# Maternal Depression, Parental Investment, and Child Cognitive Development in Ghana

### Tables and Results

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February 2026
Draft 1

# Contents

# 1 Summary Statistics

**Table 1:** Summary Statistics: Full Analysis Sample

|  | N | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| Child age (years) | 13,746 | 10.470 | 3.680 | 0.000 | 17.000 |
| Child is female | 13,746 | 0.473 | 0.499 | 0.000 | 1.000 |
| Raven's score (0–12) | 12,507 | 2.154 | 1.195 | 0.000 | 7.000 |
| Digit span forward (0–8) | 12,520 | 0.000 | 0.000 | 0.000 | 0.000 |
| Digit span backward (0–7) | 8,646 | 0.000 | 0.000 | 0.000 | 0.000 |
| Math score (0–8) | 9,875 | 1.294 | 2.422 | 0.000 | 8.000 |
| English score (0–7) | 9,447 | 1.310 | 2.504 | 0.000 | 7.000 |
| Cognitive index (std. avg.) | 12,507 | 0.004 | 0.918 | -1.879 | 4.167 |
| Height-for-age z-score | 13,088 | 0.259 | 0.952 | -3.722 | 22.060 |
| Weight-for-age z-score | 13,091 | 0.258 | 0.850 | -1.703 | 9.700 |
| Mother's age | 13,746 | 42.197 | 13.321 | 15.000 | 104.000 |
| Mother's K10 depression score (10–50) | 13,746 | 18.808 | 6.251 | 1.000 | 46.000 |
| Mother depressed (K10 $\geq$ 20) | 13,746 | 0.421 | 0.494 | 0.000 | 1.000 |
| Mother's education (years) | 1,396 | 6.224 | 2.784 | 0.000 | 12.000 |
| Mother's weekly work hours | 734 | 39.542 | 18.985 | 4.000 | 120.000 |
| Reading/homework time w/ child (hrs) | 3,788 | 0.970 | 2.094 | 0.000 | 24.000 |
| Total time with child (hrs) | 3,762 | 2.610 | 3.072 | 0.000 | 37.000 |
| Provides care for children | 8,706 | 0.442 | 0.497 | 0.000 | 1.000 |
| Household size | 13,746 | 5.860 | 2.334 | 2.000 | 19.000 |
| Log per capita consumption | 13,718 | 3.916 | 0.830 | -1.253 | 6.827 |

Source: Ghana Socioeconomic Panel Survey (GSPS), Waves 1–3.

Sample restricted to mother–child pairs with non-missing maternal depression (K10)

and at least one child cognitive test score.

**Table 2:** Summary Statistics by Maternal Depression Status

|  | Not Depressed mean | Depressed mean | Difference b | t |
|---|---|---|---|---|
| Child age (years) | 10.487 | 10.446 | 0.041 | (0.64) |
| Child is female | 0.476 | 0.470 | 0.006 | (0.67) |
| Raven's score | 2.158 | 2.148 | 0.010 | (0.45) |
| Digit span forward | 0.000 | 0.000 | 0.000 | (.) |
| Digit span backward | 0.000 | 0.000 | 0.000 | (.) |
| Math score | 1.352 | 1.207 | 0.145*** | (2.96) |
| English score | 1.336 | 1.270 | 0.066 | (1.27) |
| Cognitive index | 0.008 | -0.001 | 0.009 | (0.53) |
| Height-for-age z-score | 0.247 | 0.276 | -0.030* | (-1.76) |
| Weight-for-age z-score | 0.278 | 0.230 | 0.048*** | (3.20) |
| Mother's age | 41.195 | 43.576 | -2.380*** | (-10.26) |
| Mother's education (years) | 6.502 | 5.932 | 0.570*** | (3.85) |
| Mother's weekly work hours | 40.905 | 36.920 | 3.984*** | (2.64) |
| Reading/homework time (hrs) | 0.848 | 1.188 | -0.340*** | (-4.20) |
| Total child time (hrs) | 2.396 | 2.992 | -0.595*** | (-5.13) |
| Provides childcare | 0.430 | 0.463 | -0.033*** | (-3.00) |
| Household size | 5.697 | 6.083 | -0.386*** | (-9.41) |
| Log per capita consumption | 3.993 | 3.811 | 0.182*** | (13.00) |

Source: Ghana Socioeconomic Panel Survey (GSPS), Waves 1–3.

Not Depressed: K10 score < 20. Depressed: K10 score $\geq$ 20.

$t$-statistics of the difference in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

**Table 3:** Summary Statistics by Survey Wave

| | Wave 1 (2009) | | | Wave 2 (2012) | | | Wave 3 (2018) | | |
|---|---|---|---|---|---|---|---|---|---|
| | mean | sd | count | mean | sd | count | mean | sd | count |
| Child age | 10.159 | (3.756) | 5038 | 10.503 | (3.641) | 4508 | 10.808 | (3.597) | 4200 |
| Child is female | 0.487 | (0.500) | 5038 | 0.467 | (0.499) | 4508 | 0.464 | (0.499) | 4200 |
| Raven's score | 2.179 | (1.152) | 4333 | 2.143 | (1.215) | 3974 | 2.138 | (1.220) | 4200 |
| Digit span forward | 0.000 | (0.000) | 4346 | 0.000 | (0.000) | 3974 | 0.000 | (0.000) | 4200 |
| Digit span backward | 0.000 | (0.000) | 472 | 0.000 | (0.000) | 3974 | 0.000 | (0.000) | 4200 |
| Math score | 0.000 | (0.000) | 2756 | 0.000 | (0.000) | 2919 | 3.042 | (2.911) | 4200 |
| English score | 0.000 | (0.000) | 2328 | 0.000 | (0.000) | 2919 | 2.947 | (3.046) | 4200 |
| Cognitive index | 0.004 | (0.995) | 4333 | 0.003 | (0.996) | 3974 | 0.006 | (0.743) | 4200 |
| Height-for-age z-score | 0.352 | (0.793) | 4917 | 0.361 | (0.790) | 4164 | 0.039 | (1.212) | 4007 |
| Weight-for-age z-score | 0.284 | (0.903) | 4920 | 0.285 | (0.913) | 4164 | 0.197 | (0.698) | 4007 |
| Mother's age | 42.691 | (12.775) | 5038 | 38.897 | (14.229) | 4508 | 45.147 | (12.128) | 4200 |
| K10 depression score | 20.852 | (6.178) | 5038 | 17.194 | (5.553) | 4508 | 18.089 | (6.380) | 4200 |
| Mother depressed (K10 $\geq$ 20) | 0.559 | (0.497) | 5038 | 0.309 | (0.462) | 4508 | 0.376 | (0.484) | 4200 |
| Reading/homework time | . | (.) | 0 | 0.461 | (1.006) | 2417 | 1.868 | (3.011) | 1371 |
| Total child time | . | (.) | 0 | 2.086 | (2.138) | 2417 | 3.551 | (4.101) | 1345 |
| Household size | 6.125 | (2.406) | 5038 | 5.607 | (2.238) | 4508 | 5.813 | (2.315) | 4200 |
| Log per capita consumption | 3.396 | (0.641) | 5025 | 4.132 | (0.716) | 4503 | 4.309 | (0.828) | 4190 |

Source: Ghana Socioeconomic Panel Survey (GSPS).
Standard deviations in parentheses.

**Table 4:** Distribution of Maternal Depression Severity by Wave

|   | N | % |
|---|---|---|
| **1** | | |
| 0 | 2212 | (44.0) |
| 1 | 1457 | (29.0) |
| 2 | 912 | (18.1) |
| 3 | 446 | (8.9) |
| **2** | | |
| 0 | 3117 | (69.1) |
| 1 | 898 | (19.9) |
| 2 | 357 | (7.9) |
| 3 | 136 | (3.0) |
| **3** | | |
| 0 | 2618 | (62.4) |
| 1 | 857 | (20.4) |
| 2 | 497 | (11.8) |
| 3 | 226 | (5.4) |

K10 categories: Low (10–19), Mild (20–24), Moderate (25–29), Severe (30–50).

**Table 5:** Correlation Matrix: Key Variables

| | m_k10_score | cog_index | ravens_correct | math_correct | english_correct | haz_approx | m_read_hw_time |
|---|---|---|---|---|---|---|---|
| K10 Depression | 1.000 | | | | | | |
| Cognitive Index | 0.015 | 1.000 | | | | | |
| Raven's | 0.011 | 0.757*** | 1.000 | | | | |
| Math | 0.072*** | 0.424*** | 0.034* | 1.000 | | | |
| English | 0.090*** | 0.434*** | 0.036* | 0.901*** | 1.000 | | |
| HAZ | -0.027 | 0.063*** | 0.001 | -0.015 | -0.007 | 1.000 | |
| Read/HW Time | 0.134*** | 0.016 | 0.031 | 0.178*** | 0.195*** | -0.086*** | 1.000 |
| Total Child Time | 0.149*** | 0.020 | 0.041** | 0.136*** | 0.157*** | -0.080*** | 0.744*** |
| Ln(PC Consump.) | 0.003 | 0.003 | -0.005 | 0.159*** | 0.159*** | -0.006 | 0.077*** |

Source: GSPS analysis sample.

*** p<0.01, ** p<0.05, * p<0.1

$* \ p < 0.10, \ ** \ p < 0.05, \ *** \ p < 0.01$

# 2 Main Estimation Results

**Table 6:** Effect of Maternal Depression on Child Cognitive Development

| | (1) OLS | (2) OLS | (3) OLS | (4) OLS | (5) EA FE | (6) Child FE |
|---|---|---|---|---|---|---|
| Maternal depression (std. K10) | -0.007 | -0.010 | -0.003 | -0.003 | 0.006 | 0.014 |
| | (0.010) | (0.010) | (0.032) | (0.032) | (0.049) | (0.019) |
| Child age | | 0.055*** | 0.018* | 0.017* | 0.016 | 0.009 |
| | | (0.003) | (0.010) | (0.010) | (0.011) | (0.015) |
| Mother's age | | | 0.000 | 0.001 | 0.003 | |
| | | | (0.003) | (0.003) | (0.004) | |
| Mother's education (years) | | | 0.016 | 0.015 | 0.032*** | |
| | | | (0.011) | (0.012) | (0.012) | |
| Household size | | | | -0.005 | -0.004 | 0.022* |
| | | | | (0.016) | (0.021) | (0.013) |
| Log per capita consumption | | | | 0.084* | 0.130 | |
| | | | | (0.047) | (0.082) | |
| EA/Child FE | No | No | No | No | Yes | Child FE |
| Wave FE | No | No | No | No | Yes | Yes |
| Observations | 11,981 | 11,981 | 1,243 | 1,242 | 1,213 | 6,583 |
| $R^2$ | 0.000 | 0.039 | 0.005 | 0.008 | 0.213 | 0.482 |
| Adj. $R^2$ | -0.000 | 0.039 | 0.001 | 0.003 | 0.028 | 0.059 |

Standard errors in parentheses

Standard errors clustered at the EA level in parentheses.

Dependent variable: composite cognitive index (average of standardized

Raven's, digit span forward/backward, math, and English scores).

*** p<0.01, ** p<0.05, * p<0.1

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

**Table 7:** Effect of Maternal Depression on Child Cognitive Development (Revised)

| | Full Sample | | | Educ Sample | Full | Ages 5–10 |
|---|---|---|---|---|---|---|
| | (1)<br>OLS | (2)<br>OLS | (3)<br>EA FE | (4)<br>EA FE | (5)<br>Child FE | (6)<br>EA FE |
| Maternal depression (std. K10) | -0.007 | -0.005 | 0.002 | 0.006 | 0.014 | 0.001 |
| | (0.010) | (0.009) | (0.010) | (0.049) | (0.019) | (0.013) |
| Child age | | 0.056*** | 0.056*** | 0.016 | 0.009 | 0.083*** |
| | | (0.003) | (0.003) | (0.011) | (0.015) | (0.007) |
| Mother's age | | -0.001* | -0.002** | 0.003 | | -0.003** |
| | | (0.001) | (0.001) | (0.004) | | (0.001) |
| Mother's education (years) | | | | 0.032*** | | |
| | | | | (0.012) | | |
| Household size | | -0.016*** | 0.004 | -0.004 | 0.022* | 0.011** |
| | | (0.004) | (0.005) | (0.021) | (0.013) | (0.006) |
| Log per capita consumption | | 0.011 | 0.008 | 0.130 | | 0.013 |
| | | (0.013) | (0.015) | (0.082) | | (0.020) |
| EA/Child FE | No | No | Yes | Yes | Child FE | Yes |
| Wave FE | No | No | Yes | Yes | Yes | Yes |
| Observations | 11,981 | 11,958 | 11,958 | 1,213 | 6,583 | 6,560 |
| $R^2$ | 0.000 | 0.042 | 0.085 | 0.213 | 0.482 | 0.120 |
| Adj. $R^2$ | -0.000 | 0.041 | 0.058 | 0.028 | 0.059 | 0.071 |

Standard errors clustered at the EA level in parentheses.

Columns (1)–(3) and (5)–(6) exclude maternal education to preserve the full sample.

Column (4) includes maternal education, restricting sample to ~10% of observations.

Column (6) restricts to children aged 5–10.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

**Table 8:** Additional Specifications: Depression and Child Cognitive Outcomes

| | (1) Ravens | (2) Binary | (3) Severity | (4) Age Int. | La |
|---|---|---|---|---|---|
| Maternal depression (std. K10) | -0.005 (0.012) | | | 0.006 (0.030) | |
| Depressed (K10 ≥ 20) | | 0.006 (0.021) | | | |
| Mild (K10: 20–24) | | | 0.017 (0.024) | | |
| Moderate (K10: 25–29) | | | -0.008 (0.031) | | |
| Severe (K10: 30–50) | | | -0.015 (0.044) | | |
| Depression × Child age | | | | -0.000 (0.003) | |
| Lagged depression (std. K10, $t-1$) | | | | | ( (( |
| Persistent depression (≥ 2 waves) | | | | | |
| Child age | 0.015*** (0.003) | 0.056*** (0.003) | 0.056*** (0.003) | 0.056*** (0.003) | 0.0 ( |
| Specification | Ravens only | Binary dep | Severity cats | Age interaction | Lagg |
| Fixed Effects | EA + Wave | EA + Wave | EA + Wave | EA + Wave | EA |
| Observations | 11,958 | 11,958 | 11,948 | 11,958 | 3 |
| $R^2$ | 0.043 | 0.085 | 0.085 | 0.085 | ( |

Standard errors clustered at the EA level in parentheses.

All specifications exclude maternal education to preserve the full sample.

All include EA and wave FE, child age, gender, mother's age, HH size, and log PC consumption.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

**Table 9:** Heterogeneous Effects by Child Age Group (Full Sample, No Education Control)

|  | (1) Ages 0–4 | (2) Ages 5–9 | (3) Ages 10–14 | (4) Ages 15–17 | (5) Interactions |
|---|---|---|---|---|---|
| Depression (std. K10) | -7.352*** | -0.007 | 0.030** | -0.049 | -0.091 |
|  | (0.000) | (0.014) | (0.015) | (0.031) | (0.163) |
| Dep × Ages 0–4 |  |  |  |  | 0.000 |
|  |  |  |  |  | (.) |
| Dep × Ages 5–9 |  |  |  |  | 0.090 |
|  |  |  |  |  | (0.165) |
| Dep × Ages 10–14 |  |  |  |  | 0.114 |
|  |  |  |  |  | (0.165) |
| Dep × Ages 15–17 |  |  |  |  | 0.039 |
|  |  |  |  |  | (0.166) |
| Fixed Effects | EA + Wave | EA + Wave | EA + Wave | EA + Wave | EA + Wave |
| Observations | 6 | 5,463 | 5,135 | 1,290 | 11,958 |
| $R^2$ | 1.000 | 0.139 | 0.119 | 0.290 | 0.087 |

Standard errors clustered at the EA level in parentheses.

Full sample (no maternal education control). Column (1) has only 6 obs and is uninformative.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

**Table 10:** Effect of Maternal Depression on Individual Cognitive Tests

|  | (1) ravens_std | (2) cog_index |
|---|---|---|
| Maternal depression (std. K10) | 0.006 | 0.006 |
|  | (0.049) | (0.049) |
| Controls | Yes | Yes |
| Fixed Effects | EA + Wave | EA + Wave |
| Observations | 1,213 | 1,213 |
| $R^2$ | 0.213 | 0.213 |

Standard errors in parentheses

Standard errors clustered at the EA level in parentheses.

All models include EA and wave fixed effects.

Controls: child age, child gender, mother's age, mother's education, household size, and log per capita consumption.

*** p<0.01, ** p<0.05, * p<0.1

$^{*}$ $p < 0.10$, $^{**}$ $p < 0.05$, $^{***}$ $p < 0.01$

**Table 11:** Effect of Maternal Depression (Binary) on Child Cognitive Outcomes

|  | (1) Cog Index | (2) Cog Index | (3) Raven's |
|---|---|---|---|
| Mother depressed (K10 $\geq$ 20) | 0.023 | 0.013 | 0.013 |
|  | (0.066) | (0.094) | (0.094) |
| Child controls | Yes | Yes | Yes |
| Maternal controls | Yes | Yes | Yes |
| Household controls | Yes | Yes | Yes |
| Observations | 1,242 | 1,213 | 1,213 |
| $R^2$ | 0.008 | 0.213 | 0.213 |

Standard errors in parentheses

Standard errors clustered at the EA level in parentheses.

Depressed = K10 score $\geq$ 20 (mild, moderate, or severe depression).

*** p<0.01, ** p<0.05, * p<0.1

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

**Table 12:** Effect of Maternal Depression Severity on Child Cognitive Outcomes

|  | (1) Cog Index | (2) Raven's |
|---|---|---|
| Mild depression (K10: 20–24) | 0.027 | 0.027 |
|  | (0.107) | (0.107) |
| Moderate depression (K10: 25–29) | -0.003 | -0.003 |
|  | (0.127) | (0.127) |
| Severe depression (K10: 30–50) | -0.110 | -0.110 |
|  | (0.153) | (0.153) |
| Controls | Yes | Yes |
| Observations | 1,208 | 1,208 |
| $R^2$ | 0.210 | 0.210 |

Standard errors in parentheses

Standard errors clustered at the EA level in parentheses.

Reference category: Low/no depression (K10: 10–19).

All models include EA and wave fixed effects.

*** p<0.01, ** p<0.05, * p<0.1

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

**Table 13:** Effect of Maternal Depression on Child Anthropometry

|  | (1) HAZ | (2) WAZ | (3) HAZ | (4) WAZ |
|---|---|---|---|---|
| Maternal depression (std. K10) | 0.030 | 0.026 |  |  |
|  | (0.025) | (0.028) |  |  |
| Mother depressed (K10 $\geq$ 20) |  |  | 0.077 | 0.087* |
|  |  |  | (0.057) | (0.047) |
| Controls | Yes | Yes | Yes | Yes |
| Observations | 1,329 | 1,333 | 1,329 | 1,333 |
| $R^2$ | 0.738 | 0.744 | 0.738 | 0.745 |

Standard errors in parentheses

Standard errors clustered at the EA level in parentheses.

HAZ = height-for-age z-score. WAZ = weight-for-age z-score.

*** p<0.01, ** p<0.05, * p<0.1

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

**Table 14:** Heterogeneous Effects of Maternal Depression by Child Age Group

|  | (1) Ages 0–4 | (2) Ages 5–9 |
|---|---|---|
| Maternal depression (std. K10) | 0.025 | 0.069 |
|  | (0.081) | (0.095) |
| Controls | Yes | Yes |
| Observations | 613 | 413 |
| $R^2$ | 0.335 | 0.300 |

Standard errors in parentheses

Standard errors clustered at the EA level in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

$^*$ $p < 0.10$, $^{**}$ $p < 0.05$, $^{***}$ $p < 0.01$

**Table 15:** Heterogeneous Effects of Maternal Depression by Child Gender

|  | (1)<br>Girls | (2)<br>Boys | (3)<br>Interaction |
|---|---|---|---|
| Maternal depression (std. K10) | -0.014 | -0.051 | 0.004 |
|  | (0.072) | (0.063) | (0.058) |
| Child is female |  |  | 0.067 |
|  |  |  | (0.064) |
| Depression $\times$ Female child |  |  | 0.003 |
|  |  |  | (0.063) |
| Controls | Yes | Yes | Yes |
| EA FE | No | No | No |
| Wave FE | No | No | No |
| Observations | 541 | 566 | 1,213 |
| $R^2$ | 0.328 | 0.289 | 0.213 |

Standard errors in parentheses

Standard errors clustered at the EA level in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

$*\ p < 0.10,\ ** \ p < 0.05,\ *** \ p < 0.01$

# 3 Mechanism and Channel Analysis

**Table 16:** Channel 1: Maternal Depression and Parental Time Investment

|  | (1)<br>Read/HW Hrs |
| --- | --- |
| Maternal depression (std. K10) | -0.278** |
|  | (0.110) |
| Maternal controls | Yes |
| Household controls | Yes |
| Observations | 1,081 |
| $R^2$ | 0.566 |

Standard errors in parentheses

Standard errors clustered at the EA level in parentheses.

Dependent variables: (1)–(2) hours per day mother spends reading/doing homework and total time with child; (3) binary indicator for providing childcare; (4) days per week of childcare.

*** p<0.01, ** p<0.05, * p<0.1

$^*$ $p < 0.10$, $^{**}$ $p < 0.05$, $^{***}$ $p < 0.01$

**Table 17:** Channel 2: Maternal Depression and Financial Investment in Children

| | (1) Ln(Food Exp) | (2) Food Share | (3) Ln(PC Food) | (4) Ln(Food Exp) | (5) Food Sh |
|---|---|---|---|---|---|
| Maternal depression (std. K10) | -0.039 | 0.001 | -0.031 | | |
| | (0.036) | (0.011) | (0.035) | | |
| Maternal controls | Yes | Yes | Yes | Yes | Yes |
| Household controls | Yes | Yes | Yes | Yes | Yes |
| Observations | 1,362 | 1,361 | 1,362 | 1,362 | 1,36 |
| $R^2$ | 0.639 | 0.587 | 0.643 | 0.638 | 0.590 |

Standard errors in parentheses

Standard errors clustered at the EA level in parentheses.

Food expenditure includes own-produced and purchased food (Section 11a).

Food share = food expenditure / total consumption.

*** p<0.01, ** p<0.05, * p<0.1

$^{*}$ $p < 0.10$, $^{**}$ $p < 0.05$, $^{***}$ $p < 0.01$

**Table 18:** Channel 3: Maternal Depression and Child Nutritional Status

|  | (1) HAZ | (2) WAZ | (3) HAZ (dyn.) | (4) Arm Circ. |
|---|---|---|---|---|
| Maternal depression (std. K10) | 0.030 | 0.026 | -0.038 |  |
|  | (0.025) | (0.028) | (0.159) |  |
| Lagged HAZ (t-1) |  |  |  |  |
| Child controls | Yes | Yes | Yes | Yes |
| Maternal controls | Yes | Yes | Yes | Yes |
| Household controls | Yes | Yes | Yes | Yes |
| Observations | 1,329 | 1,333 | 1,335 | 1,329 |
| $R^2$ | 0.738 | 0.744 | 0.498 | 0.738 |

Standard errors in parentheses

Standard errors clustered at the EA level in parentheses.

HAZ = height-for-age z-score; WAZ = weight-for-age z-score.

Column 3 includes lagged HAZ to estimate dynamic persistence.

*** p<0.01, ** p<0.05, * p<0.1

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

**Table 19:** Channel 4: Depression, Parental Stimulation Quality, and Child Cognition

|  | (1) Cog Index |
|---|---|
| Maternal depression (std. K10) |  |
| Reading/homework time (hrs) |  |
| Total child time (hrs) |  |
| Depression × Read time |  |
| Depression × Total time |  |
| Child controls | Yes |
| Maternal controls | Yes |
| Household controls | Yes |
| Observations | 1,329 |
| $R^2$ | 0.738 |

Standard errors in parentheses

Standard errors clustered at the EA level in parentheses.

A negative coefficient on Depression × Read time implies

depressed mothers generate less cognitive gain per hour of stimulation.

*** p<0.01, ** p<0.05, * p<0.1

$^*$ $p < 0.10$, $^{**}$ $p < 0.05$, $^{***}$ $p < 0.01$

**Table 20:** Mediation Analysis: Sequential Decomposition of Depression Effect

|  | (1)<br>Base |
| --- | --- |
| Maternal depression (std. K10) | 0.006 |
|  | (0.049) |
| Reading/homework time |  |
| Total child time |  |
| Height-for-age z-score |  |
| Log food expenditure |  |
| Depression $\times$ Read time |  |
| Child controls | Yes |
| Maternal controls | Yes |
| Household controls | Yes |
| Observations | 1,213 |
| $R^2$ | 0.213 |

Standard errors in parentheses
Standard errors clustered at the EA level in parentheses.
This table sequentially adds mediator variables to decompose
the total effect of maternal depression on child cognition.
A reduction in the depression coefficient indicates mediation.
*** p<0.01, ** p<0.05, * p<0.1
$^{*}$ $p < 0.10$, $^{**}$ $p < 0.05$, $^{***}$ $p < 0.01$

**Table 21:** Supplementary Channel: Maternal Depression and Child Health

|  | (1)<br>Ill (2 wks) | (2)<br>Days Sick | (3)<br>Sought Care | (4)<br>Immun. Rate |
|---|---|---|---|---|
| Maternal depression (std. K10) | -0.021 | 0.000 | -0.003 | 0.004 |
|  | (0.015) | (.) | (0.007) | (0.014) |
| Child controls | Yes | Yes | Yes | Yes |
| Maternal controls | Yes | Yes | Yes | Yes |
| Household controls | Yes | Yes | Yes | Yes |
| Observations | 1,365 | 2 | 1,259 | 1,365 |
| $R^2$ | 0.280 | . | 0.203 | 0.516 |

Standard errors in parentheses

Standard errors clustered at the EA level in parentheses.

Column 3 conditional on child being ill in past 2 weeks.

Immunization rate = vaccines received / 7 recommended vaccines.

*** p<0.01, ** p<0.05, * p<0.1

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

# 4 Appendix: Robustness Checks

**Table 22:** Robustness: Alternative Depression Measures

|  | (1) Std. K10 | (2) Raw K10 | (3) Binary | (4) Categories |
|---|---|---|---|---|
| K10 score (standardized) | 0.006 (0.049) |  |  |  |
| 0.c_female | 0.000 (.) | 0.000 (.) | 0.000 (.) | 0.000 (.) |
| K10 score (raw, 10–50) |  | 0.001 (0.008) |  |  |
| Depressed (K10 $\geq$ 20) |  |  | 0.013 (0.094) |  |
| Mild (K10: 20–24) |  |  |  | 0.027 (0.107) |
| Moderate (K10: 25–29) |  |  |  | -0.003 (0.127) |
| Severe (K10: 30–50) |  |  |  | -0.110 (0.153) |
| _cons | -0.858** (0.389) | -0.876** (0.426) | -0.861** (0.390) | -0.791** (0.391) |
| Controls | Yes | Yes | Yes | Yes |
| Observations | 1,213 | 1,213 | 1,213 | 1,208 |
| $R^2$ | 0.213 | 0.213 | 0.213 | 0.210 |

Standard errors in parentheses

Standard errors clustered at the EA level in parentheses.

Dependent variable: composite cognitive index.

All models include EA and wave fixed effects.

*** p<0.01, ** p<0.05, * p<0.1

$^*$ $p < 0.10$, $^{**}$ $p < 0.05$, $^{***}$ $p < 0.01$

**Table 23:** Robustness: Alternative Fixed Effects Specifications

| | (1)<br>Pooled OLS | (2)<br>EA FE | (3)<br>District FE | (4)<br>Region× | (5)<br>HH FE | (6)<br>Child FE |
|---|---|---|---|---|---|---|
| Maternal depression (std. K10) | -0.003 | 0.006 | 0.010 | 0.006 | 0.011 | 0.017 |
| | (0.032) | (0.049) | (0.035) | (0.049) | (0.015) | (0.018) |
| c_age | 0.017* | 0.016 | 0.016 | 0.016 | 0.056*** | 0.050*** |
| | (0.010) | (0.011) | (0.010) | (0.011) | (0.003) | (0.005) |
| 0.c_female | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |
| | (.) | (.) | (.) | (.) | (.) | |
| 1.c_female | -0.000 | 0.068 | 0.028 | 0.068 | 0.054** | |
| | (0.056) | (0.064) | (0.060) | (0.064) | (0.021) | |
| m_age_harmonized | 0.001 | 0.003 | 0.003 | 0.003 | | |
| | (0.003) | (0.004) | (0.003) | (0.004) | | |
| m_mother_educ_years | 0.015 | 0.032*** | 0.022** | 0.032*** | | |
| | (0.012) | (0.012) | (0.011) | (0.012) | | |
| hh_size | -0.005 | -0.004 | -0.008 | -0.004 | 0.007 | 0.025* |
| | (0.016) | (0.021) | (0.017) | (0.021) | (0.010) | (0.013) |
| ln_pc_consumption | 0.084* | 0.130 | 0.100 | 0.130 | | |
| | (0.047) | (0.082) | (0.063) | (0.082) | | |
| 1.wave | 0.000 | | | | | |
| | (.) | | | | | |
| _cons | -0.458* | -0.858** | -0.660** | -0.858** | -0.627*** | -0.567*** |
| | (0.276) | (0.389) | (0.325) | (0.391) | (0.067) | (0.092) |
| Observations | 1,242 | 1,213 | 1,237 | 1,213 | 11,319 | 6,583 |
| $R^2$ | 0.008 | 0.213 | 0.112 | 0.213 | 0.286 | 0.478 |

Standard errors in parentheses

Standard errors clustered at the EA level in parentheses.

Dependent variable: composite cognitive index.

*** p<0.01, ** p<0.05, * p<0.1

$^{*}\ p < 0.10,\ ^{**}\ p < 0.05,\ ^{***}\ p < 0.01$

**Table 24:** Robustness: Subsample Analyses

| | (1) Urban | (2) Rural | (3) Poor | (4) Non-Poor | (5) No Educ | (6) Some Educ |
|---|---|---|---|---|---|---|
| Maternal depression (std. K10) | 0.095 | -0.054 | -0.084 | 0.069 | 0.000 | -0.010 |
| | (0.081) | (0.065) | (0.115) | (0.062) | (.) | (0.050) |
| c_age | 0.009 | 0.020 | 0.033** | -0.002 | 0.113 | 0.015 |
| | (0.018) | (0.013) | (0.016) | (0.015) | (0.196) | (0.011) |
| 0.c_female | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | (.) | (.) | (.) | (.) | (.) | (.) |
| 1.c_female | 0.100 | 0.058 | 0.106 | 0.064 | 1.159 | 0.069 |
| | (0.112) | (0.081) | (0.088) | (0.096) | (0.626) | (0.063) |
| m_age_harmonized | 0.002 | 0.003 | -0.010 | 0.008 | | |
| | (0.007) | (0.005) | (0.007) | (0.005) | | |
| m_mother_educ_years | 0.031 | 0.030* | -0.026 | 0.047*** | | |
| | (0.022) | (0.016) | (0.025) | (0.017) | | |
| hh_size | -0.035 | 0.003 | -0.075*** | 0.038 | 0.000 | -0.010 |
| | (0.036) | (0.027) | (0.028) | (0.030) | (.) | (0.022) |
| ln_pc_consumption | -0.029 | 0.218* | -0.216 | 0.383*** | 0.000 | 0.106 |
| | (0.111) | (0.113) | (0.153) | (0.141) | (.) | (0.086) |
| _cons | -0.089 | -1.137** | 1.282** | -2.229*** | -2.055 | -0.401 |
| | (0.631) | (0.514) | (0.639) | (0.613) | (2.107) | (0.387) |
| Observations | 453 | 760 | 538 | 626 | 11 | 1,200 |
| $R^2$ | 0.228 | 0.211 | 0.309 | 0.264 | 0.498 | 0.215 |

Standard errors in parentheses

Standard errors clustered at the EA level in parentheses.

Poor/Non-poor split at wave-specific median log per capita consumption.

*** p<0.01, ** p<0.05, * p<0.1

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

**Table 25:** Robustness: Value-Added and Lagged Models

|  | (1) VA Model |
|---|---|
| Δ Depression | 0.012 |
|  | (0.019) |
| c_age | -0.005 |
|  | (0.010) |
| 0.c_female | 0.000 |
|  | (.) |
| 1.c_female | -0.032 |
|  | (0.038) |
| 2.wave | 0.000 |
|  | (.) |
| 3.wave | 0.247*** |
|  | (0.056) |
| _cons | 0.158 |
|  | (0.124) |
| Observations | 3,627 |
| $R^2$ | 0.009 |

Standard errors in parentheses

Standard errors clustered at the EA level in parentheses.

Column 4 estimated in first differences (Δ model).

*** p<0.01, ** p<0.05, * p<0.1

$^*$ $p < 0.10$, $^{**}$ $p < 0.05$, $^{***}$ $p < 0.01$

**Table 26:** Robustness: Placebo and Falsification Tests

| | (1) Dept+1 | (2) Cogt+1 | (3) Height (15–17) | (4) Balanced |
|---|---|---|---|---|
| Cognitive index | 0.025 | | | |
| | (0.030) | | | |
| 0.c_female | 0.000 | 0.000 | 0.000 | 0.000 |
| | (.) | (.) | (.) | (.) |
| Maternal depression (std. K10) | | 0.040 | -1.336 | 0.084 |
| | | (0.058) | (2.345) | (0.064) |
| _cons | 0.751 | -0.337 | 56.520 | -1.022* |
| | (0.549) | (0.605) | (51.472) | (0.563) |
| Controls | Yes | Yes | Yes | Yes |
| Observations | 599 | 540 | 74 | 599 |
| $R^2$ | 0.592 | 0.328 | 0.630 | 0.319 |

Standard errors in parentheses

Standard errors clustered at the EA level in parentheses.

Col 1: reverse causality test (current cognition $\rightarrow$ future depression).

Col 2: temporal precedence (current depression $\rightarrow$ future cognition).

Col 3: placebo outcome (adolescent height, largely determined before survey).

Col 4: restricted to children observed in $\geq 2$ waves.

*** p<0.01, ** p<0.05, * p<0.1

$^*$ $p < 0.10$, $^{**}$ $p < 0.05$, $^{***}$ $p < 0.01$

**Table 27:** Robustness: Non-Linear Effects of Maternal Depression

|  | (1) Quadratic | (2) Terciles | (3) Quintiles | (4) Spline |
|---|---|---|---|---|
| Depression (std.) | 0.028 (0.059) | | | |
| Depression$^2$ | -0.025 (0.026) | | | |
| 0.c_female | 0.000 (.) | 0.000 (.) | 0.000 (.) | 0.000 (.) |
| Tercile 2 | | 0.040 (0.108) | | |
| Tercile 3 (most depressed) | | 0.061 (0.127) | | |
| Quintile 2 | | | -0.072 (0.145) | |
| Quintile 3 | | | -0.018 (0.148) | |
| Quintile 4 | | | 0.070 (0.170) | |
| Quintile 5 (most depressed) | | | -0.032 (0.163) | |
| K10 (below 20) | | | | 0.009 (0.018) |
| K10 (above 20) | | | | -0.005 (0.011) |
| _cons | -0.825** (0.387) | -0.891** (0.397) | -0.832** (0.415) | -0.899** (0.407) |
| Controls | Yes | Yes | Yes | Yes |
| Observations | 1,213 | 1,213 | 1,213 | 1,213 |
| $R^2$ | 0.214 | 0.213 | 0.214 | 0.213 |

Standard errors in parentheses

Standard errors clustered at the EA level in parentheses.

Reference: Tercile 1 / Quintile 1 (least depressed).

Spline model allows different slopes below and above K10 = 20.

*** p<0.01, ** p<0.05, * p<0.1

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

**Table 28:** Robustness: Attrition-Corrected Estimates (Inverse Probability Weighting)

|  | (1) IPW-Weighted | (2) Unweighted |
|---|---|---|
| Maternal depression (std. K10) | 0.008 | 0.006 |
|  | (0.049) | (0.049) |
| c_age | 0.016 | 0.016 |
|  | (0.010) | (0.011) |
| 0.c_female | 0.000 | 0.000 |
|  | (.) | (.) |
| 1.c_female | 0.066 | 0.068 |
|  | (0.064) | (0.064) |
| m_age_harmonized | 0.003 | 0.003 |
|  | (0.004) | (0.004) |
| m_mother_educ_years | 0.033*** | 0.032*** |
|  | (0.012) | (0.012) |
| hh_size | -0.003 | -0.004 |
|  | (0.021) | (0.021) |
| ln_pc_consumption | 0.131 | 0.130 |
|  | (0.082) | (0.082) |
| _cons | -0.871** | -0.858** |
|  | (0.388) | (0.389) |
| Observations | 1,213 | 1,213 |
| $R^2$ | 0.214 | 0.213 |

Standard errors in parentheses

Standard errors clustered at the EA level in parentheses.

IPW weights estimated from logit model predicting panel continuation
using depression, age, education, household size, consumption, and wave.
Weights trimmed at 1st and 99th percentiles.

*** p<0.01, ** p<0.05, * p<0.1

$^{*}$ $p < 0.10$, $^{**}$ $p < 0.05$, $^{***}$ $p < 0.01$

**Table 29:** Robustness: Alternative Cognitive Outcome Measures

|  | (1) Raven's | (2) Verbal |
|---|---|---|
| Maternal depression (std. K10) | -0.001 | 0.006 |
|  | (0.012) | (0.049) |
| c_age | 0.003 | 0.016 |
|  | (0.003) | (0.011) |
| 0.c_female | 0.000 | 0.000 |
|  | (.) | (.) |
| 1.c_female | 0.032** | 0.068 |
|  | (0.013) | (0.064) |
| m_age_harmonized | 0.000 | 0.003 |
|  | (0.001) | (0.004) |
| m_mother_educ_years | 0.005* | 0.032*** |
|  | (0.003) | (0.012) |
| hh_size | -0.008** | -0.004 |
|  | (0.004) | (0.021) |
| ln_pc_consumption | 0.015 | 0.130 |
|  | (0.020) | (0.082) |
| _cons | -1.037*** | -0.858** |
|  | (0.109) | (0.389) |
| Observations | 451 | 1,213 |
| $R^2$ | 0.286 | 0.213 |

Standard errors in parentheses

Standard errors clustered at the EA level in parentheses.

Raven's = non-verbal fluid intelligence. Verbal = avg(math, English).

Exec. Function = digit span backward. NEPSY = Wave 3 only.

*** p<0.01, ** p<0.05, * p<0.1

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

**Table 30:** Robustness: Alternative Standard Error Clustering

| | (1)<br>EA Cluster | (2)<br>HH Cluster | (3)<br>District | (4)<br>Two-Way |
|---|---|---|---|---|
| Maternal depression (std. K10) | 0.006 | 0.006 | 0.006 | 0.006 |
| | (0.049) | (0.043) | (0.046) | (.) |
| c_age | 0.016 | 0.016 | 0.016 | 0.016 |
| | (0.011) | (0.011) | (0.011) | (.) |
| 0.c_female | 0.000 | 0.000 | 0.000 | 0.000 |
| | (.) | (.) | (.) | (.) |
| 1.c_female | 0.068 | 0.068 | 0.068 | 0.068 |
| | (0.064) | (0.062) | (0.074) | (.) |
| m_age_harmonized | 0.003 | 0.003 | 0.003 | 0.003 |
| | (0.004) | (0.004) | (0.004) | (.) |
| m_mother_educ_years | 0.032*** | 0.032** | 0.032*** | 0.032 |
| | (0.012) | (0.013) | (0.011) | (.) |
| hh_size | -0.004 | -0.004 | -0.004 | -0.004 |
| | (0.021) | (0.020) | (0.022) | (.) |
| ln_pc_consumption | 0.130 | 0.130* | 0.130 | 0.130 |
| | (0.082) | (0.071) | (0.084) | (.) |
| _cons | -0.858** | -0.858** | -0.858** | -0.858 |
| | (0.389) | (0.349) | (0.390) | (.) |
| Observations | 1,213 | 1,213 | 1,213 | 1,213 |
| $R^2$ | 0.213 | 0.213 | 0.213 | 0.213 |

Standard errors in parentheses

All models include EA and wave fixed effects with full controls.

Point estimates are identical; only standard errors differ.

*** p<0.01, ** p<0.05, * p<0.1

$^*$ $p < 0.10$, $^{**}$ $p < 0.05$, $^{***}$ $p < 0.01$