Online Appendix 1: Additional Evidence on the Value of Time in Child Health Production

Fertility Behavior in the Demographic and Health Surveys

If changes in the value of time are an important determinant of vital events, there should also be congruent cyclical patterns of fertility. Specifically, women should be more likely to become pregnant in low price years and less likely to become pregnant in high price years (Becker and Lewis 1973, Becker 1981, Schultz 1985). In Colombia's Demographic and Health Survey data, this should be evident as decreases (increases) in preceding birth intervals among children born the year after price declines (increases). To explore how birth intervals varied with coffee prices, we estimate equations closely akin to equation 4 but use samples of children who were conceived either in the year that a price shock occurred or in the *preceding* year (or children who we born in shock years or the *following* year). Specifically, we regress children's preceding birth interval on the interaction between internal coffee prices at age -1 (the year of conception) and county-level coffee-growing intensity and the same set of other covariates. Online Appendix Table O1 reports marginal probabilities for interaction term estimates evaluated at the mean of the independent variables. Estimates for the 1985 and 1991 price shocks are positive, implying that in counties with median coffee-growing intensity, a 500 peso price decline is associated with birth intervals that are 2.7 and 6.0 months shorter (respectively) in the following year.[1] Shorter birth intervals are equivalent to higher period fertility.

Travel Time to Health Facilities and Health Service Use in the Familias en Acción Surveys

To further explore the importance of time in child health production, we also examine an explicit measure of travel time (in minutes) to health facilities in the *Familias en Acción* surveys. These analyses should be interpreted cautiously: we do not have plausibly exogenous variation in travel time, our measure is self-reported by survey participants, and our only reasonable health service indicator is compliance with infant and child growth monitoring (i.e., 'check-ups').[2] Nevertheless, Online Appendix Table O2 shows that the correlation between travel time to health facilities and health service use is negative, statistically significant, and remarkably robust to the inclusion of an unusually rich set of covariates shown in the table. (For a detailed discussion of the validity of assuming orthogonality between travel time to facilities in rural Colombia and other determinants of service use, see Attanasio and Vera-Hernández 2004.) Given that rural travel to health facilities during the 1970s and 1980s often involved daylong trips, the magnitude of these estimates is reasonable (8 hours of round-trip travel and waiting at a health facility would be associated with a 20 percentage point reduction in probability of preventive service use, an 80% reduction relative to the sample mean).

[1] These results are also in sensitive to controlling for parity.

[2] The only other health service measure available in the *Familias en Acción* data is DPT immunization rates, but because childhood immunization delivery was removed from the regular responsibilities of health facilities in 1993 – and therefore should be unrelated to travel time – we do not examine it.

Online Appendix 2: Demographic Analyses of Misreporting in the 1993 Colombian Population Census by Age and Coffee Cultivation

This appendix uses three standard demographic tools to investigate the possibility of population misreporting by age and intensity of coffee cultivation in the 1993 Colombian population census: the Whipple Index, the Myers Index, and the United Nations Index. These indices are specifically designed to assess the quality of population censuses – and in particular to examine problems of age misreporting due to a variety of causes. We extend these techniques to consider population misreporting not only by age and sex, but also by intensity of coffee cultivation. In constructing these indices by age and coffee cultivation in the 1993 Colombian population census, we also subdivide Colombia's counties into those having no coffee or some coffee, and we further subdivide coffee-growing counties into those having below median coffee cultivation or above median coffee cultivation. None of the indices is perfect for our purposes, but they all strongly suggest that there is not systematic misreporting in the 1993 population census that varies by age and intensity of coffee cultivation. Given that the 1993 census was not collected contemporaneously with any of the price shocks that we study, they are otherwise capable of detecting problematic patterns of misreporting that varies systematically along these dimensions.

The first and simplest index that we construct is the Whipple Index. The Whipple Index (W) is commonly used by demographers to assess systematic age-heaping (systematic grouping of true ages into assigned ages ending in either 0 or 5) (United Nations 1955). This index assumes that population varies lineally within age-groups – (for example: 13-17, 18-22, 23-27, 28-32,…, 58-62) according to following the equation:

$$W = \frac{5\sum_{x=5}^{x=12} K_{5x}}{\sum_{x=13}^{x=62} K_x}$$

where K_{5x} is the population in a given five year age-group and K_x is the population at a given age x. The standard ages analyzed in the demography literature are 20-60 (see United Nations 1955). However, to better incorporate cohorts born in coffee price shock years, we have also extended our index calculations back to age 10 (we denote these W(20-62) and W(10-62), respectively). Whipple Index values generally vary between 100 and 500. An index score of 100 indicates that a population is uniformly distributed within five year age groups, while a score of 500 suggests that population ages within five year age groups end only in 0 or 5 (scores below 100 indicate that a population is concentrated at ages that do not end in 0 or 5). The first two panels of Online Appendix Table O3 show Whipple Index calculations using the 1993 census by gender for counties with no coffee, counties with any coffee, counties with below median coffee cultivation, and counties with above median coffee cultivation. It suggests no systematic differences in age misreporting that vary with amount of coffee cultivation.

The second index is the Myers Index (M). Rather than measuring systematic concentrations or absences of ages ending in 0 or 5, the Myers Index measures systematic concentrations of ages ending in any digit 0-9. This measure is created by constructing a "blended" population by digit in the ones place. The index then measures deviations from a uniform age distribution by final digit (in the ones place – i.e., deviations from 10% of the population having ages ending in each digit):

$$M(j) = \frac{S_{1,j}a_{1,j} + S_{2,j}a_{2,j}}{\sum_{0}^{9} S_{1,j}a_{1,j} + S_{2,j}a_{2,j}} 100 \text{, for } j=0,1,2,\ldots,9$$

Where $S_{1,j} = \sum_{i=0}^{7} P_{(10+j)+10i}$ and $S_{2,j} = \sum_{i=0}^{6} P_{(20+j)+10i}$ (the summations of total population ages 10+ and 20+, respectively). The coefficients $a_{1,j}$ and $a_{2,j}$ are weights for deviations from a uniform distribution of ages ending in each integer. The deviation of each ending-integer age group *j* from 10% of the population is then simply calculated as: $d(j)=M(j)-10.0$. The index is then the summation of deviations across all values of *j*. The Myers Index can range from 0 to 180, where the former implies no systematic differences in population sums ending in each digit and the latter implies that all ages in a given population end in the same digit. An additional advantage of the Myers Index is that it accounts for linear differences in mortality across closed populations for which the index is computed (because deaths generally imply that the share of a population with ages ending in smaller integers will be larger – a well known 'triangular' age structure).

The third panel of Online Appendix Table O3 shows Myers Index calculations using the 1993 census by gender for counties with no coffee, counties with any coffee, counties with below median coffee cultivation, and counties with above median coffee cultivation. As with the Whipple Index, this method also suggests no systematic differences in age misreporting that vary by intensity of coffee cultivation.

The third index is the United Nations Index (UN), which captures age-heaping, systematic concentrations of ages ending in certain integers relative to others, and differential omission of certain ages – making it the most comprehensive measure of age misreporting. There are three steps required to construct the U.N. Index. The first is to calculate sex ratios for five year age groups, to then calculate first differences in these ratios between adjacent age groups, and finally to take the absolute value of these differences. Lower summary sex ratio values suggest higher quality data. The second step is to construct age ratios separately by sex. These age ratios are calculated as the quotient of population counts in a given five-year age group over the mean of both adjacent five-year age groups. The index assumes that population decreases as age increases in a first-order arithmetic progression (and that the deviation of these ratios from 1 should be small). The summary measure for these age ratios is then the summation of the absolute values of the deviations for each five-year age group from 1.

The third and final step combines the sex ratio and age ratio summary measures from the preceding steps to construct the U.N. Index as follows:

UN=3*Sex Ratio + Age Ratio Males + Age Ratio Females

The index places relatively greater weight on the sex ratio because sex ratios have been empirically shown to be more sensitive to disturbances in demographic processes (United Nations 1955). The U.N. suggests that U.N. Index values above 40 are considered to reflect poor quality data. The bottom panel of Online Appendix Table O3 shows U.N. Index calculations for areas with varying intensity of coffee cultivation. All are again close to each other, further suggesting no systematic differences in age misreporting that vary by amount of coffee cultivation.

Overall, all three standard demographic indices used to assess age misreporting suggest little evidence of systematic population misreporting by age and intensity of coffee cultivation in the 1993 Colombian population census.

Reference

United Nations. 1955. *Manuals on Methods of Estimating Population, Manual II: Methods of Appraisal of Quality of Basic Data for Population Estimates.* New York, NY: United Nations.

ONLINE APPENDIX TABLE O1:
Coffee Price Shocks in Conception Years (Lagged by One Year) and Birth Intervals

	Estimate	Standard Error	Implied Change	N	R^2
1975 Brazilian Frost	-0.04	(0.06)	---	2419	0.12
1985 Brazilian Drought	0.21*	(0.13)	2.65	3676	0.12
1990 ICA Collapse	0.48**	(0.22)	5.99	2567	0.07

Notes: Individual-level birth interval data from the pooled 1986, 1990, 1995, and 2000 Colombian Demographic and Health Survey sample; coffee cultivation data from the National Federation of Coffee Grower's early 1980s coffee census; annual internal coffee price data for the year of conception from the National Federation of Coffee Growers. Estimates and standard errors (in parentheses, clustered by county) shown for the interaction between coffee growing intensity and coffee price in the year of conception obtained by estimating equation 2 (controlling for county and year fixed effects and county -specific linear trends as well as mother's age, education, number of household members, number of preceding births, age at first birth, and age at first marriage). Coffee area is in thousands of hectares and coffee prices are in thousands of pesos per kilogram. Implied changes are calculated for 250 hectares of coffee and a 500 peso per kilogram price change. *p<0.1, **p<0.05, ***p<0.01.

ONLINE APPENDIX TABLE O2:
Travel Time to Health Facilities and Health Care Service Use (Growth and Development Monitoring)

	Without County Fixed Effects						With County Fixed Effects					
Travel Time (in Minutes) to Nearest Health Facility	-2.50***	-1.80***	-1.40***	-1.10**	-8.00***	-7.60***	-1.30***	-0.80*	-0.80*	-1.00**	-4.50**	-4.70*
	(0.45)	(0.47)	(0.47)	(0.45)	(1.87)	(2.32)	(0.48)	(0.49)	(0.46)	(0.45)	(2.36)	(2.84)
Child Age and Sex; *Familias en Acción Program* Participation	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Maternal Characteristics[1]	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Household Composition and Characteristics[2]	No	No	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes
Household Head and Maternal Labor Force Participation[3]	No	No	No	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
Houshold Income and Consumption	No	No	No	No	Yes	Yes	No	No	No	No	Yes	Yes
Travel Time to Town Center	No	No	No	No	No	Yes	No	No	No	No	No	Yes
N	22,463	19,884	13,987	9,491	2,456	2,456	22,326	19,754	13,837	9,382	2,228	2,228
Pseudo R^2	0.01	0.02	0.09	0.12	0.06	0.06	0.09	0.10	0.16	0.19	0.16	0.16

Notes: Individual-level travel time data data from the *Familias en Acción* panel survey (2002, 2003, and 2005 waves); coffee cultivation data from the National Federation of Coffee Grower's 1997 coffee censuses; annual internal coffee price data from the National Federation of Coffee Growers. Marginal probabilities (and corresponding standard errors in parentheses, clustered at the county level) are shown for travel time and were calculated using estimates from probit models relating health service use (growth and development monitoring, or "well-child care") to travel time and other covariates as indicated above. [1]Maternal Characteristics: mother's educational attainment dummy variables, mother's age, and mother's anthropometrics; [2]Household Composition and Characteristics:number of children ages 0-6, number of children ages 7-17, number of adults, age of household head, number of births, number of newborn deaths, number of child deaths under age 5; [3]Household Head and Maternal Labor Force Participation: household head ever worked for money, household head worked for pay in the past week, household head hours of monthly paid work, mother ever worked for money, mother worked for pay in the past week, mother hours of monthly paid work. Coffee area is in hundreds of hectares and coffee prices are in hundreds of pesos per kilogram. *p<0.1, **p<0.05, ***p<0.01.

ONLINE APPENDIX TABLE O3:
Whipple (W), Myers (M), and U.N. (UN) Index Calculations Using the 1993 Colombian Population Census

Index		Total Population	Coffee Growing Counties	Counties Growing No Coffee	Below Median Coffee Growing Counties	Above Median Coffee Growing Counties
Whipple Index (W20-62)	Male	108.15	109.39	107.46	107.29	111.62
	Female	110.43	110.85	110.20	109.51	112.40
Whipple Index (W10-62)	Male	105.37	106.21	104.90	104.79	107.65
	Female	107.74	108.14	107.52	107.20	109.17
Myers Index (M)	Male	10.93	11.06	10.86	9.72	12.42
	Female	10.80	10.75	10.83	9.81	11.80
U.N. Index (UN)		20.20	21.42	19.40	21.86	22.34