

Appendix

We estimate a model of the type:

$$\text{CHILDOUTCOME}_{ij} = \alpha_j + \beta_1 \text{Paternal age}_{ij} + \beta_2 \text{SOCIODEM}_{ij} + e_{ij}$$

Where (i, j) indexes a child i born to father j . α_j is the family fixed effect and B_1 is a vector of the paternal age coefficients. B_2 are child and parents socio-demographic characteristics. The model parameters are estimated by the conventional “within transformation” (Wooldridge 2012), such that the individual-specific constants α_i are not actually estimated, and are therefore allowed to be freely correlated with any of the (observed or unobserved) time-invariant characteristics of the family that may affect both the selection into paternal age at birth and the child outcomes. This within-family estimate compares a child’s own probability of e.g. LBW based on his/her father age at birth to the average probability of his/her siblings born in the same family.

Appendix Table 1: Change in probability of LBW (95% confidence intervals)

| | Model 1: unadjusted (child's sex) | Model 2: Model 1 + child characteristics | Model 3: Model 1 + maternal characteristics | Model 4: Model 1 + hh sociodemographic variables | Model 5: fully adjusted | Model 6: Model 4 + sibling fixed effects |
|--|--|---|--|---|------------------------------------|---|
| Girl | 0.25 (0.07 - 0.42) | 0.25 (0.07 - 0.42) | 0.24 (0.07 - 0.42) | 0.25 (0.07 - 0.42) | 0.24 (0.07 - 0.42) | 0.23 (0.02 - 0.45) |
| Maternal age 10-19 (reference: 25-29) | | | 0.47 (-0.35 - 1.28) | | -0.22 (-1.06 - 0.63) | 0.55 (-0.48 - 1.58) |
| Maternal age 20-24 | | | 0.38 (0.09 - 0.68) | | 0.15 (-0.15 - 0.45) | 0.29 (-0.15 - 0.73) |
| Maternal age 30-34 | | | 0.15 (-0.08 - 0.38) | | 0.34 (0.11 - 0.58) | -0.06 (-0.45 - 0.33) |
| Maternal age 35-39 | | | 0.57 (0.18 - 0.96) | | 0.85 (0.45 - 1.25) | 0.32 (-0.38 - 1.03) |
| Maternal age 40+ | | | 0.72 (-0.15 - 1.59) | | 1.06 (0.18 - 1.95) | 0.19 (-1.08 - 1.45) |
| Mother smoked during pregnancy | | | 1.33 (0.98 - 1.68) | | 1.21 (0.86 - 1.56) | 0.28 (-0.28 - 0.84) |
| Birth order: second (reference first) | | -1.27 (-1.48 - -1.07) | | | -1.33 (-1.54 - -1.13) | -1.18 (-1.43 - -0.92) |
| Birth order: third | | -1.33 (-1.60 - -1.05) | | | -1.45 (-1.73 - -1.17) | -0.89 (-1.38 - -0.41) |
| Birth order: fourth and higher | | -1.13 (-1.52 - -0.74) | | | -1.35 (-1.76 - -0.94) | -0.3 (-1.07 - 0.46) |

| | | | | | | |
|--|-----------------------|--------------------------|-----------------------|-------------------------|-------------------------|-------------------------|
| Birth year 1987-1990 (reference 1995-2000) | | -0.27 (-0.51 - -0.03) | | | -0.24 (-0.47 - 0.00) | 0.05 (-0.53 - 0.62) |
| Birth year 1991-1994 | | -0.18 (-0.38 - 0.03) | | | -0.16 (-0.36 - 0.05) | -0.03 (-0.39 - 0.33) |
| Household level of education: low (reference: high) | | | | 0.74 (0.22 - 1.26) | 0.53 (-0.01 - 1.07) | |
| Household level of education: medium | | | | 0.23 (-0.07 - 0.54) | 0.19 (-0.11 - 0.50) | |
| Household level of education: medium-high | | | | -0.09 (-0.38 - 0.19) | -0.1 (-0.39 - 0.18) | |
| Household income decile | | | | -0.02 (-0.06 - 0.02) | -0.03 (-0.07 - 0.01) | 0.02 (-0.05 - 0.09) |
| Constant | 1.78 (1.61 - 1.95) | 2.81 (2.54 - 3.08) | 1.52 (1.31 - 1.72) | 1.82 (1.41 - 2.23) | 2.66 (2.20 - 3.12) | 2.47 (1.84 - 3.09) |
| Observations | 106,652 | 106,652 | 106,652 | 106,652 | 106,652 | 106,652 |
| Number of siblings | | | | | | 45,537 |

Appendix Table 2: Change in probability of preterm (95% confidence intervals)

| | Model 1: unadjusted (child's sex) | Model 2: Model 1 + child characteristics | Model 3: Model 1 + maternal characteristics | Model 4: Model 1 + hh sociodemographic variables | Model 5: fully adjusted | Model 6: Model 5 + sibling fixed effects |
|--|--|---|--|---|------------------------------------|---|
| Girl | -0.68 (-0.90 - -0.46) | -0.68 (-0.90 - -0.46) | -0.68 (-0.91 - -0.46) | -0.68 (-0.91 - -0.46) | -0.69 (-0.91 - -0.46) | -0.59 (-0.86 - -0.32) |
| Maternal age 10-19 (reference: 25-29) | | | 0.51 (-0.47 - 1.49) | | -0.17 (-1.18 - 0.84) | 0.74 (-0.56 - 2.05) |
| Maternal age 20-24 | | | 0.52 (0.14 - 0.90) | | 0.27 (-0.12 - 0.66) | 0.51 (-0.04 - 1.07) |
| Maternal age 30-34 | | | -0.05 (-0.35 - 0.25) | | 0.19 (-0.12 - 0.50) | -0.24 (-0.73 - 0.26) |
| Maternal age 35-39 | | | 0.48 (-0.02 - 0.98) | | 0.83 (0.32 - 1.34) | 0.4 (-0.50 - 1.30) |
| Maternal age 40+ | | | 1.37 (0.26 - 2.49) | | 1.79 (0.67 - 2.92) | 0.36 (-1.25 - 1.96) |
| Mother smoked during pregnancy | | | 0.76 (0.36 - 1.17) | | 0.66 (0.25 - 1.07) | 0.5 (-0.20 - 1.21) |
| Birth order: second (reference first) | | -1.36 (-1.62 - -1.10) | | | -1.41 (-1.67 - -1.15) | -1.22 (-1.55 - -0.90) |
| Birth order: third | | -1.77 (-2.12 - -1.42) | | | -1.87 (-2.23 - -1.51) | -1.25 (-1.86 - -0.64) |
| Birth order: fourth and higher | | -1.23 (-1.75 - -0.71) | | | -1.5 (-2.04 - -0.96) | -0.31 (-1.28 - 0.66) |

| | | | | | | |
|--|-----------------------|--------------------------|-------------------------|-----------------------|-------------------------|------------------------|
| Birth year 1987-1990 (reference 1995-2000) | | -0.24 (-0.55 - 0.07) | | | -0.21 (-0.53 - 0.10) | 0.11 (-0.62 - 0.84) |
| Birth year 1991-1994 | | -0.27 (-0.53 - -0.01) | | | -0.24 (-0.51 - 0.02) | 0.06 (-0.39 - 0.52) |
| Household level of education: low (reference: high) | | | 0.52 (-0.13 - 1.18) | | 0.48 (-0.20 - 1.16) | |
| Household level of education: medium | | | 0.33 (-0.07 - 0.73) | | 0.35 (-0.05 - 0.75) | |
| Household level of education: medium-high | | | 0.14 (-0.24 - 0.51) | | 0.14 (-0.24 - 0.52) | |
| Household income decile | | | -0.03 (-0.08 - 0.02) | | -0.04 (-0.09 - 0.01) | 0 (0.00 - 0.17) |
| Constant | 3.62 (3.39 - 3.84) | 4.8 (4.45 - 5.15) | 3.5 (3.22 - 3.78) | 3.59 (3.05 - 4.13) | 4.67 (4.05 - 5.30) | 3.83 (3.04 - 4.62) |
| Observations | 106,652 | 106,652 | 106,652 | 106,652 | 106,652 | 106,652 |
| Number of siblings | | | | | | 45,537 |

Appendix Table 3: Change in probability of LBW and preterm on the full sample, with 95% CI (Linear models)

| | Low birth weight | | | | Preterm | | | |
|------------------------|---------------------------------------|----------------|----------------------------|----------------|---------------------------------------|---------------|----------------------------|----------------|
| | Model 1: unadjusted (child sex) | | Model 5: fully adjusted | | Model 1: unadjusted (child sex) | | Model 5: fully adjusted | |
| | B | 95% CI | β | 95% CI | B | 95% CI | β | 95% CI |
| Paternal age ≤ 24 | 0.78 | (0.48 - 1.08) | 0.03 | (-0.35 - 0.40) | 0.86 | (0.50 - 1.23) | -0.07 | (-0.52 - 0.39) |
| Paternal age 25-29 | 0.11 | (-0.08 - 0.30) | 0.00 | (-0.21 - 0.21) | 0.24 | (0.00 - 0.48) | 0.02 | (-0.25 - 0.29) |
| Paternal age 30-34 | | 0.000 | | 0.000 | | 0.000 | | 0.000 |
| Paternal age 35-39 | 0.44 | (0.21 - 0.67) | 0.15 | (-0.10 - 0.40) | 0.57 | (0.28 - 0.86) | 0.25 | (-0.06 - 0.55) |
| Paternal age ≥ 40 | 1.52 | (1.17 - 1.87) | 0.7 | (0.31 - 1.10) | 1.73 | (1.31 - 2.15) | 0.75 | (0.28 - 1.22) |
| Constant | 2.21 | (2.06 - 2.36) | 3.03 | (2.63 - 3.44) | 4.06 | (3.86 - 4.26) | 4.83 | (4.31 - 5.34) |
| Number of observations | | 159,225 | | 159,225 | | 159,225 | | 159,225 |

Model 5 adjusted for child birth order, child birth year, maternal age at birth, maternal smoking during pregnancy, household income and household education. Standard errors are clustered at the family level.