health Data Exchange: <http://www.healthmetricsandevaluation.org/ghdx>.

complications, and infant and child mortality, amongst others. The three rounds are nationally representative. The latest round surveyed 10,184 women ages 15 to 49. Additional details are available in the survey's official reports (CEPAR 1990; CEPAR 2000; CEPAR 2005).

Finally, administrative data on earnings were obtained from the Ecuadorian tax authority (*Servicio de Rentas Internas*; SRI). We computed annual earnings for the universe of formal employees (about 2 million wage-earners) between 2005 and 2010. Earnings information for every formal employee is regularly reported by employers (firms) to the tax authority for tax withholding purposes. Virtually all wages are subject to withholding in Ecuador and firms report this information in a separate annex that supplements their annual tax returns.

To estimate earnings regressions, we merge earnings reported to the tax authority with civil registry data. These data were merged using a unique identification identifier. Because education measures are particularly noisy among younger cohorts and because retirement in Ecuador starts at age 60 (for females), we exclude from our analysis individuals younger than 25 and older than 60 years of age. After deleting observations with missing values, the merged data contain an average of over 1.1 million earnings records per year.⁸ A description of the variables included in the merged dataset is provided in Table A1.

Descriptive statistics for workers' annual earnings are provided in Table A2. We present summary statistics for Quito, Guayaquil, and the rest of the country. Quito and Guayaquil are the main urban areas of Ecuador and the characteristics of their residents are significantly different from those in smaller cities, towns, and rural

⁸ The earnings of individuals holding multiple jobs during the year were aggregated. Observations with inconsistent information were eliminated. Nominal variables were deflated using the official CPI from the Central Bank of Ecuador.

villages.⁹ We find that yearly earnings are somewhat higher in Quito and Guayaquil. Regardless of location, however, average real earnings have remained roughly constant over time between 2005 and 2010. Interestingly, over this same period, the number of observations roughly doubled in all locations. This large increase in the number of formal workers can be attributed to a continuous expansion of the tax base. Since the late 1990's Ecuador's tax authority has engaged in continuous and steady efforts to reduce informality (see Aparicio et al. 2011).

Finally, descriptive statistics for workers' demographic characteristics are provided in Table A3. The table shows that, outside Ecuador's main cities, the share of workers born on Sunday is close to 14.3 percent (consistent with a random event); instead, this share is somewhat lower in Guayaquil and to some extent Quito. In spite of these variations, however, the aggregated statistics presented in the Table hide interesting heterogeneity across cohorts and socioeconomic groups, which will be explored later in the paper. The share of females is below 50 percent in all locations suggesting that women are less likely to participate in formal jobs than men. The average age in all locations, based on our sample, is close to 38 years of age. Finally, the highest degree of over 50 percent of workers in the formal sector is a secondary degree, and less than 30 percent hold a college degree.

3. Sunday Births, Cesarean Deliveries and Mothers'

Characteristics

In this section we study whether Sunday births and cesarean births in Ecuador follow similar patterns to those documented in developed countries. First, we measure the share of Sunday births in Ecuador, and the relationship between Sunday birth and

⁹ Note that since only formal employment is included, the most remote rural areas, where households rely on informal agriculture may not be represented.

cesarean rates. Then, we study the association between Sunday births and maternal characteristics.

Missing Sunday Births

Using the universe of vital records from Ecuador's Civil Registry, we calculate the share of Sunday births in Ecuador. Figure B1 shows the share of Sunday births for the universe of individuals registered in the Civil Registry who resided in Ecuador in January 2009 (and were born between 1940 and 2008). Results are presented separately for Quito, Guayaquil, and other regions in the country. If births were uniformly distributed over time, one would expect one in seven births (14.3%) to occur on Sundays. During the 1940's the share of Sunday births was roughly that number everywhere in Ecuador. Over time, however, the trends for Quito and Guayaquil divert greatly from those in other regions. In 1965 the share of Sunday births started to fall in Guayaquil; and in 1975 it started to fall in Quito as well. Only after the 1980's Sunday births started to fall elsewhere in the country. By this time, Quito and Guayaquil already had a disproportionately low share of Sunday births. By 2005 the share of babies born on Sunday in Quito and Guayaquil was less than 10%.

Most studies have attributed the shift in deliveries from Sundays to weekdays to obstetric practices. In particular, the fact that induced labor and cesarean sections are often not scheduled for Sundays (Mangold 1981; Rindfuss and Ladinsky 1976; 1979; Lerchl 2005; Lerchl and Reinhard 2008).¹⁰ Further, the magnitude of this shift is often

¹⁰ For instance, an analysis of Australian births shows that there is a strong time series correlation between the shares of births moved off weekends and the rate of cesareans/inductions. While in the 1960s virtually no births were shifted from weekends to weekdays; in the 2000s, as cesarean rates increased, nearly one-third of births were moved off weekends (Gans and Leigh 2008).

high and growing as the cesarean rate continues to rise, particularly so in developing countries.¹¹

Using data from Ecuador's Reproductive Health Survey, we explore whether Ecuador's decline in the Sunday birth rate can be explained by the use of cesareans. Figure B2 compares the distribution of cesarean births and vaginal births across days of the week over 1994-04. While there is a big dip in the number of cesarean births taking place on Sunday, the number of vaginal births is roughly constant throughout the week. These findings corroborate that the decline in Sunday births may be explained by the use of cesareans, which are not typically scheduled for Sundays.

Figure B3 shows the cesarean rate in Quito, Guayaquil, and the rest of Ecuador for 1984-89, 1994-99, and 1999-04. Cesarean rates were high in Quito and Guayaquil as early as the 1980s; the cesarean rate in Guayaquil was 32 percent, much higher than the 15 percent often recommended as appropriate. Cesarean rates are even higher for younger cohorts, reaching 37 percent in Guayaquil during the 2000s. Hence, cesarean are higher precisely for those cohorts and locations experiencing the largest drop in Sunday births.

Sunday Births and Mothers' Characteristics

The typical woman giving birth on Sunday is likely to differ from the typical woman giving birth on weekdays.¹² The evidence of "missing" Sunday births discussed thus far is consistent with the hypothesis that some types of mothers do not give birth on Sundays, while the remaining types are overrepresented amongst Sunday

¹¹ The cesarean rate has increased for developing countries in all regions except Sub-Saharan Africa (Stanton and Holtz 2006).

¹² In spite of the lack of research in this area, the few existing papers on the topic support this hypothesis. Relying on US data over 1999-2004, Dickert-Conlin and Elder (2010) show that weekday births are more common among women who are older, more highly educated, married, and are not African-American. Similarly, evidence from Texas in 1999 shows that women who were White, married, had Medicaid assistance, and had private prenatal care were less likely to deliver on weekends (Hamilton and Restrepo 2006). McEwan and Shapiro (2008) show that in Chile, mothers of Sunday births have 0.18 fewer years of schooling, relative to Mondays.

births. As it was discussed in the introduction, it is acknowledged that the use of maternal health in general and the use of elective cesareans may be correlated with the mother's income and education. If induced deliveries occur less often on Sundays, one would expect that mothers who give birth on Sundays are systematically different than those who give birth on other days.

Using data from Ecuador's Reproductive Health Survey, we estimate the relationship between Sunday births and mother's socioeconomic characteristics. Figure B4 shows the variation in maternal characteristics across days of the week. Maternal educational attainment is measured using an indicator equal to unity if a mother has a high school diploma or higher. We use maternal socioeconomic status (SES) as a proxy for income, as the survey does not report income.¹³ Our measure of maternal access to health is the number of prenatal checkups received by the mother. We find that maternal characteristics differ significantly for Sunday births relative to births on other days of the week.

We also study the determinants of Sunday births and cesarean births using linear probability models. Results are presented in Table A4. We find that maternal education, socioeconomic status and access to health are associated with a lower probability of giving birth on Sunday and a higher probability of giving birth via cesarean. Our finding that affluent mothers tend to give birth via cesarean on days other than Sunday is hardly surprising. Evidence from developing countries suggests that cesareans are often elective amongst high income groups; in 2005, 49% of cesareans in Latin America were elective (Villar et al 2006).

¹³ The 2004 Reproductive Health Survey includes a measure of socioeconomic status (SES) obtained using principal components. We used the same approach to obtain a SES measure for the 1999 round of the survey. Households are then grouped into 10 deciles of socioeconomic status (SES). The principal components procedure finds a group of weights that maximize the variance of the weighted sum of included variables; the SES measure is the weighted sum with the greatest variation. SES is calculated using categorical variables such as building materials, number of bedrooms, access to services, type of tenancy, and asset ownership, amongst other. For additional details see CEPAR 2005.

4. Is there a Sunday-Born Earnings Gap?

In this section we test whether individuals born on Sunday earn less than their counterparts born on other days. First, we discuss why such an association is likely to exist. Then, we present empirical evidence using data from Ecuador.

A. Discussion

Should one expect to observe a Sunday-born earnings gap? Given that affluent mothers tend not to give birth on Sunday and that individuals' labor market outcomes are correlated with those of their parents, then individuals born on Sunday are expected to attain labor market outcomes that reflect those of their less-affluent parents. We briefly review the literature on intergenerational transmissions paying particular attention to intergenerational correlations in socioeconomic status and education (i.e., the main determinants of Sunday deliveries).¹⁴

Most evidence of intergenerational correlations in socioeconomic status comes from developed countries. In these countries, the estimated partial correlation between parents' and children's income falls in the range of 0.3 to 0.6 (Solon 1999; 2002; Blanden et al. 2005; Mazumder 2005; Black and Devereux 2011). While few studies have focused on developing countries, there is evidence of intergenerational persistence in occupations in countries such as China (Emran and Sun 2011), Nepal and Vietnam (Emran and Shilpi 2011).

There is, however, strong evidence of significant intergenerational correlations in educational attainment.¹⁵ The robust relationship between mother's education and children's outcomes was amongst the factors underlying the World Bank's drive to

¹⁴ See Arrow et al. (2000), Behrman and Rosenzweig (2002), Black et al (2005), Bjorklund et al (2006), Bjorklund et al (2010), Dearden et al (1997), Mazumder (2005), Aaronson and Mazumder (2008), Hertz (2001), Mulligan (1999), Solon (1999; 2002; 2004), Morgan et al (2006), Bhalotra and Rawlings (2011), Bowles et al (2005), Blanden et al (2005), and World Bank (2005), amongst other.

¹⁵ Evidence is as available for South Africa (Hertz 2001), India (Emran and Shilpi 2012), and China (Emran and Sun 2011), amongst other.

promote maternal education in developing countries (World Bank 1993). However, a consensus has not been established regarding the channels driving the observed correlations (Carneiro et al 2007; Holmlund et al. 2008; McCrary and Royer 2011).¹⁶ Amongst the few causal studies focusing on developing countries, Andrabi et al. (2012) show a link between maternal education and time spent by their children on educational activities outside school.

The selection process that makes certain types of mothers deliver their babies more often on Sunday may be driving differentials in their children's outcomes. For instance, higher risks of stillbirth and neonatal mortality among Sunday babies have been attributed to selective use of cesareans. Weekend deliveries are often characterized by lower birth-weights and up to 27 percent higher risks of neonatal mortality and stillbirth.¹⁷ A similar selection process may also be driving the widely documented disadvantages observed amongst winter babies relative to those born in other seasons. While it is often argued that individuals born in winter have lower levels of education and earnings because of school entry policies,¹⁸ Buckles and Hungerman (2008) show that these differences occur because winter babies are conceived by less-affluent women.

¹⁶ For example, while Currie and Moretti (2003) find that maternal education causes improvement in infant health in the US; a similar study by McCrary and Royer (2011) does not find any statistically significant causal effect.

¹⁷ This evidence holds for a range of developed countries and time periods such as Australia over 1976-79 (Mathers 1983), Canada over 1985-98 (Luo et al. 2004), Arkansas over 1974-75 (Mangold 1981), US 1989-91 (Spiers and Guntheroth 1999), California 1995-07 (Malloy et al 2003), the US 2007 (Young 2011), England and Wales 1970-76 (MacFarlane 1978; 1979), amongst other.

¹⁸ See Angrist and Krueger (1991).

B. Empirical Evidence

The Sunday-born Earnings Gap

We test whether workers born on Sunday earn less than their counterparts born on other days.¹⁹ For this purpose, we estimate a set of traditional log-earnings regressions where we add an explanatory variable equal to unity if a worker was born on Sunday and zero else. Demographic covariates ($x_{i,t}$) include age, age², gender and marital status. Measures of educational attainment ($z_{i,t}$) include indicators for the highest level of education attained (high-school or college diploma). We also control for year fixed-effects (λ_y) and cohort fixed effects (λ_c). Year fixed effects denote the earnings period whereas cohort fixed effects denote the year of birth.

We estimate two different models. Model 1 controls for all variables discussed above except education; Model 2 adds educational controls. We follow this approach because differences in education may be an important channel driving the Sunday-born earnings gap; hence, it is interesting to explore how the magnitude of the earnings gap changes when we add educational controls. Further, if there is correlation between parents' education and children's education, then controlling for individual's own education may partially capture the effects of their parental characteristics on the Sunday-born earnings gap. For clarity, Model 2 is summarized below:²⁰

$$\text{Log}(\text{Earnings}_{i,t}) = \delta^{\text{Earn}} \text{Sunday}_i + x'_{i,t} \beta + z'_{i,t} \gamma + \lambda_y + \lambda_c + \varepsilon_{i,t}, \quad (1)$$

Where $\varepsilon_{i,t}$ is a random disturbance. The main parameter of interest is δ^{Earn} , which measures the mean earnings gap between formal workers born on Sunday and comparable workers born on other days of the week.

¹⁹ As explained in the data section, the sample includes all formal workers aged 26 to 59 years.

²⁰ Note that all *earnings* observations are non-zero.

Results for each geographic location are presented in Table A5. Model 1 suggests that workers born on Sunday earn less than their counterparts in all regions, but particularly so in Guayaquil and Quito. In these cities, the Sunday-born earnings gap is large (close to 3 percent in Guayaquil) and statistically significant at the 1 percent level. Even after controlling for workers' education, the Sunday-born earnings gap remains large (about 2 percent) and statistically significant at the 1 percent level in Quito and Guayaquil. The drop in the magnitude of the coefficients between Model 1 and Model 2 suggests that differences in education are an important driver of the Sunday-born earnings gap; however, it is evident that other mechanisms are also at work. In other parts of the country, the Sunday-born earnings gap is no longer statistically significant at the 10 percent level when educational controls are included in the model.²¹

Figure B1 shows that the share of Sunday births declined more for young cohorts relative to older cohorts; hence we study whether the magnitude of the Sunday-born earning gap also varies by cohort. We define three groups of cohorts: Young, Middle, and Old. The Young group consists of those born in 1975 or after. The Middle group consists of those born in or between 1965 and 1974. The Old group consists of those born in 1964 or earlier.

We estimate similar log-earnings equations to the ones described earlier. We control for education, demographic characteristics, year fixed effects and cohort fixed effects (i.e., the same variables used in columns (2), (4) and (6) of Table A5). For clarity, the model is presented below:

$$\begin{aligned} \text{Log}(Earnings_{i,t}) = & \delta^{Earn} \text{Sunday}_i + \delta_1^{Earn} \text{Sunday} \cdot \text{Middle}_i + \delta_2^{Earn} \text{Sunday} \cdot \text{Young}_i \\ & + x'_{i,t} \beta + z'_{i,t} \gamma + \lambda_t + \lambda_c + \varepsilon_{i,t} \end{aligned} \quad (2)$$

²¹ Results are virtually identical when the model is estimated with and without cohort fixed effects.

Where δ^{Earn} measures the average Sunday-born earning gap for the Old group; δ_1^{Earn} measures the difference in the Sunday-born earnings gap for the Middle group relative to the Old group; and δ_2^{Earn} measures the difference in the Sunday-born earnings gap for the Young group relative to the Old group.

Results for each geographic location of interest are presented in Table A6. For the Young group, there is a Sunday-born earnings gap both in Quito and Guayaquil, but not in other locations. For the Middle group, there is a Sunday-born earnings gap only in Guayaquil. Lastly, we do not find a Sunday-born earnings gap for the Old group in any geographic location. Comparing these results with Figure B1 shows that the Sunday-born earnings gap is largest precisely for those cohorts and locations where the share of Sunday births is lowest.²² Both phenomena appear to be intimately related.

The Sunday-born Educational Attainment Gap

We test whether formal workers born on Sunday attain lower levels of education than their counterparts. We focus on a single cross-section of individuals in 2009 because the level of education (dependent variable) and the explanatory variables change little over time in our data. The model is summarized below:

$$Education_i = \delta^{Educ} Sunday_i + x'_i \beta + \lambda_c + \varepsilon_i \quad (3)$$

The main parameter of interest is δ^{Educ} , which measures the mean educational attainment gap between workers born on Sunday and workers born on other days.

Results for each geographic location are presented in Table A7. The first row presents estimates of δ^{Educ} where the dependent variable equals one if the highest academic degree of the individual is high school; for the second row, the dependent

²² The vertical lines in Figure B1 indicate the three groups used in the earnings regressions.

variable is one if the worker has a college degree (or higher). Model 1 controls for demographic characteristics; model 2 adds cohort fixed effects. Results for both models are virtually identical. In all locations, workers born on Sunday are less likely to have a high school diploma than their counterparts: the magnitude of the effect is 1 percent in Guayaquil and 0.6 percent in Quito. Guayaquil is the only location where workers born on Sunday are less likely to have a college degree than their counterparts; the effect is 1 percent.

Additional Tests

One may argue that our sample size is so large that statistically significant results may be obtained for any explanatory variable. To rule out this alternative explanation for the Sunday-born earnings gap, we compare the earnings of individuals born on Monday to those born on other days of the week, one day at a time. For each regression, the sample includes individuals born on the two days of the week being compared. We focus on young cohorts in Guayaquil, for which the Sunday-born earnings gap is largest. Table A8 shows that workers born on Monday earn the same as workers born on other days of the week, with the exception of Sunday.

We also analyze if the marital status of workers born on Sunday is different than the marital status of their counterparts born in other days. It is not immediately clear in the context of our study if the probability of being married should be related to Sunday births at all.²³ Even if there is no relationship between these two variables, one may worry that a statistically significant correlation may appear just as a result of the large sample size. We estimate models similar to those presented in the previous sections, but use a marriage indicator as the dependent variable. Results, shown in

²³ For instance, (i) dowry and bride prices are not common in Ecuador as in other developing countries; and (ii) our sample includes individuals older than 25, and consequently it is unlikely to be affected by any possible association between socioeconomic status and the timing of first marriage (such as delaying marriage to obtain more education).

Table A9, suggest that the Sunday dummy is not statistically significant in any of the models.

5. Conclusion

Using rich administrative datasets, this paper estimates the Sunday-born earnings gap in Ecuador. Our findings contribute to the literature in the following ways. First, we assess the magnitude and trends of Sunday birth rates in the context of a developing country, highlighting that the decline in Sunday births is larger in urban areas. Second, we corroborate previous findings that the day-of-birth is associated with mothers' socioeconomic status. Third, we estimate the magnitude of the Sunday-born earnings gap, adding to a literature that has long studied the existence of earnings gaps between groups and regions.

Our results suggest that timing of birth is driven by yet poorly understood selection processes that are strong enough to influence outcomes later in life. Additional research is needed to understand the nature of these processes.

A. Tables

Table A1: Summary of Variables

Variable	Description
<i>Earnings</i>	
Log(Real Earnings)	Logarithm of real earnings (measured in USD of 2010)
<i>Educational Attainment (z_{i,t})</i>	
Highest degree: High School	Dummy equal to unity for individuals whose highest degree is high school
Highest degree: College	Dummy equal to unity for individuals whose highest degree is college
<i>Other Socioeconomic Characteristics (x_{i,t})</i>	
Sunday	Dummy equal to unity for individuals born on Sunday
Married	Dummy equal to unity for married individuals
Female	Dummy equal to unity for females
Age	Individual's age measured in years

Table A2: Descriptive Statistics: Worker's Annual Earnings (2005-2010)

	Worker's Real Annual Earnings (USD of 2010)					
	2005	2006	2007	2008	2009	2010
<i>Quito</i>						
Average	9,343	8,915	8,786	8,752	8,812	8,997
Median	6,660	6,497	6,379	6,285	6,329	6,502
S.D.	8,817	8,381	8,222	7,900	7,727	7,706
Obs.	121,288	156,965	167,818	201,112	217,762	235,428
<i>Guayaquil</i>						
Average	8,577	7,981	7,781	7,198	7,436	7,509
Median	5,795	5,397	5,371	4,827	5,156	5,228
S.D.	8,424	7,969	7,696	7,188	7,015	6,950
Obs.	94,828	121,757	133,986	175,301	190,413	205,975
<i>Rest of Ecuador</i>						
Average	7,034	6,824	6,870	6,686	6,935	6,993
Median	5,238	5,180	5,121	4,707	4,874	4,909
S.D.	6,857	6,478	6,485	6,304	6,279	6,232
Obs.	407,563	542,899	576,950	740,784	814,649	892,534
Total Obs.	623,679	821,621	878,754	1,117,197	1,222,824	1,333,937

Notes: The sample includes all formal workers aged 26 to 59 years.

Table A3: Descriptive Statistics: Socio-demographic Characteristics (2005-2010)

	Average	SD	Min	Max	Obs. 2005-10
<i>Quito</i>					
Sunday	0.141	0.348	0	1	1,100,373
female	0.407	0.491	0	1	1,100,373
age	36.91	8.41	26	59	1,100,373
married	0.637	0.481	0	1	1,100,373
Highest degree: HS	0.540	0.498	0	1	1,100,373
Highest degree: Coll	0.320	0.466	0	1	1,100,373
<i>Guayaquil</i>					
Sunday	0.136	0.343	0	1	922,260
female	0.371	0.483	0	1	922,260
age	36.43	8.30	26	59	922,260
married	0.440	0.496	0	1	922,260
Highest degree: HS	0.602	0.489	0	1	922,260
Highest degree: Coll	0.232	0.422	0	1	922,260
<i>Rest of the Country</i>					
Sunday	0.144	0.352	0	1	3,975,379
female	0.333	0.471	0	1	3,975,379
age	38.22	8.70	26	59	3,975,379
married	0.551	0.497	0	1	3,975,379
Highest degree: HS	0.453	0.498	0	1	3,975,379
Highest degree: Coll	0.239	0.427	0	1	3,975,379
<i>Total Obs.</i>					5,998,012

Notes: The sample includes all formal workers aged 26 to 59 years.

Table A4: Correlates of Cesarean Births and Sunday Births

	Dependent Var.: Sunday			Dependent Var.: Cesarean		
	(1)	(2)	(3)	(5)	(5)	(6)
High School	-0.014 *** (0.005)	-0.010 ** (0.005)	-0.009 * (0.005)	0.050 *** (0.014)	0.028 * (0.016)	0.025 (0.016)
College	-0.017 *** (0.005)	-0.013 ** (0.006)	-0.012 ** (0.006)	0.193 *** (0.019)	0.135 *** (0.020)	0.128 *** (0.020)
Socioeconomic status (SES)		-0.002 ** (0.001)	-0.002 ** (0.001)		0.024 *** (0.003)	0.023 *** (0.003)
Prenatal Checkups			-0.001 ** (0.000)			0.004 ** (0.002)
Age and Age ²	YES	YES	YES	YES	YES	YES
Province FE	YES	YES	YES	YES	YES	YES
Cohort FE	YES	YES	YES	YES	YES	YES
Mother Obs.	18,713	18,713	18,713	8,427	8,427	8,427
Children Obs.	53,355	53,355	53,355	10,841	10,841	10,841
R-squared	0.002	0.003	0.003	0.062	0.082	0.085

Notes: Table shows results from linear probability models. The dependent variable for models (1) to (3) is a dummy equal to unity for a mother giving birth on Sunday; the dependent variable for models (4) to (6) is a dummy equal to unity for a mother given birth via cesarean. The covariates describe the socio-demographic characteristics of the mother. Data on type of delivery (i.e. cesarean vs. vaginal) is available only for births during the 5 years prior to the Survey. Information on day of birth is available for all live births delivered by the interviewed women. Cohort fixed effects are indicators for the year when individuals were born. Robust standard errors, clustered at the mother level, are in parenthesis. *, **, ***, denote significance at the 10, 5, and 1 percent level.

Table A5: The Sunday-born Earnings Gap

	Dependent Variable: Log(Real Earnings)					
	Guayaquil		Quito		Other Regions	
	Model 1 (1)	Model 2 (2)	Model 1 (3)	Model 2 (4)	Model 1 (5)	Model 2 (6)
Born on Sunday	-0.027*** (0.003)	-0.022*** (0.003)	-0.012*** (0.003)	-0.010*** (0.003)	-0.004*** (0.001)	-0.002 (0.001)
Female	0.085*** (0.002)	-0.036*** (0.002)	-0.112*** (0.002)	-0.171*** (0.002)	0.042*** (0.001)	-0.156*** (0.001)
Age	0.074*** (0.001)	0.158*** (0.003)	0.087*** (0.001)	0.158*** (0.003)	0.045*** (0.001)	0.137*** (0.001)
Age ²	-0.001*** (0.000)	-0.002*** (0.000)	-0.001*** (0.000)	-0.002*** (0.000)	0.000*** (0.000)	-0.001*** (0.000)
Married	0.274*** (0.002)	0.201*** (0.002)	0.079*** (0.002)	0.095*** (0.002)	0.280*** (0.001)	0.187*** (0.001)
Highest degree: HS		0.484*** (0.003)		0.602*** (0.003)		0.630*** (0.001)
Highest degree: Coll		0.935*** (0.004)		1.014*** (0.003)		1.013*** (0.001)
Constant	6.532*** (0.023)	4.723*** (0.063)	6.613*** (0.021)	4.579*** (0.055)	6.869*** (0.011)	4.510*** (0.029)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.067	0.137	0.056	0.156	0.084	0.214
Observations	922,260	922,260	1,100,373	1,100,373	3,975,379	3,975,379

Note: Table shows results from ordinary least squares regressions. The dependent variable is the log of workers' annual earnings. The sample includes all formal workers aged 26 to 59 years. Year fixed effects denote the earnings period, whereas cohort fixed effects denote the year of birth. Robust standard errors are shown in parenthesis. *, **, ***, denote significance at the 10, 5, and 1 percent level.

Table A6: The Sunday-born Earnings Gap, by Cohort

	Dependent Variable: Log(Real Earnings)					
	Guayaquil		Quito		Other Regions	
	(1)	(2)	(3)	(4)	(5)	(6)
Born on Sunday	-0.022 *** (0.003)	-0.002 (0.006)	-0.010 *** (0.003)	-0.004 (0.005)	-0.002 (0.001)	-0.001 (0.002)
Sunday * Born between 1965 & 1974		-0.028 *** (0.008)		0.005 (0.007)		0.001 (0.003)
Sunday * Born after 1975		-0.025 *** (0.008)		-0.018 *** (0.006)		-0.003 (0.003)
Education	Yes	Yes	Yes	Yes	Yes	Yes
Demographic	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.137	0.137	0.156	0.156	0.214	0.214
Observations	922,260	922,260	1,100,373	1,100,373	3,975,379	3,975,379

Note: Table shows results from an OLS model. Dependent variable is the log of workers' annual earnings. Sample includes universe of workers (age 26 to 59) in the formal sector in Ecuador between 2005 and 2010. In addition to the variables shown above, independent variables include educational attainment, demographic characteristics, year fixed effects and cohort fixed effects; that is, the same variables used in columns (2), (4) and (6) of Table A5. Year fixed effects denote the earnings period. Cohort fixed effects are indicators for the year when individuals were born. Robust standard errors are shown in parenthesis. *, **, ***, denote significance at the 10, 5 and 1 percent level.

Table A7: The Sunday-Born Educational Attainment Gap

	Guayaquil		Quito		Other Regions	
	Model 1 (1)	Model 2 (2)	Model 1 (3)	Model 2 (4)	Model 1 (5)	Model 2 (3)
Dependent Variable						
Highest degree: High School	-0.006 *** (0.001)	-0.006 *** (0.001)	-0.004 *** (0.001)	-0.004 *** (0.001)	-0.003 *** (0.001)	-0.002 *** (0.001)
Highest degree: College	-0.005 *** (0.001)	-0.005 *** (0.001)	0.001 (0.001)	0.001 (0.001)	0.000 (0.001)	0.000 (0.001)
Demographic	Yes	Yes	Yes	Yes	Yes	Yes
Cohort FE	No	Yes	No	Yes	No	Yes
Observations	330,489	330,489	349,193	349,193	1,390,317	1,390,317

Note: The table shows results from ordinary least squares regressions. The dependent variables are shown in the first column of the table. They include: (a) high school degree or higher; (b) college or higher. The values shown denote the coefficient for the Sunday-born dummy variable. The sample includes formal workers aged 26 to 59 years. Demographic controls include female, age, age², and married. Cohort fixed effects are indicators for the year when individuals were born. Robust standard errors are shown in parenthesis. *, **, ***, denote significance at the 10, 5, and 1 percent level.

Table A8: Monday-born Earnings Gap (Premium)

	Dependent Variable: Log(Real Earnings)					
	(1) Tuesday	(2) Wednesday	(3) Thursday	(4) Friday	(5) Saturday	(6) Sunday
Born on Monday	-0.002 (0.009)	-0.008 (0.009)	-0.011 (0.009)	-0.005 (0.009)	-0.010 (0.009)	0.023 ** (0.009)
Education	Yes	Yes	Yes	Yes	Yes	Yes
Demographic	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.089	0.089	0.093	0.090	0.089	0.094
Observations	121,080	120,700	119,974	121,912	120,522	115,349

Note: Table shows results from an OLS model. Dependent variable is the log of workers' annual earnings. Sample includes universe of workers born after 1975, in the formal sector in Guayaquil. Each model uses data from workers born on Monday and the day listed in each column. For each regression, the sample includes individuals born on the two days of the week being compared. In addition to the variables shown above, independent variables include educational attainment, other demographic characteristics, year fixed effects and cohort fixed effects. Year fixed effects denote the earnings period. Cohort fixed effects are indicators for the year when individuals were born. Robust standard errors are shown in parenthesis. *, **, ***, denote significance at the 10, 5 and 1 percent level.

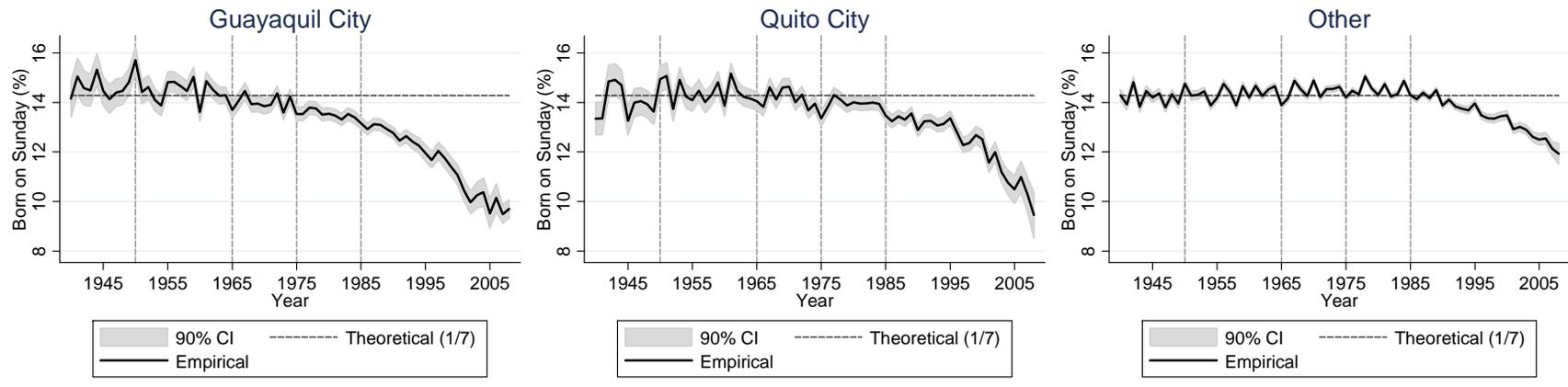
Table A9: Marriage, by Cohort

	Dependant Variable: Married					
	Guayaquil		Quito		Other Regions	
	(1)	(2)	(3)	(4)	(5)	(3)
Born on Sunday	-0.002 (0.003)	-0.005 (0.007)	0.004 (0.003)	0.006 (0.005)	0.000 (0.001)	-0.001 (0.003)
Sunday * Born between 1965 & 1974		0.006 (0.009)		-0.005 (0.007)		-0.002 (0.004)
Sunday * Born after 1975		0.003 (0.008)		-0.001 (0.007)		0.003 (0.003)
Education	Yes	Yes	Yes	Yes	Yes	Yes
Demographic	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.070	0.070	0.091	0.091	0.075	0.075
Observations	922,260	922,260	1,100,373	1,100,373	3,975,379	3,975,379

Note: Table shows results from a linear OLS model. Dependent variable is a dummy equal to unity for married workers. Sample includes universe of workers (age 26 to 59) in the formal sector in Ecuador between 2005 and 2010. In addition to the variables shown above, independent variables include educational attainment, other demographic characteristics, year fixed effects and cohort fixed effects; that is, the same variables used in columns (2), (4) and (6) of Table 6. Year fixed effects denote the earning's period. Cohort fixed effects are indicators for the year when individuals were born. Robust standard errors are shown in parenthesis. *, **, ***, denote significance at the 10, 5 and 1 percent level, respectively.

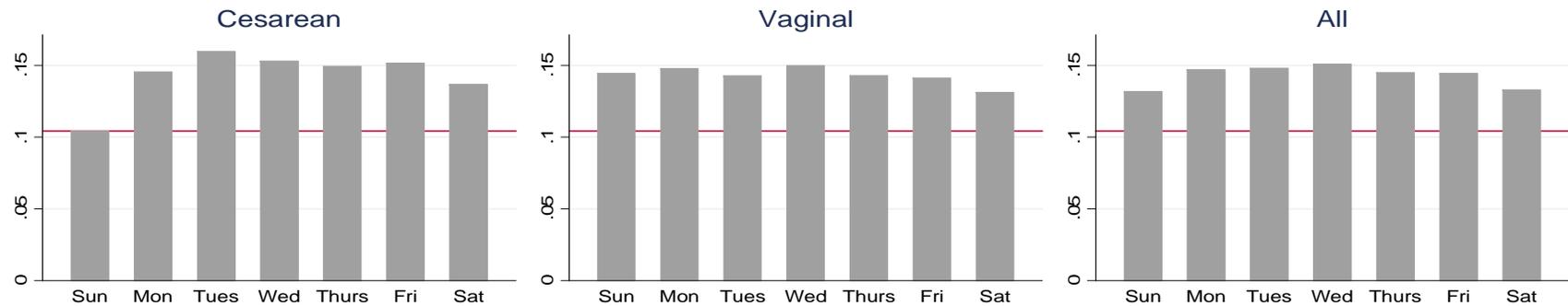
B. Figures

Figure B1: Percentage of Individuals Born on Sunday



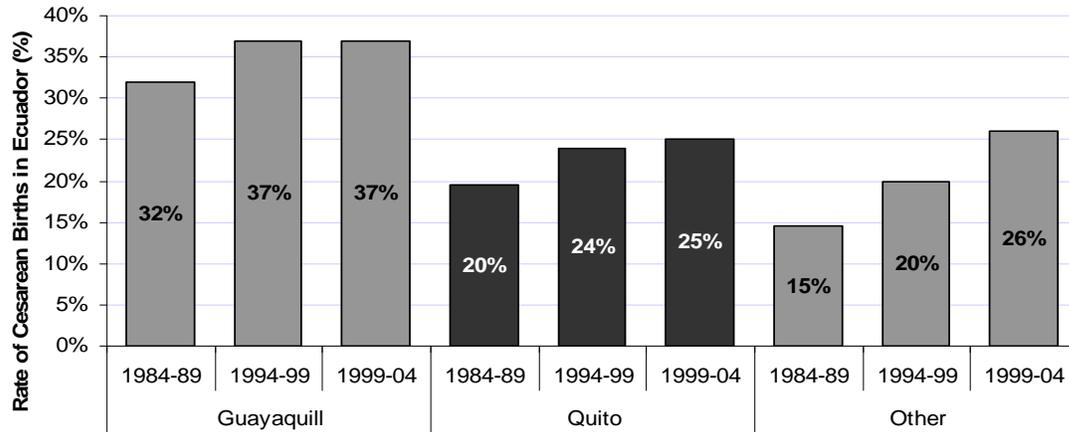
Notes: Confidence intervals are obtained from regressions where the dependent variable is the share of babies born in Sunday and the controls are dummies for each year.
Source: Universe of birth records in Ecuador's Civil Registry.

Figure B2: Distribution of Births by Day and Type



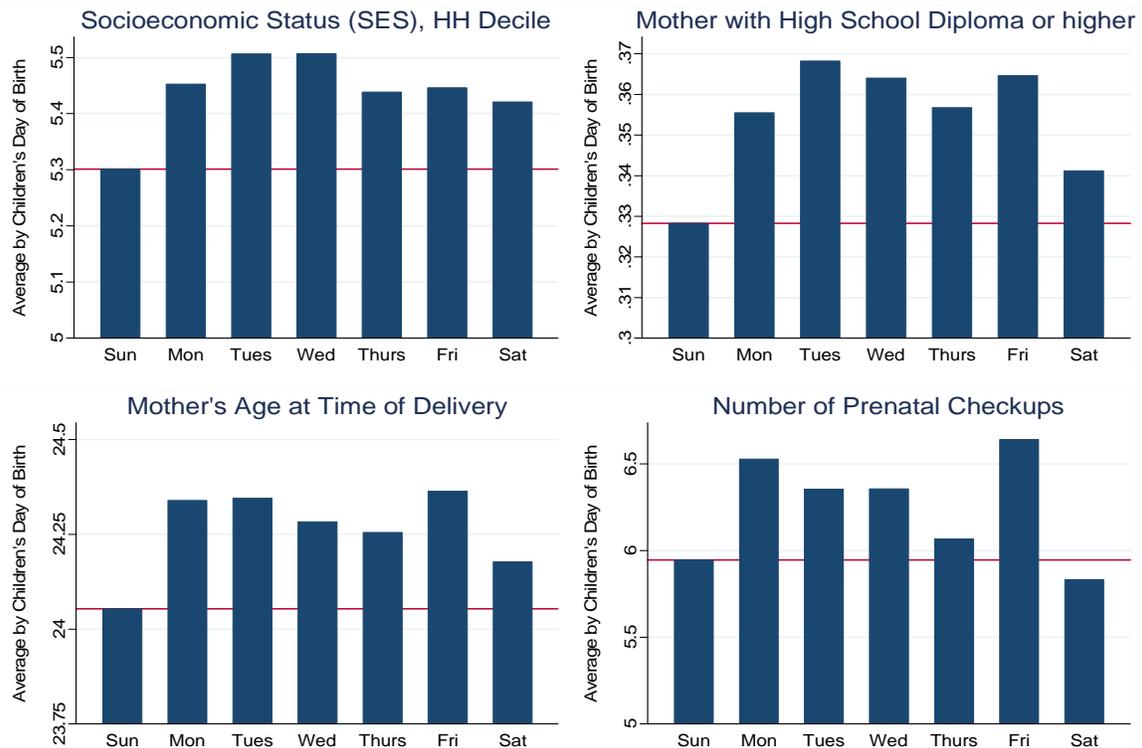
Notes: The figure shows the share of births occurring each day of the week for different types of delivery (i.e., cesarean and vaginal). Sample includes all births between 1999 and 2004. Source: Ecuador's Reproductive Health Survey 2004.

Figure B3: Caesarean Birth Rates in Ecuador



Notes: The figure shows the percentage of cesarean births as a share of all live births. For 1984-89 results differ from the official report which uses institutional births as a denominator. The sample includes the universe of women, aged 15 to 49 years. The sample is representative for the entire country (except for the 1989 round, which excludes Amazonia and Galapagos). Source: Ecuador's Reproductive Health Survey 1989, 1999 and 2004.

Figure B4: Sunday Births, Descriptive Statistics



Notes: Households are classified into SES deciles; households can have more than one child. Source: Ecuador's Reproductive Health Survey

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