

The Undercounting of Births to Child Mothers^{*}

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Abstract

Births to child mothers—girls aged 10 to 14—are undercounted. Using birth registries from 37 countries and census data from 73 countries, we show that contemporaneous census-based estimates of births to child mothers are significantly lower than registry counts, consistent with censuses counting only co-resident children. In contrast, censuses conducted a decade later for the same birth cohorts report more such births than earlier censuses and, in over 65% of country-censuses, more than the registries. This pattern does not hold for older mothers: birth counts based on consecutive censuses closely align, and censuses almost never exceed registry counts. We develop a model in which social stigma discourages disclosure among young mothers but fades over time, explaining why retrospective sources uncover births missed by contemporaneous ones. Consistent with the model, we find a single crossing in reporting, with census counts eventually surpassing registry counts as time since birth increases. Finally, we provide evidence of the underlying mechanisms by documenting excess reported births among mothers aged 45 and older, delayed registration of births among child mothers, and no discontinuity in reporting at the minimum age of consent.

JEL Codes: J13, D10, J18, D82

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1 Introduction

Accurate demographic and health data are public goods critical for effective resource allocation, policy design, and advocacy. Producing these data relies on institutional capacity and on truthful reporting by individuals. However, when truthful reporting carries private costs—such as legal exposure or social stigma—individuals may withhold or distort information, undermining the data that researchers and policymakers depend on ([Blank et al., 2009](#); [Duflo et al., 2013](#)).

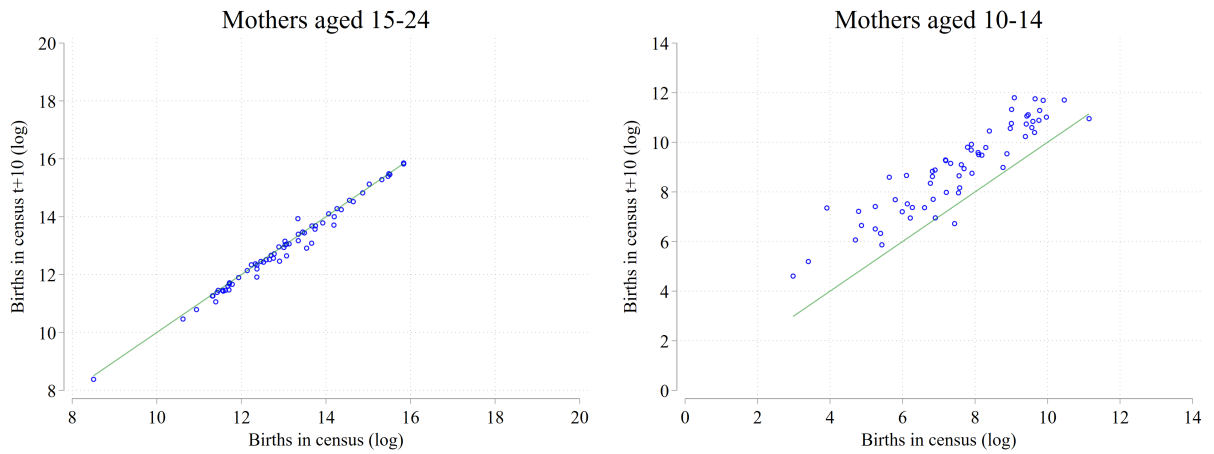
We study this problem in the context of births to child mothers—girls aged 10 to 14. Childbearing at a young age harms the well-being of both mother and child ([Duflo, 2012](#); [Kearney and Levine, 2015](#); [Lang and Weinstein, 2015](#)), especially for the youngest mothers, whose pregnancies are often a result of sexual violence ([Aizer et al., 2022](#)). Accurate data are therefore essential to gauge the scale of the problem and monitor trends. Yet this is precisely the group for which the information problem is most severe: social stigma and potential legal consequences intensify with the mother’s youth, creating strong incentives to conceal or misreport births.

We provide evidence that births to child mothers are substantially and systematically undercounted. First, we document that the timing of the census relative to the birth affects household reporting behavior regarding child motherhood. A simple comparison using census data illustrates the differential reporting. Each census allows us to measure fertility in every year and for every cohort prior to the census. For example, if in the 2010 census we observed that a 17-year-old is a mother of a 2-year-old, we can infer that a 15-year-old had a baby in 2008. Similarly, if the 2020 census has a 27-year-old mother of a 12-year-old, we can also infer that a 15-year-old had a baby in 2008. Therefore, each census provides an independent measure of births for the same cohort, but with different mother ages at the time of reporting. We compare these measures at two time points for the same cohort: once in the census conducted shortly after childbirth, when the mother is still in her teens,

and again a decade later, when she is in her twenties.

Figure 1 plots these consecutive census birth counts for the countries with available data, with the baseline census on the horizontal axis and the subsequent census on the vertical axis. For mothers aged 15–24, observations cluster along the 45-degree line: both censuses yield similar counts. However, for mothers aged 10–14, we observe a very different pattern: observations rise well above the 45-degree line. The later census, conducted when these mothers were in their twenties, reveals substantially more births than the one taken when they were still teenagers.

Figure 1: Birth Counts in Subsequent Censuses



Source: [IPUMS \(2020\)](#)

Notes: The figure plots the natural logarithm of birth counts from two consecutive censuses; the x-axis has the first (baseline) census of the pair, and the y-axis has the second (subsequent) one, which is mostly 10 years afterward. The birth counts are the total births to mothers in that age group that occurred between 1 and 5 years before the baseline census. For each child residing with their mother, we infer the child's year of birth as the census year minus the child's age at the time of the census, and the mother's age at birth as her current age minus the child's age. Table B3 in the Online Appendix lists the countries included. The figure restricts the sample to children co-residing with their birth mothers, born in the country of the census, and whose mothers' ages at the time of the census are at least the minimum age of mothers observed in the census. The census pairs are restricted to pairs where the variable stepmom has the same possible values and both censuses of the pair include place of birth. Figure A1 in the Online Appendix displays three less-conservative alternative figures that remove some of these restrictions with consistent and very similar patterns.

We then quantify the average underreporting by the mother's age at the time of child-birth across countries in the earlier census relative to the later one. For ages 10 to 14, we find that the intra-household relationship reported in the first census, on average, leads to an estimate of births to child mothers that excludes more than 50% of the births. The share

of undercounted mothers decreases for mothers aged 15 and 16 and practically disappears for mothers aged 17 and older. Interestingly, we document the opposite pattern for mothers aged 40 onwards, which gains magnitude and significance after age 45. This pattern is consistent with households attributing motherhood to the grandmother (and not the very young mother) in the census when the mother is still in her teens, but not in the later one.

The undercount extends beyond census-to-census comparisons. We compare census-based birth counts with registry-based counts of births by the mother's age, compiled by the World Health Organization for 37 countries, and with United Nations World Population Prospects estimates—a model-based series that reconciles censuses, surveys, and registration records—for 89 countries. Before providing the average across all countries, we leverage the data availability for Mexico, where IPUMS has 4 available population counts, and three external series exist: Mexico's own INEGI birth registry, the WHO registry-based counts, and the UN WPP estimates. The census taken five years after the 2005 birth cohort records only 5,140 births to mothers aged 10–14, whereas the censuses taken ten and fifteen years later record 12,776 and 12,223—against roughly 8,700 to 8,900 in the three external series. Therefore, we document that even the data sources considered most reliable for fertility measurement—administrative birth registries—can substantially undercount births to child mothers.

Extending this exercise across the globe, we find that for mothers aged 15 and above, registries consistently produce higher birth counts than censuses (both shortly after the birth and a decade later) — which is the expected pattern, since census estimates count only children still residing with their mother. For mothers aged 10–14, this relationship reverses with the time elapsed since the birth: censuses conducted one to five years after the birth recover, on average, 45% fewer births to child mothers than the registries; however, censuses conducted ten to fifteen years after the birth recover 20% more births than the WHO registries and over 50% more than the UN WPP estimates.

Why does this undercount occur, and why is it specific to the youngest mothers? We

develop a simple framework in which mothers weigh the benefits of reporting a birth against age-dependent private costs. Social stigma and potential legal consequences make the cost of truthful reporting high when the mother is young, but these costs fade as she ages. The expectation is that, because birth registries offer stronger instrumental incentives (e.g., access to healthcare and social programs) than census interviews, registry reporting exceeds census reporting when they both occur close to the time of birth and the social costs of truthful reporting are high.

The main prediction of the model is a single crossing: as social costs decline over time since birth, census reporting will increase as the census occurs further and further apart from the birth, catching up and eventually surpassing registry counts. For births to mothers aged 10 to 14, we document this single crossing in Mexico census by census, on average across the countries in our sample, and at the level of individual country-censuses: two-thirds of the classifiable cases in the WHO registry comparison cross, as do 56% in the broader WPP comparison. This does not occur among mothers aged 15 to 19 (occurring in only 1 of 28 country-censuses in the WHO comparison, and 2 of 300 in the WPP comparison).

Beyond the cross-census comparison, administrative data on birth registration timing from Mexico provide independent support for the model's mechanism. If the social cost of reporting is larger for younger mothers and decays with time since childbirth, when possible, households would prefer to delay the reporting of births to young mothers and to delay more the younger the mother is. We document this pattern in the data. Delays between birth and registration increase sharply for child mothers. While births to mothers aged 15–24 are, on average, registered within a year, births to mothers aged 10 to 12, on average, take over 3 years to register.

We then examine which country characteristics correlate with the underreporting of child-mother births in censuses. We find that the undercount is smaller in countries where the potential cost of misreporting is higher (higher share of birth registration), where the

social costs of truthful reporting are likely lower (more egalitarian gender norms, stronger legal protections for women, greater female autonomy over health and reproductive decisions, higher perceived rule of law, and lower rates of violence against women), or where the benefits of reporting are higher (coverage of social assistance programs).

Finally, to assess the potential role of judicial costs, we exploit variation in pregnancy timing relative to the minimum age-of-consent law in each country. Births to mothers who are not at least nine months older than the minimum age of consent could be flagged by authorities as evidence of a potential crime. Therefore, using a regression discontinuity design, we test for a discontinuity in reporting behavior around the country's minimum age of consent plus 9 months. We find no discontinuous change in reporting, suggesting that mechanisms related to legal penalties are not a primary driver of misreporting.

This paper contributes to three bodies of research. First, we contribute to the literature on child and teenage motherhood. Prior work studies the causes and consequences of fertility among teenage girls, documenting negative outcomes for both mothers and their children (e.g., [Corbacho et al., 2012](#); [Duflo, 2012](#); [Kearney and Levine, 2015](#); [Klepinger et al., 1999](#); [Lang and Weinstein, 2015](#)). This social problem has received substantial policy attention, and the United Nations included reducing fertility among girls aged 10–19 in the Sustainable Development Goals. However, both research and policy data focus primarily on girls aged 15–19, for whom reliable statistics are widely available. Fertility data for girls younger than 15 are scarce and incomplete ([Schoumaker and Sánchez-Páez, 2022](#); [WHO, 2024](#)). Our evidence indicates that child motherhood is more prevalent than previously recognized, and that under-reporting arises not only in surveys but also in birth registries—often viewed as the most reliable source of birth counts ([Kearney and Levine, 2012](#)).

Second, we contribute to a growing literature on the economics of measurement and information. In recent work, [Dutz et al. \(2026\)](#) show that nonresponse bias in surveys persists even after standard corrections and can substantially distort estimates of labor

market outcomes, highlighting that systematic biases in standard data sources have first-order implications for research and policy. We document another form of measurement distortion: birth counts for child mothers are systematically understated in both censuses and administrative records, a pattern we argue is driven by social costs of disclosure. Our findings complement prior work showing that private costs can deter truthful reporting in contexts such as environmental auditing ([Duflo et al., 2013](#)), school enrollment ([Sander and Glassman, 2015](#)), and income declaration ([Hurst and Pugsley, 2010](#)), as well as finding that outlawing early marriage creates incentives to misreport age at marriage in administrative records ([Blank et al., 2009](#)).

Finally, we contribute to the literature on social norms. Prior research shows that concerns for reputation and social image can be as influential as material incentives ([Bénabou and Tirole, 2006](#); [Butera et al., 2022](#); [Daughety and Reinganum, 2009](#)). Social pressure can promote socially beneficial behavior in contexts such as voting ([Ali and Lin, 2013](#)), workplace safety ([Johnson, 2020](#)), saving ([Breza and Chandrasekhar, 2019](#)), and vaccination ([Karing, 2024](#)), but can also generate welfare-reducing actions, including charitable giving beyond individual preferences ([Dellavigna et al., 2012](#)) and under-investment in education ([Bursztyn and Jensen, 2015](#); [Bursztyn et al., 2019](#)). We show that such pressures can also induce under-reporting of socially sensitive information, including births to child mothers.

2 Data

Birth Registries. We use two sources of registry-based birth counts. For the cross-country comparison of registries and censuses, we use the World Health Organization’s estimates of adolescent birth rates by age of the mother (10–14 and 15–19), which we restrict to country-years flagged as derived from civil-registration records and convert into birth counts using United Nations estimates of the female population in each age group. For the analysis of registration delays, we use Mexico’s administrative birth records (Estadística

de Nacimientos del Registro Civil), compiled by INEGI, which report both the date of occurrence and the date of registration of each birth. Additional details are provided in Online Appendix B.

Demographic Estimates. As a complement to the registration-based counts, we use the United Nations World Population Prospects 2024 estimates of births by five-year age group of the mother. The WPP series is not a registry: it is a model-based demographic reconstruction that combines censuses, surveys, and vital registration into a complete annual series for every country from the 1950s onward. Its near-universal coverage allows us to extend the registry–census comparison to a much larger set of countries and census years (details in Online Appendix B2). Because the reconstruction draws on census data, however, it is not independent of the census records we study; we therefore use it to extend coverage rather than as a registry benchmark, and we return to what its construction implies for the comparison in Section 3.3.

Censuses. We use census microdata from 73 countries, obtained from the Integrated Public Use Microdata Series (IPUMS, 2020).¹ Appendix Table B3 displays the list of countries and census pairs.

Our analysis requires linking children to their biological mothers within households. IPUMS provides harmonized variables for this purpose, with linkages that agree with direct reports of family interrelationships more than 98% of the time (Sobek and Kennedy, 2009). This harmonization also flags age gaps between mothers and their children below 12. Leveraging the IPUMS harmonization, we restrict the sample to children identified as living with their biological mother ($\text{stepmom} = 0$) or whose mother–child age difference is less than 12 years ($\text{stepmom} = 5$). Section B1 of the Online Data Appendix provides more details on the IPUMS data harmonization.

The linkage of children to their birth mothers allows for counting births by the mother’s

¹The United States data available in IPUMS is from the American Community Survey (ACS), which replaced the long-form census questionnaire starting in 2010.

age at childbirth and year of birth. For instance, a household in the 2010 census with an 18-year-old mother of a four-year-old indicates that a 14-year-old girl gave birth in 2006. Importantly, if a subsequent census is conducted, births can be recounted for the same cohort of mothers and year. In our example, by the 2020 census, the same mother would be 28 years old, and her child would be 14, also indicating that a child was born to a 14-year-old in 2006. Using census data to reconstruct birth histories retrospectively is part of a class of "reverse-survival" methods ([United Nations, 1983](#)), a long-standing but relatively under-utilized technique in demography ([Spoorenberg, 2014](#)). This approach allows for two independent, time-distant counts of births by mother's age and year.

A relevant limitation of census-based birth counts is that they only capture children residing with their mothers. To mitigate this concern, we include cohorts of births from the five years preceding the data collection for the earlier census, ensuring that these children are still in their teens in the latter census and increasing the likelihood that they live in the same household as their biological mothers.² However, even with this restriction, the second count is likely to be lower because older children are less likely to reside with their birth mothers.

To ensure the undercount estimates are not driven by mechanical truncation, we keep only cohorts whose mothers had reached the minimum recorded mother's age of the baseline census by the time it was taken. We apply this restriction at the census-pair level, so a cohort that is unobservable in the baseline census is dropped from the later census as well. Therefore, the comparison always involves cohorts that are observable in both censuses.

Country Characteristics and Legal Data. For the cross-country analysis of reporting incentives, we use indices of social norms, women's rights, and institutional quality constructed from publicly available sources (details in Online Appendix [B3](#)). We also use

²Because census intervals range from 8 to 12 years, this five-year window restricts the maximum age of children in the subsequent census to between 13 and 17, depending on the exact span.

data on the legal minimum age of consent (MAoC) by country, compiled from national legislation as reported by AgeOfConsent.net ([AgeOfConsent, 2023](#)).

3 Estimation

3.1 Census Timing, Mothers' Age, and Reporting

In this section we document how reporting behavior on acknowledging the presence of children and intra-household relationships vary by the age of the mother at childbirth and by the time since the birth. Reporting in census surveys is generally predetermined and available only once every decade. The timing of the census is therefore quasi-exogenous to the child's birth date, the mother's age at delivery, and the mother's age at the time of reporting.

Thus, we can isolate the effect of the mother's age at the time of reporting by comparing estimates from two different census rounds for the same cohort of mothers, holding the reporting method and age at childbirth constant. Moreover, we can compare this under-reporting by the mother's age at childbirth to characterize how the incentives to report vary with the mother's age at childbirth.

Indeed, we find sharply different patterns between the child and adolescent/young-adult mother groups, as previewed in Figure 1: the two census counts coincide for mothers aged 15–24 but diverge sharply for child mothers.

Other mechanisms could also explain higher birth counts for child mothers in the latter census. First, changes in the likelihood of residing with the biological mother: children may initially live with other family members and later rejoin their biological mother. This is unlikely to be an issue because children are more likely to live with their biological mother when they are young, which is consistent with the first census showing slightly higher birth counts for mothers aged 15 to 24 than the later one.

Second, immigration could introduce children who appear only in the later census, which would be a concern in high-immigration countries. We address this by including only children born in the country of the census in the estimation and by limiting the census pairs to those that include place of birth. Third, the stepmom variable, which identifies biological mothers, could have different values within a census pair. For example, one census could explicitly identify step relationships while the other doesn't. This could marginally increase the likelihood that IPUMS classifies a relationship as biological. To address this concern, we include only census pairs in which the stepmom variable takes the same value in both censuses of the pair. However, the observed patterns are very robust. Removing these restrictions renders very similar patterns, but with more observations (see Figure A1).

We estimate underreporting in the baseline census by the mother's age at childbirth across our global sample covering 73 countries listed in Table B3 using the following measure:

$$Undercount_{a_b}^C = 1 - \frac{1}{N} \sum_{c=1}^N \left(\frac{1}{P_c} \sum_{p=1}^{P_c} \left(\frac{\sum_{t=1}^5 Census_{a_b,t,c,p}}{\sum_{t=1}^5 Census_{a_b,t,c,p}^S} \right) \right) \quad (1)$$

Where $Undercount_{a_b}^C$ is the average birth undercount across countries in censuses for mothers aged a_b at childbirth, $Census_{a_b,t,c,p}$ are the birth estimates for mothers aged a_b at childbirth in year t in census pair p for country c based on the first census of the pair, and $Census_{a_b,t,c,p}^S$ is the same but based on the subsequent census. We include cohorts of births from the five years preceding the data collection for the earlier census, ensuring that these children are still in their teens in the latter census and increasing the likelihood that they live in the same household as their biological mothers.³ We first average across census pairs within countries so that every country has the same weight in the cross-country average.

³Because census intervals range from 8 to 12 years, this five-year window restricts the maximum age of children in the subsequent census to between 13 and 17, depending on the exact span.

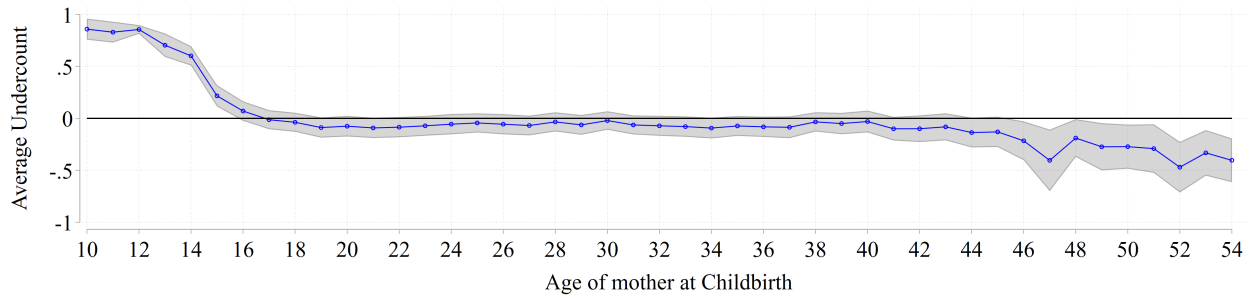


Figure 2: Global Average Undercounting in Censuses

Notes: The figure displays the average birth undercount across countries by the mother’s age at childbirth, estimated using equation 1. Birth counts are restricted to children born between one and five years before each baseline census year. Table B3 in the Online Appendix lists the countries included. The figure restricts the sample to children co-residing with their birth mothers, born in the country of the census, and whose mothers’ ages at the time of the census are at least the minimum age observed among mothers in the census. The census pairs are restricted to pairs where the variable stepmom has the same possible values and both censuses of the pair include place of birth. Figure A2 in the Online Appendix displays three less-conservative alternative figures that relax some of these restrictions, yielding consistent and very similar patterns.

Figure 2 presents the cross-country average census undercounts and their 95% confidence intervals. Underreporting of births to child mothers in censuses conducted within one to five years after the birth is widespread and, on average, exceeds 50% of births. It is only for mothers aged 17 or older that, on average, earlier censuses yield the mechanically expected higher counts. The likelihood of reporting increases (the under-reporting declines) monotonically with the mother’s age at childbirth. These findings are robust to a less conservative list of countries and census pairs. Figure A2 displays consistent findings when removing the restriction to include only censuses that ask for the country of birth, and when both census pairs have the exact same possible values for the stepmom variable in IPUMS.

Attributing the child to other female household members. Underreporting a child-mother’s birth does not necessarily mean the child goes unrecognized. The household may acknowledge the child but attribute parentage to another woman—either one outside the household or an older woman within it. If such misattribution were common, we would expect some of the missing births among mothers aged 10 to 14 to appear as excess births among mothers aged 40 or older. This is indeed what we observe: for ages after 40, we

start observing excess births in the first census relative to the second one (see Figure 2).

This pattern could also be explained by mortality or migration, since some of the mothers aged 40 and older at the time of childbirth may not have been alive (or in the country) in the later census. However, these do not account for the entire discrepancy in fertility across census waves. While census estimates of intercensal attrition (share of missing women from one census to the next) are 7% for women aged 40 to 44, 10% for women aged 45 to 49, and 12% for women aged 50 to 54,⁴ the magnitudes of excess fertility measures in the first census relative to the next one widely surpass these: the share of excess births are 15% for mothers aged 40 to 44, 26% for mothers aged 45 to 49, and 42% for mothers aged 50 to 54.

3.2 Undercounting in Registries

Many nations incentivize birth registration through benefits such as child tax credits, healthcare access, and social security. In countries with reliable birth registries (i.e., with 90% or higher coverage), United Nations guidelines regard them as the most reliable data source for estimating birth rates ([Kisambira and Schmid, 2022](#)). However, the accuracy of birth registries is usually evaluated based on the total number of births. Since births to mothers under 15 account for a small proportion of this total, if under-reporting is disproportionately skewed toward younger mothers, even birth registries regarded as accurate at the aggregate level may significantly underestimate births to child mothers.

We estimate the extent of underreporting in administrative records by comparing them with census-based counts for the same country, year of birth, and mother's age at childbirth. Our measure of unrecorded births is:

⁴The attrition could be due to mortality, migration, and other events that would cause a woman in one census not to be present in the next.

$$Undercount_{a_b,t}^A = 1 - \frac{AdministrativeRecords_{a_b,t}}{Census_{a_b,t}^S} \quad (2)$$

where $Undercount_{a_b,t}^A$ is the undercount of births in administrative records for mothers aged a_b at childbirth in year t , and $Census_{a_b,t}^S$ is the estimated number of births based on a census (where S stands for subsequent) collected approximately 10 years after the birth. Both counts refer to the same country, whose index we suppress here. An $Undercount_{a_b,t}^A < 0$ implies that administrative records exceed the census estimates, which would be expected in the absence of social or judicial costs because the estimate $Census^S$ is downward biased by not including children who do not cohabit with their birth mothers. In contrast, a positive value indicates undercounting in administrative records relative to $Census^S$. Since $Census^S$ is likely a lower bound for the actual number of births due to survey frictions⁵, our undercount measure can be interpreted as a lower bound of underreporting.

We implement this comparison globally using two external series. The first is registration-based: the World Health Organization’s adolescent birth rates, which we restrict to country-years flagged as derived from civil-registration records and convert into birth counts using United Nations estimates of the female population (10–14 and 15–19 age groups; coverage begins around 2000). The second is the United Nations World Population Prospects 2024 (WPP) estimates of births by five-year age group of the mother. The WPP series is not a registry: it is a model-based demographic reconstruction that reconciles censuses, surveys, and registration records into a complete series, and it has well-known limitations—the estimates are smoothed across age and time and lean on model assumptions where data are thin, which can lead to large miscalculations (e.g., [Chatterjee and Vogl, 2018](#); [GBD 2021 Fertility and Forecasting Collaborators, 2024](#)); we discuss what these limitations imply for our comparison in Section 3.3. Its completeness—near-universal country coverage extending back decades—and widespread usage—which, as we argue, can be greatly

⁵We are not able to count children who do not live with their mothers, or for which their mother’s information is missing due to, for instance, mortality or migration.

misleading—make it a useful complement against which retrospective census counts can be benchmarked, while the WHO series carries the registry interpretation. Matching each source to the census counts yields 64 country-censuses from 37 countries for the WHO comparison and 300 country-censuses from 89 countries for the WPP comparison (details in Online Appendix B2).⁶

Figure 3 illustrates the comparison for Mexico, plotting annual birth counts implied by each of the four Mexican censuses with mother–child linkages in IPUMS (2000, 2010, 2015, and 2020) against three external series: the counts from Mexico’s own INEGI birth registry, the WHO registration-based counts, and the WPP estimates.⁷ For mothers aged 15–24 (panel a), every census-based count lies below the external series throughout, and the gap is roughly constant: censuses capture only children co-residing with their mothers, so they recover fewer births than complete-coverage sources at every horizon. For child mothers (panel b), the pattern is starkly different and varies by each census’s distance from the birth year.

Births counted in a census occurring close to the birth are relatively few, but many more appear in the following one: each census curve starts well above the external series for cohorts born 10–15 years earlier and dives below it for recent cohorts, with the crossing repeating census after census. For example, for births in 2005, the census taken five years later (in 2010) records only 5,140 births to mothers aged 10–14, whereas the censuses taken ten and fifteen years later (in 2015 and 2020) record 12,776 and 12,223—against approximately 8,700 births in both the WHO registration-based series and the WPP estimates, and 8,891 in Mexico’s own INEGI registry. The census conducted five years after the births

⁶The age groupings follow the standard age-bracket classification used by the United Nations and other providers of demographic statistics (United Nations DESA, 2017). Because the WHO series does not cover mothers aged 20–24, we use 15–19 as the older group in both comparisons for consistency; Online Appendix Figure A6 shows the WPP comparison with the full 15–24 older group, with the same pattern.

⁷The 2005 Mexican census is excluded because IPUMS does not provide the variable needed to link children to their mother in that year. Pre-2000 censuses are omitted to match the post-2000 coverage of the registration-based series. The WHO series appears only on the 10–14 panel because WHO does not publish counts for mothers aged 20–24.

thus recovers 41% fewer than the registry, while those conducted ten and fifteen years after recover 47% and 40% more—a single crossing visible within Mexico, census by census. Note that each census here is read against the same benchmark: for a given birth cohort, the external series is a single number, so the movement from 5,140 to 12,776 recorded births is variation coming purely from census reporting.

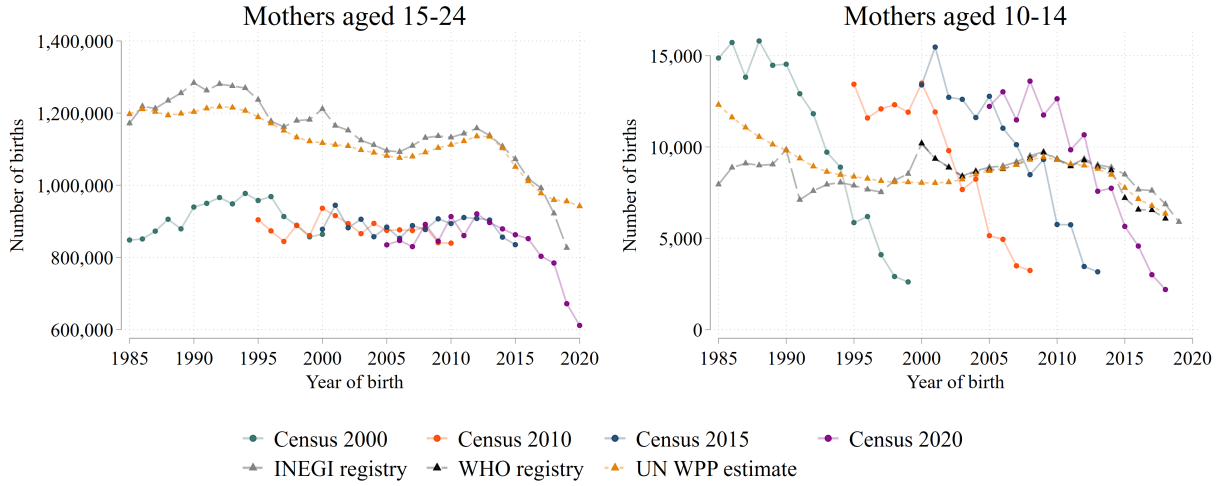


Figure 3: Mexico: Census Birth Counts vs. INEGI Registry, WHO Registry, and UN WPP Estimates, by Year of Birth

Notes: Each colored line with circular markers plots retrospective birth counts by year of birth implied by one Mexican census (2000, 2010, 2015, 2020), restricted to children linked to their biological mothers and to year-of-birth cells where the full age bracket is observable given the census’s minimum observed age of mothers. The three external series carry triangle markers. The gray long-dashed line is the INEGI registry count: births by year of occurrence from Mexico’s Estadística de Nacimientos del Registro Civil, cumulating all registrations through the 2022 files, so late registrations are included; it is shown for cohorts 1985–2019 because later cohorts’ registrations are still accumulating. The black dashed line (panel b only) is the WHO registration-based birth count, computed as the WHO adolescent birth rate times the United Nations estimate of the female population in the age group; it is available for Mexico from 2000 onward and has no counterpart for the 15–24 bracket because WHO does not publish a 20–24 series. The orange dashed line is the United Nations World Population Prospects 2024 estimate of births by age group of the mother. The 2005 Mexican census is omitted because that IPUMS sample lacks the mother-pointer variable *mom1oc*; pre-2000 censuses are omitted to match the coverage of the registration-based comparison. Panel (a): mothers aged 15–24 at childbirth. Panel (b): mothers aged 10–14.

To test this pattern systematically, we organize the comparison by the time elapsed between the birth and the census enumeration. Let i denote a country-census: a census conducted in country $c(i)$ in year y_i . A census observes births that occurred in year t at horizon $\ell = y_i - t$. For each age bracket a_b and horizon ℓ , we average the log gap between the two counts over every country-census and birth year observed at that horizon:

$$\Delta_{ab,\ell} = \frac{1}{N_{ab,\ell}} \sum_{\{(i,t) : y_i - t = \ell\}} \left[\ln(Census_{i,ab,t}^S) - \ln(AdministrativeRecords_{c(i),ab,t}) \right], \quad (3)$$

where $N_{ab,\ell}$ is the number of (i, t) pairs entering the sum at horizon ℓ , and a negative value indicates that censuses recover fewer births than the external series.⁸ Because country-censuses enter the panel at different horizons (censuses that do not observe mothers below age 15 contribute only at horizons where the full 10–14 bracket is observable), the average at each ℓ would mix composition changes with reporting behavior. In our preferred specification we therefore apply an entry normalization: when a country-census first enters at horizon ℓ_0 , its entire series is shifted so that its value at ℓ_0 equals the average of the country-censuses already present at ℓ_0 . This keeps the level of the average continuous as the sample composition changes while leaving every series' shape untouched; Online Appendix Figures A4 and A5 show that the raw and balanced-sample versions display the same pattern.

For mothers aged 15–19, the census–registry gap is negative and essentially flat: censuses recover roughly 30–40% fewer births than the external series at every horizon, exactly as expected from co-residence attrition (left panels of Figure 4; see Table 1 for magnitudes). For child mothers, the gap starts deeply negative—censuses conducted one to five years after the birth recover 45% fewer births than the WHO registration-based counts (62% fewer than the WPP estimates)—and then rises steadily, crossing zero seven to eight years after the birth (right panels of Figure 4). Ten to fifteen years after the birth, censuses recover 20% *more* births to child mothers than the WHO registry counts and 59% more than the WPP estimates.

The crossing is common at the country level as well. For a country-census i and age

⁸For a single country-census i , age bracket, and year of birth, the log gap $\Delta_{i,ab,t}$ and equation 2 are two expressions of the same comparison: $Undercount_{ab,t}^A = 1 - e^{-\Delta_{i,ab,t}}$. We work with logs so that averages across country-censuses of very different sizes are not dominated by the largest countries.

group a_b , let $\bar{g}_{i,a_b}^{[1,5]}$ and $\bar{g}_{i,a_b}^{[10,15]}$ denote country-census i 's own log gap—the summand of equation 3—averaged over the horizons it observes within 1–5 and within 10–15 years of the birth, respectively.⁹ To capture this early-to-late crossing pattern at the individual country-census level, we classify the country-census as crossing when

$$SC_{i,a_b} = \mathbf{1} \left[\bar{g}_{i,a_b}^{[1,5]} < 0 \text{ and } \bar{g}_{i,a_b}^{[10,15]} > 0 \right]. \quad (4)$$

By this measure, 12 of the 18 classifiable country-censuses in the WHO comparison (67%) and 161 of the 288 in the WPP comparison (56%) single-cross¹⁰ for mothers aged 10–14. For older mothers, single crossings are essentially absent: 1 of 28 country-censuses in the WHO comparison and 2 of 300 in the WPP comparison.¹¹

For illustrative purposes, a back-of-the-envelope aggregation gives a sense of the absolute number of births that this issue may be hiding. For each country and birth cohort from 2000 onward, we take the census count observed at the longest available horizon between 10 and 15 years after the birth, subtract the external count (i.e. WHO or WPP) for the same country and cohort, and sum the differences across the country-cohort cells in which both sources are observed. Against the WHO registration-based counts, censuses imply roughly 111,000 more births to mothers aged 10–14 than the registries recorded, across 17 countries and the 2000–2010 birth cohorts: 53 percent more.¹²

The same calculation against the WPP estimates yields close to 400,000 additional births across 51 countries in the 2000–2010 period—roughly 36,000 per birth cohort, and 37

⁹The short window starts one year after the birth: at horizon 0 the census year is only partially elapsed at enumeration, so those cells are mechanically incomplete.

¹⁰We use the term single crossing only to link the empirical pattern to the model's prediction. Formally, the indicator captures a sign reversal between the early and late horizon windows rather than establishing a unique crossing point.

¹¹A country-census is classifiable if it has at least one observation in each of the two horizon windows; for the 10–14 bracket, censuses that truncate mothers' ages above 10 enter the panel only at horizons where the full bracket is observable, which is why the classifiable count is below the total.

¹²The birth-weighted gap exceeds the unweighted average of Table 1 because undercounting is most severe in several populous countries. The sum nets cells where the census exceeds the external count against cells where it falls short. Counting only the former yields slightly larger totals.

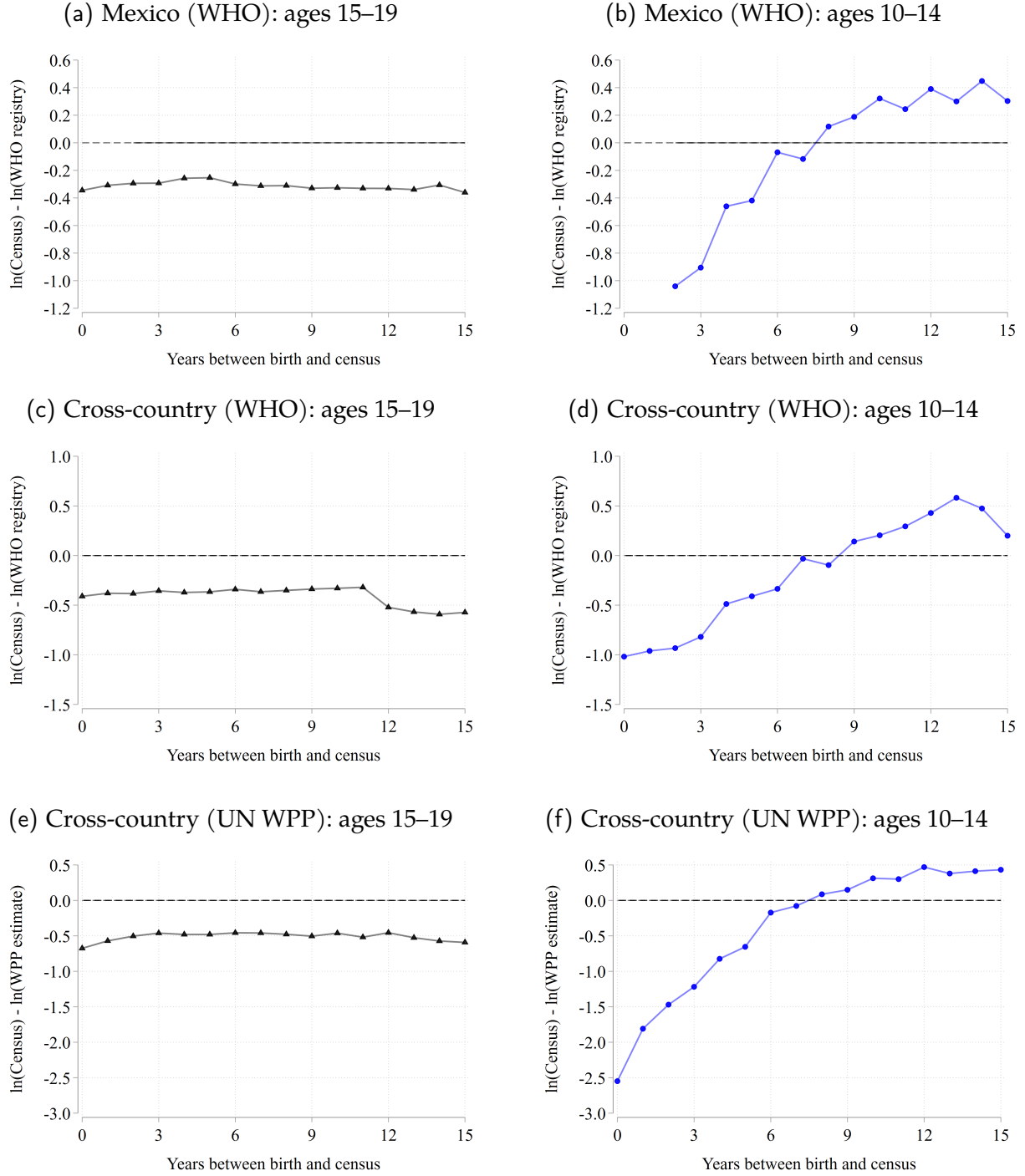


Figure 4: Single Crossing of Census and Registry Birth Counts

Notes: Each panel plots the average gap in log births between retrospective census counts and an external series (equation 3), by the number of years between the birth and the census; values above the dashed zero line indicate more births in the census. Left panels: mothers aged 15–19 at childbirth; right panels: mothers aged 10–14; the two panels of each row share the same vertical axis. Panels (a)–(b) compare Mexico’s 2000–2020 censuses with the WHO registration-based counts. Panels (c)–(d) average across the 64 country-censuses (37 countries) of the WHO comparison and panels (e)–(f) across the 300 country-censuses (89 countries) of the WPP comparison using an entry normalization that shifts each newly entering country-census to the prevailing average at its entry horizon. Online Appendix Figures A4 and A5 report the unnormalized and balanced-sample versions, together with the number of country-censuses contributing at each horizon. Both comparisons use 15–19 as the older group, since WHO does not publish a 20–24 series; Online Appendix Figure A6 uses the full 15–24 group.

Table 1: Census versus Registry Birth Counts: Summary

Mother’s age at childbirth	WHO registry		UN WPP estimates		
	10–14	15–19	10–14	15–19	15–24
<i>Panel A. Mexico</i>					
Census gap, 1–5 years after birth (%)	-50.7	-24.5	-57.9	-31.3	-25.0
Census gap, 10–15 years after birth (%)	+39.6	-28.2	+26.2	-30.5	-26.5
<i>Panel B. Cross-country</i>					
Census gap, 1–5 years after birth (%)	-45.0	-31.4	-62.4	-39.3	-31.7
Census gap, 10–15 years after birth (%)	+20.0	-30.8	+59.2	-40.3	-37.1
Country-censuses with early-to-late crossing	12/18	1/28	161/288	2/300	2/300
Country-censuses	64		300		
Countries	37		89		

Notes: Census gaps are $100(e^{\Delta} - 1)$, where Δ is the census–registry log gap of equation 3 averaged over all country–census $\times$ year-of-birth cells (unweighted) within the indicated horizon window; negative values mean the census recovers fewer births than the external series. The short window starts one year after the birth because the census year is only partially elapsed at enumeration. A country–census displays a single crossing when its average log gap is negative over horizons 1–5 and positive over horizons 10–15 (equation 4); the denominator counts country-censuses observed in both windows. Panel A restricts the sample to Mexico’s censuses (2000, 2010, 2015, and 2020). The WHO comparison uses 15–19 as the older group, since WHO does not publish a 20–24 series; for WPP we report both the comparable 15–19 group and the full 15–24 group. Online Appendix Figure A6 shows the single-crossing profile for the 15–24 group. The WPP figures are model-based demographic estimates rather than raw registry counts; the WPP series for mothers aged 10–14 is derived from the neighboring 15–19 series and is not an independent measurement of that age group (see Online Appendix B2).

percent above the roughly 1 million births to child mothers that the WPP records in the same country-cohort cells. These figures are conservative: census counts are themselves a lower bound because of co-residence attrition—as the negative gaps for the older age groups in Table 1 document—and the covered countries, home to 30 percent of the world’s population, account for only about one-eighth of the roughly 845,000 births to mothers aged 10–14 that the WPP records worldwide each year over this period. Therefore, the true global miscount of child mothers for 2000–10 is likely a multiple of 400,000.

These results reveal that administrative registries—the “gold standard” for fertility measurement—and official international statistics, can significantly undercount births to child mothers. Birth registries are considered accurate, especially in high-income countries like the United States, where the CDC reports over 99% completeness in the final Vital Statistics counts (National Center for Health Statistics, 2020, 2024). However, births to mothers aged 10–14 represent less than 0.5% of all births: if births to child mothers take

longer to register, they will be overrepresented among the missing, and the unreported share of total births can include a significant fraction of births to this age group ([Driscoll and Hamilton, 2025](#)). Other vulnerabilities in the birth registration process, including delayed registration and misattribution of the child’s birth to other female household members, may further contribute to undercounting for this group ([DHH, 2000](#)); we discuss these mechanisms in Section 5. Conversely, retrospective census birth counts, despite their tendency to underestimate births for older age groups, can provide a more accurate account of births to child mothers than registries once enough time has passed since the birth.¹³

3.3 Discussion: Potential Limitations of Estimates

There are limitations to estimating births from censuses. For instance, immigrants might become more likely to self-report their children as native-born in later censuses, which could artificially inflate later domestic counts. However, among countries that report place of birth, less than 7 percent of the children are foreign-born, leaving little room for this margin to drive the results. Additionally, our main findings are robust to not conditioning on domestic births at all. Moreover, such a reporting shift should exist regardless of the mother’s age at childbirth. Because we do not observe a massive subsequent-census reporting surge for older mothers, changes in immigrant self-classification are highly unlikely to account for the dramatic differences we see uniquely among very young mothers.

A separate concern is that complex household structures might solidify over time—such as adoption or step-parenting arrangements—resulting in non-biological ties being reported as biological in later censuses. While it is plausible that informal care arrangements are differentially concentrated among very young women, the data show this margin is simply too small to drive our results. Among countries that report step-relationships, these cases account for less than 1 percent of the considered births. Even when restricting the

¹³Section 3.3 discusses additional limitations of census-based birth estimates, including potential biases from household structure changes and the statistical stability of rare events.

sample to cases where the mother-child age difference is 15 years or less, they represent less than 2 percent of the sample. Furthermore, the simultaneous baseline-census excess of births attributed to older household members, combined with our registry single-crossing evidence, strongly suggests that these later-census updates reflect the delayed disclosure of true, initially concealed biological ties.

Another potential concern is the statistical stability of rare events, particularly in countries with representative counts rather than censuses. If the estimates were very unstable, we would observe that the latter census sometimes provided higher estimates and sometimes lower ones. However, as shown in Figure 1, in practically all countries the estimates based on the later census are higher for young mothers.

Official birth registries may also be truncated: only including births up to a certain amount of time after the birth. We consider this a potential mechanism, and one way to reduce the undercounting of births to child mothers would be to update these data with registrations occurring afterward, because although they are few in absolute terms, they likely overrepresent child mothers.

Finally, a natural question is whether the WPP comparison is independent enough to be informative, since the WPP estimates are based on a model that ingests census data itself. However, censuses represent only around 3 percent of the WPP fertility data inputs, and what the model takes from a census is almost always the answer to a direct question about births in the year before the census, not the retrospective counts we build from the household structure years after the births. Moreover, the WPP does not estimate the 10–14 rate using data for that age group itself, but derives it from the 15–19 series (we describe the WPP construction in detail in Online Appendix B2). This modeling choice supplies a direct check: if the patterns we find are an artifact of the WPP’s model, they would need to also show up in the 15–19 comparison. Instead, the 15–19 gap is flat across the time horizon (x-axis of Figure 4) and crossings are essentially absent (2 of 300 country-censuses). If anything, this works against our finding: the fertility of girls aged 15–19

has been declining, so the WPP assigns recent cohorts fewer births than older ones, and holding census reporting fixed should raise the short-horizon gap, which is the opposite of what the crossing we show requires. Nor is the pattern driven by countries where the WPP has little underlying data. Restricting the comparison to the 37 registration-rich countries of the WHO sample leaves the crossing intact and, if anything, larger: the gap for child mothers moves from -53% at horizons 1–5 to $+85\%$ at horizons 10–15, with no crossing for older mothers in any of the 141 country-censuses (Online Appendix Figure A7).

4 Conceptual Framework

The preceding sections document three empirical patterns: underreporting of births is more severe for younger mothers, it fades as mothers age, and it exhibits a single crossing between birth registries and censuses. We develop a simple framework that rationalizes these patterns through two forces—social stigma costs that decline with the mother’s age at childbirth and at reporting, and judicial costs associated with early motherhood.

Consider a child born to a mother of age a_b .¹⁴ The mother can report the birth using two methods, $\tau \in \{C, A\}$: a census interview (C) or administrative records such as birth registries (A). At time of reporting using method τ , when the mother’s age is $a_{r,\tau} \geq a_b$, she decides whether to report the birth truthfully ($r_\tau = 1$) or not ($r_\tau = 0$).

Instrumental Payoffs

Reporting the child’s birth generates method-specific instrumental payoffs. In census interviews, these stem from improved access to and quality of public services, as well as from government transfers frequently allocated using census data. In administrative

¹⁴For simplicity, we assume that each mother has only one child and that she makes the decision on whether to report the birth or not. In practice, other household members may be responsible for this decision. In such cases, we assume they are exposed to the same set of incentives and would make the same choice as the mother.

records, they include access to childcare, healthcare, education, and social programs. Reporting also entails method-specific costs, such as registration fees, transportation, and the opportunity cost of time. We denote the instrumental payoffs net of the reporting costs v_τ , which vary across households.

Social and Judicial Costs

Beyond instrumental payoffs, truthful reporting can generate a “social” cost (S) and a “judicial” cost (J), reflecting the joint role of social sanctions and legal incentives in shaping private decisions (Bénabou and Tirole, 2026).¹⁵ We denote this social cost $S(a_b, a_r) \geq 0$ and assume it decreases with the mother’s age at birth (a_b) and at reporting (a_r). These assumptions are consistent, for example, with the stigma or the negative effects in the marriage market outcome arising from the young pregnancy being strongest for the youngest mothers and fading over time. Specifically, we parameterize the social cost as $S(a_b, a_r) = se^{(-\alpha a_b - \beta a_r)}$, where s is the social cost and $\alpha > 0$ and $\beta > 0$ govern the rate at which it diminishes with the mother’s age at birth and at reporting, respectively.

Judicial costs arise in contexts where minimum age of consent laws prohibit sexual relations with individuals below a certain age. Even if direct penalties affect only the father, mothers experience a disutility from this legal exposure—whether because they share a bond with the father, because they face retaliation from him, or because the legal process itself generates stress. Crucially, reporting the birth increases the likelihood of judicial action: public birth records are accessible to prosecutors, and enumerators may report suspicions of abuse to authorities.¹⁶ We model judicial costs as:

¹⁵Recent field experiments document that social image concerns affect a wide range of economic behaviors, particularly when actions become public and observable to others (Bursztyn and Jensen, 2017).

¹⁶For instance, in the 1990s, Florida made the impregnation of a minor under the age of 16 by a male aged 21 or older a reportable form of child abuse, effectively using pregnancies as evidence of statutory rape (Donovan, 1997).

$$J(a_b, \bar{a}, r_\tau) = \begin{cases} (\pi + \kappa r_\tau) \bar{J} & \text{if } a_b < \bar{a} \\ 0 & \text{if } a_b \geq \bar{a} \end{cases} \quad (5)$$

where $\bar{a}$ represents the minimum age of consent plus nine months (i.e., the lowest age in which consensual sexual relations are legally allowed plus the gestation period), $\bar{J}$ is the size of the penalty (e.g., years of mandatory prison or fines), π is the baseline probability of the offender being prosecuted and/or convicted, and κ is a constant representing the increase in the likelihood of prosecution and/or conviction associated with truthfully reporting the birth.

Mother's Utility and Testable Implications

Assuming that the net instrumental payoffs are uniformly distributed, $v_\tau \sim U[0, V_\tau]$, the mother's utility of reporting the birth using method τ is:

$$U_\tau(r_\tau, a_b, a_r, \bar{a}) = r_\tau v_\tau - r_\tau s e^{(-\alpha a_b - \beta a_r)} - \mathbf{1}_{a_b < \bar{a}} (\pi + \kappa r_\tau) \bar{J} \quad (6)$$

The probability of a mother reporting under method τ is the probability that her reporting payoff is larger than the expected increase in social and judicial costs:

$$p_\tau(a_b, a_r, \bar{a}) = P[v_\tau \geq s e^{(-\alpha a_b - \beta a_r)} + \mathbf{1}_{a_b < \bar{a}} \kappa \bar{J}] \quad (7)$$

From this framework, we derive four propositions and one theorem that formalize the empirical patterns documented above (proofs are in Online Appendix C).

For the following comparative statics, we assume parameter values admit an interior solution where reporting probabilities are strictly bounded between zero and one. The first two propositions establish that underreporting is a consequence of social costs and map directly to assumptions about social and legal costs, providing empirical tests for the

validity of these assumptions.

Proposition 1. Reporting is increasing with the mother's age at childbirth. For a fixed age of reporting (a_r) and minimum age of consent ($\bar{a}$), the utility from reporting, $U_\tau(r = 1, a_b, a_r, \bar{a})$, and the reporting probability, $p_\tau(a_b, a_r, \bar{a})$, are increasing in age at childbirth, a_b .

Proposition 2. Reporting is increasing with the mother's age at reporting. For a fixed age at childbirth (a_b) and minimum age of consent ($\bar{a}$), the utility from reporting, $U_\tau(r = 1, a_b, a_r, \bar{a})$, and the reporting probability, $p_\tau(a_b, a_r, \bar{a})$, are increasing in the age of reporting, a_r .

Together, these propositions state that younger mothers at childbirth are less likely to report, and that reporting increases as time passes. These predictions are consistent with the patterns documented in Section 3: birth counts based on the later census are higher and the deficit in birth counts in the first census is largest for the youngest mothers (Figure 4). Moreover, the delay in registration declines with the mother's age at childbirth (see Figure 5).

The next proposition and theorem concern the comparison across reporting methods—a key empirical contribution of the paper.

Proposition 3. Reporting is increasing with the instrumental payoff. For a fixed age at childbirth (a_b), age of reporting (a_r), and minimum age of consent ($\bar{a}$), the probability of reporting in administrative records will be higher than that of reporting on the census, $p_A(a_b, a_r, \bar{a}) > p_C(a_b, a_r, \bar{a})$, if and only if the net payoff of reporting in administrative records is higher, $V_A > V_C$.

As documented in Section 3.2, comparing contemporaneous reporting behavior across registries and censuses provides a test of this prediction. The following theorem shows that the interaction between differential payoffs and time of reporting and declining social costs generates a distinctive dynamic pattern: a single crossing in reporting.

Theorem 1. Single Crossing. Assume $V_A > V_C$ and $s > 0$. Fix a_b and $\bar{a}$, and let a_r^A denote the mother's age at reporting via administrative records. Assume that $V_C > s + \mathbf{1}_{a_b < \bar{a}} \kappa \bar{J}$ to ensure interior solutions and $p_C(a_r^C \rightarrow \infty) > p_A$ for existence.¹⁷ Define a_r^{C*} as the age at census reporting such that $p_C(a_b, a_r^{C*}, \bar{a}) = p_A(a_b, a_r^A, \bar{a})$. Then:

- If $a_r^C < a_r^{C*}$, then $p_C(a_b, a_r^C, \bar{a}) < p_A(a_b, a_r^A, \bar{a})$
- If $a_r^C > a_r^{C*}$, then $p_C(a_b, a_r^C, \bar{a}) > p_A(a_b, a_r^A, \bar{a})$

In other words, $p_C(a_b, a_r^C, \bar{a})$ single-crosses $p_A(a_b, a_r^A, \bar{a})$ from below as a_r^C increases. Moreover, such a crossing point a_r^{C*} exists only if $s > 0$.

The theorem formalizes the single crossing pattern documented in Figure 4. When the census occurs shortly after childbirth, reporting is lower than in birth registries because registries offer higher net instrumental payoffs (Proposition 3). As the mother ages, however, stigma fades, and census reporting overtakes registry reporting once stigma has declined enough to offset the payoff gap.

Proposition 4. Reporting discontinuity at the age of legal consent. The function $p_\tau(a_b, a_r, \bar{a})$ is discontinuous in a_b at $a_b = \bar{a}$. In particular, if and only if $\kappa \bar{J} > 0$, then

$$\lim_{a_b \downarrow \bar{a}} p_\tau(a_b, a_r, \bar{a}) > \lim_{a_b \uparrow \bar{a}} p_\tau(a_b, a_r, \bar{a}).$$

If judicial costs are strictly positive, reporting rates jump discretely at the legal age of consent. We test this prediction in Section 5.

¹⁷This assumption is without further loss of generality when there is no judicial cost. When judicial costs are present, it requires the social cost to be sufficiently large relative to the judicial one. See Online Appendix C for the exact condition.

5 Mechanisms

5.1 Delayed Reporting

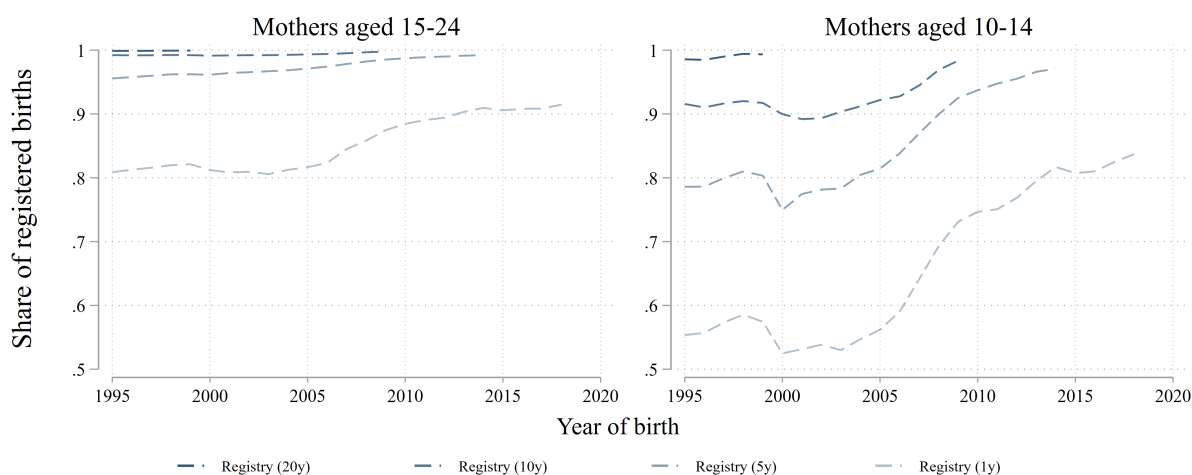
If the social cost of reporting decreases with the mother's age at childbirth and the time between reporting and the birth, reporting behavior in administrative records would be affected in two ways. First, if the mother could, to some extent, control the timing of reporting, we would expect registration delays. These delays would arise because, at the time of birth, the social cost is so high that the optimal choice is not to report; as this cost decreases, the benefits of reporting may eventually outweigh it. Second, the duration of the reporting delay is a function of the social cost. Therefore, if the social cost declines with the mother's age at childbirth, delays should be longer the younger the mother was at childbirth.

Mexico has detailed data on delayed registration, which allow us to estimate reporting delays across different maternal age groups and birth cohorts. Our findings are consistent with the social cost of reporting decreasing with the mother's age at childbirth and the time between reporting and the birth. Panel (a) in Figure 5 shows the share of children of mothers aged 15–24 (left figure) and 10–14 (right figure) registered within one, five, ten, or twenty years of their birth date. Registration delays are significantly larger for younger mothers. For mothers aged 15–24: between 1995 and 2005, fewer than 20% of births were registered within one year of birth, decreasing to 10% between 2010 and 2018. In contrast, for child mothers aged 10–14, registering at least 1 year after birth is twice as common, ranging from 40 to 50% in the earlier period (1995–2005), improving to around 20% by 2018.

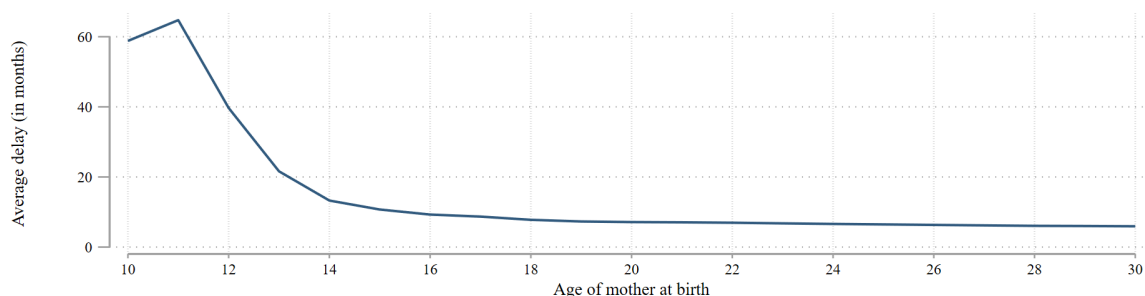
Panel (b) illustrates how the average delay in birth registration decreases with the mother's age, dropping from over 40 months for 10- to 12-year-old mothers to 10 or fewer months for 16-year-old and older mothers. These findings align with the work of [Keskin](#)

Figure 5: Birth Registration Delays in Mexico

(a) Share of births registered by time span since year of birth



(b) Average delay in registration (1995-2019)



Source: INEGI (Mexico) Birth Registry data

Notes: Panel A plots the share of births registered within 1, 5, 10, and 20 years relative to all those registered by December 2019. For each series, we plot data only up to the year we can still observe the respective reporting delay. Panel B plots the average delay in birth registration by the mother's age, conditional on the children being registered within 15 years of birth.

and Çavlin (2020) in Turkey, who found that, while 98% of births to adolescent mothers were eventually registered between 2011 and 2015, only 78% were registered promptly, compared to 95% for all births.

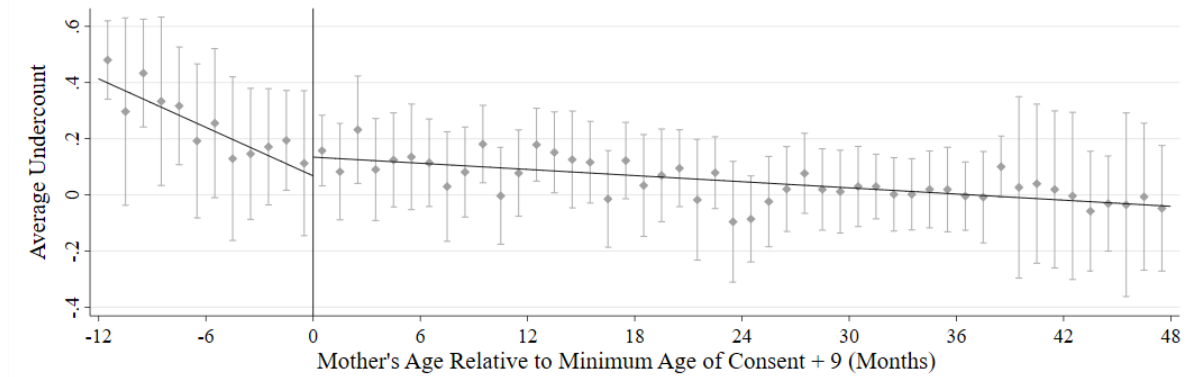
While the cross-age delay pattern is consistent with social reporting costs decreasing as the mother ages, these extreme delays for the youngest mothers are likely compounded by administrative barriers. In many settings, minors lack the civil capacity to register a birth independently and require an adult guardian. Therefore, the observed delay reflects a combination of the household's reluctance to formalize the birth (due to stigma or legal

fears) and the bureaucratic frictions specific to child mothers. Regardless of the exact mix of mechanisms, the outcome remains the same: a severe delay in the registration of these births.

5.2 Judicial Costs and Minimum Age of Consent

Proposition 4 states that if judicial costs influence the reporting decision, we should observe a discontinuous increase in the probability of truthful reporting once the mother reaches an age where she is no longer subject to such costs. MAoC laws prohibit sexual encounters between adults and individuals below a specific age threshold, creating a natural discontinuity in judicial exposure. We test this prediction using a regression discontinuity design (RDD) across the 12 countries where we observe month-of-birth data and the minimum age of consent is at most 16 years.

Figure 6: Judicial Costs and Minimum Age of Consent



Notes: The graph presents a regression discontinuity estimation of our undercount measure by the months between the mother's age at childbirth and the minimum age of consent (MAoC) in her country plus 9 months. The sample includes births occurring 1 to 5 years before each baseline census. The analysis covers 12 countries for which MAoC is available and at most 16 years ([AgeOfConsent, 2023](#)), and with census data including month of birth. The MAoC for these countries is: 13 in Burkina Faso; 14 in China and Malawi; 15 in Romania and Thailand; 16 in Armenia, Fiji, Indonesia, Jamaica, Kyrgyz Republic, Mongolia and Papua New Guinea. The undercount measured is trimmed at 5% level on each side within the month relative to the minimum age of consent. Figure A3 in the Online Appendix presents alternative estimates that include countries with MAoC up to 18 years old (Benin, the Dominican Republic, Nicaragua, Rwanda, Vietnam, Uganda, and Egypt) and trimming at a 10% level instead.

Figure 6 presents the RDD plot. While we observe a change in slope, we do not find evidence of a discontinuity at nine months after the mother reaches the minimum age of

consent. Using a triangular kernel and a local linear regression (polynomial of order 1), we estimate a discontinuity of 0.027, which is small and not statistically different from zero (p-value = .847). This suggests that, on average across the countries and census pairs in the sample, judicial costs or the likelihood of their enforcement are not substantial enough to influence the decision to report births in censuses, implying that social costs play a relatively larger role in reporting behavior. Moreover, the change in slope is consistent with the social cost decreasing faster before the minimum age of consent than after.

This finding aligns with prior research indicating that transgressions of these laws are difficult to detect and prosecute. For example, in California in the late 1990s, cases filed under statutory rape laws accounted for only about 2 percent of the total number of births to underage teens fathered by adult men ([Donovan, 1997](#)).

5.3 Cross-Country Heterogeneity

The conceptual framework predicts that undercounting varies with the net instrumental benefits of reporting, the magnitude of social costs, and the presence of judicial costs. We explore these predictions using cross-country variation in reporting incentives. We begin by estimating the following equation:

$$Undercount_{a_b,c}^C = \gamma_c + \beta_1 \mathbb{1}[10 \leq a_b \leq 14]_{a_b,c} + \beta_2 \mathbb{1}[10 \leq a_b \leq 14]_{a_b,c} \times H_c + \epsilon_{a_b,c} \quad (8)$$

where

$$Undercount_{a_b,c}^C = 1 - \left(\frac{\sum_{t=1}^5 Census_{a_b,c,t}}{\sum_{t=1}^5 Census_{a_b,c,t}^S} \right) \quad (9)$$

and where $Undercount_{a_b,c}^C$ is the birth undercount for mothers aged a_b at childbirth in country c , calculated from births occurring within the five years preceding the baseline

census. $Census_{ab,c,t}$ denotes birth estimates based on the first census of the pair, and $Census_{ab,c,t}^S$ is the analogous count from the subsequent census. γ_c is a country fixed effect, and $\mathbb{1}[10 \leq a_b \leq 14]$ indicates whether the mother's age at childbirth falls between 10 and 14 (the omitted category is ages 15–29).

Table 2: Undercounting and Reporting Incentives

Dependent Variable: Births Underreporting Gap in Baseline Census								
		Birth registration	Gender Roles	Women's Legal Rights	Women's Health Autonomy	Social Protection	Violence Against Women	World Bank Rule of Law
Heterogeneity by	None	(%)	(3)	(4)	(5)	(6)	(7)	(8)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Age 10-14	0.682*** (0.075)	0.730*** (0.064)	0.670*** (0.069)	0.732*** (0.077)	0.778*** (0.057)	0.684*** (0.070)	0.686*** (0.066)	0.674*** (0.067)
Age 10-14 x Heterogeneity		-0.241*** (0.061)	-0.222*** (0.062)	-0.358** (0.165)	-0.342*** (0.073)	-0.185** (0.075)	0.330*** (0.084)	-0.196*** (0.051)
Observations	488	458	473	458	473	473	458	473
Country FE	Y	Y	Y	Y	Y	Y	Y	Y
Mean Dep. Var	0.250	0.283	0.256	0.255	0.250	0.250	0.248	0.250

Note: The table reports the estimates of equation 8. The dependent variable is the birth undercount for mothers aged a_b at childbirth in country c ; birth counts are restricted to children born between one and five years before each baseline census year. The difference across columns is the variable for which a correlation with the underreporting gap is tested. In column (2), *Birth registration* (%) is the standardized proportion of children under age 5 whose births have been registered with a civil authority. Columns (3)–(8) use standardized heterogeneity indices: column (3) summarizes attitudes and legal frameworks regarding gender roles in the labor market, politics, marriage, and family (higher values indicate less traditional and more egalitarian gender norms); column (4) captures women's *de jure* legal capacity in employment, family, and economic transactions (higher values denote stronger formal rights); column (5) reflects women's decision-making power over their own health and access to sexual and reproductive health services (higher values indicate greater autonomy and access); column (6) summarizes coverage by child, maternity, and broader social assistance programs (higher values indicate more extensive social protection systems); column (7) combines measures of intimate-partner and non-partner violence and female homicides (higher values indicate greater prevalence of violence against women); and column (8) refers to the World Bank Rule of Law Estimate, a perception-based governance indicator that captures confidence in and adherence to societal rules (higher values indicate a stricter rule of law). All heterogeneity indices are standardized to have mean zero and unit standard deviation across country–census pairs. Details on the construction of these indices and their underlying indicators are provided in Section B3 of the Online Appendix. Standard errors, reported in parentheses, are clustered at the country level; ***, **, and * denote statistical significance at the 0.01, 0.05, and 0.1 levels, respectively. The table restricts the sample to children co-residing with their birth mothers, born in the country of the census, and whose mothers' ages at the time of the census are at least the minimum age observed among mothers in the census. The census pairs are restricted to those where the variable *stepmom* has the same possible values, and both censuses in the pair include place of birth. Tables A1, A2, and A3 in the Online Appendix display three less-conservative estimates that relax some of these restrictions, yielding consistent and very similar patterns.

The coefficient β_1 captures the within-country difference in undercounting between child mothers and those aged 15–29, and β_2 captures how this difference varies with country characteristic H_c . For each country, the estimation uses the most recent available undercount measure and the value of H_c for the year closest to that measure.

Table 2 presents the results. The baseline specification (column 1) shows that within-country undercounting based on censuses is, on average, 68 percentage points (pp) higher for ages 10 to 14 than for ages 15 to 29. We find that this underreporting gap is smaller in countries with greater institutional capacity: column 2 shows that in countries with a higher share of births registered, there is lower underreporting in Censuses. On the benefits-of-reporting side, we find less underreporting in countries with more generous social protection programs (Column 6).

Similarly, there is less underreporting of child motherhood in countries where the social costs of truthfully reporting are likely lower: countries with more egalitarian gender norms (Column 3), stronger legal protections for women (Column 4), greater female autonomy over health and reproductive decisions (Column 5), lower rates of violence against women (Column 7), and higher perceived rule of law (Column 8).

6 Conclusions

This paper documents that births to child mothers are systematically and substantially undercounted across countries and data sources. Even for the considered “gold standard”, birth registries, we document that counts based on censuses conducted a decade after the birth for the same birth cohorts recover more births to child mothers in over 65% of country-censuses. Our analysis suggests that social norms—particularly fears of stigmatization and ostracism—play a central role in the decision to underreport. The probability of truthful reporting increases with the mother’s age at childbirth and at the time of reporting.

These findings have implications for research and policy. First, they illustrate how private costs can generate systematic underprovision of socially valuable information. Second, the numbers that guide policy on child motherhood likely understate the scale of the problem. The WPP, despite acknowledging its own limitations, is the official statistical series endorsed by the UN and a natural reference for policymakers monitoring child

fertility. For the 2000–2010 birth cohorts alone, our back-of-the-envelope calculations suggests that it records at least 400,000 fewer births to child mothers than the censuses of the 51 countries we can compare eventually reveal, with the global figure likely being a multiple of that. Since policymakers rely on these official numbers, programs to prevent child motherhood and to assist child mothers could be severely underfunded, simply because the magnitude of the problem is underestimated.

When social norms discourage truthful reporting, the resulting data gaps can lead to inadequate policy responses to sensitive social issues. This highlights a key policy recommendation: the need for data collection mechanisms that better align private incentives to report with public information needs, particularly where social stigma affects reporting.

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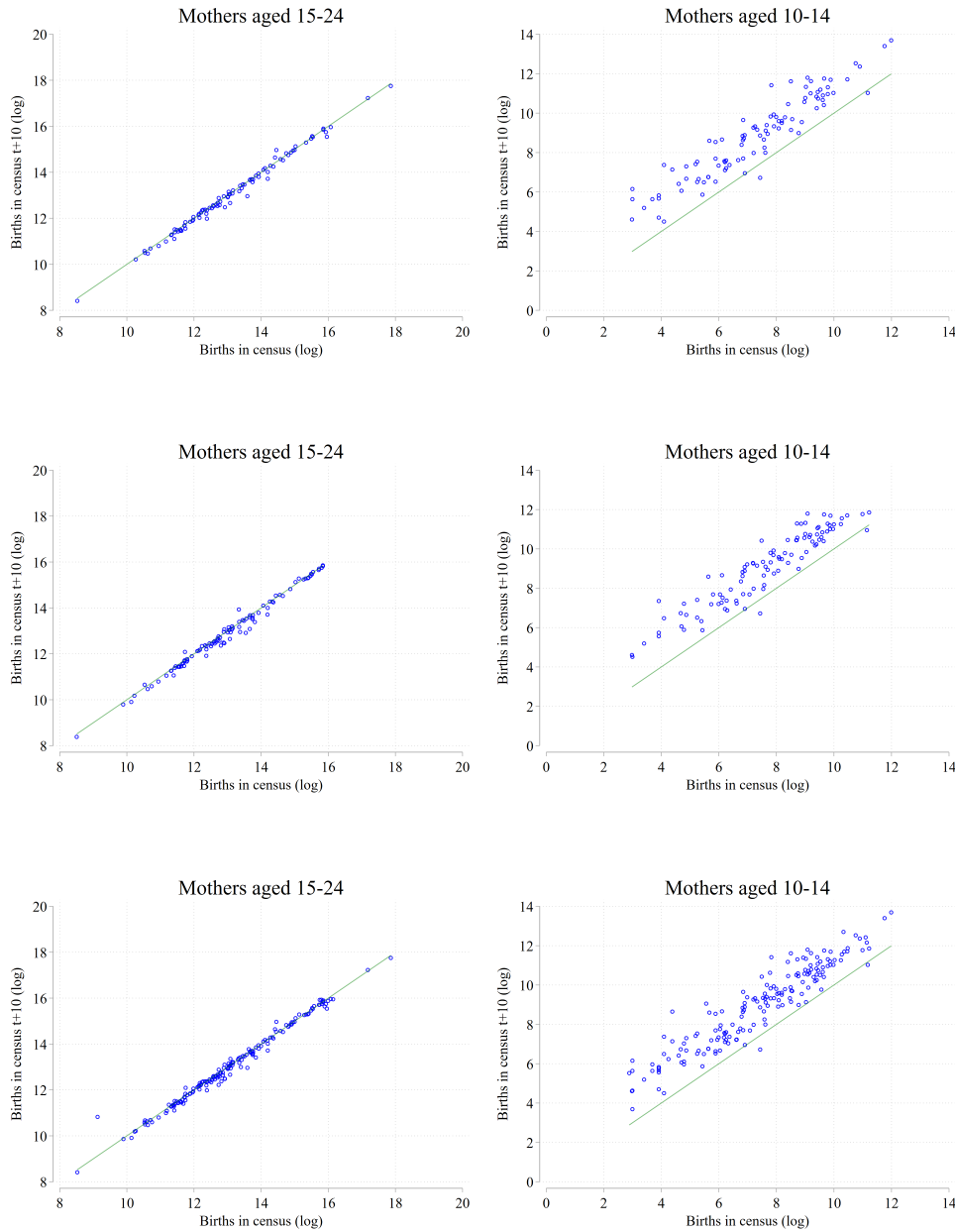
Appendix (For Online Publication)

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A Additional Figures

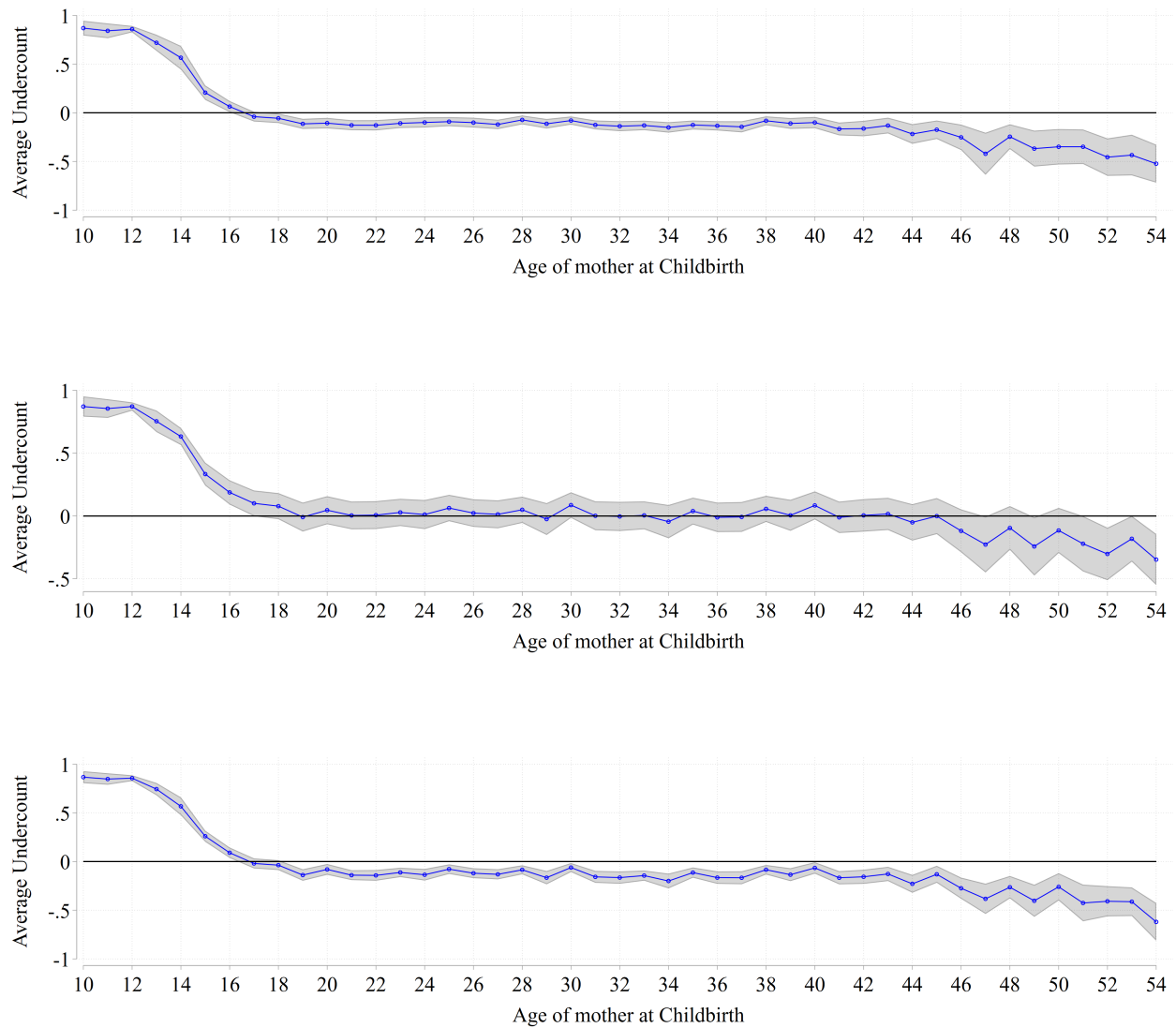
Figure A1: Birth Counts in Subsequent Censuses (Robustness)



Source: [IPUMS \(2020\)](#)

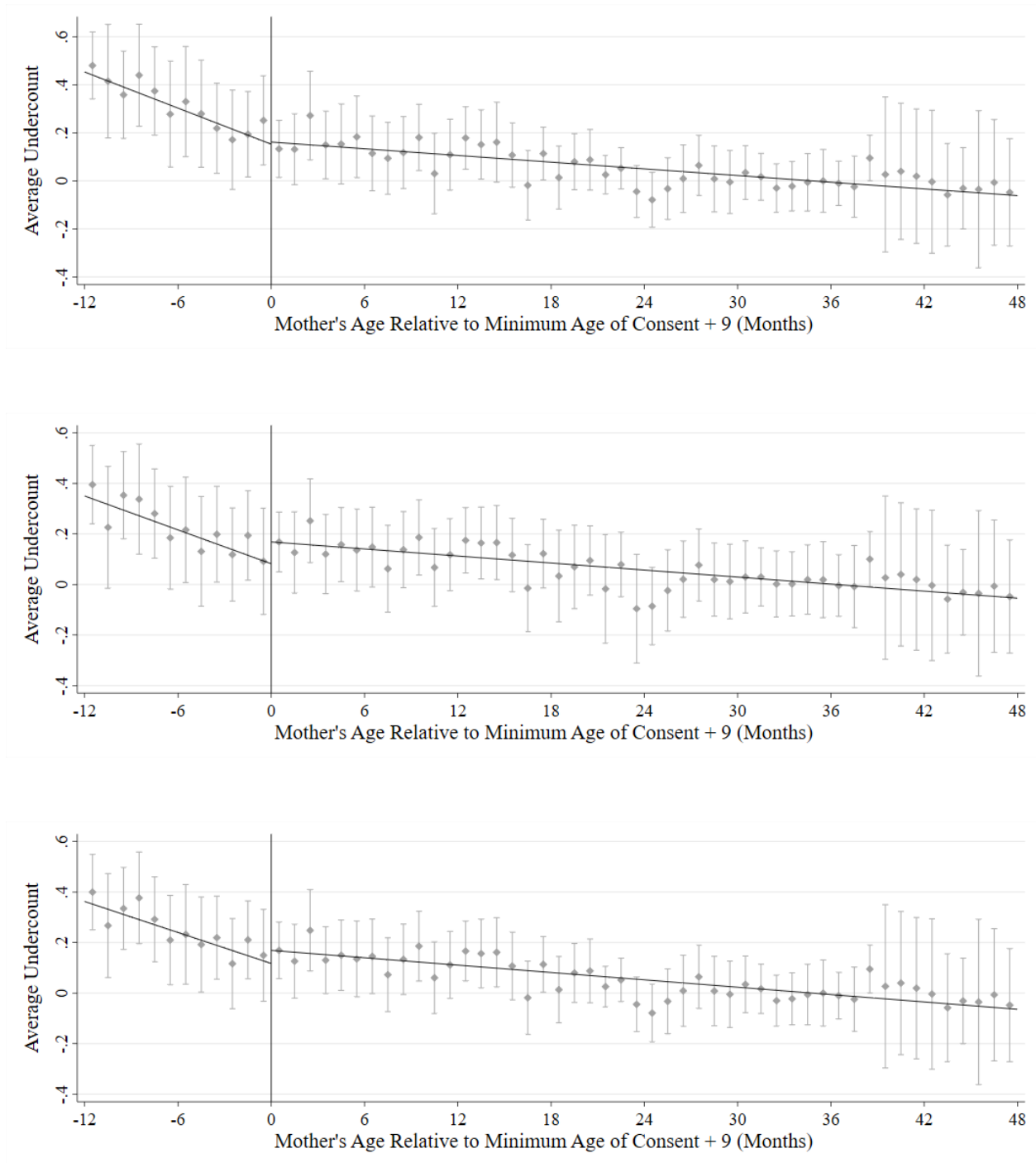
Notes: The figures replicate Figure 1 removing restrictions on the births and census pairs included. The top figure removes the restriction that children be born in the country of the census, expanding the sample to countries whose censuses do not include place of birth. The second figure removes the restriction of both censuses having the same possible values for the stepmom variable. The third figure removes both constraints. Table B3 in the Online Appendix lists the countries included.

Figure A2: Global Average Undercounting in Censuses - Including Middle Age Females (Robustness)



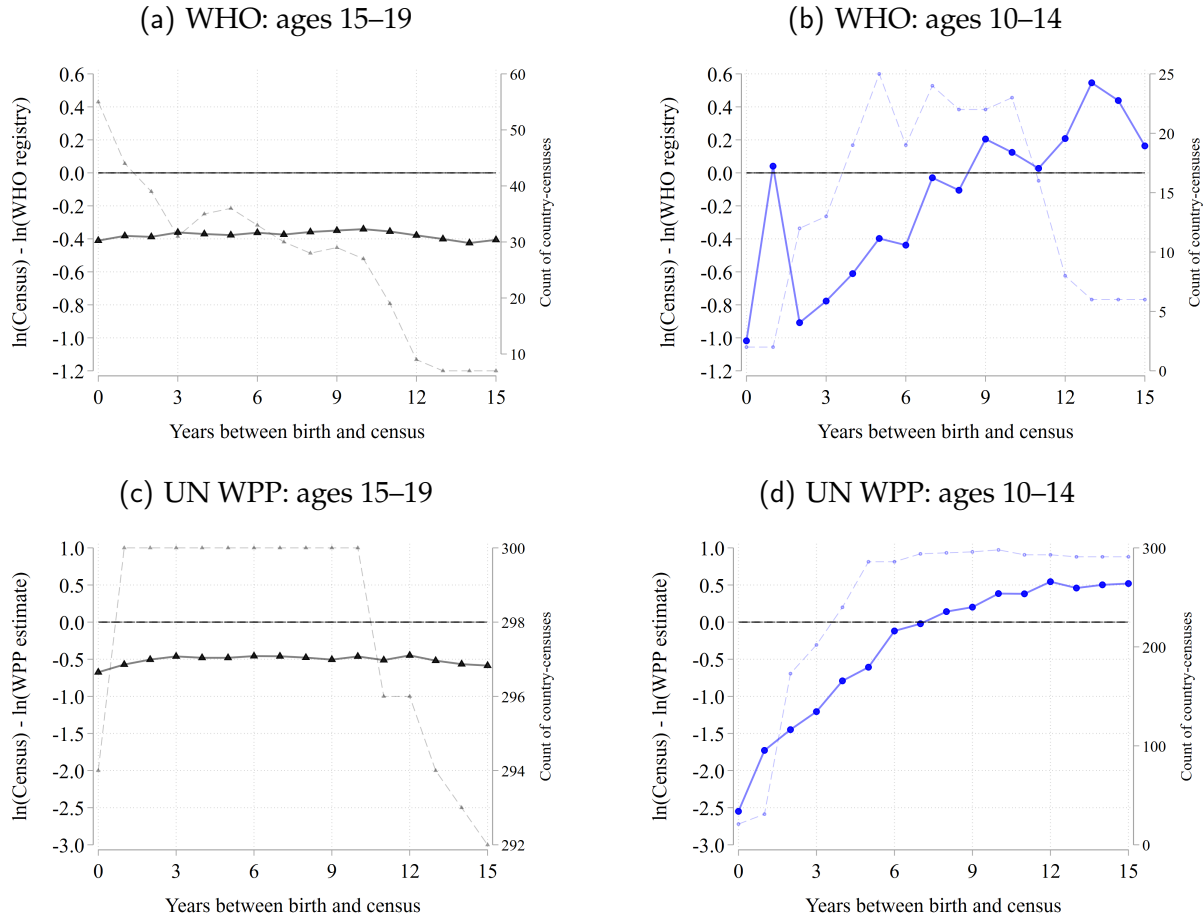
Notes: The figures replicate Figure 2 removing restrictions on the births and census pairs included. The top figure removes the restriction that children be born in the country of the census, expanding the sample to countries whose censuses do not include place of birth. The second figure removes the restriction of both censuses having the same possible values for the stepmom variable. The third figure removes both constraints. Table B3 in the Online Appendix lists the countries included.

Figure A3: Judicial Costs and Minimum Age of Consent (Robustness)



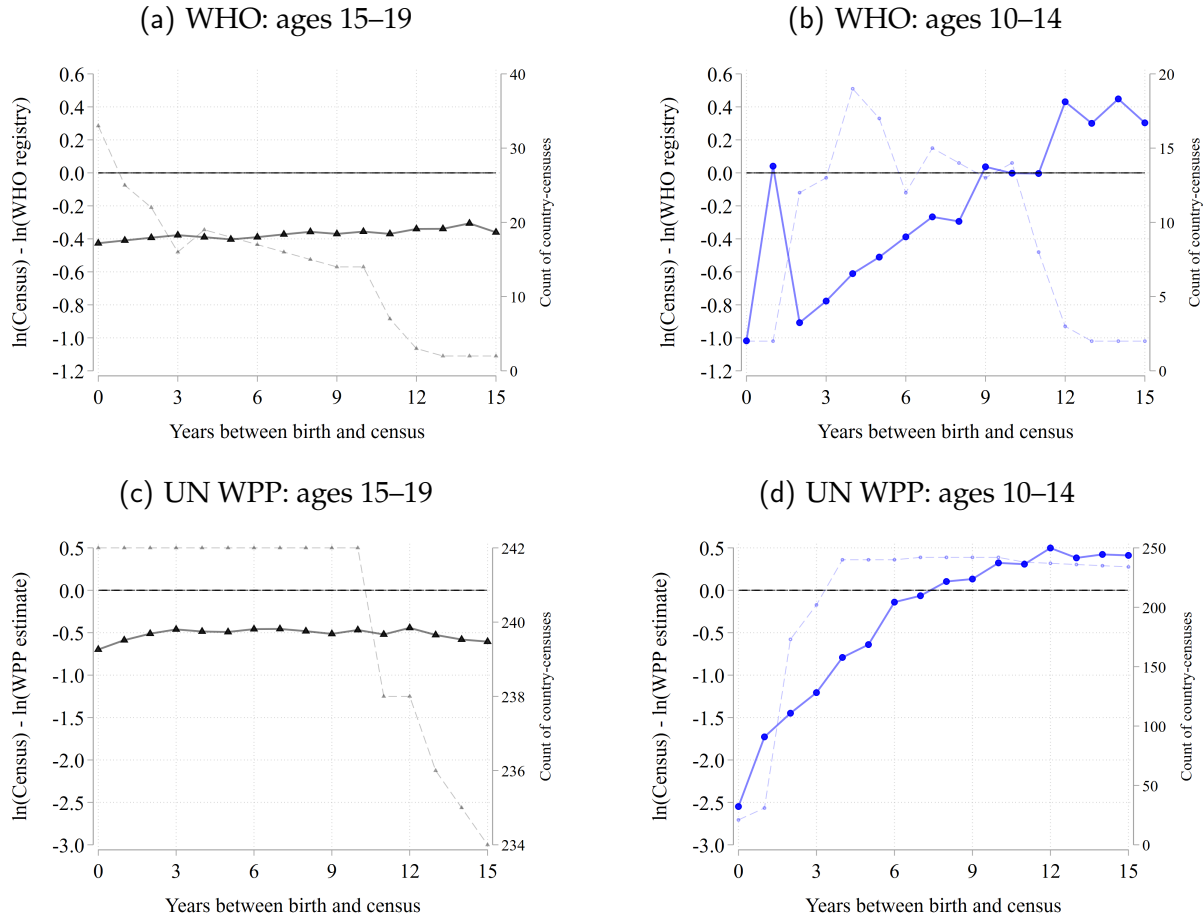
Notes: The figures replicate Figure 6 but winsorizing at a 10% level (top figure), including countries with minimum age of consent up to 18 years of age (middle figure), and applying both variations simultaneously (bottom figure).

Figure A4: Single Crossing of Census and Registry Birth Counts (No Normalization)



Notes: The figure replicates the cross-country comparisons of Figure 4 without the entry normalization: each point is the raw average of the census–registry log gap (equation 3) across the country–censuses observed at that horizon. Left panels: mothers aged 15–19 at childbirth; right panels: mothers aged 10–14; the two panels of each row share the same vertical axis. The light dashed line in each panel shows the number of country-censuses contributing at each horizon, on the right axis; because country-censuses whose minimum observed age of mothers exceeds 10 enter the 10–14 panels only at horizons where the full bracket is observable, the sample composition changes with the horizon. Panels (a)–(b) use WHO registration-based counts; panels (c)–(d) use UN WPP 2024 estimates, which are model-based demographic estimates rather than raw registry counts.

Figure A5: Single Crossing of Census and Registry Birth Counts (Balanced Sample)



Notes: The figure replicates the cross-country comparisons of Figure 4 restricting the sample to country-censuses that observe mothers below age 15 (no entry normalization is needed because these censuses contribute at every horizon at which both sources are observed). Left panels: mothers aged 15–19 at childbirth; right panels: mothers aged 10–14; the two panels of each row share the same vertical axis. The light dashed line in each panel shows the number of country-censuses contributing at each horizon, on the right axis. Panels (a)–(b) use WHO registration-based counts; panels (c)–(d) use UN WPP 2024 estimates, which are model-based demographic estimates rather than raw registry counts.

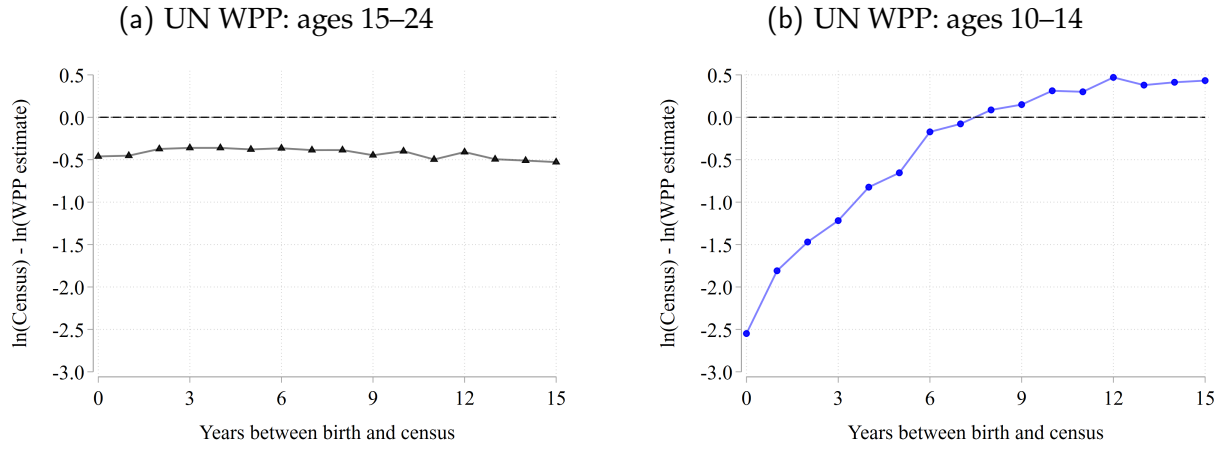


Figure A6: Single Crossing of Census and WPP Birth Counts, Older Group 15–24

Notes: The figure replicates the cross-country WPP comparison of Figure 4 using the full 15–24 age group (the sum of the 15–19 and 20–24 brackets) as the older group, instead of the 15–19 group used in the main text for comparability with WHO. Left panel: mothers aged 15–24 at childbirth; right panel: mothers aged 10–14; the two panels share the same vertical axis. The single-crossing pattern for mothers aged 10–14 and the flat negative gap for older mothers are unchanged. Cross-country average with entry normalization; UN WPP 2024 estimates, which are model-based demographic estimates rather than raw registry counts.

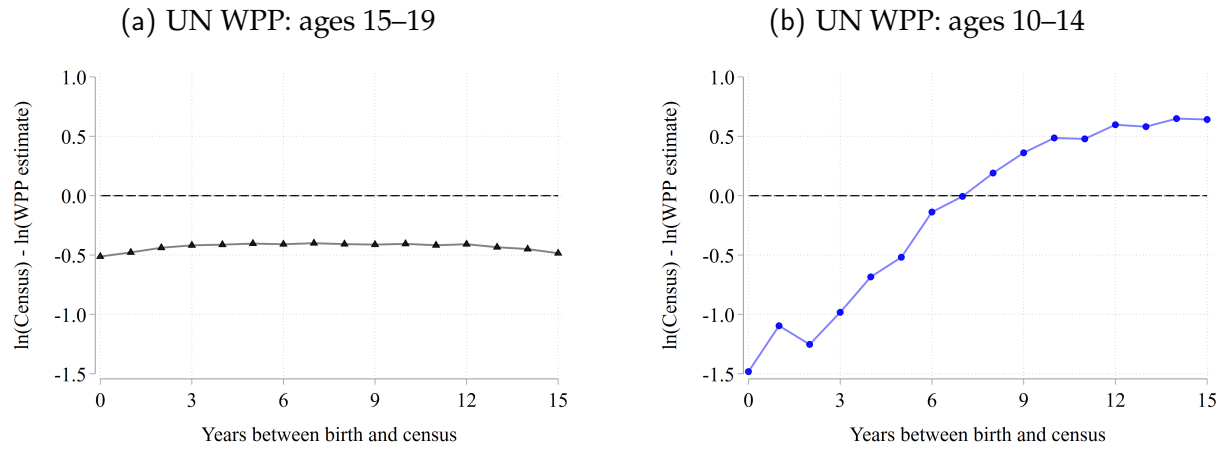


Figure A7: Single Crossing of Census and WPP Birth Counts, Registration-Rich Countries

Notes: The figure replicates the cross-country WPP comparison of Figure 4 restricting the sample to the 37 countries that appear in the WHO registration-based comparison (141 country-censuses). Left panel: mothers aged 15–19 at childbirth; right panel: mothers aged 10–14; the two panels share the same vertical axis. Within this registration-rich set, censuses recover 53% fewer births to mothers aged 10–14 than the WPP estimates one to five years after the birth and 85% more ten to fifteen years after; 81 of the 135 classifiable country-censuses display a single crossing for mothers aged 10–14, and 0 of 141 do for mothers aged 15–19. Cross-country average with entry normalization; UN WPP 2024 estimates, which are model-based demographic estimates rather than raw registry counts.

A Additional Tables

Table A1: Undercounting and Reporting Incentives (Robustness 1)

Dependent Variable: Births Underreporting Gap in Baseline Census								
Heterogeneity by	None	Birth registration (%)	Gender Roles (3)	Women's Legal Rights (4)	Women's Health Autonomy (5)	Social Protection (6)	Violence Against Women (7)	World Bank Rule of Law (8)
Age 10-14	0.758*** (0.038)	0.783*** (0.033)	0.753*** (0.037)	0.753*** (0.038)	0.786*** (0.036)	0.758*** (0.038)	0.749*** (0.037)	0.747*** (0.035)
Age 10-14 x Heterogeneity		-0.069** (0.034)	-0.109** (0.045)	-0.114* (0.063)	-0.182*** (0.049)	-0.110** (0.045)	0.135*** (0.038)	-0.152*** (0.040)
Observations	1,080	1,036	1,065	1,050	1,065	1,065	1,050	1,065
Country FE	Y	Y	Y	Y	Y	Y	Y	Y
Mean Dep. Var	0.201	0.219	0.203	0.202	0.200	0.200	0.198	0.200

Note: The table replicates Table 2 removing two restrictions from the sample of countries included in the analysis. The first one is the restriction that children be born in the country of the census, expanding the sample to countries whose censuses do not include place of birth. The second one is the restriction that both censuses have the same possible values for the stepmom variable.

Table A2: Undercounting and Reporting Incentives (Robustness 2)

Dependent Variable: Births Underreporting Gap in Baseline Census								
Heterogeneity by	None	Birth registration (%)	Gender Roles (3)	Women's Legal Rights (4)	Women's Health Autonomy (5)	Social Protection (6)	Violence Against Women (7)	World Bank Rule of Law (8)
Age 10-14	0.660*** (0.056)	0.675*** (0.053)	0.664*** (0.054)	0.678*** (0.051)	0.704*** (0.053)	0.666*** (0.051)	0.642*** (0.053)	0.638*** (0.050)
Age 10-14 x Heterogeneity		-0.147*** (0.052)	-0.156** (0.065)	-0.322*** (0.089)	-0.244*** (0.067)	-0.227*** (0.064)	0.224*** (0.068)	-0.196*** (0.044)
Observations	828	798	813	798	813	813	798	813
Country FE	Y	Y	Y	Y	Y	Y	Y	Y
Mean Dep. Var	0.314	0.335	0.318	0.319	0.315	0.315	0.315	0.315

Note: The table replicates Table 2 removing the restriction that both censuses have the same possible values for the stepmom variable.

Table A3: Undercounting and Reporting Incentives (Robustness 3)

Dependent Variable: Births Underreporting Gap in Baseline Census								
		Birth registration	Gender Roles	Women's Legal Rights	Women's Health Autonomy	Social Protection	Violence Against Women	World Bank Rule of Law
Heterogeneity by	None (1)	(%) (2)	(3)	(4)	(5)	(6)	(7)	(8)
Age 10-14	0.746*** (0.054)	0.795*** (0.044)	0.716*** (0.056)	0.757*** (0.054)	0.803*** (0.049)	0.746*** (0.055)	0.739*** (0.054)	0.748*** (0.049)
Age 10-14 x Heterogeneity		-0.070 (0.057)	-0.169*** (0.055)	-0.162* (0.085)	-0.226*** (0.067)	-0.102* (0.059)	0.145*** (0.051)	-0.161*** (0.056)
Observations	638	594	623	608	623	623	608	623
Country FE	Y	Y	Y	Y	Y	Y	Y	Y
Mean Dep. Var	0.180	0.209	0.182	0.180	0.177	0.177	0.174	0.177

Note: The table replicates Table 2 removing the restriction that children be born in the country of the census, expanding the sample to countries whose censuses do not include place of birth.

B Data appendix

B1 Census Data - IPUMS

The census microdata used in this paper are from the Integrated Public Use Microdata Series ([IPUMS, 2020](#)), a repository that harmonizes and integrates census data from around the world into a standardized format. [Sobek and Kennedy \(2009\)](#) describes the development of family interrelationship variables for international census data. We downloaded a single unified IPUMS extract containing all available census samples from 1990 to 2020. The extract includes mother’s characteristics at the individual level—such as age and other demographic attributes—whenever IPUMS is able to establish the mother-child relationship within the household (see [Table B1](#) for the list of relevant variables). We use the mother’s age to compute the mother’s age at childbirth (b) as the difference between the mother’s age and the child’s age at the time of the census (see [Table B2](#)).

B1.1 Sample

We link consecutive censuses within each country to construct consecutive census pairs with spans ranging from 8 to 12 years. The resulting sample comprises 170 country–census pairs spanning 73 countries, as reported in [Table B3](#).

From the available census microdata, we exclude those where age is reported in age groups. Within each census, we restrict the analysis to children under the age of 16 at the time of the census, as older children are less likely to still reside with their birth mothers. Observations for which no information on the mother could be established are excluded. We also restrict the sample to children linked to biological mothers ($\text{stepmom} = 0$) or those whose age difference between mother and child was flagged due to being less than 12 ($\text{stepmom} = 5$), and exclude observations where mother’s age at childbirth is less than 10 years, greater than 54 years, or missing. For the United States, we restrict the sample

Table B1: Variables from IPUMS International

Variable	Description
country	Country code
year	Census year.
sample	IPUMS sample identifier, constructed from the country code, census/survey year, and a within-year code for sample and survey type.
serial	Constructed variable assigning an identifying number unique to each household in a given sample.
pernum	Constructed variable that numbers all persons within each household consecutively.
perwt	Indicates the number of persons in the actual population represented by the person in the sample.
sex	Sex of individual.
age	Age of individual.
age_mom	Age of individual's mother (if in household).
momloc	Indicates whether or not the person's mother lived in the same household and, if so, gives the person number of the mother (pernum). Identifies both biological and social relationships (IPUMS International, a).
stepmom	Indicates whether a person's mother, as identified by momloc, was most probably not the person's biological mother. The codes for STEPMOM are as follows: 0 = Biological mother or no mother of this person present in household; 1 = Mother has no children born or surviving; 2 = Child reports mother is deceased; 3 = Explicitly identified relationship (stepchild, adopted child, child of unmarried partner, stepchild/child-in-law); 4 = Mother reports no children in the home; 5 = Age difference between mother and child was less than 12 or greater than 54 years; 6 = Child exceeds known fertility of mother (IPUMS International, c).
parrule	Describes the criteria by which momloc linked the person to a probable mother. The codes for PARRULE are as follows: 00 = No parent of person in household; 11 = Link to head or spouse, unambiguous; 12 = Link to head or spouse, ambiguous; 21 = Child-Grandchild, within empirical child cap; 22 = Child-Grandchild, within constructed child cap; 23 = Child-Grandchild, exceeds child cap; 31 = Specified Other Relatives, within empirical child cap; 32 = Specified Other Relatives, within constructed child cap; 33 = Specified Other Relatives, exceeds child cap; 41 = Other Relatives, within empirical child cap; 42 = Other Relatives, within constructed child cap; 51 = Non-Relatives, within empirical child cap; 52 = Non-Relatives, within constructed child cap (IPUMS International, b).
bplcountry	Country of birth of individual.

Table B2: Variables generated from IPUMS International

Variable	Description
b	Estimated age of the mother at the time of the child's birth, computed as the difference between the mother's age and the child's age at the time of the census: $\text{age_mom} - \text{age}$, where age_mom is the attached mother characteristic provided directly by IPUMS.

to native-born children to avoid conflating birth registration patterns with international migration flows.

We sum individual weights (*perwt*) by country, census year, mother's age at childbirth, and child's age to obtain the total number of births, and compute the year of birth as the census year minus the child's age. We exclude the census year itself because births occurring after the census date within that year would not be captured in the data.

Table B3: Countries and Census Years

Country	Census		Minimum Recorded Age of Mothers		Possible Values of Stepmom		Includes Country of Birth	
	Year							
	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Argentina	1970	1980	10	14	0 1 5 6	0 1 5 6	yes	yes
Argentina	1980	1991	14	12	0 1 5 6	0 1 5 6	yes	yes
Argentina	1991	2001	12	12	0 1 5 6	0 1 5 6	yes	yes
Austria	1971	1981	15	15	0 3 5	0 1 3 5 6	no	no
Austria	1981	1991	15	15	0 1 3 5 6	0 1 3 5 6	no	no
Austria	1991	2001	15	15	0 1 3 5 6	0 1 3 5 6	no	yes
Bangladesh	1991	2001	10	12	0 5	0 5	no	no
Bangladesh	2001	2011	12	12	0 5	0 5	no	no
Armenia	2001	2011	15	15	0 1 5 6	0 1 5 6	no	yes
Bolivia	1992	2001	12	12	0 1 5 6	0 1 5 6	no	yes
Bolivia	2001	2012	12	12	0 1 5 6	0 1 5 6	yes	yes
Botswana	1981	1991	13	13	0 1 4 5 6	0 1 4 5 6	no	no
Botswana	1991	2001	13	13	0 1 4 5 6	0 1 2 3 4 5 6	no	no

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Country	Census		Minimum Recorded Age of Mothers		Possible Values of Stepmom		Includes Country of Birth	
	Year							
	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Botswana	2001	2011	13	15	0 1 2 3 4 5 6	0 1 2 3 4 5 6	no	no
Brazil	1960	1970	12	12	0 1 5 6	0 1 5 6	yes	yes
Brazil	1970	1980	12	12	0 1 5 6	0 1 2 5 6	yes	yes
Brazil	1980	1991	12	10	0 1 2 5 6	0 1 2 3 5 6	yes	yes
Brazil	1991	2000	10	10	0 1 2 3 5 6	0 1 5 6	yes	yes
Brazil	2000	2010	10	10	0 1 5 6	0 1 3 5 6	yes	yes
Belarus	1999	2009	15	15	0 1 4 5 6	0 1 5 6	no	yes
Cambodia	1998	2008	12	12	0 1 5 6	0 1 5 6	yes	yes
Cambodia	2004	2013	15	16	0 1 2 3 5 6	0 1 2 3 5 6	yes	yes
Cambodia	2008	2019	12	12	0 1 5 6	0 1 5 6	yes	yes
Cameroon	1976	1987	12	12	0 5	0 2 5	yes	yes
Chile	1970	1982	12	12	0 1 3 5 6	0 1 3 5 6	yes	yes
Chile	1982	1992	12	14	0 1 3 5 6	0 1 3 5 6	yes	yes
Chile	1992	2002	14	15	0 1 3 5 6	0 1 3 5 6	yes	yes
China	1982	1990	13	15	0 1 5 6	0 1 5 6	no	no
China	1990	2000	15	10	0 1 5 6	0 1 5 6	no	no
Colombia	1973	1985	13	11	0 1 5 6	0 1 2 5 6	yes	no
Colombia	1985	1993	11	12	0 1 2 5 6	0 1 5 6	no	yes
Colombia	1993	2005	12	12	0 1 5 6	0 1 5 6	yes	yes
Costa Rica	1973	1984	12	12	0 1 5 6	0 1 5 6	yes	yes

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Country	Census		Minimum Recorded Age of Mothers		Possible Values of Stepmom		Includes Country of Birth	
	Year							
	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Costa Rica	2000	2011	12	12	0 1 5 6	0 1 5 6	yes	yes
Cuba	2002	2012	13	12	0 3 5	0 3 5	yes	yes
Benin	1992	2002	12	12	0 1 5 6	0 1 2 5 6	no	yes
Benin	2002	2013	12	12	0 1 2 5 6	0 1 2 3 5 6	yes	yes
Dominican Republic	2002	2010	12	12	0 1 2 3 5 6	0 1 3 5 6	yes	yes
Ecuador	1974	1982	12	12	0 1 5 6	0 1 5 6	yes	yes
Ecuador	1982	1990	12	12	0 1 5 6	0 1 2 5 6	yes	no
Ecuador	1990	2001	12	12	0 1 2 5 6	0 1 5 6	no	no
Ecuador	2001	2010	12	12	0 1 5 6	0 1 5 6	no	yes
Ethiopia	1984	1994	10	12	0 1 3 4 5 6	0 1 3 4 5 6	no	no
Fiji	1976	1986	15	14	0 1 2 3 5 6	0 2 4 5	yes	yes
Fiji	1986	1996	14	15	0 2 4 5	0 2 4 5	yes	yes
Fiji	1996	2007	15	15	0 2 4 5	0 1 2 3 4 5 6	yes	yes
France	1982	1990	14	14	0 5	0 5	no	no
France	1990	1999	14	14	0 5	0 5	no	no
France	1999	2011	14	14	0 5	0 5	no	yes
Ghana	2000	2010	12	12	0 1 5 6	0 1 3 5 6	no	no
Greece	1971	1981	13	12	0 5	0 5	no	no
Greece	1981	1991	12	12	0 5	0 1 5 6	no	no
Greece	1991	2001	12	13	0 1 5 6	0 1 3 5 6	no	yes

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Country	Census		Minimum Recorded Age of Mothers		Possible Values of Stepmom		Includes Country of Birth	
	Year							
	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Guatemala	1964	1973	14	12	0 1 5 6	0 1 2 5 6	yes	yes
Guatemala	1973	1981	12	13	0 1 2 5 6	0 1 2 5 6	yes	yes
Guatemala	1994	2002	12	12	0 1 2 5 6	0 1 2 3 5 6	yes	yes
Haiti	1971	1982	11	12	0 5	0 1 4 5 6	no	no
Honduras	2001	2013	12	12	0 1 5 6	0 1 5 6	yes	yes
Hungary	1970	1980	15	11	0 1 5 6	0 1 5 6	no	no
Hungary	1980	1990	11	14	0 1 5 6	0 1 5 6	no	no
Hungary	1990	2001	14	13	0 1 5 6	0 1 5 6	no	no
Hungary	2001	2011	13	15	0 1 5 6	0 1 5 6	no	no
Indonesia	1971	1980	12	10	0 1 5 6	0 1 4 5 6	no	no
Indonesia	1976	1985	13	12	0 1 2 3 4 5 6	0 5	no	no
Indonesia	1980	1990	10	12	0 1 4 5 6	0 1 4 5 6	no	no
Indonesia	1985	1995	12	14	0 5	0 1 2 3 4 5 6	no	no
Indonesia	1990	2000	12	12	0 1 4 5 6	0 1 5 6	no	no
Indonesia	1995	2005	14	13	0 1 2 3 4 5 6	0 5	no	no
Indonesia	2000	2010	12	12	0 1 5 6	0 1 3 4 5 6	no	yes
Côte d'Ivoire	1988	1998	12	12	0 1 2 5 6	0 1 2 5 6	yes	yes
Jamaica	1982	1991	12	12	0 1 5 6	0 1 5 6	yes	yes
Jamaica	1991	2001	12	15	0 1 5 6	0 1 3 5 6	yes	yes
Kenya	1989	1999	10	15	0 1 2 4 5 6	0 1 2 4 5 6	yes	yes

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Country	Census		Minimum Recorded Age of Mothers		Possible Values of Stepmom		Includes Country of Birth	
	Year							
	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Kenya	1999	2009	15	12	0 1 2 4 5 6	0 1 2 4 5 6	yes	yes
Kenya	2009	2019	12	12	0 1 2 4 5 6	0 1 2 4 5 6	yes	yes
Kyrgyz Republic	1999	2009	15	15	0 1 5 6	0 1 5 6	yes	yes
Laos	1995	2005	12	12	0 1 4 5 6	0 1 4 5 6	yes	yes
Laos	2005	2015	12	13	0 1 4 5 6	0 1 4 5 6	yes	yes
Lesotho	1996	2006	13	15	0 1 2 4 5 6	0 1 2 4 5 6	yes	yes
Malawi	1987	1998	11	10	0 1 5 6	0 1 2 5 6	yes	yes
Malawi	1998	2008	10	12	0 1 2 5 6	0 1 2 5 6	yes	yes
Malawi	2008	2018	12	12	0 1 2 5 6	0 1 2 5 6	yes	yes
Malaysia	1970	1980	11	13	0 1 5 6	0 1 5 6	yes	yes
Malaysia	1980	1991	13	12	0 1 5 6	0 5	yes	yes
Malaysia	1991	2000	12	12	0 5	0 5	yes	yes
Mali	1987	1998	12	11	0 1 2 5 6	0 1 2 5 6	yes	yes
Mali	1998	2009	11	10	0 1 2 5 6	0 1 2 5 6	yes	yes
Mauritius	1990	2000	14	14	0 1 5 6	0 1 5 6	no	no
Mauritius	2000	2011	14	14	0 1 5 6	0 1 5 6	no	no
Mexico	1990	2000	12	11	0 1 3 5 6	0 1 5 6	yes	yes
Mexico	2000	2010	11	12	0 1 5 6	0 1 5 6	yes	yes
Mexico	2010	2020	12	12	0 1 5 6	0 1 3 5 6	yes	yes
Mongolia	1989	2000	15	15	0 1 5 6	0 5	no	yes

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Country	Census		Minimum Recorded Age of Mothers		Possible Values of Stepmom		Includes Country of Birth	
	Year							
	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Mongolia	2000	2010	15	15	0 5	0 5	yes	yes
Mongolia	2010	2020	15	15	0 5	0 5	yes	yes
Morocco	1982	1994	13	12	0 1 4 5 6	0 1 4 5 6	no	no
Morocco	1994	2004	12	14	0 1 4 5 6	0 1 4 5 6	no	no
Mozambique	1997	2007	12	12	0 1 2 5 6	0 1 2 3 5 6	yes	yes
Mozambique	2007	2017	12	12	0 1 2 3 5 6	0 1 2 3 5 6	yes	yes
Nepal	2001	2011	12	12	0 1 4 5 6	0 1 4 5 6	yes	yes
Nicaragua	1995	2005	13	13	0 1 5 6	0 1 3 5 6	yes	yes
Panama	1960	1970	14	12	0 1 5 6	0 1 5 6	yes	no
Panama	1970	1980	12	12	0 1 5 6	0 1 2 5 6	no	yes
Panama	1980	1990	12	12	0 1 2 5 6	0 1 2 5 6	yes	no
Panama	1990	2000	12	12	0 1 2 5 6	0 1 5 6	no	yes
Panama	2000	2010	12	12	0 1 5 6	0 1 5 6	yes	yes
Papua New Guinea	1980	1990	10	12	0 1 2 3 4 5 6	0 2 3 5	yes	yes
Papua New Guinea	1990	2000	12	12	0 2 3 5	0 1 2 3 4 5 6	yes	yes
Paraguay	1962	1972	14	13	0 1 5 6	0 1 2 5 6	no	yes
Paraguay	1972	1982	13	14	0 1 2 5 6	0 1 2 5 6	yes	yes
Paraguay	1982	1992	14	14	0 1 2 5 6	0 1 2 5 6	yes	yes
Paraguay	1992	2002	14	13	0 1 2 5 6	0 1 3 5 6	yes	yes
Peru	2007	2017	12	12	0 1 5 6	0 1 5 6	yes	yes

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Country	Census		Minimum Recorded Age of Mothers		Possible Values of Stepmom		Includes Country of Birth	
	Year							
	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Philippines	1990	2000	12	12	0 1 3 5 6	0 3 5	no	yes
Philippines	2000	2010	12	12	0 3 5	0 1 3 5 6	yes	no
Portugal	1981	1991	13	14	0 5	0 3 5	yes	yes
Portugal	1991	2001	14	14	0 3 5	0 3 5	yes	yes
Portugal	2001	2011	14	15	0 3 5	0 3 5	yes	yes
Puerto Rico	1970	1980	14	15	0 1 5 6	0 1 5 6	yes	yes
Puerto Rico	1980	1990	15	12	0 1 5 6	0 1 3 5 6	yes	yes
Puerto Rico	1990	2000	12	15	0 1 3 5 6	0 3 5	yes	yes
Puerto Rico	2000	2010	15	12	0 3 5	0 3 5	yes	yes
Puerto Rico	2005	2015	15	15	0 3 5	0 3 5	yes	yes
Puerto Rico	2010	2020	12	16	0 3 5	0 3 5	yes	yes
Romania	1992	2002	14	13	0 1 5 6	0 1 3 5 6	yes	yes
Romania	2002	2011	13	14	0 1 3 5 6	0 1 5 6	yes	yes
Russia	2002	2010	13	12	0 1 5 6	0 1 5 6	yes	yes
Rwanda	1991	2002	12	12	0 1 2 5 6	0 1 2 5 6	yes	yes
Rwanda	2002	2012	12	12	0 1 2 5 6	0 1 2 5 6	yes	yes
Saint Lucia	1980	1991	15	15	0 1 5 6	0 1 5 6	yes	yes
Senegal	2002	2013	12	10	0 1 5 6	0 1 2 5 6	no	yes
Sierra Leone	2004	2015	10	12	0 1 2 4 5 6	0 1 2 3 4 5 6	yes	yes
Vietnam	1989	1999	10	12	0 1 5 6	0 1 4 5 6	no	no

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Country	Census		Minimum Recorded Age of Mothers		Possible Values of Stepmom		Includes Country of Birth	
	Year							
	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Vietnam	1999	2009	12	12	0 1 4 5 6	0 1 4 5 6	no	no
Vietnam	2009	2019	12	12	0 1 4 5 6	0 1 4 5 6	no	no
South Africa	1996	2007	10	12	0 1 2 5 6	0 1 2 3 4 5 6	yes	no
South Africa	2001	2011	12	10	0 1 2 3 5 6	0 1 2 3 5 6	yes	yes
South Africa	2007	2016	12	10	0 1 2 3 4 5 6	0 1 2 3 5 6	no	yes
Spain	1991	2001	12	14	0 1 5 6	0 5	no	yes
Switzerland	1970	1980	16	15	0 5	0 5	no	no
Switzerland	1980	1990	15	16	0 5	0 5	no	no
Switzerland	1990	2000	16	16	0 5	0 1 5 6	no	no
Thailand	1970	1980	11	12	0 1 3 5 6	0 1 3 4 5 6	yes	yes
Thailand	1980	1990	12	12	0 1 3 4 5 6	0 1 3 4 5 6	yes	yes
Thailand	1990	2000	12	13	0 1 3 4 5 6	0 1 5 6	yes	yes
Togo	1960	1970	13	15	0 1 5 6	0 5	yes	no
Trinidad and Tobago	1970	1980	13	14	0 1 5 6	0 5	yes	yes
Trinidad and Tobago	2000	2011	15	15	0 1 5 6	0 1 3 5 6	yes	yes
Turkey	1990	2000	12	12	0 1 5 6	0 1 5 6	no	no
Uganda	1991	2002	12	12	0 1 2 5 6	0 1 2 3 4 5 6	yes	yes
Uganda	2002	2014	12	12	0 1 2 3 4 5 6	0 1 2 3 5 6	yes	no
Egypt	1986	1996	12	14	0 5	0 5	no	no
Egypt	1996	2006	14	15	0 5	0 5	no	no

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Country	Census		Minimum Recorded Age of Mothers		Possible Values of Stepmom		Includes Country of Birth	
	Year							
	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Tanzania	2002	2012	12	12	0 1 2 4 5 6	0 1 2 4 5 6	yes	yes
United States	1960	1970	14	14	0 1 5 6	0 1 5 6	yes	yes
United States	1970	1980	14	15	0 1 5 6	0 1 5 6	yes	yes
United States	1980	1990	15	12	0 1 5 6	0 1 3 5 6	yes	yes
United States	1990	2000	12	15	0 1 3 5 6	0 3 5	yes	yes
United States	2000	2010	15	11	0 3 5	0 3 5	yes	yes
United States	2005	2015	15	15	0 3 5	0 3 5	yes	yes
United States	2010	2020	11	15	0 3 5	0 3 5	yes	yes
Burkina Faso	1996	2006	12	12	0 1 5 6	0 1 2 5 6	yes	yes
Uruguay	1963	1975	12	13	0 5	0 1 5 6	yes	yes
Uruguay	1975	1985	13	15	0 1 5 6	0 1 5 6	yes	yes
Uruguay	1985	1996	15	12	0 1 5 6	0 1 3 5 6	yes	yes
Uruguay	1996	2006	12	15	0 1 3 5 6	0 1 3 4 5 6	yes	no
Venezuela	1971	1981	12	12	0 1 5 6	0 5	no	yes
Venezuela	1981	1990	12	12	0 5	0 1 5 6	yes	yes
Venezuela	1990	2001	12	12	0 1 5 6	0 1 5 6	yes	yes
Zambia	1990	2000	15	13	0 1 3 4 5 6	0 1 3 4 5 6	yes	yes

Zambia	2000	2010	13	12	0 1 3 4 5 6	0 1 2 3 4 5 6	yes	yes
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Notes: The table includes the 170 country–census pairs covering 73 countries. Census microdata are obtained from the Integrated Public Use Microdata Series (IPUMS) International. Pairs are constructed from censuses with intervals ranging from 8 to 12 years. The sample excludes census rounds that report age in grouped categories.

B2 Administrative Birth Registries and Demographic Estimates

This section documents the three external sources of birth counts used in the paper: Mexico’s administrative birth records (used for the registration-delay analysis), the WHO registration-based adolescent birth rates, and the United Nations World Population Prospects estimates (both used in the registry–census comparisons of Section 3.2).

Estadística de Nacimientos del Registro Civil, INEGI (Mexico). This dataset is part of Mexico’s official vital statistics and has been compiled by the Mexican National Institute of Geography and Statistics (Instituto Nacional de Estadística y Geografía, INEGI) since 1985. In Mexico, when a birth occurs, healthcare providers are required to issue a Certificate of Live Birth within the first 24 hours. This certificate is mandatory and serves both legal and statistical purposes. The parents must then take the Certificate of Birth to the local Civil Registry office to obtain the official Acta de Nacimiento (birth certificate). The Civil Registry offices across the country then send these Acta de Nacimiento documents directly to INEGI, whether in printed or electronic form. After receiving the information, INEGI processes, validates, and disseminates the data.

We use public microdata from the annual birth records ([Instituto Nacional de Estadística y Geografía, 2025](#)), spanning 1985 to 2022. The raw data files are organized by year of registration and therefore include births that may have occurred in earlier years, as the dataset distinguishes the date of occurrence (when the birth happened) from the date of registration (when it was recorded at the Civil Registry). The microdata contain detailed information on three broad sets of variables: (i) characteristics of the registered child (e.g., sex, age, and survival status at the time of registration); (ii) characteristics of the birth and registration events, including date and place; and (iii) parental sociodemographic characteristics, including age at the time of the child’s birth [Instituto Nacional de Estadística y Geografía \(2015\)](#). We drop observations with missing birth year values.

Exploiting the availability of month-level data, we compute the registration delay as the difference in

months between the date of registration and the date of birth. We then construct birth count variables subject to different delay windows: births registered within 12, 60, 120, and 240 months of occurrence. To ensure comparability across birth cohorts, these delay-restricted counts are computed only for birth years with sufficient follow-up time in the data to observe registrations within the full delay window. For instance, births registered within 12 months are computed only for birth cohorts where registrations were observed at least 12 months after birth. Births occurring in 2020 or later were excluded from the sample, though we use data files through 2022 to capture subsequent delayed registrations for the included 1985–2019 birth cohorts.

WHO Registration-Based Birth Counts. The World Health Organization publishes country-year estimates of the adolescent birth rate—annual births per 1,000 women—for mothers aged 10–14 and 15–19 ([World Health Organization, 2023](#)). Each observation is documented with the source type underlying the estimate; we retain only observations flagged as derived from civil-registration records (source descriptions beginning with “Registration”), discarding survey- and census-based entries so that the series carries a registry interpretation. We drop observations reporting a rate of exactly zero, which are placeholder values rather than true zeros. We convert rates into birth counts by multiplying each rate by the United Nations World Population Prospects 2024 estimate of the female population in the corresponding age group, country, and year. Coverage begins around 2000 for most countries and is limited to country-years with functioning civil registration; matching these counts to the census panel yields 64 country-censuses from 37 countries. Because WHO does not publish a 20–24 series, comparisons based on this source use 15–19 as the older age group.

United Nations World Population Prospects 2024 (WPP). The WPP provides estimated annual births by five-year age group of the mother (10–14, 15–19, 20–24, ...) for every country from 1950 onward ([United Nations, Department of Economic and Social Affairs, Population Division, 2024](#)); we convert the published counts in thousands into absolute births. Unlike the WHO series, the WPP figures are not registry counts: they are model-based demographic estimates that reconcile censuses, surveys, and vital registration into a smooth, complete series, produced by a Bayesian hierarchical model that pools information across countries and smooths fertility over age and time ([Chao et al., 2023](#)). Two features of that construction matter for our comparison. Censuses represent only around 3 percent of the model’s fertility inputs. In most cases, what enters the model from a census is the fertility rate implied by a question asking women whether they gave birth in the 12 or 24 months before the census date; this is a different piece of information from ours, since our counts recover births from the ages of children living in the household, up to fifteen years after they happened. Around one sixth of the census observations (0.4 percent of all inputs) are

estimated with “own-children” methods, which reconstruct fertility rates from household population counts and are the closest method to our retrospective counts. For the youngest age groups, the main input of the model is instead survey birth histories, in which adult women report their past births, sometimes decades after they happened. These histories are compiled from archives that include the DHS, the MICS, and IPUMS-International, and they differ from our counts, which come from the census household roster rather than from the mother’s reports. Moreover, the WPP does not model the 10–14 rate directly: it estimates the ratio (on a logit scale) of the 10–14 rate to a ten-year moving average of the (modeled) 15–19 rate, fitted to the 10–14 observations where they exist; in periods without data the series follows the level and trend of the 15–19 series, and in country-periods with no data it is largely model output. We accordingly use the WPP for coverage, treat the levels of its 10–14 series with caution, and label the figures as estimates—never as registry counts—throughout the paper. Its near-universal coverage extends the comparison to 300 country-censuses from 89 countries. The same WPP release provides the female population by five-year age group used to convert the WHO rates into counts.

Construction of the Registry–Census Comparison Panel. We match each source to the IPUMS census counts by country and year of birth, using the same sample restrictions as the census-pair analysis (children linked to biological mothers, $\text{stepmom} \in \{0, 5\}$). Births are assigned to the age brackets 10–14, 15–19, and 20–24 by the mother’s age at childbirth; a year-of-birth cell enters the panel only when the full bracket is observable given the census’s minimum observed age of mothers (for bracket lower bound $b_{\min}$ and years between birth and census ℓ , the cell requires $\ell \geq \max(\text{min age} - b_{\min}, 0)$), and, when the older group aggregates two brackets (15–24), only when both brackets are observed in both the census and the external source. For each country-census, age group, and year of birth we compute the log gap between the census count and the external count, and we organize the panel by the horizon ℓ between the birth and the census enumeration, using horizons of 0 to 15 years. In the preferred cross-country figures we apply an entry normalization: letting ℓ_0 denote the first horizon at which a country-census appears, we add to its entire series the difference between the average gap of the country-censuses already present at ℓ_0 and its own gap at ℓ_0 . The normalization keeps the cross-country average continuous when the sample composition changes while leaving each series’ shape unchanged; Online Appendix Figures A4 and A5 report the unnormalized and balanced-sample versions. A country-census is classified as displaying a single crossing for an age group when its average log gap over horizons 1–5 is negative and its average over horizons 10–15 is positive; country-censuses lacking observations in either window are excluded from the denominator of those counts. The first window starts at horizon 1 rather than 0 because the census year is only partially

elapsed at enumeration, so horizon-0 cells are mechanically incomplete.

B3 Data on Country Characteristics

This section describes the construction of the indices used in Table ??, which analyzes how the birth undercount for child mothers varies by country characteristics. The indices aggregate sets of country-level indicators corresponding to five dimensions: Gender Roles, Women’s Legal Rights, Women’s Health Autonomy and Access, Social Protection, and Violence Against Women.

For each dimension, we construct the corresponding index in three steps. First, we identify and compile country-level indicators from multiple international sources that are conceptually related to each dimension. Second, we link these series to the IPUMS data using a nearest-year matching procedure: we assign to every country-census pair the value of each indicator observed in the baseline census year whenever available; otherwise, we take the closest non-missing observation. Third, we standardize the indicators across all country-census pairs and, within each dimension, compute the index value for each country as the simple average of its standardized components. The average is taken over all non-missing components, so the index remains defined even when some indicators or years are unavailable for a given country.

The indices are described below; Table B4 lists the underlying indicators used to construct each one.

- Gender Roles. Index summarizing traditional attitudes and legal frameworks regarding gender roles in the labor market, politics, marriage, and family. Higher values indicate more egalitarian gender norms.
- Women’s Legal Rights. Index of women’s de jure legal capacity in employment, family, and economic transactions. Higher values denote stronger rights for women.
- Women’s Health Autonomy and Access. Index of women’s decision-making power over their own health and their access to sexual and reproductive health services. Higher values indicate greater autonomy and access.
- Social Protection. Index summarizing coverage by child, maternity, and broader social assistance programs. Higher values indicate more extensive social protection.
- Violence Against Women. Index combining measures of intimate-partner and non-partner violence and female homicides. Higher values indicate greater prevalence of violence against women.

In addition, we use the following stand-alone indicators:

- Birth registration. Proportion of children under age 5 whose births have been registered with a civil authority.
- World Bank Rule of Law Index. Perception-based governance indicator from the Worldwide Governance Indicators, capturing confidence in and adherence to societal rules.

Table B4: Heterogeneity variables

Index	Variable	Description	Source
Birth Registration	child_births	Proportion of children under age 5 whose births have been registered with a civil authority.	UN Women
Gender Roles	Q28	Indicates respondent agreement or disagreement, on a scale of 1 to 4, with the statement that children suffer when their mother is employed.	World Values Survey, Wave 7 2017–2021
	Q29	Indicates respondent agreement or disagreement, on a scale of 1 to 4, with the statement that men are generally better political leaders than women.	World Values Survey, Wave 7 2017–2021
	Q31	Indicates respondent agreement or disagreement, on a scale of 1 to 4, with the statement that men are typically better business executives than women.	World Values Survey, Wave 7 2017–2021
	Q32	Indicates respondent agreement or disagreement, on a scale of 1 to 4, with the statement that being a housewife is equally fulfilling as paid employment.	World Values Survey, Wave 7 2017–2021
	Q35	Indicates respondent agreement or disagreement, on a scale of 1 to 5, with the statement that a woman earning more than her husband is likely to create household conflict.	World Values Survey, Wave 7 2017–2021
	Q37	Indicates respondent agreement or disagreement, on a scale of 1 to 5, with the statement that having children is a social duty.	World Values Survey, Wave 7 2017–2021
	eq_job	Dummy variable equal to 1 if a woman has the legal capacity and ability to obtain a job in the same way as a man, and 0 otherwise.	World Development Indicators, World Bank
	eq_headhousehold	Dummy variable equal to 1 if a woman can, legally, serve as head of household or head of family in the same way as a man, and 0 otherwise.	World Development Indicators, World Bank
Women's Rights	eq_signcontract	Dummy variable equal to 1 if a woman can sign a legally binding contract in the same way as a man, and 0 otherwise.	World Development Indicators, World Bank
	eq_regbusiness	Dummy variable equal to 1 if a woman can register a business without requiring her husband's or guardian's permission, signature, or consent, or providing additional information not required of a man, and 0 otherwise.	World Development Indicators, World Bank
	eq_passport	Dummy variable equal to 1 if a woman can apply for a passport in the same way as a man, and 0 otherwise.	World Development Indicators, World Bank
	eq_bankaccount	Dummy variable equal to 1 if a woman can open a bank account in a financial institution in the same way as a man, and 0 otherwise.	World Development Indicators, World Bank
	eq_loclive	Dummy variable equal to 1 if a woman can choose her domicile and residence in the same way as a man, and 0 otherwise.	World Development Indicators, World Bank
Women's Health Autonomy	women_healthdecisions	Percentage of currently married women aged 15–49 who report that they alone or jointly have the final say in decisions regarding their own health care.	Demographic and Health Surveys (DHS), World Bank
	access_women_srhealth	Extent to which countries have laws and regulations guaranteeing women aged 15–49 access to sexual and reproductive health care, information and education (percent of achievement).	World Health Organization
	contraceptive_prev	Contraceptive prevalence of any modern method among women aged 15–49 years.	World Health Organization
	women_decisions	Proportion of women aged 15–49 who make their own informed decisions regarding sexual relations, contraceptive use and reproductive health care.	UNDESA
Social Protection	benefits_child	Proportion of population covered by social protection systems providing child or family cash benefits.	ILO Social Security Inquiry Database
	benefits_maternity	Proportion of population covered by maternity benefits.	ILO Social Security Inquiry Database
	cov_uncondtransfer	Proportion of the population participating in unconditional cash transfer programs.	ASPIRE, World Bank
	cov_inkind	Proportion of the population participating in in-kind programs.	ASPIRE, World Bank
	cov_socialassistance	Percentage of the population participating in all types of social assistance programs tracked by ASPIRE.	ASPIRE, World Bank

Table B4: Heterogeneity variables (continued)

Index	Variable	Description	Source
Violence Against Women	non_ipv_rate	Proportion of women aged 15+ subjected to sexual violence by non-partners in the previous 12 months.	UNDESA
	ipv_rate	Proportion of ever-partnered women aged 15+ subjected to physical, sexual or psychological violence by a partner in the previous 12 months.	UNDESA
	female_homicides	Female victims of intentional homicide per 100,000 population.	UNODC
World Bank Rule of Law Index	ruleoflaw_wb	Indicator summarizing perceptions of how much agents have confidence in and abide by the rules of society. It captures views on the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. Higher values indicate stronger rule of law.	Worldwide Governance Indicators, World Bank

C Proofs

A mother reports a birth using method $\tau \in \{C, A\}$. Her utility is:

$$U_\tau(r_\tau, a_b, a_r, \bar{a}) = r_\tau v_\tau - r_\tau s e^{-\alpha a_b - \beta a_r} - \mathbf{1}_{\{a_b < \bar{a}\}}(\pi + \kappa r_\tau) \bar{J}.$$

The probability of reporting via method τ is:

$$p_\tau(a_b, a_r, \bar{a}) = \Pr \left[v_\tau \geq s e^{-\alpha a_b - \beta a_r} + \mathbf{1}_{\{a_b < \bar{a}\}} \kappa \bar{J} \right], \quad v_\tau \sim \text{Uniform}(0, V_\tau).$$

For Propositions 1–3, let the threshold $T(a_b, a_r) = s e^{-\alpha a_b - \beta a_r} + \mathbf{1}_{\{a_b < \bar{a}\}} \kappa \bar{J}$.

C1 Proposition 1: Reporting Increases with Age at Childbirth

Statement: For fixed a_r , $p_\tau(a_b + \varepsilon, a_r, \bar{a}) > p_\tau(a_b, a_r, \bar{a})$ for any $\varepsilon > 0$.

Proof: $T(a_b, a_r)$ decreases or stays constant as a_b increases because $\alpha > 0$. Also, $\mathbf{1}_{\{a_b < \bar{a}\}}$ turns off when $a_b \geq \bar{a}$, removing the judicial cost. Thus, p_τ increases with a_b . $\square$

C2 Proposition 2: Reporting Increases with Age at Reporting

Statement: For fixed a_b , $p_\tau(a_b, a_r + \varepsilon, \bar{a}) > p_\tau(a_b, a_r, \bar{a})$ for any $\varepsilon > 0$.

Proof: $T(a_b, a_r)$ is decreasing in a_r when $\beta > 0$. So as a_r increases, T decreases, and p_τ increases. $\square$

C3 Proposition 3: Reporting Increases with Instrumental Payoff

Statement: For fixed a_b, a_r , and $\bar{a}$, $p_A > p_C$ if and only if $V_A > V_C$.

Proof: For $v_\tau \sim \text{Uniform}(0, V_\tau)$, we have:

$$p_\tau = \max \left(0, 1 - \frac{T}{V_\tau} \right).$$

If T is the same across methods, then higher V_τ implies higher p_τ . Thus, $V_A > V_C \Rightarrow p_A > p_C$. $\square$

C4 Theorem 1: Single Crossing

Assume $V_A > V_C$ and $s > 0$. Fix a_b and $\bar{a}$, and let a_r^A denote the mother's age at reporting via administrative records. Assume that $V_C > s + \mathbf{1}_{a_b < \bar{a}} \kappa \bar{J}$ to ensure interior solutions. Define a_r^{C*} as the age at census reporting such that $p_C(a_b, a_r^{C*}, \bar{a}) = p_A(a_b, a_r^A, \bar{a})$. Then:

- If $a_r^C < a_r^{C*}$, then $p_C(a_b, a_r^C, \bar{a}) < p_A(a_b, a_r^A, \bar{a})$
- If $a_r^C > a_r^{C*}$, then $p_C(a_b, a_r^C, \bar{a}) > p_A(a_b, a_r^A, \bar{a})$

In other words, $p_C(a_b, a_r^C, \bar{a})$ single-crosses $p_A(a_b, a_r^A, \bar{a})$ from below as a_r^C increases. Moreover, such a crossing point a_r^{C*} exists only if $s > 0$.

From equation 7, since $v_\tau \sim U[0, V_\tau]$, the reporting probability under method τ is:

$$p_\tau(a_b, a_r, \bar{a}) = \frac{V_\tau - se^{-\alpha a_b - \beta a_r} - \mathbf{1}_{a_b < \bar{a}} \kappa \bar{J}}{V_\tau} \quad (10)$$

Let $K = \mathbf{1}_{a_b < \bar{a}} \kappa \bar{J}$ for notational convenience. Then:

$$p_A(a_b, a_r^A, \bar{a}) = \frac{V_A - se^{-\alpha a_b - \beta a_r^A} - K}{V_A} \quad (11)$$

$$p_C(a_b, a_r^C, \bar{a}) = \frac{V_C - se^{-\alpha a_b - \beta a_r^C} - K}{V_C} \quad (12)$$

Step 1: Existence and uniqueness of a_r^{C*} .

The crossing point a_r^{C*} is defined by:

$$p_C(a_b, a_r^{C*}, \bar{a}) = p_A(a_b, a_r^A, \bar{a}) \quad (13)$$

This equality holds if and only if:

$$\frac{V_C - se^{-\alpha a_b - \beta a_r^{C*}} - K}{V_C} = \frac{V_A - se^{-\alpha a_b - \beta a_r^A} - K}{V_A} \quad (14)$$

Rearranging:

$$V_A V_C - V_A se^{-\alpha a_b - \beta a_r^{C*}} - V_A K = V_A V_C - V_C se^{-\alpha a_b - \beta a_r^A} - V_C K \quad (15)$$

Simplifying:

$$V_A se^{-\alpha a_b - \beta a_r^{C*}} = V_C se^{-\alpha a_b - \beta a_r^A} - (V_A - V_C)K \quad (16)$$

If $s > 0$, we can solve for a_r^{C*} :

$$e^{-\beta a_r^{C*}} = \frac{V_C e^{-\beta a_r^A} - (V_A - V_C) K e^{\alpha a_b} / s}{V_A} \quad (17)$$

Taking the natural logarithm:

$$a_r^{C*} = -\frac{1}{\beta} \ln \left(\frac{V_C e^{-\beta a_r^A} - (V_A - V_C) K e^{\alpha a_b} / s}{V_A} \right) \quad (18)$$

When there are no judicial costs ($K = 0$), this solution exists and is unique if and only if $s > 0$. When judicial costs are present ($K > 0$), existence also requires s to be sufficiently large ($s > \frac{(V_A - V_C) K e^{\alpha a_b + \beta a_r^A}}{V_C}$) to ensure the argument inside the logarithm is strictly positive. If $s = 0$, then the condition for equal probabilities becomes:

$$0 = (V_A - V_C) K \quad (19)$$

which has no solution when $V_A > V_C$ and $K > 0$. If both $s = 0$ and $K = 0$, the equation holds for all ages, meaning reporting probabilities are identical everywhere rather than exhibiting a unique dynamic crossing from below.

Step 2: Monotonicity of p_C in a_r^C .

Taking the derivative with respect to a_r^C :

$$\frac{\partial p_C(a_b, a_r^C, \bar{a})}{\partial a_r^C} = \frac{s \beta e^{-\alpha a_b - \beta a_r^C}}{V_C} > 0 \quad (20)$$

Since $s > 0$, $\beta > 0$, and all exponential terms are positive, p_C is strictly increasing in a_r^C .

Step 3: Single crossing property.

Since $p_C(a_b, a_r^C, \bar{a})$ is strictly increasing in a_r^C and $p_C(a_b, a_r^{C*}, \bar{a}) = p_A(a_b, a_r^A, \bar{a})$ by definition:

- If $a_r^C < a_r^{C*}$, then by monotonicity:

$$p_C(a_b, a_r^C, \bar{a}) < p_C(a_b, a_r^{C*}, \bar{a}) = p_A(a_b, a_r^A, \bar{a}) \quad (21)$$

- If $a_r^C > a_r^{C*}$, then by monotonicity:

$$p_C(a_b, a_r^C, \bar{a}) > p_C(a_b, a_r^{C*}, \bar{a}) = p_A(a_b, a_r^A, \bar{a}) \quad (22)$$

Therefore, $p_C(a_b, a_r^C, \bar{a})$ single-crosses $p_A(a_b, a_r^A, \bar{a})$ from below at a_r^{C*} . $\square$

Remark (Existence condition). The existence assumption $p_C(a_r^C \rightarrow \infty) > p_A$ is without loss of generality when there is no judicial cost ($K = \mathbf{1}_{a_b < \bar{a}} \kappa \bar{J} = 0$), since as $a_r^C \rightarrow \infty$ social costs vanish and $p_C \rightarrow 1 > p_A$. When judicial costs are present ($K > 0$), the assumption requires:

$$s > \frac{(V_A - V_C) K \cdot e^{\alpha a_b + \beta a_r^A}}{V_C}.$$

This ensures that the argument of the logarithm in the expression for a_r^{C*} is positive, so that the crossing point is well defined.

C5 Proposition 4: Discontinuity at Legal Age

Statement: If $\kappa \bar{J} > 0$ and the post-cutoff reporting threshold lies within the payoff support (i.e., $se^{-\alpha \bar{a} - \beta a_r} < V_\tau$), then p_τ has a discontinuity at $a_b = \bar{a}$.

Proof: For $a_b < \bar{a}$, the reporting threshold is $T = se^{-\alpha a_b - \beta a_r} + \kappa \bar{J}$. At $a_b = \bar{a}$, the $\kappa \bar{J}$ term vanishes. Therefore, T drops discontinuously. Because $v_\tau \sim U[0, V_\tau]$ and the post-cutoff threshold is strictly less than V_τ , this discrete drop in the threshold translates directly into a discrete upward jump in the reporting probability $p_\tau = \max(0, 1 - T/V_\tau)$. $\square$