I Z A Institute of Labor Economics

Initiated by Deutsche Post Foundation

DISCUSSION PAPER SERIES

IZA DP No. 14576

Immigration and the Short- and Long-Term Impact of Improved Prenatal Conditions

Victor Lavy
Analia Schlosser
Adi Shany

JULY 2021

DISCUSSION PAPER SERIES

IZA DP No. 14576

Immigration and the Short- and Long-Term Impact of Improved Prenatal Conditions

Victor Lavy
University of Warwick, Hebrew University, NBER, CEPR and IZA

Adi Shany
Tel Aviv University

Analia Schlosser
Tel Aviv University, CESifo, IZA and CEPR

JULY 2021

ISSN: 2365-9793

IZA – Institute of Labor Economics

Schaumburg-Lippe-Straße 5–9
53113 Bonn, Germany

Phone: +49-228-3894-0
Email: publications@iza.org

www.iza.org

ABSTRACT

Immigration and the Short- and Long-Term Impact of Improved Prenatal Conditions*

This paper investigates the effects of immigration from a developing country to a developed country during pregnancy on offspring's outcomes. We focus on intermediate and long-term outcomes, using quasi-experimental variation created by the immigration of Ethiopian Jews to Israel in May 1991. Individuals conceived before immigration experienced dramatic changes in their environmental conditions at different stages of prenatal development depending on their gestational age at migration. We find that females whose mothers immigrated at an earlier gestational age have lower grade repetition and dropout rates in high school. They also show better cognitive performance during primary and middle school and in the high school matriculation study program. As adults, they have higher post-secondary schooling, employment rates, and earnings than those whose mothers migrated at a later stage of pregnancy.

JEL Classification: I24, I25, I15, J15
Keywords: prenatal, immigration, human capital

Corresponding author:
Analía Schlosser
Tel Aviv University
P.O.B. 39040
Ramat Aviv, Tel Aviv, 69978
Israel
E-mail: analias@tauex.tau.ac.il

* An earlier version of this paper was published as National Bureau of Economic Research (NBER) working paper no. 21894 in 2016. We delayed the current, revised version of the paper in order to allow individuals in our sample to reach the age of university schooling and enter the labor market, thus providing data on long-term outcomes. We thank the Israel Ministry of Education for allowing restricted access to secondary-school data in the Ministry's online protected research lab, and the Israel Central Bureau of Statistics (CBS) and National Insurance Institute (NII) for allowing restricted access to data on post-secondary school economic and social outcomes in their respective protected research labs. We benefited from comments and suggestions from Ran Abramitzky, Gabriella Conti, Pascaline Dupas, Marcel Fafchamps, Grant Miller, Petra Persson, Marcos Vera Hernandez, and seminar participants at the Hebrew University of Jerusalem, the IDC Herzelia, Stanford University, the University of Warwick, the University of York, the Barcelona GSE Summer Forum 2014, the Indian Statistical Institute's 10th Annual Conference on Economic Growth and Development (2014), the World Bank's 8th International Conference on Migration and Development (2015), the 4th SOLE/EALE World Conference in Montreal (2015), the Copenhagen Education Network Workshop 2015, and the NBER's 2015 Summer Institute conference in health economics. Lavy acknowledges financial support from the European Research Council (ERC) through ERC Advanced Grant no. 323439, and from the Maurice Falk Institute for Economic Research in Israel at the Hebrew University. Schlosser acknowledges financial support from the Pinhas Sapir Center for Development and the Foerder Institute for Economic Research, both at Tel Aviv University. Shany acknowledges financial support from the Henry Crown Institute of Business Research at Tel Aviv University.

1 Introduction

A growing body of evidence suggests that where a child grows up influences their adult income, education, and social outcomes, while moving to the more advantaged neighborhood has large benefits, particularly for young children (Chetty et al., 2016, Chetty and Hendren, 2018, Chyn, 2018, Deutscher, 2020). This evidence has significant implications for developed countries hosting immigrants from developing countries. Studies on the economic integration of first- and second-generation low-skilled immigrants and refugees show that both children's age at immigration and years spent by parents in the host country play a central role in children's health, educational, and labor market outcomes (Böhlmark, 2008, Corak, 2012, Nielsen and Rangvid, 2012, Stillman et al., 2012, Van den Berg et al., 2014, Lemmermann and Riphahn, 2018, Basu, 2018). In light of the well-established literature on the importance of the intrauterine environment for health, cognitive and non-cognitive skills, and labor market outcomes later in life (see reviews by Almond and Currie, 2011, Currie and Vogl, 2013 and Almond et al., 2018), it is essential to understand how moving to more advantaged places even before birth, while in utero, affect long term outcomes. Evidence on this, however, is still scant.

This paper brings the "in-utero" literature to the migration context and provides new insights into migration's intergenerational effects. We examine how the timing of immigration in utero from a developing country to a developed country affects childhood and adulthood outcomes by following individuals through a long period using comprehensive administrative data. To this end, we exploit quasi-experimental variation generated by the large and sudden immigration of Ethiopian Jews to Israel in 1991. This immigration episode named "Operation Solomon", was unexpected and swift, with more than 14,000 Ethiopian Jews airlifted to Israel over 36 hours on May 24-25, 1991.

Migration decisions, including the timing of migration, are usually endogenous and correlate with the immigrant's characteristics and potential outcomes, posing several challenges for identifying causal effects. Operation Solomon created a different setting, as it was an unexpected event completed in a short time. As detailed in section 2.1, the airlift was organized by the Israeli government, and it brought to Israel almost the entire Jewish community still in Ethiopia at the time. Thus, the immigrants were not a selected group, and the sudden occurrence and timing of the operation did not allow families to plan or time pregnancies or immigration dates. In this setting, variation in pregnancy timing relative to immigration can be regarded as random. These conditions provide a unique opportunity to evaluate the causal short-, intermediate- and long-term impacts of a shift from a low-income country to a high-income country.

Our analysis focuses only on children whose mothers immigrated while pregnant. That is, they all were conceived in Ethiopia and born in Israel. Hence these children faced the same conditions at birth and later life but experienced dramatic differences in prenatal conditions based on their gestational age upon arrival in Israel in May 1991. For example, children conceived earlier and were therefore in utero in Ethiopia for a more extended period faced micronutrient deficiencies, inadequate health care, a lower standard of living, and more maternal stress due to the conditions in Ethiopia at that time over more months of gestation. By contrast, children conceived not long before Operation Solomon were in utero in Israel for a longer period and benefited from better environmental conditions.[1]

Our sample includes children whose mothers arrived in Israel via Operation Solomon (May 24-25, 1991) and were born in Israel between May 27, 1991, and February 15, 1992. We define gestational age at the time of immigration based on children's birth date and immigration date. We then classify gestational age into three trimesters to examine how immigrating at different stages of their mothers' pregnancy affects children's outcomes during childhood and adulthood. We focus on multiple high school outcomes, including repetition, dropout, and math/English credits at an advanced level. We provide additional evidence on shorter-term outcomes during primary and middle school and longer-term outcomes during adulthood. The latter includes post-secondary schooling, employment, and earnings, recipiency of welfare benefits, marriage, and childbearing. We also estimate the impact on early life health outcomes - birth weight and child mortality.

We perform a separate analysis by gender motivated by prior research that found differential effects of prenatal conditions by sex due to biological and social factors. The medical literature highlights biological gender differences in the fetus that impart vulnerability or protection to the

[1]The migration event itself might have led to maternal stress. We consider it as a part of the impact of immigration in-utero. We further discuss this on section 4.1.

developing nervous system (Kraemer, 2000, DiPietro and Voegtline, 2017). Studies on in-utero and early childhood shocks related to prenatal conditions that we consider in our setting (i.e., nutrition, medical care, and living conditions) find significant differences by gender. Most studies on positive shocks find larger benefits for females.[2] Studies on the effects of early childhood environmental conditions also show that girls and boys may respond differently, usually finding a larger impact on females than males (Kling et al., 2007, Gould et al., 2011, Sanbonmatsu et al., 2012. Ludwig et al., 2013). Other studies on prenatal conditions find no differences by gender (e.g., Currie and Schwandt, 2013 and Black et al., 2019) or even larger benefits for boys (e.g., Venkataramani, 2012). However, they focus on different shocks than those examined in this paper, such as exposure to radioactive fallout, flu, or malaria, respectively. Studies on the impact of age on immigration find either similar or stronger effects for females than males (Böhlmark, 2008, Van den Berg et al., 2014, Lemmermann and Riphahn, 2018).

We find that females whose mothers immigrated during the first trimester of pregnancy have substantially better medium- and long-term cognitive outcomes relative to those whose mothers arrived at later pregnancy stages. For example, females in utero in Israel starting from the first trimester of pregnancy were 16 percentage points more likely to obtain a matriculation diploma, a large effect relative to the mean of those who arrived in the third trimester (31%). They were more likely to achieve higher proficiency levels in math and English and less likely to repeat a grade or drop from high school. These effects persist into early adulthood, with higher enrollment in post-secondary education, higher employment rates, and earnings at age 23–25. We also obtain positive effects on behavioral outcomes and academic achievement during elementary and middle school. Still, we do not find significant effects on birth weight or child mortality, although this might be due to lack of power.

The results for males are less pronounced. Males who 'immigrated' in utero during the first trimester of gestation have better behavioral outcomes in elementary and middle school.

[2] For example, Field et al. (2009) and Adhvaryu et al. (2019) provide evidence for biological factors by showing that exposure in utero to iodine fortification results in better educational and labor market outcomes for women than for males. Maccini and Yang (2009) show that higher early-life rainfall leads to improved health, schooling, and socioeconomic status for women, which imply on existing gender bias in the allocation of nutrition and other resources. Hoynes et al. (2016) find that increasing family resources during early childhood improves health at adulthood for both men and women, but has a positive significant effect on economic self-sufficiency only for women. Brown et al. (2019) examine long-term impacts of childhood Medicaid eligibility expansion on outcomes in adulthood, and show stronger and larger effects on fertility and wages for females.

However, these effects do not manifest into better school achievement or labor market outcomes.

We assess the robustness of the results on high school outcomes by controlling for birth cohort, seasonality, and age-for-grade effects. We do so by adding a comparison group of individuals of the same birth cohort and an older cohort born during the same months but a year earlier in Israel whose parents emigrated from Ethiopia before Operation Solomon. We also conduct a placebo test using a sample of children who immigrated in utero from the former Soviet Union. These additional analyses support our main finding that females benefit from a more extended period in utero in Israel (from the first trimester). Birth cohort, seasonality, age-for grade effects, miscarriages, and premature births do not confound this result.

Our study contributes to the emerging literature on the effects of "place" (e.g., migration or neighborhood effects) on various outcomes through an individual's life. Recent studies exploit within-family variation in children's age when families move, either within a country or between countries, from disadvantaged to more advantaged places (Böhlmark, 2008, Chetty and Hendren, 2018, Chyn, 2018, Lemmermann and Riphahn, 2018, Basu, 2018, Deutscher, 2020). These studies find that moving to a better area at a younger age is more beneficial, while this effect usually incurs both the impact of age at arrival and length of exposure. Other studies exploit a quasi-random assignment of immigrants across different areas to analyze the early childhood environment's effect on a large array of social and economic outcomes.[3]

Our study is the first to focus on immigration while in utero stressing the potential benefits of moving to a better place during this period. Our findings suggest that even a small difference in months of exposure during this critical early period can lead to significant differences equal in magnitude to serval years of exposure later in life.[4] Our study is also the first in the immigration literature that follows individuals for an extended period, from birth to adulthood. It analyzes effects on a wide range of outcomes at different points between early life and adulthood.

This study also contributes to the extensive literature on the fetal origins hypothesis that

[3]Gould et al. (2004) exploit Operation Solomon to examine the extent to which the initial elementary school environment affected the high school outcomes of Ethiopian children. Gould et al. (2011) exploit variation in the living conditions experienced by Yemenite children immigrants who arrive to Israel in 1949 on education, labor market and family outcomes. Damm and Dustmann (2014) investigate the effect of early exposure to neighborhood crime on subsequent criminal behavior of youth refugee immigrants in Denmark.

[4]For example, Basu (2018) find that immigrants who arrive to US at the age 16-17 were 9% less likely to finish high school compared to an infant immigrant. Lemmermann and Riphahn (2018) show that immigrating to Germany at age 15 vs. age 1 increases the risk of not graduating from secondary school by 47 percentage points.

shows that even relatively mild shocks in utero have short- and long-term effects on children's health and long-term human capital development (see reviews by Almond and Currie, 2011, Currie and Vogl, 2013 and Almond et al., 2018). However, most studies focus on a specific domain (e.g., test scores, health, birth weight) at a particular age, while we present a comprehensive analysis of the effect of prenatal conditions and the implications for a variety of outcomes by following individuals through an extended period. Our data allow us to hone in on the timing of exposure during pregnancy and highlight heterogeneous effects of prenatal inputs during the critical periods of gestation.

The remainder of the paper is organized as follows. The next section outlines the historical background of Ethiopian Jews and the differences between the environmental conditions they experienced in Ethiopia and upon arrival in Israel. Section 3 describes our data, and section 4 outlines our empirical strategy. In Section 5, we report our results. In Section 6, we discuss measurement issues, and in section 7, we examine potential alternative interpretations and present a placebo test. Section 8 concludes.

2 Context

2.1 Immigration of Ethiopian Jews to Israel[5]

The Ethiopian Jewish community, also known as "Beta Israel", lived in the region of Northern Ethiopia called Gondar for several centuries. In 1975 they were recognized as Jewish by the State of Israel and were entitled to migrate to Israel as full citizens under the Law of Return. Since then, 92,000 Ethiopians have been brought to Israel in organized immigration projects and immediately become Israeli citizens.

Figure 1 presents the distribution of Ethiopian Jewish immigrants to Israel by immigration year. The peak in 1984 reflects the "Operation Moses" immigration, which began on November 21, 1984, and ended on January 5, 1985, and involved the air transport of about 8,000 Ethiopian Jews from Sudan via Brussels to Israel.[6]

[5]This section is based on Kaplan (1992)

[6]Following worsening conditions in Ethiopia (due to a major drought and consequent famine, and the unstable political situation) thousands of Beta Israel fled Ethiopia on foot for refugee camps in Sudan, a journey which took from two weeks to a month. It is estimated that as many as 4,000 died during the trek, due to violence and illness along the way. Sudan secretly allowed Israel to evacuate the refugees to Israel and stopped it when the operation became public and Arab countries pressured Sudan to stop the airlift.

Between 1985 and 1989, the Ethiopian authorities limited all citizens' movement, Jews included, making emigration almost impossible. The renewal of diplomatic relations between Israel and Ethiopia in November of 1989 and American and Canadian Jewish organizations' involvement, notably the American Association for Ethiopian Jews (AAEJ) and North American Conference on Ethiopian Jewry (NACEJ), opened new possibilities to renew immigration to Israel. In May 1990, the AAEJ hired buses to bring Jews from their villages in the north of the country to Addis Ababa, where the NACEJ operated a compound in which Jewish families could reside until they received permission to fly to Israel. They did not know when that permission would be granted, and they accepted that they would be living in Addis Ababa for the time being. However, following political and military turmoil in Ethiopia, culminating in the Ethiopian dictator Mengistu's flight from the country in May 1991, the Israeli government decided to airlift the Ethiopian Jews from the capital before rebel forces took it over. On May 24 and 25, 1991, over 14,000 Ethiopian Jews—all the Jewish population then living in Addis Ababa, and almost the entire Jewish population remaining in Ethiopia—were airlifted to Israel within 36 hours in Operation Solomon (see Figure 2). The only Jews left in Addis Abba were the Falas Mura, who were Christianized Jews and were allowed to immigrate to Israel later on.[7] Upon arrival in Israel, the immigrants were placed in absorption centers, where most stayed for several years until they could move to permanent housing.[8] Immigration from Ethiopia to Israel continued after Operation Solomon but in much smaller numbers. It was composed of small groups of Jews from remote rural areas in Ethiopia, mainly from Qwara and Gondar (Kaplan and Rosen, 1994) and the Falash Mura people.

2.2 Environmental Conditions of Operation Solomon Immigrants in Ethiopia and in Israel

Pregnant mothers were exposed to large environmental differences between Ethiopia and Israel. We conducted in-depth interviews with fifteen mothers of children from our base sample who were pregnant at the time of immigration. We asked them about conditions in five areas before and after immigration: living conditions, general medical care, nutrition, micronutrient

[7] Falash Mura is the name given to members of the Beta Israel community in Ethiopia who converted to Christianity under pressure from missionaries during the 19th and 20th centuries. In 2003, the Israeli government gave those with Jewish maternal lineage (through the Beta Israel) the right to immigrate to Israel under the Law of Return, but to obtain citizenship only if they converted to Orthodox Judaism.

[8] For more details, see Gould et al. (2004).

supplements, antenatal care, and pre-and post-natal monitoring. Section A in the Online Appendix outlines the differences between Ethiopia and Israel based on these interviews, media reports from the period, and other relevant literature. The main features of these findings are summarized here.

In the year before Operation Solomon, a large part of the Ethiopian Jews population who lived in small remote rural villages in northern Ethiopia migrated to Addis Ababa, where they were housed in refugee camps with inadequate housing scattered around the city. After they arrived in Israel, most immigrants (80%) were housed in absorption centers comprising furnished rooms or apartments, and the rest in mobile home camps (Gould et al., 2004). Upon arrival in Israel, immigrants underwent extensive medical examinations (Nahmias et al., 1993). In most of the absorption centers, they had access to a primary care clinic, staffed by a physician, a nurse, and an interpreter/mediator (Flatau et al., 1993; Sgan-Cohen et al., 1993; Shtarkshall et al., 2009; Levin-Zamir et al., 1993), which provided comprehensive health and immunization services (Yaphe et al., 2001 and Levin-Zamir et al., 1993). Women received access to pre-and postnatal monitoring for themselves and the newborns, and almost all births were at hospitals. Also, they received micronutrient supplements (i.e., iron and folic acid) following standard practice among Israeli pregnant women.[9] In contrast, the three micronutrient supplements essential for cognition and are recommended for pregnant women—iron, iodine, and folic acid—were mostly unavailable in Ethiopia (DHS, 2000).[10] Immigrants' calorie intake almost doubled upon arrival in Israel. Also, its composition changed, as many traditional Ethiopian staples were not available in Israel at the time (Levin-Zamir et al., 1993).

3 Data and Descriptive Statistics

3.1 Data

Our study focuses on the Israeli population of Ethiopian ethnicity born (in Israel or Ethiopia) in 1980-2005. For these individuals, we obtain information from Israel's Population Registry, which provides the following variables: birth date; date of immigration; country of origin;

[9] Iodine was not provided since the food chain in that period was considered to contain adequate amounts (Benbassat et al., 2004).

[10] Online Appendix B provides additional information on the importance of micronutrients for development.

parents' date of immigration and country of origin; the number of siblings; mother's place of residence upon arrival in Israel, and marital status and childbearing. Our primary analysis sample is limited to individuals whose parents immigrated to Israel from Ethiopia in Operation Solomon on May 24 or 25, 1991, and were born in Israel. The pregnancy was incepted in Ethiopia. This sample includes 570 individuals born to Operation Solomon immigrants between May 27, 1991, and February 15, 1992, who immigrated while in utero to Israel at different stages of their mothers' pregnancy. We exclude children born just before the airlift. These children also faced very different conditions during birth in refugee camps in Addis Ababa compared to children born in Israeli hospitals.[11] In addition, we do not include children who were born beyond nine months after the airlift, as those children were conceived in Israel. We cannot claim that the timing of conception relative to immigration timing was random for these children. We also exclude twins because they tend to have different birth outcomes from singletons.

We merge the population registry data with data from other sources. From the Israel Central Bureau of Statistics (CBS) we obtained administrative records on birth weight for individuals born in Israel, data on parents' first locality of residence upon immigration to Israel and income in the years 1995 and 2000, and administrative records collected by the Israel Ministry of Education on students' parental education, yearly schooling status (graduated, currently attending school, dropped out), and high school outcomes.[12] The high school outcomes include repeating a grade between 7th to 12th grade, high school completion, receiving a matriculation certificate, and various indicators on the quality of schooling attainments, such as total credit units in the matriculation study program, and credit units in mathematics and English.[13]

From Israel's National Insurance Institute (NII), we obtained data on enrollment in postsec-

[11] Daysal et al. (2015) and Daysal et al. (2019) documented that physician supervision and conditions during births have significant effect on birth outcomes.

[12] Data on parents' first locality of residence upon immigration to Israel include the socio-economic index (SES) of the locality. The Israel CBS computes a socio-economic index of Israeli localities based on several demographic and economic variables, including dependency ratio, average years of schooling in the adult population, percentage of academic degree holders, employment and income levels, etc. Lower values correspond to lower socio-economic status.

[13] A matriculation certificate is a prerequisite for higher education in Israel, and hence has a large impact on students' future prospects. Students take matriculation exams in basic, intermediate or advance levels, and receive credit units accordingly, between one and five. We assign zero units to students who do not achieve the basic level (either because they failed or because they did not take the test). We avoid using test scores as outcomes because not all students were tested in all subjects and test scores are not comparable across different proficiency levels of the same subject. See Online Appendix C for more details.

ondary schooling, employment, earnings, and welfare payments. This information is available when individuals in our sample were 23 to 26 years old. We also merge to the NII data, test scores data from national exams administered by the Israeli Ministry of Education in math, science, English, and Hebrew to 5th and 8th grade (GEMS outcomes). As part of this national testing, a survey is administered to 5th-9th graders, and it provides data on self-reported behavioral outcomes, which we also examine.[14] See Online Appendix C for more details about the CBS and the NII data.

The key variable for our analysis is the gestational age of the child at immigration. Gestational age is measured as the difference between the date of immigration (May 24 or 25, 1991) and the individual's birth date, transformed into numbers of weeks, and then subtracted from 40 (the standard measure of gestation). We assume 38 weeks of post-conception pregnancy, which is equivalent to 40 weeks of gestational age. We are interested only in the 38 weeks after fertilization, rather than the traditional 40-week measure, because we do not want to include children whose mothers became pregnant upon arrival in Israel. We, therefore, drop from our analysis individuals who immigrated at weeks 0 and 1.[15]

We follow the medical literature and divide the duration of pregnancy into three trimesters: (1) first trimester—conception (week 2) through week 12; (2) second trimester—week 13 through week 26; and (3) third trimester—week 27 through birth.[16] These three trimesters can be mapped into three groups defined by the date of birth. We assume that children whose birth date is between December 4, 1991, and February 15, 1992, arrived in Israel during the first trimester. Children born between August 28 and December 3, 1991, are assumed to come during the second trimester; and children born between May 27 and August 27, 1991, are assumed

[14]For these outcomes, the sample comprises 557 individuals from our primary sample of 570 who were in utero during Operation Solomon. We transform test scores and behavioral outcomes into z-scores and compute a standardized test score average across the four subjects and a standardized behavioral index across the behavioral questions.

[15]Gestational age is defined based on the number of weeks elapsed from the mother's last menstrual period. The average length of a pregnancy as computed by gestational age is 40 weeks, which means 38 weeks from the point of fertilization. We employ the traditional measure of gestational age in order to maintain consistency with the common nomenclature, while dropping weeks 0 and 1 in order to ensure that all individuals in the sample were conceived before immigration.

[16]The medical literature (e.g. Cunningham et al., 2014) suggests that the first trimester is a period of rapid growth for both internal and external body systems and organs. By the end of the first trimester, even though the fetus is less than two inches long, all the major systems and organs are developed, including the brain. In the second trimester, the fetus grows considerably in size. By the beginning of the third trimester, the fetus may survive if born premature. In this period, growth slows down but there is substantial weight gain.

to have arrived during the third trimester (these dates assume an immigration date of May 24, 1991). Figure 3 graphically depicts the three trimesters by birth date and estimated conception date. One potential challenge regarding our definition of the treatment is that we do not have precise information on conception dates and instead estimate them based on birth dates. This means that we might misclassify some children regarding their length of exposure in utero to the Israeli environment. We discuss this issue in Section 6 and show that our results are robust to potential treatment status misclassifications.

3.2 Descriptive Statistics

Table 1 presents summary statistics showing the background characteristics of our primary sample by gender. Mothers were on average around 31 years of age upon giving birth, while fathers were about 41. Families are relatively large, with 6.3 children on average; individuals in our sample were, on average, the third or fourth child in the family, and their parents tended to have little formal education (1–2 years of schooling). Overall, there are no large differences in family background characteristics between females and males. Panels I and II of Table 2 report means and standard deviations of the high school outcomes and early life health outcomes (birth weight and child mortality), respectively.[17] While more than 80% of the individuals in our sample completed high school and did not repeat a grade, their academic achievement in high school is quite low. For example, the matriculation rate is 30%, while the rate for all Israeli twelfth-grade students was 59% in 2012.[18] The average of total matriculation units is 11.3 while 21 is the minimum required to obtain a matriculation certificate. Females have higher high school academic achievement compared to males. The birth weight in our primary sample is about 3 kg. About 9% of the females and 6% of the males were born at low birth weight (less than 2.5 kg). The mortality rate by age 6 is 1.4% and is slightly higher for males than females (1.7% versus 1.1%). During the same period, the Israeli population's equivalent rate was about

[17]The administrative data collected by the Israel CBS does not include information on date of death. Hence, we define a proxy measurement for mortality before age 6 if the child is not observed in the administrative records of the Israel Ministry of Education starting in first grade (given that the Ministry of Education maintains complete records of all Israeli children throughout their education). Overall, given the small sample size, we observe few mortality cases: two children from the first-trimester group, two from the second, and four from the third died before reaching first grade.

[18]The matriculation rate is the percentage of twelfth-grade students entitled to a matriculation certificate by the end of the academic year. For figures on the Israeli population, see the Statistical Abstract of Israel 2014: https://www.cbs.gov.il/he/publications/doclib/2014/shnatoneducation/st08_26.pdf.

1% (World Bank data catalog, 1991).

Table 3 reports the means and standard deviations of the outcomes based on the NII sample. Females have higher test scores and better behavioral outcomes than males at elementary and middle school. Overall, concerning adulthood outcomes, 25% of the sample individuals had enrolled in any post-secondary education, and 19% had done so at higher-tier institutions (universities or colleges). For comparison, the equivalent enrollment rates for the same cohort in Israel's Jewish population were 44% and 33%, respectively.[19] Enrollment rates are substantially higher for females, by ten percentage points. About 12% of the sample received welfare benefits (either disability payments or income support) between ages 18 and 26. This rate is similar for females and males. At age 23–25, the employment rate is 90%, higher for females (92% vs. 88%). Because young adults in Israel typically do compulsory military service from the age of 18, with the standard length of two years-service for females and about three years for males, it is not unusual for Israelis aged 23 through 25 to still be enrolled in post-secondary schooling. However, we do not find in our sample a significant difference between the rate of individuals age 23-25 that are registered as employed or the rate of those registered as employed or studying. Hence, our analysis on employment is not affected by individuals who are still studying. Monthly earnings are on average NIS 4,225 (equivalent to about US $1,200). Despite their higher employment rate, females' monthly earnings are lower than those of males (NIS 3,816 compared to NIS 4,612). Marriage rates by age 26 are relatively low (15% for females and 4% for males). Fourteen percent of the women and 5% of the men also had children by that age.

Online Appendix Table A1 reports means and standard deviations for all outcome variables by trimesters of pregnancy at immigration and by gender. Overall, for most of the outcomes reported, it seems that children who arrived in utero during the first trimester of their mothers' pregnancy have better outcomes than those who arrived when their mothers were at later stages of pregnancy. The gaps are more pronounced for females than for males. We now turn to the empirical analysis to examine these patterns in more detail and control possible confounders.

[19]For figures on the Israeli population, see the Statistical Abstract of Israel 2020: https://www.cbs.gov.il/he/publications/doclib/2020/4.shnatoneducation/st04_59.pdf.

4 Empirical Strategy

4.1 Baseline Model and Specification

The events and timing of Operation Solomon can be viewed as a quasi-experiment. Ethiopian immigrants' children who shared the same background characteristics and were born shortly after arrival in Israel experienced one important differential treatment: their mothers were at different pregnancy stages on the day of immigration. All these children faced the same general conditions at birth and later life but experienced dramatic differences in prenatal conditions given their gestational age upon arrival in Israel in May 1991.[20]

Therefore, we estimate the causal effect of exposure to improved conditions in utero due to immigration from Ethiopia to Israel on later life outcomes by comparing outcomes of children who arrived in utero at different stages of pregnancy. Our primary identifying assumption is that children born in Israel but whose mothers were at various stages of pregnancy at the time of immigration have identical unobserved characteristics and the same potential outcomes. In other words, we assume that the timing of conception in Ethiopia relative to the timing of immigration was random.

The treatment effect can potentially embed also a differential impact of maternal stress due to immigration. Evidence from various studies suggests that stress during the early stages of pregnancy has more detrimental effects (Camacho, 2008, Aizer, 2011, Mansour and Rees, 2012, Brown et al., 2014, Quintana-Domeque and Ródenas-Serrano, 2017). This finding works against finding any beneficial effect of early exposure to the Israeli environment. In contrast, Currie et al. (2020) examine the impact of stress due to exposure to physical assault and finds that it is more detrimental when occurring during the third trimester. In any case, our results still have a causal interpretation even if third-trimester maternal stress is more harmful as they reflect the causal effect of immigration to a higher income country in utero. Our setup is similar to studies that estimate the effect of age at immigration, which can potentially embed a differential effect of stress at immigration by age.

[20]Given the sudden timing of arrival and large number of households, Ethiopian immigrants were placed in absorption centers across Israel in which they lived in for at least two years (Gould et al., 2004). As described by Kaplan and Rosen (1994) and Lazin (1997), the length of stay in the absorption centers varied across families but there is no evidence that this was related to mothers' stage of pregnancy upon immigration.

We classify children by gestational age at immigration into three trimesters: children in the first-trimester group are considered fully treated since they were exposed for a more extended period to Israel's improved conditions. Children in the second-trimester group are considered partly treated. Children in the third trimester are the reference group, which had the shorter exposure to the improved conditions in utero. Based on this definition, we examine the effect of length of exposure to the Israeli environment by estimating the following model:

$$Y_i = \beta_0 + \beta_1 FirstTrimester_i + \beta_2 SecondTrimester_i + \gamma X_i' + u_i \tag{1}$$

where Y_i is the outcome of individual i. The dummy variables $FirstTrimester_i$ and $SecondTrimester_i$ are the key explanatory variables that denote arrival during the first or second trimester of pregnancy respectively. The omitted category includes those who arrived in Israel during the third trimester (individuals with the shortest exposure to better in-utero conditions, whose mothers spent most of their pregnancy in Ethiopia). The estimated parameters β_1 and β_2 reflect the difference between immigrating in utero during the first or second trimester, respectively, relative to the third trimester. X_i' is a vector of individual characteristics; it includes a gender dummy, mother's age at birth, parents' age gap, birth order, parents' education, and the SES of the mother's first locality of residence upon immigration to Israel. Standard errors are clustered at the gestational age (week) on immigration day to allow for any type of correlation of the error term by the week of conception.

We estimate equation (1) for females and males separately as a system of seemingly unrelated regressions to allow the coefficients to differ by gender but permit correlation between the error term of both genders.

4.2 Controlling for Cohort and Age-for-grade Effects

Our benchmark estimates may be confounded by unobserved cohort, seasonality in births, or month of birth effects. Especially, the baseline specification does not account for age-for-grade effects on school performance (see Bedard and Dhuey, 2006, McEwan and Shapiro, 2008, Elder and Lubotsky, 2009, Cook and Kang, 2016 and Dhuey et al., 2019 for evidence on age-for-grade effects). In Israel, the school entrance cutoff until the cohort born in 2007 was on the first day of the fourth month of the Jewish calendar, which bounced around different dates in December for each Gregorian year (Attar and Cohen-Zada, 2018). For the cohort born in 1991, the entrance cutoff date was December 8th, which means that the full treatment group (first trimester) consists mainly of children who start school one year later than the other groups and are among the oldest in their grade. In contrast, the second and third trimesters are below median age in their classrooms.

To address these concerns, we apply a difference-in-differences (DID) framework. We added a comparison group of second-generation Ethiopian immigrants whose families arrived in Israel before 1989 (in Operation Moses) and were born during the same time window as our main analysis (i.e., individuals born between May 27, 1991, and February 15, 1992). This group comprises 451 individuals. In addition, to control for cohort effects, we also add second-generation Ethiopian individuals born one year before our treated cohort (i.e., born between May 27, 1990, and February 15, 1991). This group comprises 403 individuals.[21] Because all the children in that group were conceived in Israel they are not subject to any effect of age at immigration. Differences between individuals born in different months within the comparison group reflect cohort effects, month of birth effects, and age-for-grade effects.

The Operation Solomon group and the comparison group differ in many respects (Online Appendix Table A2 reports means and standard deviations of background characteristics for the comparison group). However, individuals in both groups originate in the same country, have the same genetic profile and culture, and were raised by immigrant parents. Moreover, all were conceived and born during the same period and faced the same school entrance cutoff date in Israel. This key assumption here is that any birth cohort effect, birth month effect, or age-for-grade effect of these groups (including the older cohort's equivalent) are good proxies for our main sample's same effects.[22]

The estimated model includes interactions between the trimester indicators and the "*Operation Solomon*" group, indicators for the first and second trimesters, an indicator for the "*Opera-*

[21] The school entrance cutoff date for the 1990 cohort was December 18th.

[22] A possible confounder could be a shock that affected pregnant women in the refugee camps differentially, depending on weeks of gestation. An example of such a shock is a violent attack in a specific date. While we cannot rule out such alternative explanation, we note that this is the inherent concern of any difference-in-differences strategy. That is, the standard assumption in difference-in-differences strategy is that there are no time specific shocks affecting the treated cohort.

tion Solomon" group, and an indicator for the young cohort (i.e., individuals born between May 27, 1991, and February 15, 1992) as specified in the following specification:

$$
\begin{aligned}
Y_i = \alpha_0 &+ \alpha_1 FirstTrimester_i * Solomon_i + \alpha_2 SecondTrimester_i * Solomon_i \\
&+ \alpha_3 FirstTrimester_i + \alpha_4 SecondTrimester_i + \alpha_5 Solomon_i \\
&+ \alpha_6 YoungCohort_i + \gamma X_i' + u_i
\end{aligned}
\tag{2}
$$

Where the trimester indicators are defined according to month and day of birth for all groups. Namely, the first trimester equals one if the child was born between December 4 and February 15; the second trimester equals one if the child was born between August 28 and December 3. The third trimester equals one if the child was born between May 27 and August 27. $Solomon_i$ is an indicator for individuals born to parents who immigrated on Operation Solomon. $YoungCohort_i$ is an indicator for individuals born between May 27, 1991, and February 15, 1992. α_1 and α_2 embed the effect of immigration during the first or second trimester relative to the third trimester on top of any seasonality, cohort, and age-for-grade effects. They should be equivalent to β_1 and β_2 in equation (1) if our benchmark estimates are not confounded by unobserved seasonality, cohort or age-for-grade effects.[23] Standard errors are clustered at the week and year of birth level. Due to limitations of the data provided by the CBS and NII we estimate equation (2) only for the high school outcomes given that we do not have other outcomes available for the comparison group.

5 Results

5.1 Balancing Tests on Observables and Birth Frequencies

Our primary identifying assumption is that the timing of pregnancy relative to immigration date can be seen as random among mothers who were already pregnant when airlifted to Israel on May 24 or 25, 1991. We support this assumption by showing in this section the similarity in background characteristics among individuals from the three-trimester groups. In addition, we show that the frequency of births in the three-trimester groups is similar to the observed

[23] Other forms of specifications for the DID model that include also month of birth fixed effects, or an indicator for born in 1992 generate similar estimates as the those produced by equation (2).

frequencies in the two comparison groups born during the same period.

Table 4 presents background characteristics for individuals whose mothers arrived in Israel during the first trimester and differences in these characteristics between trimesters. Also, we report F statistics and p-values for joint significance of all covariates. The data are presented for the sample as a whole (columns 1–4) and by gender (columns 5–12).

The median gestational age at the day of immigration is seven weeks for the first-trimester group, 20 weeks for the second-trimester group, and 32 weeks for the third-trimester group. There is no difference in median gestational age by gender. The median is roughly in the middle of each group's range, so no group is over-represented.

The proportion of females at birth in the first- and third-trimester groups is similar (around 47% with a gap of 0.012). It is slightly lower in the second-trimester group (about 43%). Overall, there are no marked differences for females or males in most background characteristics of individuals in the full sample who arrived in Israel at different stages of their mother's pregnancy. There are a few exceptions: for females, mothers' education is slightly lower for those who arrived in the first trimester relative to the second or third. There is also a significant disadvantage in SES index for the locality of residence of mothers who came in the first trimester relative to the second. This leads to a low p-value for the test of jointly significant differences in covariates between the first and second trimester. However, this calculation militates against our primary concern, which is the possibility of positive selection bias if better family background correlates with arrival in Israel at earlier pregnancy stages. We also find that covariates cannot jointly predict birth in either the first or second-trimester groups versus the third-trimester group for females.

For males, there are some differences in parental schooling between the trimester groups: father's education is higher among those who arrived in the first trimester relative to the third, and mother's education is higher among those who arrived in the second trimester relative to the third. Parents' age gap is also lower for those who arrived in the first-trimester relative to the second. However, differences are much smaller and not statistically significant for those who arrived in the first trimester relative to the third. Overall, there are some differences in males' characteristics between the trimester groups, but they mainly derive from one covariate.

We assess this further by estimating a regression of weeks of gestation upon arrival in Israel on all covariates. The F statistic for all covariates' joint significance is 0.8, and the p-value is 0.616 (with similar numbers for females and males separately). The implication is that there is no clear trend showing an association between better family background and more prolonged exposure in utero to the Israeli environment (i.e., arrival at earlier stages of pregnancy). Furthermore, we do not find significant differences in parental characteristics or family structure by birth timing for the comparison groups used to control for cohort and month of birth effects (results available upon request). These results support our claim that treatment exposure is indeed random in this natural experiment.

It is also worth noting that there are no significant differences in family income by trimesters, both in 1995 and 2000, which implies that arriving early in pregnancy to Israel did not affect the parents' labor market outcomes. This eliminates a potential mechanism for our results and strengthens the claim that the arrival process for immigrants to Israel was the same for everyone regardless of the pregnancy's visibility.

Figure 4 plots the frequency of births in our primary sample (Operation Solomon children) and the comparison group by month of birth and by immigration trimester (by date) for the whole sample (Panel A) and for females and males separately (Panels B and C). The frequency of births for those immigrating in the three trimesters is similar across the three samples, and there is no clear evidence for the selection of births at the trimester cutoffs. To further examine this issue, we plot in Figure 5 the share of births by gestational week upon immigration to Israel for our primary sample and the births distribution of the same calendar dates for the comparison group. Gestational week for the comparison group was computed as the number of weeks since estimated conception to May 25. The vertical lines denote the trimesters. The figure shows two important points: (i) there is no apparent discontinuity around the trimester cutoffs in our primary analysis sample; and (ii) the share of births by week is not significantly different across the groups. To formally test this issue, we also estimated a model where the dependent variable is the share of births by week and examined whether there were significant differences by trimester groups between our primary sample and each of the two comparison groups. The results (available upon request) show no significant differences in any of the three trimester groupings.

5.2 Main Results: High School Outcomes

Table 5 presents the results for high school outcomes by gender. Odd columns present estimates for β_1 and β_2 of equation (1). Even columns present estimates for α_1 and α_2 of equation (2), where we account for cohort, seasonality in births, and age-for-grade effects. Panel A reports estimates for females and Panel B for males. Panel C reports p-values from F-tests for the test of equality of parameters between females and males. We also report means and standard deviations of the reference group's outcome variables, individuals whose mothers arrived during the third trimester.

Estimates of immigration's effect at earlier stages of pregnancy on offspring's high school outcomes reveal an interesting differential pattern by gender. We observe a large impact in the first trimester for females in all outcomes. In contrast, the impact for males is smaller and not statistically significant. The DID estimates are very similar to the respective ordinary least squares (OLS) estimates, and in most cases slightly larger for the first-trimester effect and slightly smaller for the second-trimester effect (although differences are not statistically significant) suggesting that seasonality, cohort, and age-for-grade are not confounding our main results.

Estimates from the OLS specification (odd columns) show that for females, immigration in the first trimester lowers the likelihood of repeating a grade by 16 percentage points (s.e.=0.045). For males, this effect is much smaller and insignificant. Immigration in the second trimester also lowers grade repetition for females, but the effect is smaller (10 percentage points). Exposure to the Israeli environment from the first trimester for females raises the high school completion rate by 7.4 percentage points (s.e.=0.042). The average rate of high school completion among females in the third-trimester group is 89%; therefore, this absolute gain implies an 8% increase. This effect is similar to the effect of moving out of disadvantaged neighborhoods in Chicago for children at the ages of 7 to 12 found by Chyn (2018) for boys and girls together.[24]

[24]Our estimated effect is also similar to findings of other studies that estimated the effect of prenatal conditions on cognitive outcomes of females. For example, Field et al. (2009) find that intensive iodine supplementation for pregnant women in Tanzania increased schooling by half a year, a 6% increase. Almond (2006) found that prenatal exposure to an influenza pandemic reduced schooling by 0.25 years (2.3% relative to an average of 10.6 years of schooling), and the likelihood of completing high school by 0.03 percentage points (6% relative to an average rate

Performance in Israel's matriculation exams among females is also improved by more prolonged exposure to treatment. For example, exposure from the first trimester increases the matriculation rate by 15 percentage points (s.e.=0.088)—an improvement of about 50% relative to the mean of 31% for the third-trimester group. This gain amounts to 50% of the matriculation gap between non-Ethiopian Israeli Jewish females and Ethiopian immigrant females. This effect size is larger than attending a high versus low-quality primary school among Ethiopian students in Israel (Gould et al., 2004). Indeed, it is even larger than being exposed at age 15-16 to a large increase in the rate of return to schooling (Abramitzky and Lavy, 2014).

The above gains are accompanied by improvements in other measures relating to the high school matriculation study program's quality, as shown in columns 7 through 12. Females who arrived in the first trimester earned about five more matriculation credit units (s.e.=1.686) than females who arrived in the third trimester, which is nearly 50% increase. Credit units in math and English rise by about 0.6 and 0.8 units, respectively, for gains of (respectively) about 60% and 40%. These are considerable and important quality gains. Estimates for arrival in the second trimester on the matriculation diploma quality are positive and significant (except math). While these are smaller than the first-trimester effect, we cannot reject the hypothesis of equality of coefficients in this subset of outcomes.

Differences in the magnitude of the estimated effects of the first trimester indicator between females and males all point to the same pattern: immigrating to high income country in utero starting from the first trimester dramatically improves females' outcomes relative to immigrating during the third trimester, but not for males. This pattern is similar to findings from previous studies that examined the effects of in-utero and early childhood positive shocks.[25] We also observe a smaller but still positive and even sometimes significant effect for females in the second trimester, while there is no equivalent effect for males.

of 48%).

[25] Field et al. (2009),Maccini and Yang (2009), Brown et al. (2019), Adhvaryu et al. (2019).

5.3 Effect on Additional Outcomes

5.3.1 Mid-Childhood Outcomes

Table 6 reports the results for fifth-grade test scores (column 1) and own behavior during elementary and middle school (column 2) for the baseline model, i.e., equation (1) for females (Panel A) and males (Panel B) in the same structure as Table 5. These estimates are important because they provide evidence on treatment effects midway between birth and the end of high school, solidifying a pattern that we add in the next section: evidence of treatment effects in adulthood.

To estimate treatment effects on test scores during primary school, we regress the fifth-grade standardized test scores (by subject and year) on the first and second trimester indicators. We include controls for both parents' schooling, the number of siblings, mother's age at birth, parents' age gap, and year and subject fixed effects. We use the stacked data on all four subjects and weight observations by the inverse of the number of times each student appears in the data.[26] Consistent with our high school achievement findings, we find beneficial effects of earlier exposure to the Israeli environment only for females. Test scores of females whose mothers arrived during the first trimester are 0.631 standard deviations (s.e.=0.199) higher than those of females whose mothers arrived in the third trimester. The effect for males is about half this magnitude, 0.314 standard deviations (s.e.=0.247), and not statistically significant.

Column 2 in Table 6 reports the estimated effect on an index that summarizes several measures of students' feelings regarding his/her learning, behavior, and social environment. We focus specifically on all questions where the child has to report his/her behavior and feelings (see Online Appendix C for details). We pool in this analysis the samples of fifth-, sixth- and seventh-graders. We use the same specification as in column 1 with the addition of an indicator for the grade. The estimates reported in column 2 of Table 6 suggest that exposure to Israeli environmental conditions from the first trimester of pregnancy has positive and significant effects on students' behavior at school relative to late exposure at the third trimester. This effect is evident for both females and males, with effect sizes of 0.235 (s.e. = 0.093) for girls and 0.206 (s.e. = 0.123) for boys, relative to arrival during the third trimester.

[26] Estimates for each subject are qualitative similar though noisier due to much smaller sample size compared to our baseline sample as described in Online Appendix C.

5.3.2 Early Adulthood Outcomes

Table 7 presents estimates for longer-term outcomes measured by age 26, following the same pattern as Table 6. The table shows that for females, the positive effect of immigration at an earlier gestational age extends beyond high school to the labor market.

The effect of arrival to Israel during the first trimester is positive for females for the long-term human capital outcomes. Exposure from the first trimester increases enrollment in any post-secondary institution by 12 percentage points (s.e.=0.063). The likelihood of enrollment in a university or academic college increases by 10 percentage points (s.e.=0.056) at a significant level of 10%. These gains represent a 35% and 53% increase relative to the outcome means for arrival in the third trimester. These effect sizes are similar to the treatment effect on high school outcomes. They are also larger than the impact of various educational interventions in primary or secondary school, estimated based on the Israeli context. For example, they are larger than the effect of providing free school choice to middle school students (Lavy, 2020a) or paying teachers based on their students' performance (Lavy, 2020b). The effect on welfare recipiency is relatively small and not significant.

Exposure to the Israeli environment from the first trimester also raises female employment between ages 23 and 25 by 9 percentage points (s.e.=0.034). Women whose mothers arrived in Israel during the first trimester accumulated, on average, 1.5 more months of work experience (s.e.=0.462) compared to women whose mothers arrived during the third trimester. These effects are much larger than the effect of other educational interventions from an Israeli context (Lavy, 2020a,Lavy, 2020b). They are also large compared to the impact of moving out of disadvantaged neighborhoods in Chicago (Chyn, 2018) but close to the estimated effect found by Gould et al. (2011) on the improvements in early childhood living conditions among families emigrated from Yemen to Israel in 1948–49. We also find that their average monthly earnings are also higher, by 11% (NIS 406, s.e.=217.3), but this is a smaller effect in magnitude compared to other studies on the "place" effect (Chetty et al., 2016, Chyn, 2018). There is no effect on the likelihood of being married and having children by 26. However, it is worth noting that the effect size for the probability of having children by age 26 for the first-trimester group compared to the third-trimester group is not small and might be noisy. In some specifications in our robustness checks (see Online Appendix Table A9 and Table A10) it is negative and significant.

For males, we observe some positive effects on higher education enrollment for the group whose mothers immigrated to Israel during the second trimester, significant at the 10% level. However, we do not observe sizable or significant differences in labor market outcomes or other outcomes examined. It is important to note that many individuals in our sample might be only entering the labor market at these ages because of Israel's compulsory military service. Due to the age for grade effect, the first-trimester group completes their compulsory military service later. As a result, we might not observe full-time employment and earnings, particularly for men. Therefore, our results on labor market outcomes for males should be taken with caution.

5.3.3 Early Childhood Health Outcomes

To further examine the impact of immigration in utero from a low-income country to a high income country, we also examine two health outcomes: birth weight and child mortality. Table 8 presents estimates of the treatment effect on birth weight (measured in grams), on the probability of low birth weight (less than 2,500 grams), and child mortality (under age 6) for the baseline OLS specification (equation 1).[27] The estimates on birth weight for females are not significant, with opposite directions for birth weight and the likelihood of low birth weight. Estimates for males show some positive effect on birth weight from exposure in the second trimester, but no effects from the first trimester.

However, a possible reason for the non-significant birth weight results could be also lack of power since our sample is relatively small. Previous studies that found effects on birth weight (e.g., Almond and Mazumder, 2011, Bozzoli and Quintana-Domeque, 2014, Black et al., 2016 and Persson and Rossin-Slater, 2018) report an effect size in the range of 10–30 grams. To detect such an effect (given the standard deviation of birth weight), we would need a sample of more than 6,600 children.[28] The effect examined in our study might be larger than in the

[27] The sample size is smaller since there are a few observations with missing values for birth weight (1.5%). Birth weight is missing for two females in the third trimester group and six males (two in the first and the third trimesters groups and three in the second trimester group). We found no correlation between missing birth weight and the three trimester-group indicators, suggesting that these missing values are unlikely to affect our results. Moreover, replicating Table 5 while excluding these observations from the sample does change our results (these estimates are available upon request).

[28] We compute the expected sample size needed to detect an increase of 30 grams based on the mean of the third trimester (3,027 grams) and the standard deviation of residualized birth weight (435 grams), where residuals come from a regression of birth weight on the list of controls included in equation (1). We take $\alpha = 0.05$ and

cited studies since exposure to better conditions lasted for a more extended period and included a broader set of inputs. Our point estimates reported in Table 8 are in the range of 40–90 grams (though they are not significant). To detect an effect of 90 grams, we would need a sample of over 734 children. This is closer but still above our sample size (especially since we mainly contrast only the first- and third-trimester groups). We find some evidence for a positive effect on both genders' birth weight when we use weeks of gestation upon arrival in Israel instead of the trimester indicators (see Online Table A4).

The second health outcome we examine is child mortality (under age 6). The results reported in column 3 show no effect of in utero early exposure to the Israeli environment on child mortality. However, we are cautious with any firm statement about the effect on mortality because we might lack the power to detect such effects. We also note that all the outcomes in this paper, except test scores and behavioral outcomes, are binary indicators or count variables. Therefore, we imputed zero value to cases of missing outcomes due to an individual's death. Including these observations in the sample avoids potential selection bias, which would be small in any case given the non- significant effect on child mortality and the relatively small number of deaths. In Online Appendix Table A3, we replicate the results for all primary outcomes after excluding from the sample children who died before age 6. The table's estimates are very similar to those presented in Tables 5, 7, and 8.

6 Measurement Issues and Alternative Specifications

Our analysis is based on gestational age computed using the information on the birth date because we do not have data on clinical pregnancy records. In addition, we do not observe miscarriages or stillbirths. In this section, we examine the sensitivity of our results to these data limitations.

6.1 Alternative Specifications

In Online Appendix Tables A4 and A5, we explore an alternative specification where we use weeks of pregnancy in Israel as the primary explanatory variable instead of the first and second-trimester indicators. This is an alternative treatment that measures the number of weeks in utero

---

$power = 0.8$.

of exposure to the Israeli environment, and it is just a linear transformation of the gestational age (in weeks) at the time of immigration. Note that weeks of exposure to the Israeli environment is not measured with error because the date of immigration and birth date is known. The estimates using the number of weeks in utero in Israel as the treatment variable are positive for females for most outcomes. They show that more weeks in Israel, i.e., immigration at an earlier stage of the pregnancy, generates better outcomes, indicating beneficial effects for earlier exposure to better in-utero conditions. Estimates for males are small and not significant except for a positive effect of weeks in Israel on behavioral outcomes in elementary and middle school, which is significant at the 10% percent level (consistent with the results obtained from the specification based on trimesters). In addition, we obtain a positive effect of weeks in utero in Israel on birth weight at a 10% significance level for both genders, suggesting that an additional week in utero in Israel increases birth weight by 5-6 grams for girls and boys, respectively. However, note that we do not observe any impact on the likelihood of low birth weight or child mortality.

To assess how robust these results are to the linear specification, we estimated a model based on higher-order polynomials instead of a linear term. However, this model's fit to the data was inferior (lower adjusted R-squared and higher AIC values). We also estimated a model that included both a week linear effect and trimester dummies to examine whether the week effect could have additional explanatory power beyond the trimester indicators. Standard errors were large due to the high correlation between the week and trimester indicators. However, the trimester dummies estimated coefficients are almost unchanged and remain statistically significant, highlighting the trimester's nonlinear effect. Finally, we tried specifications designed to formally search for a structural break in the effect of weeks of exposure and obtained noisy and inconsistent estimates across outcomes, most likely because of the relatively small sample size (570 observations).

6.2 Preterm Births

The definition of gestational age based on the date of birth may misclassify children who were born preterm. This measurement error is a concern if misclassification of preterm births is more likely in a particular trimester. In Online Appendix Table A6, we report results based on the baseline sample used to produce results presented in Tables 5 and 8. Still, here we exclude children with very low birth weight (<2,500gr) and missing birth weight data —altogether, 8.7% of the sample. These children are more likely to have been born prematurely, and therefore they might have been assigned to the wrong trimester on immigration day. The results based on this 'trimmed' sample are very similar to those presented in Tables 5 and 8.

A second related concern is that we may have included some children conceived in Israel and born preterm in the first trimester. These children are more likely to have been born in late January or early February 1992. Therefore, we stratify the first trimester into three gestation groups, weeks 2–4, weeks 5–8, weeks 9–12, and estimate equation (1) using these three sub-samples. Estimates reported in Online Appendix Table A7 show that the positive effects of arrival during the first-trimester do not stem from pregnant mothers that arrived just a few weeks after conception, thus alleviating the concern about the erroneous assignment to treatment.

We examine further the robustness of our results to the possibility that we misclassify some births to trimesters by re-estimating our two main models after imposing alternative restrictions on the sample. Given that our findings indicate an effect on females and not on males and for saving space, we report only the female sample results. We experiment with various sample restrictions. First, we exclude from the sample cases where arrival was during the first two weeks of each trimester (see Online Appendix Table A8). We thus exclude cases of possible late-term or post-term births. Next, we exclude cases where the date of immigration was during the last two weeks of each trimester. This restriction reduces the likelihood of misclassification of preterm births (see Online Appendix Table A9). Last, we re-assign births where arrival to Israel was in the first (last) two weeks of each trimester to the previous (next) trimester (see Online Appendix Table A10). Overall, the estimates from these modified samples are very similar to results obtained from the baseline sample. Our conclusion from this evidence is that our results are not driven by misclassification of gestational age upon immigration.

6.3 Miscarriages or Stillbirths

Another concern is that we do not observe in our data miscarriages or stillbirths. If these events occurred more among mothers who arrived in Israel during the first trimester, the first-trimester sample might be positively selected. Medical research suggests that first trimester pregnancies are at higher risk for miscarriage than more progressed pregnancies to stress and traumatic events (Maconochie et al., 2007). The migration event itself likely led to stress among pregnant women, potentially leading to miscarriages among pregnant women in the first trimester.

While we do not have data on miscarriages, we follow several papers by examining the sex ratio as a signal of changes to miscarriage rates (e.g., Sanders and Stoecker, 2015 and Persson and Rossin-Slater, 2018). Males are more likely to be miscarried or die prematurely in hard times. Therefore, the existence of more miscarriages and stillbirths among mothers who arrived in the first trimester would lead to a lower sex ratio (males relative to females) in the first-trimester sample relative to the other two trimesters. However, as we showed in section 5.1, children's sex ratios at birth in the first- and third-trimester samples are equal. Also, as noted above in Figures 4 and 5, there are no significant differences in the share of births by calendar week between our primary analysis sample and the two comparison groups. Last, we believe that, if anything, the better environmental conditions upon arrival in Israel should have lowered the incidence of miscarriage among women who arrived at earlier stages of pregnancy relative to those who arrived at a later stage. This would lead to the inclusion of more marginal children born to mothers who arrived in the first trimester, which would work against finding a positive effect on longer-term cognitive outcomes.

7 Alternative Interpretations and Placebo Test

7.1 Alternative Interpretations

Our results show that individuals, particularly females, whose mothers arrived in Israel at earlier stages of pregnancy have better outcomes relative to those whose mothers arrived at more advanced pregnancy stages. We interpret this as a positive impact of immigration from a disadvantaged area to a more advantaged one. An alternative interpretation is that mothers who arrived at an earlier stage of pregnancy had more time to adjust, prepare for the birth, and build social networks that would help them care for their newborns. We believe this explanation is unlikely because all new Ethiopian immigrants were housed in absorption centers for at least 24 months. In these centers, they received assistance from social and health workers and interacted socially with others. Therefore, we can safely assume that all women who gave birth within our nine-month window upon arrival in Israel received the same postnatal care and had similar social networks.

To further rule out this alternative interpretation, we examine the association between child outcomes and mother's length of residence in Israel following immigration (in weeks) when the child was born, using a sample of children conceived in Israel shortly after their mothers immigrated from Ethiopia. Specifically, we examine outcomes for children born to Operation Solomon mothers 10 to 20 months after their mothers' arrival in Israel.[29]

These results are presented in Online Appendix Table A11. The regressions include the same controls as our baseline model (equation 1). Even if the timing of conception in this sample is not random, we believe that, if anything, the results should be biased upward since waiting to conceive until one has gained familiarity and experience with Israeli life might be positively correlated with better unobservables. The evidence in Table A11 shows that the mother's length of residence in Israel when the child was born is not associated with children's outcomes: the estimates are small, varying in sign, and not statistically significant. Only 2 of the 18 estimates are statistically significant, having opposite signs than expected, showing negative associations between mothers' length of residence and (i) birth weight for males and (ii) likelihood of completing high school for females. This evidence further mitigates concerns that our results are driven by the more extended residence in Israel of mothers who arrived during the first trimester of pregnancy.

7.2 Placebo Test

To test our research design's validity, we estimate the model based on a placebo treatment sample. We consider the following placebo treatment: immigration to Israel at the same time as Operation Solomon, but from a developed country where in-utero conditions were similar to those in Israel. The immigrants to Israel from the Former Soviet Union (FSU) in 1991—1992 form an appropriate sample for such a placebo estimation. In-utero conditions in the Soviet Union (especially in areas where the immigrants lived) were relatively similar to those in Is-

[29] We include in this sample only children conceived less than a year after the immigration date to ensure that the mothers were likely all still in absorption centers during the pregnancy, and therefore received similar prenatal care. We perform this analysis only for the high school outcomes and early childhood health outcomes since only for these outcomes (stored at the CBS) we have access to the additional cohorts from Ethiopian origin.

rael.[30] In addition, parental background characteristics among FSU immigrants are similar to those of the Israeli native population. For example, the average parental years of schooling among FSU immigrants was about 11 years, close to the relevant Israeli population's respective mean. Therefore, we expect to find no effect of treatment defined by the length of gestation in Israel.

For this placebo test, we used data from the remotely accessed research lab of the Ministry of Education. The sample we use includes all children whose mothers were pregnant upon arrival in Israel from the FSU in 1990–1992. The data includes all high school outcomes and students' demographics. We follow the same definition of treatment groups and compute the gestational age at immigration as the difference between the mother's immigration date and the child's birth date, subtracted from 40.[31] The immigration from FSU was a steady flow over few years. Therefore, we cannot define the treatment group relative to a single specific immigration date. We do, however, control for cohort and month of birth effects in this sample.

Online Appendix Table A12 presents estimates based on equation (1) with a year and birth-month fixed effects, including parents' schooling and the number of siblings as controls. The results show no evidence for the beneficial effects of earlier exposure to the Israeli environment. Estimates for treatment effects of the first and second trimester are small and insignificant for both genders despite being more precisely measured relative to the results obtained for Ethiopian immigrants (except for one significant outcome for boys for the second trimester).

8 Conclusions

This paper shows that the benefits of growing up in a better place start exceptionally early when individuals are still in utero. We document this by examining the impact of gestational age at

[30]More than 80% of the FSU immigrants came from the previous Soviet European republics, mainly Russia and Ukraine, primarily from urban areas (Israel CBS, 2001). Infant and child mortality rates in these areas were 2% and 2.3% respectively (versus 1% and 1.2% in Israel and 12% and 20% in Ethiopia). Prenatal care in these countries was also relatively similar to that in Israel (The World Bank, 1991). Until the fall of the Soviet Union, salt was routinely iodized by government policy (van der Haar et al., 2011). Also, while anemia in pregnant women has increased significantly in the former Soviet Union, this change happened only after the collapse of the Soviet Union (Sedik et al., 2003).

[31]Because we only have administrative data from the Ministry of Education for the former Soviet Union sample, we cannot use the richer set of covariates that we used for the Ethiopian sample. Nevertheless, we find no evidence for differential selection according gestational age at time of immigration in any of the available covariates. It is then reasonable to assume that selection in other unobserved characteristics is also unlikely.

the time of immigration from a developing country to a developed country on a wide range of childhood and early adulthood outcomes. To isolate causality, we exploit exogenous variation in environmental conditions in utero caused by the sudden immigration of Ethiopian Jews to Israel in May 1991. Individuals in utero on immigration date were exposed to better environmental conditions in terms of nutrition, access to health care services, and living standards as they arrived in Israel.

The results suggest that females whose mothers immigrated to a high-income country from a low-income country during the first trimester of pregnancy had substantially improved educational outcomes throughout schooling stages relative to those exposed to these conditions at later stages of pregnancy. The improvements are evident in behavior, test scores, grade repetition, dropout, and high school matriculation. These effects persist into early adulthood and manifest in higher post-secondary education attainment and better labor market outcomes. The results are robust to using an alternative comparison group designed to control seasonality of births, age-for-grade, and cohort effects. The benefits for males are smaller and are only manifested in higher birth weight and better behavioral outcomes during elementary and middle school.

Our findings are in line with prior studies on the importance of early-life conditions that find larger impacts for girls. We contribute to this literature by showing that this is also true for improvements in in-utero conditions. This paper adds to the growing economic literature investigating the effect of "place" by providing compelling evidence from an unusual natural experiment. To the best of our knowledge, this is the first paper that estimates the effect of moving from a disadvantaged place, especially from an impoverished African country, to an advantaged location in a Western economy, even before birth. The implications of these findings are relevant for many industrialized countries that experience large immigration waves from developing countries.

Our findings show that immigration to a developed country from the first trimester of pregnancy has large and important benefits for female offsprings that persist beyond childhood and are reflected in human capital accumulation and earnings capacity in the long run.

References

Abramitzky, R. and V. Lavy (2014). How responsive is investment in schooling to changes in redistributive policies and in returns? *Econometrica 82*(4), 1241–1272.

Adhvaryu, A., S. Bednar, T. Molina, Q. Nguyen, and A. Nyshadham (2019). When it rains it pours: The long-run economic impacts of salt iodization in the United States. *Review of Economics and Statistics*, 1–45.

Aizer, A. (2011). Poverty, violence, and health: The impact of domestic violence during pregnancy on newborn health. *Journal of Human Resources 46*(3), 518–538.

Almond, D. (2006). Is the 1918 influenza pandemic over? Long-term effects of in utero influenza exposure in the post-1940 US population. *Journal of Political Economy 114*(4), 672–712.

Almond, D. and J. Currie (2011). Killing me softly: The fetal origins hypothesis. *Journal of Economic Perspectives 25*(3), 153–172.

Almond, D., J. Currie, and V. Duque (2018). Childhood circumstances and adult outcomes: Act II. *Journal of Economic Literature 56*(4), 1360–1446.

Almond, D. and B. Mazumder (2011). Health capital and the prenatal environment: The effect of Ramadan observance during pregnancy. *American Economic Journal: Applied Economics 3*(4), 56–85.

Attar, I. and D. Cohen-Zada (2018). The effect of school entrance age on educational outcomes: Evidence using multiple cutoff dates and exact date of birth. *Journal of Economic Behavior & Organization 153*, 38–57.

Basu, S. (2018). Age-of-arrival effects on the education of immigrant children: A sibling study. *Journal of Family and Economic Issues 39*(3), 474–493.

Bedard, K. and E. Dhuey (2006). The persistence of early childhood maturity: International evidence of long-run age effects. *The Quarterly Journal of Economics 121*(4), 1437–1472.

Benbassat, C., G. Tsvetov, B. Schindel, M. Hod, Y. Blonder, and B. A. Sela (2004). Assessment of iodine intake in the Israel coastal area. *The Israel Medical Association Journal 6*(2), 75–77.

Black, S. E., A. Bütikofer, P. J. Devereux, and K. G. Salvanes (2019). This is only a test? long-run and intergenerational impacts of prenatal exposure to radioactive fallout. *Review of Economics and Statistics 101*(3), 531–546.

Black, S. E., P. J. Devereux, and K. G. Salvanes (2016). Does grief transfer across generations? Bereavements during pregnancy and child outcomes. *American Economic Journal: Applied Economics 8*(1), 193–223.

Böhlmark, A. (2008). Age at immigration and school performance: A siblings analysis using Swedish register data. *Labour Economics 15*(6), 1366–1387.

Bozzoli, C. and C. Quintana-Domeque (2014). The weight of the crisis: Evidence from newborns in argentina. *Review of Economics and Statistics 96*(3), 550–562.

Brown, D. W., A. E. Kowalski, and I. Z. Lurie (2019). Long-term impacts of childhood Medicaid expansions on outcomes in adulthood. *The Review of Economic Studies*.

Brown, R. et al. (2014). The intergenerational impact of terror: Does the 9/11 tragedy reverberate into the outcomes of the next generation? *Households in Conflict Network. https://econpapers. repec. org/paper/hicwpaper/165. htm.*

Camacho, A. (2008). Stress and birth weight: Evidence from terrorist attacks. *American Economic Review 98*(2), 511–515.

Chetty, R. and N. Hendren (2018). The impacts of neighborhoods on intergenerational mobility i: Childhood exposure effects. *The Quarterly Journal of Economics 133*(3), 1107–1162.

Chetty, R., N. Hendren, and L. F. Katz (2016). The effects of exposure to better neighborhoods on children: New evidence from the moving to opportunity experiment. *American Economic Review 106*(4), 855–902.

Chyn, E. (2018). Moved to opportunity: The long-run effects of public housing demolition on children. *American Economic Review 108*(10), 3028–56.

Cook, P. J. and S. Kang (2016). Birthdays, schooling, and crime: Regression-discontinuity analysis of school performance, delinquency, dropout, and crime initiation. *American Economic Journal: Applied Economics 8*(1), 33–57.

Corak, M. (2012). Age at immigration and the education outcomes of children. *Realizing the potential of immigrant youth*, 90–114.

Cunningham, F., K. Leveno, S. Bloom, C. Y. Spong, and J. Dashe (2014). *Williams Obstetrics, 24th ed.* McGraw-Hill.

Currie, J., M. Mueller-Smith, and M. Rossin-Slater (2020). Violence while in utero: The impact of assaults during pregnancy on birth outcomes. *Review of Economics and Statistics*, 1–46.

Currie, J. and H. Schwandt (2013). Within-mother analysis of seasonal patterns in health at birth. *Proceedings of the National Academy of Sciences 110*(30), 12265–12270.

Currie, J. and T. Vogl (2013). Early-life health and adult circumstance in developing countries. *Annual Review of Economics 5*(1), 1–36.

Damm, A. P. and C. Dustmann (2014). Does growing up in a high crime neighborhood affect youth criminal behavior? *American Economic Review 104*(6), 1806–32.

Daysal, N. M., M. Trandafir, and R. Van Ewijk (2015). Saving lives at birth: The impact of home births on infant outcomes. *American Economic Journal: Applied Economics 7*(3), 28–50.

Daysal, N. M., M. Trandafir, and R. Van Ewijk (2019). Low-risk isn't no-risk: Perinatal treatments and the health of low-income newborns. *Journal of health economics 64*, 55–67.

Deutscher, N. (2020). Place, peers, and the teenage years: long-run neighborhood effects in australia. *American Economic Journal: Applied Economics 12*(2), 220–49.

DHS (2000). *Ethiopia Demographic and Health Survey 2000*. Central Statistical Authority/Ethiopia and ORC Macro.

Dhuey, E., D. Figlio, K. Karbownik, and J. Roth (2019). School starting age and cognitive development. *Journal of Policy Analysis and Management 38*(3), 538–578.

DiPietro, J. A. and K. M. Voegtline (2017). The gestational foundation of sex differences in development and vulnerability. *Neuroscience 342*, 4–20.

Elder, T. E. and D. H. Lubotsky (2009). Kindergarten entrance age and children's achievement impacts of state policies, family background, and peers. *Journal of Human Resources 44*(3), 641–683.

Field, E., O. Robles, and M. Torero (2009). Iodine deficiency and schooling attainment in Tanzania. *American Economic Journal: Applied Economics 1*(4), 140–69.

Flatau, E., Z. Nishri, A. Mates, G. Qupty, N. Reichman, and R. Raz (1993). Seroprevalence of antibodies against *Toxoplasma gondii* among recently immigrating Ethiopian Jews. *Israel Journal of Medical Sciences 29*(6-7), 395–397.

Gould, E. D., V. Lavy, and M. D. Paserman (2004). Immigrating to opportunity: Estimating the effect of school quality using a natural experiment on Ethiopians in Israel. *The Quarterly Journal of Economics 119*(2), 489–526.

Gould, E. D., V. Lavy, and M. D. Paserman (2011). Sixty years after the magic carpet ride: The long-run effect of the early childhood environment on social and economic outcomes. *Review of Economic Studies 78*(3), 938–973.

Hoynes, H., D. W. Schanzenbach, and D. Almond (2016). Long-run impacts of childhood access to the safety net. *American Economic Review 106*(4), 903–934.

Kaplan, S. and C. Rosen (1994). Ethiopian jews in israel. In *American Jewish Year Book*, Volume 94, pp. 59–109.

Kaplan, S. B. (1992). *The Beta Israel: Falasha in Ethiopia: From Earliest Times to the Twentieth Century*. NYU Press.

Kling, J. R., J. B. Liebman, and L. F. Katz (2007). Experimental analysis of neighborhood effects. *Econometrica 75*(1), 83–119.

Kraemer, S. (2000). The fragile male. *Bmj 321*(7276), 1609–1612.

Lavy, V. (2020a). Long run effects of free school choice: College attainment, employment, earnings, and social outcomes at adulthood. *Journal of the European Economic Association*, Forthcoming.

Lavy, V. (2020b). Teachers' pay for performance in the long-run: The dynamic pattern of treatment effects on students' educational and labor market outcomes in adulthood. *The Review of Economic Studies 87*(5), 2322–2355.

Lazin, F. A. (1997). The housing policies for ethiopian immigrants in israel: Spatial segregation, economic feasbility and political acceptability. *Nationalism and Ethnic Politics 3*(4), 39–68.

Lemmermann, D. and R. T. Riphahn (2018). The causal effect of age at migration on youth educational attainment. *Economics of Education Review 63*, 78–99.

Levin-Zamir, D., D. Lipsky, E. Goldberg, and Z. Melamed (1993). Health education for Ethiopian immigrants in Israel, 1991-92. *Israel Journal of Medical Sciences 29*(6-7), 422–428.

Ludwig, J., G. J. Duncan, L. A. Gennetian, L. F. Katz, R. C. Kessler, J. R. Kling, and L. Sanbonmatsu (2013). Long-term neighborhood effects on low-income families: Evidence from moving to opportunity. *American Economic Review 103*(3), 226–31.

Maccini, S. and D. Yang (2009). Under the weather: Health, schooling, and economic consequences of early-life rainfall. *American Economic Review 99*(3), 1006–26.

Maconochie, N., P. Doyle, S. Prior, and R. Simmons (2007). Risk factors for first trimester miscarriage—results from a uk-population-based case–control study. *BJOG: An International Journal of Obstetrics & Gynaecology 114*(2), 170–186.

Mansour, H. and D. I. Rees (2012). Armed conflict and birth weight: Evidence from the al-Aqsa Intifada. *Journal of Development Economics 99*(1), 190–199.

McEwan, P. J. and J. S. Shapiro (2008). The benefits of delayed primary school enrollment discontinuity estimates using exact birth dates. *Journal of Human Resources 43*(1), 1–29.

Nahmias, J., Z. Greenberg, S. Berger, L. Hornstein, B. Bilgury, B. Abel, and S. Kutner (1993). Health profile of Ethiopian immigrants in Israel: An overview. *Israel Journal of Medical Sciences 29*(6-7), 338–343.

Nielsen, H. S. and B. S. Rangvid (2012). The impact of parents' years since migration on children's academic achievement. *IZA Journal of Migration 1*(1), 6.

Persson, P. and M. Rossin-Slater (2018). Family ruptures, stress, and the mental health of the next generation. *American Economic Review 108*(4-5), 1214–52.

Quintana-Domeque, C. and P. Ródenas-Serrano (2017). The hidden costs of terrorism: The effects on health at birth. *Journal of Health Economics 56*, 47–60.

Sanbonmatsu, L., N. A. Potter, E. Adam, G. J. Duncan, L. F. Katz, R. C. Kessler, J. Ludwig, J. Marvakov, F. Yang, W. J. Congdon, et al. (2012). The long-term effects of moving to opportunity on adult health and economic self-sufficiency. *Cityscape*, 109–136.

Sanders, N. J. and C. Stoecker (2015). Where have all the young men gone? using sex ratios to measure fetal death rates. *Journal of Health Economics 41*, 30–45.

Sedik, D. J., S. Sotnikov, and D. Wiesmann (2003). Food security in the Russian Federation. *Food & Agriculture Org.* (153).

Sgan-Cohen, H., D. Steinberg, S. Zusman, R. Naor, and M. Sela (1993). Periodontal status among adult immigrants from rural Ethiopia. *Israel Journal of Medical Sciences 29*(6-7), 407–410.

Shtarkshall, R. A., F. Baynesan, and B. S. Feldman (2009). A socio-ecological analysis of Ethiopian immigrants' interactions with the Israeli healthcare system and its policy and service implications. *Ethnicity & Health 14*(5), 459–478.

Stillman, S., J. Gibson, and D. McKenzie (2012). The impact of immigration on child health: experimental evidence from a migration lottery program. *Economic Inquiry 50*(1), 62–81.

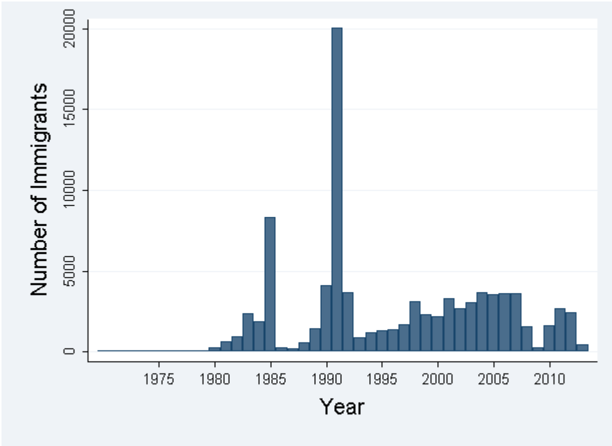
Van den Berg, G. J., P. Lundborg, P. Nystedt, and D.-O. Rooth (2014). Critical periods during childhood and adolescence. *Journal of the European Economic Association 12*(6), 1521–1557.

van der Haar, F., G. Gerasimov, V. Q. Tyler, and A. Timmer (2011). Universal salt iodization in the Central and Eastern Europe, Commonwealth of Independent States (CEE/CIS) region during the decade 2000–09: Experiences, achievements, and lessons learned. *Food and Nutrition Bulletin 32*(4_suppl4), S175–S175.

Venkataramani, A. S. (2012). Early life exposure to malaria and cognition in adulthood: evidence from mexico. *Journal of Health Economics 31*(5), 767–780.

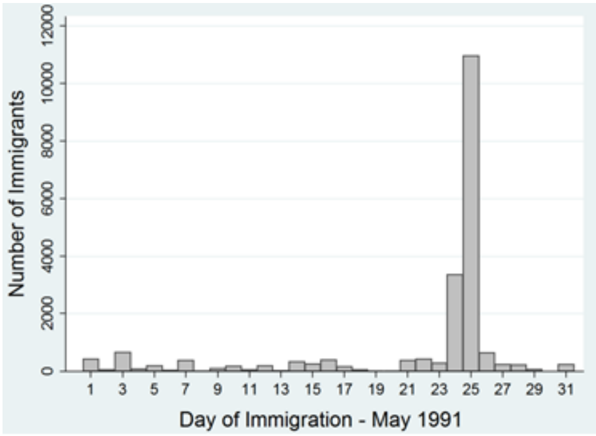
Yaphe, J., M. Schein, and P. Naveh (2001). Ethiopian parents' perception of their children's health: A focus group study of immigrants to Israel. *The Israel Medical Association Journal 3*(12), 932–936.

Figure 1: Immigration of Ethiopian Jews to Israel, 1975–2010



Notes: Distribution of Ethiopian immigrants to Israel by year. Source: CBS.

Figure 2: Immigration of Ethiopian Jews to Israel, May 1991



Notes: Distribution of Ethiopian immigrants to Israel in May 1991 by date. Source: CBS.

Figure 3: Definition of the Three Trimester Groups

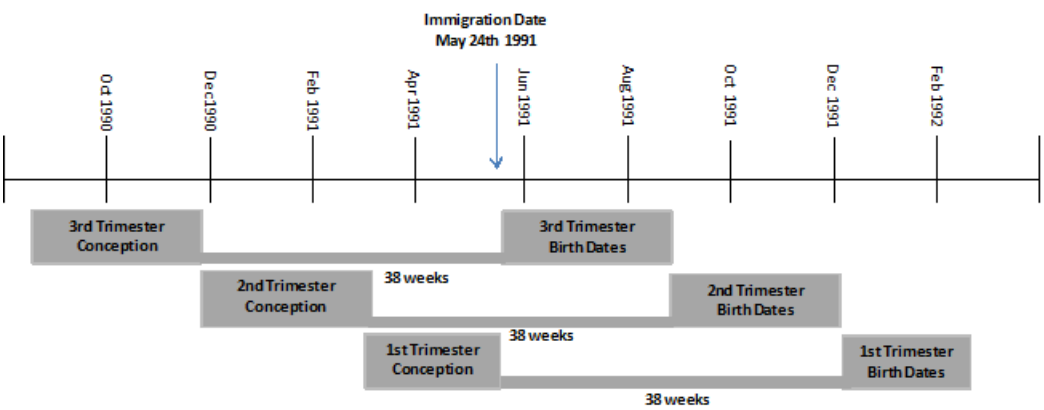
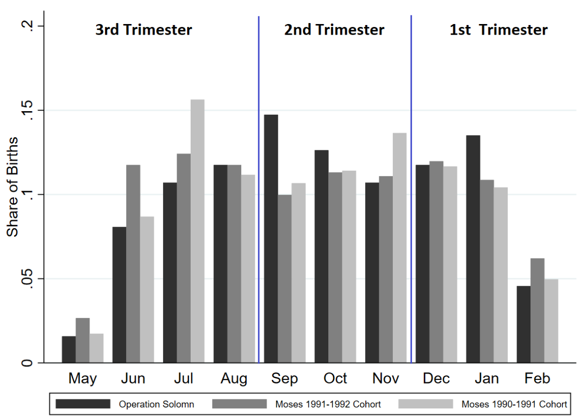
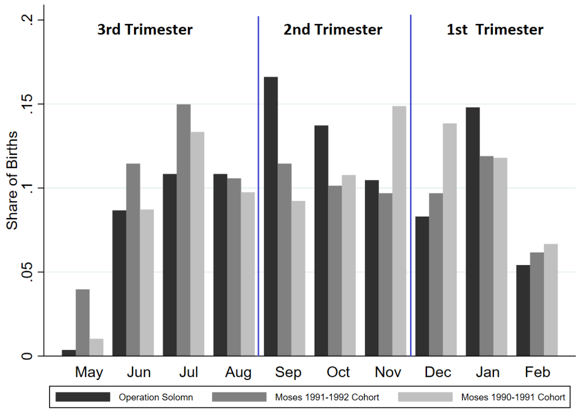


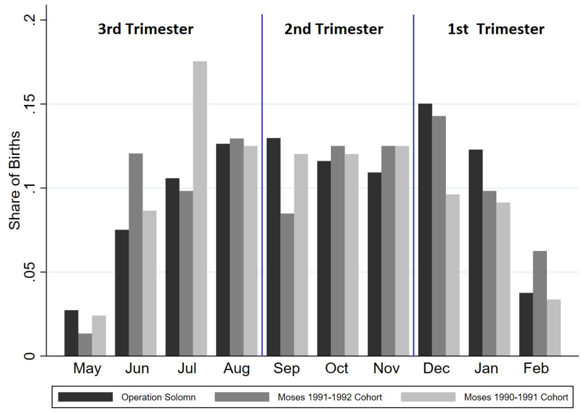
Figure 4: Birth Distribution of Main Sample and Comparison Group



(a) All



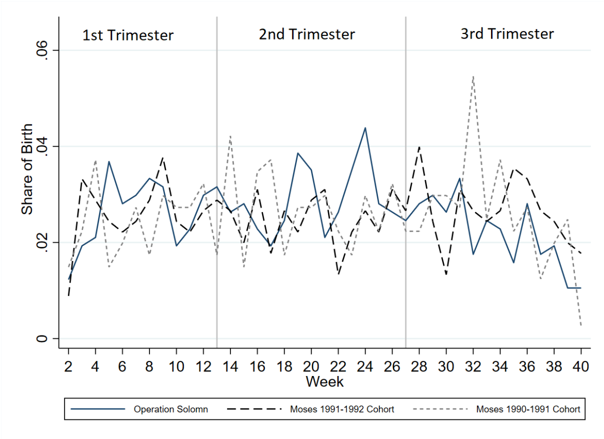
(b) Females



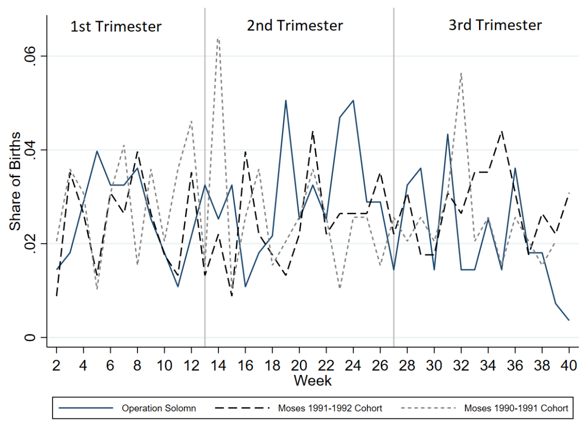
(c) Males

Notes: The figure reports the share of births (from the total birth during that 9 months period) by month of birth for the main analysis sample (Operation Solomon children) and the comparison group. Vertical lines denote the trimester groups by month of birth. The comparison group comprises second-generation Ethiopian immigrants whose families arrived in Israel before 1989 (in Operation Moses): Moses 1991-1992 Cohort includes 451 individuals born between May 27, 1991 and February 15, 1992. Moses 1990-1991 Cohort includes 403 individuals born between May 27, 1990 and February 15, 1991.

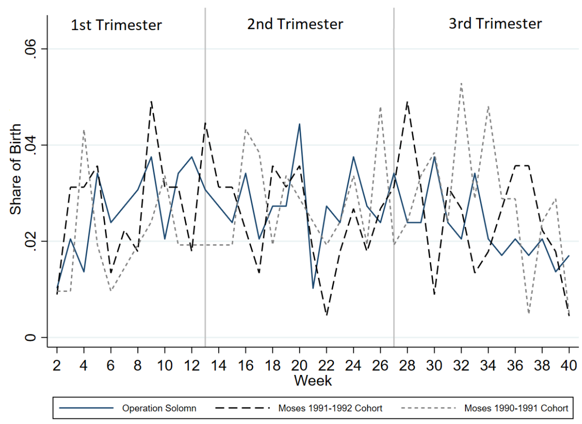
Figure 5: Share of Children by Gestational Week on Date of Immigration (May 24 or 25, 1991) for the Main Sample and by Equivalent Birth Date for the Comparison Group



(a) All



(b) Females



(c) Males

Notes: The figure plots the birth's distribution of the main analysis sample and the comparison group. Births of the Operation Solomon sample are grouped by estimated gestational week upon immigration to Israel. Births of the comparison sample are grouped by estimated gestational week on May 25. The vertical lines denote the trimester cutoffs. The comparison group comprises second-generation Ethiopian immigrants whose families arrived in Israel before 1989 (in Operation Moses): Moses 1991-1992 Cohort includes 451 individuals born between May 27, 1991 and February 15, 1992. Moses 1990-1991 Cohort includes 403 individuals born between May 27, 1990 and February 15, 1991.

Table 1. Descriptive Statistics: Background Characteristics

	All	Females	Males
	(1)	(2)	(3)
Mother's age at birth	30.55	30.55	30.54
	[8.887]	[8.924]	[8.868]
Father's age at birth	41.48	41.27	41.68
	[12.16]	[12.19]	[12.16]
Mother's age at first birth	23.04	22.91	23.17
	[5.415]	[5.505]	[5.335]
Parents' age gap	10.94	10.71	11.14
	[7.384]	[7.389]	[7.385]
Number of siblings	5.304	5.318	5.290
	[1.913]	[1.965]	[1.866]
Birth order	3.658	3.671	3.645
	[2.207]	[2.159]	[2.254]
Birth spacing	2.565	2.573	2.559
(years to the next birth)	[2.187]	[2.263]	[2.116]
Father's years of schooling	1.316	1.509	1.133
	[3.097]	[3.319]	[2.864]
Mother's years of schooling	1.433	1.560	1.314
	[3.275]	[3.312]	[3.241]
Family income (NIS), 1995	16,280	16,035	16,512
	[14,336]	[14,223]	[14,461]
Family income (NIS), 2000	26,575	27,767	25,449
	[31,320]	[31,142]	[31,499]
SES of the mother's first	-0.028	-0.037	-0.020
locality of residence upon	[0.543]	[0.526]	[0.560]
immigration			
Observations	570	277	293

Notes: Standard deviations are presented in brackets. Individuals in the sample were born in Israel between May 27, 1991, and February 15, 1992 and whose parents immigrated in Operation Solomon (May 24-25, 1991). Family income is measured in Shekels in nominal terms. SES is a socio-economic index of Israeli localities based on several demographic and economic variables, including dependency ratio, average years of schooling in the adult population, percentage of academic degree holders, employment and income levels, etc. Lower values correspond to lower socio-economic status.

Table 2. Means and Standard Deviations of Outcome Variables (Israel CBS Data Source)

	All	Females	Males
	(1)	(2)	(3)
I. High School Outcomes			
No grade repetition (6th–12th grade)	0.807	0.884	0.734
	[0.395]	[0.320]	[0.443]
Completed 12th grade	0.851	0.921	0.785
	[0.357]	[0.271]	[0.412]
Obtained a matriculation diploma	0.300	0.397	0.208
	[0.459]	[0.490]	[0.407]
Total matriculation units	11.30	14.18	8.573
	[11.04]	[10.97]	[10.42]
Math matriculation units (0 to 5)	1.258	1.520	1.010
	[1.509]	[1.545]	[1.432]
English matriculation units (0 to 5)	1.949	2.422	1.502
	[1.880]	[1.827]	[1.822]
II. Early Life Health Outcomes			
Birth weight (*gr*)	3,099	3,043	3,152
	[460.2]	[479.2]	[435.5]
Low birth weight ($<$2500 *gr*)	0.075	0.091	0.059
	[0.263]	[0.288]	[0.236]
Child mortality (by age 6)	0.014	0.011	0.017
	[0.118]	[0.104]	[0.130]
Observations	570	277	293

Notes: Standard deviations are presented in brackets. Individuals in the sample were born between May 27, 1991, and February 15, 1992. The Sample comprises individuals born in Israel whose parents immigrated in Operation Solomon (May 24-25, 1991).

Table 3. Means and Standard Deviations of Outcome Variables (NII Data Source)

	All	Females	Males
	(1)	(2)	(3)
I. GEMS Outcomes			
GEMS test scores	0.000	0.188	-0.210
	[1.000]	[0.896]	[1.056]
Own behavior at school	0.012	0.085	-0.072
	[0.477]	[0.559]	[0.476]
II. Long-Term Human Capital Outcomes			
i.By Age 26			
Enrolled in any post-secondary institution	0.251	0.358	0.150
	[0.434]	[0.480]	[0.358]
Enrolled in university or collage	0.190	0.291	0.094
	[0.393]	[0.455]	[0.293]
Received any welfare benefits	0.118	0.125	0.112
	[0.323]	[0.332]	[0.316]
ii.Between Ages 23 and 25			
Employed	0.902	0.924	0.882
	[0.297]	[0.266]	[0.322]
Employed or studying	0.908	0.931	0.887
	[0.288]	[0.253]	[0.317]
Annual months worked	9.117	9.411	8.839
	[4.044]	[3.849]	[4.204]
Monthly earnings (NIS)	4,225	3,816	4,612
	[2,320]	[2,010]	[2,522]
Monthly earnings conditional on employment (NIS)	4,682	4,132	5,227
	[1,957]	[1,752]	[1,997]
III. Marriage and Childbearing by Age 26			
Married	0.095	0.151	0.042
	[0.294]	[0.359]	[0.201]
Any children	0.097	0.144	0.052
	[0.296]	[0.352]	[0.223]
Observations	557	271	286

Notes: Standard deviations are presented in brackets. Individuals in the sample were born between May 27, 1991, and February 15, 1992. The Sample comprises individuals born in Israel whose parents immigrated in Operation Solomon (May 24-25, 1991). GEMS test score is the mean z-score (by year and subject) in math, Hebrew, science and English. It is based on a sample of 956 tests (504 from females and 452 from males) taken by 260 fifth-grade students (135 females and 125 males), out of 557 students in the sample. Own behavior at school is the mean of the standardized answers for the seven items that relate to students' feelings or self-reported behavior in the student questionnaire. It is based on a sample of 576 questionnaires (307 from females and 269 from males) filled in by 470 fifth- to seventh-grade students (269 females and 201 males), out of 557 students in the sample. Long-term human capital outcomes between age 23 and 25 are observed for each individual once at each age. Hence the sample for these outcomes is a panel of 1,671 observations. Monthly earnings are measured in Shekels in nominal terms.

Table 4. Differences in Observable Characteristics Between Trimester Groups

	All				Females				Males			
	1st Trim.	Difference (t-test)			1st Trim.	Difference (t-test)			1st Trim.	Difference (t-test)		
	Mean, SD	1st-2nd	1st-3rd	2nd-3rd	Mean, SD	1st-2nd	1st-3rd	2nd-3rd	Mean, SD	1st-2nd	1st-3rd	2nd-3rd
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
% Female at birth	0.472	-0.043	0.012	0.055								
	[0.501]	(0.051)	(0.055)	(0.050)								
Mother's age at birth	30.88	0.575	0.308	-0.268	31.41	0.800	1.741	0.942	30.40	0.427	-0.937	-1.363
	[9.777]	(0.982)	(1.002)	(0.885)	[9.752]	(1.558)	(1.476)	(1.091)	[9.832]	(1.032)	(1.293)	(1.235)
Father's age at birth	40.80	-1.023	-0.846	0.176	41.20	-0.236	0.111	0.347	40.45	-1.792	-1.679	0.113
	[12.51]	(1.341)	(1.326)	(1.104)	[12.36]	(2.099)	(2.135)	(1.707)	[12.71]	(1.352)	(1.592)	(1.516)
Mother's age at first birth	23.37	0.424	0.509	0.085	22.91	-0.250	0.377	0.627	23.79	1.063	0.641	-0.422
	[6.058]	(0.661)	(0.549)	(0.596)	[6.147]	(0.951)	(0.905)	(0.732)	[5.982]	(0.744)	(0.716)	(0.733)
Parents' age gap	9.925	-1.598***	-1.154	0.444	9.789	-1.036	-1.630	-0.595	10.05	-2.218***	-0.742	1.476
	[6.342]	(0.570)	(0.688)	(0.608)	[6.289]	(0.874)	(1.108)	(1.023)	[6.423]	(0.773)	(0.887)	(0.913)
Number of siblings	5.329	0.020	0.056	0.036	5.289	-0.194	0.191	0.385	5.365	0.241	-0.056	-0.297
	[1.942]	(0.190)	(0.209)	(0.184)	[1.910]	(0.251)	(0.268)	(0.229)	[1.981]	(0.229)	(0.277)	(0.269)
Birth order	3.578	-0.070	-0.167	-0.096	3.842	0.150	0.361	0.210	3.341	-0.261	-0.627*	-0.367
	[2.215]	(0.235)	(0.283)	(0.253)	[2.209]	(0.329)	(0.309)	(0.271)	[2.207]	(0.228)	(0.373)	(0.354)
Birth spacing	2.640	0.217	-0.045	-0.262	2.893	0.486	0.374	-0.112	2.415	-0.026	-0.412	-0.386
(years to the next birth)	[2.136]	(0.251)	(0.308)	(0.277)	[2.477]	(0.390)	(0.459)	(0.327)	[1.763]	(0.229)	(0.281)	(0.317)
Father's years of schooling	1.255	-0.252	0.135	0.387	1.000	-0.775	-0.593	0.182	1.482	0.261	0.767**	0.505
	[2.866]	(0.291)	(0.314)	(0.265)	[2.638]	(0.443)	(0.476)	(0.503)	[3.054]	(0.366)	(0.348)	(0.312)
Mother's years of schooling	1.137	-0.644**	-0.108	0.537	0.855	-1.036**	-0.873**	0.163	1.388	-0.275	0.557	0.832*
	[2.908]	(0.298)	(0.326)	(0.313)	[2.647]	(0.410)	(0.419)	(0.514)	[3.117]	(0.486)	(0.465)	(0.412)
Family income (NIS), 1995	17,156	1,150	1,315	164.2	16,010	-546.1	721.4	1,267	18,182	2,760	1,868	-891.5
	[15,200]	(1,591)	(1,600)	(1,471)	[14,294]	(2,226)	(2,107)	(1,840)	[15,981]	(1,824)	(2,063)	(1,778)
Family income (NIS), 2000	27,980	425.9	3,984	3,558	27,445	-1,707	1,427	3,134	28,458	2,601	6,187	3,586
	[31,717]	(2,573)	(2,889)	(2,388)	[30,408]	(4,808)	(4,587)	(4,534)	[33,015]	(4,682)	(4,629)	(4,298)
SES of the mother's first locality of residence upon immigration	-0.065	-0.062	-0.036	0.026	-0.130	-0.148*	-0.101	0.047	-0.006	0.018	0.023	0.005
	[0.547]	(0.063)	(0.052)	(0.057)	[0.498]	(0.081)	(0.063)	(0.073)	[0.584]	(0.090)	(0.086)	(0.087)
Joint Significance of all Covariates												
F Statistic		2.48	1.59	0.53		2.48	1.54	0.87		4.02	1.92	1.09
P-value		0.033	0.169	0.854		0.033	0.185	0.573		0.002	0.092	0.404

Notes: Means and standard deviations (in brackets) of first-trimester group are presented in columns 1, 5 and 9 for all individuals, and for females and males respectively. Columns 2, 6 and 10 report differences in means and standard errors clustered at week of pregnancy between the first- and second-trimester groups for all individuals, and for females and males respectively. Columns 3, 7 and 11 report differences in means and standard errors clustered at week of pregnancy between the first- and third-trimester groups for all individuals, and for females and males respectively. Columns 4, 8 and 12 report differences in means and standard errors clustered at week of pregnancy between the second- and third-trimester groups for all individuals, and for females and males respectively. The last two rows report F statistics and p-values for joint significance of all covariates. First-trimester group includes 161 individuals (76 females and 85 males) born between December 4, 1991, and February 15, 1992; second-trimester group includes 233 individuals (120 females and 113 males) born between August 28 and December 3, 1991; and third-trimester group includes 176 individuals (81 females and 95 males) born between May 27 and August 27, 1991. Family income is measured in Shekels in nominal terms. SES is a socio-economic index of Israeli localities based on several demographic and economic variables, including dependency ratio, average years of schooling in the adult population, percentage of academic degree holders, employment and income levels, etc. Lower values correspond to lower socio-economic status.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 5. Estimated Effect of Prenatal Environment on High School Outcomes by Gender

	No Grade Repetition (6th—12th grade)		Completed 12th Grade		Obtained a Matriculation Diploma		Total Matriculation Units		Math Matriculation Units		English Matriculation Units	
	Baseline Sample (OLS)	Extended Sample (DID)	Baseline Sample (OLS)	Extended Sample (DID)	Baseline Sample (OLS)	Extended Sample (DID)	Baseline Sample (OLS)	Extended Sample (DID)	Baseline Sample (OLS)	Extended Sample (DID)	Baseline Sample (OLS)	Extended Sample (DID)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Panel A. Females												
1st-trimester	0.164***	0.184***	0.074*	0.083	0.148*	0.200**	4.527***	5.212***	0.599**	0.776***	0.741***	1.001***
	(0.045)	(0.053)	(0.042)	(0.051)	(0.088)	(0.099)	(1.686)	(1.775)	(0.245)	(0.285)	(0.287)	(0.345)
2nd-trimester	0.104**	0.074	0.040	0.017	0.103	0.087	3.467**	3.877**	0.377	0.292	0.649***	0.818***
	(0.045)	(0.047)	(0.042)	(0.052)	(0.092)	(0.103)	(1.556)	(1.974)	(0.233)	(0.283)	(0.226)	(0.316)
P-value: 1st = 2nd	0.078	0.024	0.346	0.172	0.552	0.185	0.485	0.447	0.287	0.048	0.711	0.566
3rd-trimester Mean and SD	0.802 [0.401]		0.889 [0.316]		0.309 [0.465]		11.51 [10.68]		1.198 [1.528]		1.938 [1.880]	
Panel B. Males												
1st-trimester	0.028	-0.053	0.005	-0.029	0.056	-0.026	1.297	-1.210	0.156	0.0003	0.182	-0.267
	(0.066)	(0.083)	(0.059)	(0.072)	(0.052)	(0.078)	(1.236)	(1.757)	(0.202)	(0.238)	(0.199)	(0.342)
2nd-trimester	-0.024	-0.103	-0.020	-0.085	0.015	-0.0244	0.447	-0.910	0.163	0.139	-0.020	-0.274
	(0.059)	(0.079)	(0.048)	(0.067)	(0.051)	(0.063)	(1.177)	(1.424)	(0.207)	(0.210)	(0.152)	(0.255)
P-value: 1st = 2nd	0.372	0.485	0.665	0.370	0.409	0.984	0.438	0.851	0.969	0.539	0.294	0.982
3rd-trimester Mean and SD	0.737 [0.443]		0.789 [0.410]		0.189 [0.394]		8.116 [9.882]		0.926 [1.362]		1.463 [1.737]	
Panel C. P-value for equality of the coefficient between females and males												
1st-trimester	0.129	0.028	0.369	0.181	0.351	0.036	0.091	0.000	0.165	0.007	0.079	0.003
2nd-trimester	0.103	0.055	0.345	0.179	0.358	0.307	0.091	0.019	0.439	0.618	0.010	0.002

Notes: Standard errors reported in parentheses are clustered at week of pregnancy for the OLS regressions and at week and year of birth for the DID regressions. Odd columns report estimates for β_1 and β_2 of equation (1) and even columns report estimates for α_1 and α_2 of equation (2). Both were estimated for females and males separately as a system of seemingly unrelated regressions. Panel A reports estimates for females and Panel B reports estimates for males. Panel C reports p-values from F-tests that check the difference between coefficients of females and males. All specifications control for both parents' years of schooling, mother's age at birth, parents' age gap, SES of first locality in Israel, and birth order. The baseline sample includes 570 individuals (277 female and 293 males) born between May 27, 1991, and February 15, 1992, and the two-cohorts sample includes 1,424 individuals (699 females and 725 males) born either between May 27, 1991, and February 15, 1992, or between May 27, 1990, and February 15, 1991.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 6. Estimated Effect of Prenatal Environment on Test Scores and Own Behavior in Elementary and Middle School

	GEMS Test Scores (Fifth Grade)	Own Behavior at School (Fifth to Seventh Grade)
	(1)	(2)
Panel A. Females		
1st-trimester	0.631***	0.235**
	(0.199)	(0.093)
2nd-trimester	0.294**	0.007
	(0.138)	(0.070)
P-value: 1st = 2nd	0.048	0.007
3rd-trimester	-0.026	0.026
Mean and SD	[0.939]	[0.494]
Panel B. Males		
1st-trimester	0.314	0.206*
	(0.247)	(0.123)
2nd-trimester	-0.081	-0.032
	(0.207)	(0.111)
P-value: 1st = 2nd	0.089	0.060
3rd-trimester	-0.187	-0.094
Mean and SD	[0.954]	[0.650]
Panel C. P-value for equality of the coefficient between females and males		
1st-trimester	0.358	0.812
2nd-trimester	0.136	0.767

Notes: Standard errors reported in parentheses are clustered at week of pregnancy. The table reports estimates for β_1 and β_2 of equation (1), estimated for females and males separately as a system of seemingly unrelated regressions. Panel A reports estimates for females and Panel B reports estimates for males. Panel C reports p-values from F-tests that check for the equality of coefficients of females and males. The dependent variable in column 1 is the standardized GEMS test score (by year and subject) of fifth-grade students in math, Hebrew, science and English. The sample in column 1 stacks for all GEMS subjects and includes 956 tests (504 from females and 452 from males) taken by 260 fifth-grade students (135 females and 125 males), out of 557 overall in the sample. Estimates are weighted by the inverse number of appearances of each student. Controls in column 1 include both parents' years of schooling, number of siblings, mother's age at birth, parents' age gap, test year fixed effects, and indicators for the subject of the test. The dependent variable in column 2 is the mean of the standardized answers for the seven items that relate to students' feelings or self-reported behavior in the student questionnaire. The sample in column 2 pools data for students from the fifth, sixth and seventh grades (the same student may appear more than once) and includes 576 questionnaires (307 from females and 269 from males) filled in by 470 students (269 females and 201 males), out of 557 students from the sample. Estimates are weighted by the inverse number of appearances of each student. Controls in column 2 include both parents' years of schooling, number of siblings, mother's age at birth, parents' age gap, and year and grade dummies. The baseline category is arrival in Israel in the third trimester of pregnancy.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 7. Estimated Long-Term Effects of Prenatal Environment: Post-Secondary Schooling, Labor Market Outcomes, Marriage and Childbearing

	Post-secondary Schooling and Welfare Recipiency, Ages 18–26			Labor Market Outcomes Ages 23–25					Marriage and Childbearing by Age 26	
	Any Post-secondary Enrollment	University or College Enrollment	Welfare Recipiency	Employed	Employed or Studying	Annual Months Worked	Monthly Earnings (NIS)	Monthly Earnings Conditional on Employment	Married	Any Children
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Panel A. Females										
1st-trimester	0.117*	0.101*	0.018	0.090***	0.073**	1.495***	406.2*	-46.18	-0.026	-0.072
	(0.063)	(0.056)	(0.045)	(0.034)	(0.031)	(0.462)	(217.3)	(243.2)	(0.052)	(0.054)
2nd-trimester	0.079	0.114**	-0.002	0.063*	0.052*	0.656	225.0	-69.91	-0.28	-0.019
	(0.058)	(0.054)	(0.052)	(0.034)	(0.031)	(0.493)	(219.9)	(242.9)	(0.041)	(0.054)
P-value: 1st = 2nd	0.612	0.846	0.710	0.357	0.457	0.039	0.326	0.884	0.963	0.318
3rd-trimester Mean and SD	0.265	0.187	0.113	0.871	0.883	8.708	3,636	4,175	0.175	0.163
	[0.443]	[0.393]	[0.318]	[0.336]	[0.322]	[4.342]	[2,171]	[1,776]	[0.382]	[0.371]
Panel B. Males										
1st-trimester	0.032	0.008	0.037	-0.010	-0.011	-0.516	51.769	176.1	0.023	0.021
	(0.039)	(0.034)	(0.032)	(0.039)	(0.039)	(0.500)	(276.7)	(244.4)	(0.021)	(0.026)
2nd-trimester	0.096*	0.070*	0.043	-0.000	0.013	-0.310	-325.7	-296.3	0.065	0.032
	(0.054)	(0.040)	(0.032)	(0.035)	(0.031)	(0.480)	(259.3)	(216.3)	(0.024)	(0.031)
P-value: 1st = 2nd	0.216	0.103	0.825	0.795	0.499	0.634	0.056	0.020	0.135	0.726
3rd-trimester Mean and SD	0.106	0.064	0.096	0.872	0.872	8.954	4,610	5,285	0.011	0.032
	[0.310]	[0.246]	[0.296]	[0.334]	[0.334]	[4.248]	[2,429]	[1,786]	[0.103]	[0.177]
Panel C. P-value for equality of the coefficient between females and males										
1st-trimester	0.288	0.139	0.730	0.079	0.110	0.012	0.381	0.541	0.431	0.168
2nd-trimester	0.805	0.519	0.426	0.220	0.357	0.188	0.131	0.507	0.036	0.410

Notes: Standard errors reported in parentheses are clustered at week of pregnancy. The table reports estimates for β_1 and β_2 of equation (1), estimated for females and males separately as a system of seemingly unrelated regressions. Panel A reports estimates for females and Panel B reports estimates for males. Panel C reports p-values from F-tests that test for the equality of coefficients of females and males. The dependent variables in columns 1–3, 9 and 10 are observed once for each individual by age 26. Controls include both parents' years of schooling, number of siblings, mother's age at birth and parents' age gap. The dependent variables in columns 4–8 are observed three times for each individual: at age 23, 24 and 25. Controls include both parents' years of schooling, mother's age at birth, parents' age gap, number of siblings and dummies for age. The sample comprises 557 individuals (271 females and 286 males) born between May 27, 1991, and February 15, 1992. In column 8 the sample includes only individuals with positive earnings. The baseline category is arrival in Israel in the third trimester of pregnancy. Monthly earnings are measured in Shekels in nominal terms.

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

Table 8. Estimated Effect of Prenatal Environment on Birth Weight and Child Mortality

	Birth Weight (*gr*)	Low Birth Weight (<2500 *gr*)	Child Mortality (by age 6)
	(1)	(2)	(3)
Panel A. Females			
1st-trimester	92.99	0.050	-0.011
	(70.94)	(0.043)	(0.014)
2nd-trimester	30.46	0.036	-0.007
	(59.71)	(0.040)	(0.013)
P-value: 1st = 2nd	0.277	0.655	0.735
3rd-trimester	2,997	0.076	0.012
Mean and SD	[438.7]	[0.267]	[0.111]
Panel B. Males			
1st-trimester	91.18	-0.026	-0.031
	(73.56)	(0.038)	(0.020)
2nd-trimester	172.1**	-0.046	-0.018
	(74.47)	(0.038)	(0.017)
P-value: 1st = 2nd	0.093	0.415	0.396
3rd-trimester	3,054	0.106	0.032
Mean and SD	[449.0]	[0.310]	[0.176]
Panel C. P-value for equality of the coefficient between females and males			
1st-trimester	0.986	0.238	0.291
2nd-trimester	0.094	0.176	0.544

Notes: Standard errors reported in parentheses are clustered at week of pregnancy. The table reports estimates for β_1 and β_2 of equation (1), estimated for females and males separately as a system of seemingly unrelated regressions. Panel A reports estimates for females and Panel B reports estimates for males. Panel C reports p-values from F-tests that check the difference between coefficients of females and males. All specifications control for both parents' years of schooling, mother's age at birth, parents' age gap, SES of first locality in Israel and birth order. The sample comprises 570 individuals (277 females and 293 males) born between May 27, 1991, and February 15, 1992. Birth weight is missing for two females in the third trimester group and six males (two in the first and the third trimesters groups and three in the second trimester group. The baseline category is immigration in the third trimester of pregnancy.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Online Appendix

Immigration and the Short- and Long-Term Impact of Improved Prenatal Conditions

Victor Lavy [1], Analia Schlosser [2], and Adi Shany[3]

[1]University of Warwick, Hebrew University, NBER and CEPR

[2]Tel Aviv University, CESifo, IZA and CEPR

[3]Tel Aviv University

June 30, 2021

A. Environmental Conditions of Operation Solomon Immigrants in Ethiopia and in Israel

We summarize here the main differences in environmental conditions experienced by mothers in our sample in Ethiopia and in Israel based on interviews, reports in the contemporary media, and other relevant literature.

Living conditions. Prior to Operation Solomon, the Ethiopian Jews lived in hundreds of small remote villages in northern Ethiopia. Their lifestyle, beliefs and occupations were typical of a traditional society. Less than 30% of the population was literate in their native tongue, and schools were not accessible to the majority of the population. In May 1990, a large part of this population migrated to Addis Ababa, where they were housed in refugee camps scattered around the city, in living conditions not better than in the rural areas they came from . After their arrival in Israel, most of the immigrants (80%) were housed for the first few years in absorption centers, and the remainder in mobile home camps (Gould et al., 2004).

General medical care. In rural villages, local traditional practitioners provided most medical care, utilizing traditional medications and treatments. Standard Western perceptions of disease causation were uncommon. For many, their first exposure to Western medical practices was through medical clinics established by the American Jewish Joint Distribution Committee

(AJDC) in Addis Ababa, where the immigrants were housed before their evacuation to Israel. These clinics were established in August 1990 following an increase in the incidence of malaria, hepatitis and tuberculosis after the refugees' arrival in Addis Ababa. The AJDC developed a comprehensive medical program that included immunization and training of Ethiopian health practitioners by Israeli doctors, and that served approximately 4,000 families. These health services significantly reduced the death rate in the following months (Myers, 1993).

Following their arrival in Israel, the immigrants were registered in family groups according to date of arrival, age and sex. The immigrants' weight and height were recorded, and physical examinations were carried out by medical teams.[1] Blood samples were obtained for complete blood count, VDRL, HBsAg, GCPD and SMA-12. Urinalysis and thick film examination for malaria and borreliosis were also performed, along with chest X-rays and tuberculin tests (Nahmias et al., 1993).

Most of the absorption centers had access to a primary care clinic on location or nearby. These provided medical services to the immigrants. All clinics were staffed by a physician, a nurse, and an interpreter/mediator (Flatau et al., 1993; Sgan-Cohen et al., 1993; Shtarkshall et al., 2009; Levin-Zamir et al., 1993). They provided care for acute and chronic illness and preventive care, along with mother and child health care and immunizations (Yaphe et al., 2001). The Israeli health authorities developed an educational program to bridge the cultural gaps between immigrants and health care practitioners, and to promote the transfer of skills to the immigrants regarding proper health care, nutrition, prescribed medications, and personal hygiene (Levin-Zamir et al., 1993).

Nutrition. The International Food Policy Research Institute (IFPRI) reports that in 1993 the calorie supply per capita in Ethiopia was 1,516, while in Israel it was twice as large, 3,089 (Israeli CBS, 2008). The traditional Ethiopian diet consisted of unrefined flours, grains, vegetables, refined sugars, and processed foods, and was limited in meat. These eating habits changed upon arrival in Israel, as many of the traditional Ethiopian staples were not available at the time in Israel (Levin-Zamir et al., 1993).

Micronutrient supplements for pregnant women. Three main micronutrient supplements are

[1]Unfortunately, these data are not available

important for cognition and recommended for pregnant women: iron, iodine and folic acid.[2] The 2011 Ethiopian Demographic and Health Survey reports that 83% of women did not take iron tablets during their last pregnancy, and less than 1% took them for 90 days or more during their last pregnancy.[3] Furthermore, a situational analysis carried out by the Ministry of Health (MOH) and the United Nations Children's Fund (UNICEF) in Ethiopia in 1993 reports that 78% of the population are exposed to iodine deficiency and 62% are iodine-deficient (Taye and Argaw, 1997). In a 2004 WHO report, Ethiopia was categorized among moderately iodine-deficient countries, with only 20% of households having access to adequately iodized salt.[4]

In Israel, in contrast, it was a standard practice at the time to prescribe vitamin and iron supplements to pregnant women. Ethiopian women who arrived in Operation Solomon agreed to take these supplements even though many believed that in Ethiopia this was not needed because "the food was better, it contains more vitamins than the food in Israel" (Granot et al., 1996). No iodine deficiency disorders are found among pregnant women in Israel, largely because Israel's food chain contains adequate amounts of iodine (Benbassat et al., 2004).

Antenatal care and monitoring. Ethiopian women who lived in rural areas shared the view that pregnancy does not require medical attention. They gave birth at home with assistance from family and neighbors, and a traditional birth attendant or lay midwife. In contrast, in Israel, pregnancies among Ethiopians were closely monitored, the baby and mother were examined periodically before and after birth, and almost all births were in hospitals. In 1990-1991, the infant mortality rate was 12% in Ethiopia and 1% in Israel, and the child mortality rate was 20% in Ethiopia but only 1.2% in Israel (The World Bank, 1991). All the women we surveyed attested that in Ethiopia they had received no pregnancy-related medical care, while in Israel their pregnancies were medically monitored, with blood tests, ultrasound, and vitamin supplement prescriptions (mainly iron and folic acid).

B. Micronutrient Deficiencies During Pregnancy

Vitamins and minerals, referred to collectively as micronutrients, have important influences on the health of pregnant women and the growing fetus. A recent joint statement by the World

[2]In Appendix B we provide additional information on the importance of micronutrients for development.
[3]Ethiopia Demographic and Health Survey 2011, p. 187.
[4]Ethiopia Demographic and Health Survey 2005, p. 151.

Health Organization (WHO), the World Food Program, and the United Nations Children's Fund (2007) estimates that more than two billion people in the world are deficient in key vitamins and minerals, particularly vitamin A, iodine, iron and zinc. Most of these people live in low-income countries and are typically deficient in more than one micronutrient. Iron, iodine and folic acid are among the most important micronutrients for in-utero cognition and brain development. A 2008 WHO report on the worldwide prevalence of anemia in 1993–2005 estimates that Africa contains the highest proportion of individuals affected by anemia. In Ethiopia, anemia is a severe problem affecting both pregnant (62.7%) and non-pregnant women of childbearing age (52.3%). According to the WHO report, more than half of this anemia burden is due to iron deficiency (ID), with the rest partly due to deficiency of folic acid, vitamin B12, and vitamin A, along with parasitic infections.

Many important developmental processes, including myelination, dendritogenesis, synaptogenesis, and neurotransmission, are highly dependent on iron-containing enzymes and hemoproteins (Lozoff, 2007). ID disrupts these processes in a regionally specific manner, depending on which brain areas are most rapidly developing at the time of the deficiency (Kretchmer et al., 1996). Longitudinal studies in humans have concluded that fetal or neonatal iron deficiency anemia is associated with diminished general autonomic response, motor maturity and self-regulation (Hernández-Martínez et al., 2011), higher levels of negative emotionality and lower levels of alertness and suitability in infants (Wachs et al., 2005), slower neuronal conduction (Amin et al., 2010), worse learning ability and memory at 3 to 4 years, and poorer performance (Riggins et al., 2009). The irreversibility of maternal iron deficiency was demonstrated by reports on cognitive and behavioral alterations that persisted into childhood and adolescence despite iron treatment in infancy (Grantham-McGregor and Ani, 2001; Lozoff et al., 2000).

Researchers have hypothesized that there exists a "window of vulnerability" to the harmful effects of iron deficiency. In an animal study, Mihaila et al. (2011) demonstrated that maternal exposure to an iron-deficient diet either prior to conception, at the start of the first trimester, or at the onset of the second trimester had a significant negative impact on the offspring's nervous system, placing the window of vulnerability for the fetus in the first two trimesters of gestation.

An additional critical micronutrient deficiency in developing countries is iodine deficiency.The 2004 WHO report mentioned above estimates that almost two billion people (260 million of them in Africa) are at risk of iodine deficiency. Iodine deficiency is now recognized by the WHO as the most common preventable cause of brain damage in the world today (Preedy et al., 2009). Populations who live in areas with low iodine content in the soil and water are at highest risk for iodine deficiency. Dairy foods and certain fruits and vegetables can be rich in iodine, but only if they originate from iodine-rich areas where the nutrient can be absorbed into foods (Ahmed et al., 2012).

Humans require iodine for the biosynthesis of thyroid hormones, especially thyroxine. These hormones affect development of the central nervous system, which is required for intellectual functioning, and regulate many other physiological processes. In utero, development of the central nervous system depends critically on an adequate supply of these hormones, which influence the density of neural networks established in the developing brain (Lamberg, 1991). Up to mid-gestation, the mother is the only source of iodine for the developing brain of the fetus. An inadequate supply of iodine during gestation, if not corrected by timely intervention to reverse the accompanying maternal hypothyroxinemia, results in damage to the fetal brain that is irreversible by mid-gestation. Even mild to moderate maternal hypothyroxinemia may result in suboptimal neurodevelopment (De Escobar et al., 2007).

Indeed, a longitudinal study in China showed that iodine supplementation in the first and second trimesters of pregnancy decreased the prevalence of moderate and severe neurological abnormalities and increased developmental test scores through age 7, compared with supplementation later in pregnancy or treatment after birth (Cao et al., 1994). Results from a long-term follow-up of this intervention suggest that iodine supplementation before the third trimester predicted higher psychomotor test scores for children relative to those who were provided with iodine later in pregnancy or at 2 years of age (O'Donnell et al., 2002). Other studies similarly found that iodine treatment late in pregnancy or afterwards had no benefits on children's IQ at up to 5 years of age, but treatment early in pregnancy or prior to conception improved IQ (see review by Bougma et al., 2013). Overall, the consensus in the literature is that cognition is sensitive to iodine deficiency exclusively during early fetal life (prior to mid-gestation), while growth and psychomotor development are believed to be most affected by deficiency in infancy (Cao et al., 1994; Isa et al., 2000).

Folic acid deficiency in pregnant women is a major public health problem in developing countries. Adequate folic acid (folate) is critical to embryonic and fetal growth at developmental stages characterized by accelerated cell division. It plays an important part in the development of the central nervous system (the spinal cord and brain). In particular, folate is needed for closure of the neural tube—the embryonic precurser to the brain and spinal cord—early in pregnancy (Czeizel and Dudás, 1992; Czeizel et al., 2004). Folic acid deficiency in early pregnancy dramatically increases the risk of neural tube defects and problems with brain development. Therefore, folic acid supplementation is advised for at least the first 12 weeks of pregnancy for all women, even if they are healthy and have a good diet. Folic acid supplementation that begins after the first trimester of pregnancy will not help to prevent these poor birth outcomes. Several human studies have also demonstrated improved cognitive performance in children following maternal folic acid supplement use during the first trimester of pregnancy (Villamor et al., 2012; Chatzi et al., 2012; Roth et al., 2011; Julvez et al., 2009).

C. Data

Our empirical analysis is based on two data sources. One dataset is stored at the research room of the Israeli Central Bureau of Statistics (CBS) and the second dataset is stored at the research room of the National Insurance Institute of Israel (NII). [5]

The CBS dataset include:

1. Population Registry data containing the birth date, date of immigration, and country of origin for the individuals in our baseline sample and their parents, as well as information on parents' marital status, number of children and their birth dates.

2. Administrative records on birth weight for individuals born in Israel collected from hospital delivery records.

3. Israel Tax Authority (ITA) information on income and earnings of employees and self-employed individuals for 1995 and 2000. We link this data to the parents in our sample to

[5] The analysis on early life health outcomes and high school outcomes was done in the CBS research room. The analysis on elementary and middle school outcomes and the early adulthood outcomes was done in the NII research room. The placebo test on the FSU immigrants from the FSU was done in the Israeli Ministry of Education (MOE) research room on a data set identical in its structure to the data set from the MOE that we analyzed in the CBS research room. All three research rooms require a formal application to access the data and provide restricted access for data analysis.

measure parents' income in the 4 and 9 years after the immigration for the individuals in our sample.

4. Administrative records collected by the Israel Ministry of Education including information on students' parental education, yearly schooling status for each year since first grade till end of high school outcomes. High school outcomes include schooling attainment (repeating a grade after primary school, completing high school, and receiving a matriculation certificate) and quality of schooling attainment (total credit units awarded in the matriculation certificate, and credit units awarded in mathematics and English). High school in Israel runs from 10th grade to 12th grade. Students on an academic track are expected to obtain a matriculation certificate when they finish high school. A matriculation certificate is a prerequisite for admission to academic post-secondary institutions and is also required by many employers. Students earn certification by passing a series of national exams in core and elective subjects during their high-school years. Within subjects, students can choose the proficiency level they want to study and credits are awarded by passing the relevant exams: one credit for the least demanding level through to five credits for the higher level. It takes a minimum of twenty-one credits to qualify for a matriculation certificate.

The NII dataset include:

1. Population Registry data containing the birth date, date of immigration, and country of origin for the individuals in our baseline sample and their parents, as well as information on parents' marital status, number of children and their birth dates.

2. NII records of tertiary education enrollment from 2008 through 2018, based on annual reports submitted to the NII every autumn term by all of Israel's tertiary education institutions.[6] Based on these year-to-year records we define two outcome variables: ever enrolled in post-secondary education up to age 26, and ever enrolled in university or college up to age 26.

[6] Israel has seven universities (one of which confers only Master's and PhD degrees), and more than 50 academic colleges that confer undergraduate degrees (some of these also award Master's degrees). The universities require a matriculation diploma and a psychometric exam for enrollment. Most academic colleges also require a matriculation diploma, although some accept specific matriculation diploma components without requiring full certification.

3. Israel Tax Authority (ITA) information on income and earnings of employees and self-employed individuals for each year during 2008–2017. Only individuals with non-zero self-employment income are required to file tax returns in Israel, but the ITA has information on annual gross earnings from salaried and non-salaried employment and the number of months employed for all employees through the employer reporting system. This information is transferred annually to the NII, which produces an annual series of total earnings from salaried work and self-employment. To account for outliers, we winsorize the top and bottom 5th percentile of earnings. We focus on labor market outcomes at ages 23–25 by pooling individuals' annual records.

4. NII records on unemployment and welfare benefits for 2008–2018. This is a panel dataset that contains monthly information on unemployment and welfare transfers.

5. Students' national standardized tests and questionnaires administered by the Ministry of Education for the years 2002—2005 (GEMS - Growth and Effectiveness Measures for Schools). Annually since 2002, a representative sample of elementary and middle schools in Israel participate in standardized national tests and complete questionnaires on behavioral outcomes and the school environment. The GEMS student data includes test scores of fifth- and eighth-graders in math, science, Hebrew, and English, and responses of fifth-through ninth-grade students to questionnaires. In the GEMS data sets for 2002–2005 we found 470 of our sample of 570 children who were in utero during Operation Solomon. In the GEMS test scores data, we have 260 fifth-graders and 111 eighth-graders, and in the GEMS questionnaires data, we have 234 fifth-graders, 209 sixth-graders, 201 seventh-graders and 95 eighth-graders.[7] To estimate the treatment effect on test scores and behavioral outcomes, we use only test scores of fifth-graders and questionnaires of fifth- to seventh-graders, as there is pronounced selection in the eighth-grade data.[8]

[7]Some students in our sample took the GEMS tests and questionnaires more than once in different grades.

[8]Children whose mothers arrived in Israel during the third trimester are older. Hence, their likelihood of appearing in the GEMS tests and questionnaires in eighth grade during the years 2002–2005 is significantly higher. In contrast, we do not observe significant differences by trimester group for the probability of appearing in the GEMS tests and questionnaires in the fifth, sixth or seventh grade during the same period. Hence, we limit the test score sample to include only fifth-graders, and the student questionnaire data to include fifth- through seventh-graders, with some of the students appearing in the data more than once. Student questionnaires are distributed among students in ninth grade as well but the students in our sample are too young to be in grade ninth between 2002-2005.

To address the issue of multiple hypothesis testing directly and to draw general conclusions about treatment effects on middle school test scores and behavioral outcomes, we first converted test scores into z-scores by subject and year and stacked data for the four subjects. We then grouped seven items in the student questionnaires that relate to students' feelings or self-reported behavior into one category by computing z-scores for each item and averaging within each student. These seven items were as follows: (1) I have a good understanding of my teacher's scholastic requirements; (2) I know what behavior is allowed or forbidden in school; (3) This year I was involved in many fights [reversed]; (4) Sometimes I'm scared to go to school because there are violent students [reversed]; (5) I feel well-adjusted socially in my class; (6) When I have a problem at school there is always someone I can turn to from the teaching staff; and (7) I feel good in school. Students were asked to rate the extent to which they agreed with each statement on a 6-point scale where 1 = "strongly disagree" and 6 = "strongly agree."

References

Ahmed, T., M. Hossain, and K. I. Sanin (2012). Global burden of maternal and child undernutrition and micronutrient deficiencies. *Annals of Nutrition and Metabolism 61*(Suppl. 1), 8–17.

Amin, S. B., M. Orlando, A. Eddins, M. MacDonald, C. Monczynski, and H. Wang (2010). In utero iron status and auditory neural maturation in premature infants as evaluated by auditory brainstem response. *The Journal of Pediatrics 156*(3), 377–381.

Benbassat, C., G. Tsvetov, B. Schindel, M. Hod, Y. Blonder, and B. A. Sela (2004). Assessment of iodine intake in the Israel coastal area. *The Israel Medical Association Journal 6*(2), 75–77.

Bougma, K., F. E. Aboud, K. B. Harding, and G. S. Marquis (2013). Iodine and mental development of children 5 years old and under: A systematic review and meta-analysis. *Nutrients 5*(4), 1384–1416.

Cao, X.-Y., X.-M. Jiang, Z.-H. Dou, M. A. Rakeman, M.-L. Zhang, K. O'Donnell, T. Ma, K. Amette, N. DeLong, and G. R. DeLong (1994). Timing of vulnerability of the brain to iodine deficiency in endemic cretinism. *New England Journal of Medicine 331*(26), 1739–1744.

Chatzi, L., E. Papadopoulou, K. Koutra, T. Roumeliotaki, V. Georgiou, N. Stratakis, V. Lebentakou, M. Karachaliou, M. Vassilaki, and M. Kogevinas (2012). Effect of high doses of folic acid supplementation in early pregnancy on child neurodevelopment at 18 months of age: The mother–child cohort 'Rhea' study in Crete, Greece. *Public Health Nutrition 15*(9), 1728–1736.

Czeizel, A. E., M. Dobó, and P. Vargha (2004). Hungarian cohort-controlled trial of periconceptional multivitamin supplementation shows a reduction in certain congenital abnormalities. *Birth Defects Research Part A: Clinical and Molecular Teratology 70*(11), 853–861.

Czeizel, A. E. and I. Dudás (1992). Prevention of the first occurrence of neural-tube defects by periconceptional vitamin supplementation. *New England Journal of Medicine 327*(26), 1832–1835.

De Escobar, G. M., M. J. Obregón, and F. E. Del Rey (2007). Iodine deficiency and brain development in the first half of pregnancy. *Public Health Nutrition 10*(12A), 1554–1570.

Flatau, E., Z. Nishri, A. Mates, G. Qupty, N. Reichman, and R. Raz (1993). Seroprevalence of antibodies against *Toxoplasma gondii* among recently immigrating Ethiopian Jews. *Israel Journal of Medical Sciences 29*(6-7), 395–397.

Gould, E. D., V. Lavy, and M. D. Paserman (2004). Immigrating to opportunity: Estimating the effect of school quality using a natural experiment on Ethiopians in Israel. *The Quarterly Journal of Economics 119*(2), 489–526.

Granot, M., A. Spitzer, K. J. Aroian, C. Ravid, B. Tamir, and R. Noam (1996). Pregnancy and delivery practices and beliefs of Ethiopian immigrant women in Israel. *Western Journal of Nursing Research 18*(3), 299–313.

Grantham-McGregor, S. and C. Ani (2001). A review of studies on the effect of iron deficiency on cognitive development in children. *The Journal of Nutrition 131*(2), 649S–668S.

Hernández-Martínez, C., J. Canals, N. Aranda, B. Ribot, J. Escribano, and V. Arija (2011). Effects of iron deficiency on neonatal behavior at different stages of pregnancy. *Early Human Development 87*(3), 165–169.

Isa, Z. M., I. Z. Alias, K. A. Kadir, and O. Ali (2000). Effect of iodized oil supplementation on thyroid hormone levels and mental performance among Orang Asli schoolchildren and pregnant mothers in an endemic goitre area in Peninsular Malaysia. *Asia Pacific Journal of Clinical Nutrition 9*(4), 274–281.

Julvez, J., J. Fortuny, M. Mendez, M. Torrent, N. Ribas-Fitó, and J. Sunyer (2009). Maternal use of folic acid supplements during pregnancy and four-year-old neurodevelopment in a population-based birth cohort. *Paediatric and Perinatal Epidemiology 23*(3), 199–206.

Kretchmer, N., J. L. Beard, and S. Carlson (1996). The role of nutrition in the development of normal cognition. *The American Journal of Clinical Nutrition 63*(6), 997S–1001S.

Lamberg, B.-A. (1991). Endemic goitre—iodine deficiency disorders. *Annals of Medicine 23*(4), 367–372.

Levin-Zamir, D., D. Lipsky, E. Goldberg, and Z. Melamed (1993). Health education for Ethiopian immigrants in Israel, 1991-92. *Israel Journal of Medical Sciences 29*(6-7), 422–428.

Lozoff, B. (2007). Iron deficiency and child development. *Food and Nutrition Bulletin 28*(4_suppl4), S560–S571.

Lozoff, B., E. Jimenez, J. Hagen, E. Mollen, and A. W. Wolf (2000). Poorer behavioral and developmental outcome more than 10 years after treatment for iron deficiency in infancy. *Pediatrics 105*(4), e51–e51.

Mihaila, C., J. Schramm, F. G. Strathmann, D. L. Lee, R. M. Gelein, A. E. Luebke, and M. Mayer-Pröschel (2011). Identifying a window of vulnerability during fetal development in a maternal iron restriction model. *PLoS One 6*(3).

Myers, T. M. (1993). A medical care program for Ethiopian Jewish migrants in Addis Ababa. *Israel Journal of Medical Sciences 29*(6-7), 334–338.

Nahmias, J., Z. Greenberg, S. Berger, L. Hornstein, B. Bilgury, B. Abel, and S. Kutner (1993). Health profile of Ethiopian immigrants in Israel: An overview. *Israel Journal of Medical Sciences 29*(6-7), 338–343.

O'Donnell, K. J., M. A. Rakeman, D. Zhi-Hong, C. Xue-Yi, Z. Y. Mei, N. DeLong, G. Brenner, M. Tai, W. Dong, and G. R. DeLong (2002). Effects of iodine supplementation during pregnancy on child growth and development at school age. *Developmental Medicine and Child Neurology 44*(2), 76–81.

Preedy, V. R., G. N. Burrow, and R. R. Watson (2009). *Comprehensive handbook of iodine: Nutritional, biochemical, pathological and therapeutic aspects*. Academic Press.

Riggins, T., N. C. Miller, P. J. Bauer, M. K. Georgieff, and C. A. Nelson (2009). Electrophysiological indices of memory for temporal order in early childhood: Implications for the development of recollection. *Developmental Science 12*(2), 209–219.

Roth, C., P. Magnus, S. Schjølberg, C. Stoltenberg, P. Surén, I. W. McKeague, G. D. Smith, T. Reichborn-Kjennerud, and E. Susser (2011). Folic acid supplements in pregnancy and severe language delay in children. *Journal of the American Medical Association 306*(14), 1566–1573.

Sgan-Cohen, H., D. Steinberg, S. Zusman, R. Naor, and M. Sela (1993). Periodontal status among adult immigrants from rural Ethiopia. *Israel Journal of Medical Sciences 29*(6-7), 407–410.

Shtarkshall, R. A., F. Baynesan, and B. S. Feldman (2009). A socio-ecological analysis of Ethiopian immigrants' interactions with the Israeli healthcare system and its policy and service implications. *Ethnicity & Health 14*(5), 459–478.

Taye, A. and H. Argaw (1997). Prevalence and prominent factors for iodine deficiency disorders in Shebe area, Seka Chekorsa district, South-Western Ethiopia. *Ethiopian Journal of Health Sciences 7*(1), 63–76.

Villamor, E., S. L. Rifas-Shiman, M. W. Gillman, and E. Oken (2012). Maternal intake of methyl-donor nutrients and child cognition at 3 years of age. *Paediatric and Perinatal Epidemiology 26*(4), 328–335.

Wachs, T. D., E. Pollitt, S. Cueto, E. Jacoby, and H. Creed-Kanashiro (2005). Relation of neonatal iron status to individual variability in neonatal temperament. *Developmental Psychobiology 46*(2), 141–153.

Yaphe, J., M. Schein, and P. Naveh (2001). Ethiopian parents' perception of their children's health: A focus group study of immigrants to Israel. *The Israel Medical Association Journal 3*(12), 932–936.

Table A1. Means and Standard Deviations of Outcome Variables by Trimester Groups

	All			Females			Males		
	1st-trimester	2nd-trimester	3rd-trimester	1st-trimester	2nd-trimester	3rd-trimester	1st-trimester	2nd-trimester	3rd-trimester
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
I. High School Outcomes									
No grade repetition (6th–12th grade)	0.845	0.811	0.767	0.961	0.892	0.802	0.741	0.726	0.737
	[0.363]	[0.392]	[0.424]	[0.196]	[0.312]	[0.401]	[0.441]	[0.448]	[0.443]
Completed 12th grade	0.863	0.854	0.835	0.961	0.917	0.889	0.776	0.788	0.789
	[0.345]	[0.354]	[0.372]	[0.196]	[0.278]	[0.316]	[0.419]	[0.411]	[0.410]
Obtained a matriculation diploma	0.348	0.309	0.244	0.474	0.408	0.309	0.235	0.204	0.189
	[0.478]	[0.463]	[0.431]	[0.503]	[0.494]	[0.465]	[0.427]	[0.404]	[0.394]
Total matriculation units	12.47	11.72	9.676	16.18	14.72	11.51	9.141	8.531	8.116
	[11.19]	[11.34]	[10.37]	[10.48]	[11.21]	[10.68]	[10.80]	[10.63]	[9.882]
Math matriculation units (0 to 5)	1.410	1.309	1.051	1.829	1.542	1.198	1.035	1.062	0.926
	[]1.514]	[1.542]	[1.443]	[1.464]	[1.577]	[1.528]	[1.467]	[1.472]	[1.362]
English matriculation units (0 to 5)	2.137	2.021	1.682	2.711	2.567	1.938	1.624	1.442	1.463
	[1.872]	[1.920]	[1.815]	[1.703]	[1.818]	[1.880]	[1.877]	[1.861]	[1.737]
II. Early Life Health Outcomes									
Birth weight (*gr*)	3,127	3,132	3,028	3,104	3,034	2,997	3,148	3,238	3,054
	[458.5]	[469.4]	[444.0]	[472.9]	[507.8]	[438.7]	[446.8]	[399.4]	[449.0]
Low birth weight (<2500 *gr*)	0.082	0.070	0.075	0.105	0.100	0.063	0.060	0.036	0.085
	[0.275]	[0.255]	[0.264]	[0.309]	[0.301]	[0.245]	[0.239]	[0.188]	[0.281]
Child mortality (by age 6)	0.012	0.009	0.023	0.013	0.008	0.012	0.012	0.009	0.0316
	[0.111]	[0.092]	[0.149]	[0.115]	[0.091]	[0.111]	[0.108]	[0.094]	[0.176]
Observations	161	233	176	76	120	81	85	113	95

Notes: Standard deviations are presented in brackets. Individuals in all samples were born between May 27, 1991, and February 15, 1992. The sample comprises individuals born in Israel whose parents immigrated to Israel in Operation Solomon (May 24-25, 1991).

Table A1. Continued

	All			Females			Males		
	1st-trimester	2nd-trimester	3rd-trimester	1st-trimester	2nd-trimester	3rd-trimester	1st-trimester	2nd-trimester	3rd-trimester
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
I. GEMS Outcomes									
GEMS test scores	0.154	-0.033	-0.100	0.323	0.256	-0.021	-0.017	-0.383	-0.187
	[0.944]	[1.052]	[0.945]	[0.798]	[0.900]	[0.939]	[1.047]	[1.118]	[0.955]
Own behavior at school	0.133	-0.031	-0.033	0.224	0.040	0.026	0.027	-0.118	-0.094
	[0.514]	[0.561]	[0.578]	[0.400]	[0.493]	[0.494]	[0.607]	[0.627]	[0.650]
Observations	153	238	185	82	131	94	71	107	91
II. Long-Term Human Capital Outcomes									
i.By Age 26									
Enrolled in any post-secondary institution	0.270	0.295	0.178	0.427	0.379	0.263	0.131	0.204	0.106
	[0.446]	[0.457]	[0.384]	[0.498]	[0.487]	[0.443]	[0.339]	[0.405]	[0.310]
Enrolled in university or college	0.195	0.241	0.121	0.333	0.336	0.188	0.071	0.139	0.064
	[0.397]	[0.429]	[0.327]	[0.475]	[0.474]	[0.393]	[0.259]	[0.347]	[0.246]
Received any welfare benefits	0.126	0.125	0.103	0.147	0.121	0.113	0.107	0.130	0.096
	[0.333]	[0.331]	[0.305]	[0.356]	[0.327]	[0.318]	[0.311]	[0.337]	[0.296]
Observations	159	224	174	75	116	80	84	108	94
ii.Between Ages 23 and 25									
Employed	0.918	0.915	0.872	0.960	0.937	0.871	0.881	0.892	0.872
	[0.274]	[0.279]	[0.335]	[0.196]	[0.244]	[0.336]	[0.324]	[0.311]	[0.334]
Employed or studying	0.0.92	0.924	0.877	0.964	0.943	0.883	0.881	0.904	0.872
	[0.271]	[0.265]	[0.328]	[0.186]	[0.233]	[0.322]	[0.324]	[0.295]	[0.334]
Annual months worked	9.373	9.150	8.841	10.18	9.397	8.708	8.651	8.886	8.954
	[3.852]	[3.974]	[4.289]	[3.175]	[3.802]	[4.342]	[4.247]	[4.140]	[4.248]
Monthly earnings (NIS)	4,452	4,113	4,162	4,012	3,815	3,636	4,845	4,433	4610
	[2,417]	[2,208]	[2,363]	[1,999]	[1,892]	[2,171]	[2,679]	[2,467]	[2,429]
Monthly earnings conditional on employment (NIS)	4,848	4,494	4,775	4,179	4,072	4,175	5,500	4,969	5,285
	[2,106]	[1,901]	[1,863]	[1,861]	[1,665]	[1,776]	[2,130]	[2,037]	[1,786]
Observations	477	672	522	225	348	240	252	324	282
III. Marriage and Childbearing by Age 26									
Married	0.088	0.107	0.086	0.147	0.138	0.175	0.036	0.074	0.011
	[0.284]	[0.310]	[0.281]	[0.356]	[0.346]	[0.382]	[0.187]	[0.263]	[0.103]
Any children	0.088	0.107	0.092	0.120	0.147	0.163	0.060	0.065	0.032
	[0.284]	[0.310]	[0.290]	[0.327]	[0.355]	[0.371]	[0.238]	[0.247]	[0.177]
Observations	159	224	174	75	116	80	84	108	94

Notes: Standard deviations are presented in brackets. Individuals in the sample were born between May 27, 1991, and February 15, 1992. Sample comprises individuals born in Israel whose parents immigrated in Operation Solomon (May 24-25, 1991). GEMS test score is the mean z-score (by year and subject) in math, Hebrew, science and English. It is based on a sample of 956 tests (504 from females and 452 from males) taken by 260 fifth-grade students (135 females and 125 males), out of 557 students in the sample. Own behavior at school is the mean of the standardized answers for the seven items that relate to students' feelings or self-reported behavior in the student questionnaire. It is based on a sample of 576 questionnaires (307 from females and 269 from males) filled in by 470 fifth- to seventh-grade students (269 females and 201 males), out of 557 students in the sample. Long-term human capital outcomes between age 23 and 25 are observed for each individual once at each age. Hence the sample for these outcomes is a panel of 1,671 observations. Monthly earnings are measured in Shekels in nominal terms.

Table A2. Descriptive Statistics for Comparison Group: Background Characteristics

	Young Cohort (born May 27, 1991 - Feb 15, 1992)			Old Cohort (born May 27, 1990 - Feb 15, 1991)		
	All	Females	Males	All	Females	Males
	(1)	(2)	(3)	(4)	(5)	(6)
Mother's age at birth	28.81	29.25	28.37	28.18	28.22	28.13
	[7.022]	[6.905]	[7.127]	[6.866]	[6.644]	[7.083]
Father's age at birth	35.79	36.13	35.44	36.00	35.61	36.36
	[9.412]	[9.428]	[9.404]	[9.494]	[8.897]	[10.03]
Mother's age at first birth	21.34	21.54	21.13	21.40	21.47	21.34
	[4.140]	[4.225]	[4.051]	[4.373]	[4.034]	[4.677]
Parents' age gap	6.978	6.885	7.071	7.819	7.385	8.226
	[5.827]	[5.818]	[5.847]	[6.302]	[5.955]	[6.599]
Number of siblings	4.350	4.282	4.420	4.221	4.123	4.313
	[1.863]	[1.912]	[1.815]	[1.961]	[1.981]	[1.942]
Birth order	3.406	3.374	3.438	3.189	3.179	3.197
	[1.902]	[1.911]	[1.898]	[1.767]	[1.745]	[1.792]
Birth spacing	2.926	2.811	3.042	3.397	3.447	3.349
(years to the next birth)	[2.803]	[2.707]	[2.898]	[3.125]	[3.332]	[2.926]
Father's years of schooling	4.016	4.115	3.915	3.494	3.559	3.433
	[5.300]	[5.374]	[5.234]	[5.110]	[5.169]	[5.066]
Mother's years of schooling	3.867	3.890	3.844	3.449	3.677	3.236
	[5.027]	[4.979]	[5.086]	[4.886]	[4.952]	[4.826]
Family income (NIS), 1995	47,210	49,781	44,606	46,622	48,477	44,882
	[33,946]	[37,156]	[30,210]	[40,374]	[43,513]	[37,214]
Family income (NIS), 2000	70,488	74,264	66,661	70,568	74,498	66,883
	[54,739]	[58,811]	[50,119]	[59,883]	[64,795]	[54,783]
SES of the mother's first	-0.009	-0.012	-0.006	-0.067	-0.049	-0.085
locality of residence upon immigration	[0.553]	[0.541]	[0.565]	[0.491]	[0.486]	[0.495]
Observations	451	227	224	403	195	208

Notes: Standard deviations are presented in brackets. Individuals in columns 1–3 were born between May 27, 1991, and February 15, 1992. Individuals in columns 4–6 were born between May 27, 1990, and February 15, 1991. All individuals born in Israel and their parents immigrated before 1989 (second-generation immigrants from Operation Moses). Family income is measured in Shekels in nominal terms. SES is a socio-economic index of Israeli localities based on several demographic and economic variables, including dependency ratio, average years of schooling in the adult population, percentage of academic degree holders, employment and income levels, etc. Lower values correspond to lower socio-economic status.

Table A3. Estimated Effect of Prenatal Environment Excluding Individuals Who Died Before Age 6

	Females		Males	
	1st-trimester	2nd-trimester	1st-trimester	2nd-trimester
	(1)	(2)	(3)	(4)
Panel A. High School Outcomes				
No grade repetition (6th–12th grade)	0.157***	0.099**	0.006	-0.037
	(0.046)	(0.045)	(0.065)	(0.061)
Completed 12th grade	0.065	0.034	-0.019	-0.035
	(0.041)	(0.041)	(0.056)	(0.048)
Obtained a matriculation diploma	0.150*	0.102	0.046	0.007
	(0.090)	(0.093)	(0.050)	(0.050)
Total matriculation units	4.495***	3.419**	1.061	0.292
	(1.690)	(1.521)	(1.212)	(1.194)
Math matriculation units	0.599**	0.365	0.129	0.147
	(0.246)	(0.231)	(0.200)	(0.209)
English matriculation units	0.730***	0.643***	0.137	-0.051
	(0.280)	(0.222)	(0.202)	(0.155)
Panel B. Early Life Health Outcomes				
Birth weight (*gr*)	58.41	5.725	81.97	165.5**
	(59.19)	(51.79)	(74.22)	(73.92)
Low birth weight (<2500 *gr*)	0.069**	0.043	-0.030	-0.049
	(0.035)	(0.033)	(0.039)	(0.039)
Panel C. Long Term Outcomes				
Any post-secondary enrollment	0.118*	0.076	0.030	0.092*
	(0.062)	(0.058)	(0.039)	(0.054)
University and collage enrollment	0.103*	0.113**	0.006	0.067*
	(0.054)	(0.054)	(0.034)	(0.040)
Welfare recipiency	0.018	-0.003	0.036	0.042
	(0.046)	(0.052)	(0.032)	(0.032)
Employed	0.085***	0.052	-0.033	-0.030
	(0.031)	(0.032)	(0.039)	(0.036)
Employed or studying	0.068**	0.041	-0.033	-0.017
	(0.026)	(0.029)	(0.039)	(0.031)
Annual months worked	1.452***	0.549	-0.743	-0.614
	(0.442)	(0.467)	(0.518)	(0.506)
Monthly earnings (NIS)	388.7*	178.1	-61.49	-483.9*
	(218.9)	(206.8)	(300.4)	(276.2)
Monthly earnings conditional on employment (NIS)	-46.18	-69.91	176.1	-296.3
	(243.2)	(242.9)	(244.4)	(216.3)
Married	-0.028	-0.031	0.023	0.065***
	(0.053)	(0.042)	(0.022)	(0.025)
Any children	-0.073	-0.021	0.021	0.032
	(0.064)	(0.055)	(0.027)	(0.032)

Notes: Standard errors reported in parentheses are clustered at week of pregnancy. Panel A replicates the results of the odd columns in Table 5 while excluding individuals who died before age 6. The sample includes 562 individuals (274 females and 288 males). Panel B replicates the results in Table 8 while excluding individuals who died before age 6. The sample includes 548 individuals (267 females and 281 males). Panel C replicates the results in Table 7 while excluding children who died before age 6. Monthly earnings are measured in Shekels in nominal terms. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A4. Estimated Effect of Prenatal Environment on Early Life Health Outcomes and School Outcomes by Weeks of Exposure to the Israeli Environment

	Early Life Health Outcomes			Test scores and Own Behavior at Elementary & Middle School		High School Outcomes					
	Birth Weight (gr)	Low Birth Weight ($<2500gr$)	Child Mortality	GEMS Test Scores	Owen Behavior at School	No Grade Repetition (6th–12th Grade)	Completed 12th Grade	Obtained a Matriculation Diploma	Total Matriculation Units	Math Matriculation Units	English Matriculation Units
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Panel A. Females											
Weeks in-utero in Israel	4.633*	0.0013	-0.0004	0.020***	0.007**	0.005***	0.003	0.004	0.142**	0.020**	0.022**
	(2.522)	(0.002)	(0.0005)	(0.007)	(0.004)	(0.002)	(0.002)	(0.003)	(0.064)	(0.009)	(0.011)
Panel B. Males											
Weeks in-utero in Israel	5.598*	-0.002	-0.0012	-0.008	0.009*	0.001	0.0001	0.001	0.027	0.003	0.004
	(3.147)	(0.002)	(0.0008)	(0.008)	(0.005)	(0.002)	(0.003)	(0.002)	(0.042)	(0.008)	(0.007)
Panel C. P-value for equality of the coefficient between females and males											
	0.805	0.174	0.300	0.263	0.696	0.220	0.447	0.419	0.121	0.165	0.161

Notes: Standard errors reported in parentheses are clustered at week of pregnancy. The table reports estimates of equation (1) with weeks in utero in Israel as the main explanatory variable instead of the trimester indicators, estimated for females and males separately as a system of seemingly unrelated regressions. Panel A reports estimates for females and Panel B reports estimates for males. Panel C reports p-values from F-tests that check the difference between coefficients of females and males. All specifications control for both parents' years of schooling, mother's age at birth and parents' age gap. Columns 1–3 and 6–11 also include controls for SES of first locality in Israel and birth order. Columns 4–5 include controls for number of siblings. Column 4 includes test year fixed effect and indicators for test subject, and column 5 includes year and grade dummies. The sample in columns 1 and 2 includes 562 individuals (275 females and 287 males); the sample in columns 3 and 6–11 includes 570 individuals (277 females and 293 males); and the sample in columns 4–5 includes 557 individuals (271 females and 286 males). All individuals were born between May 27, 1991, and February 15, 1992.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A5. Estimated Long-Term Effect of Prenatal Environment by Weeks of Exposure to the Israeli Environment

	Post-Schooling and Welfare Recipiency, Ages 18–26			Labor Market Outcomes, Ages 23–25					Marriage and Childbearing by Age 26	
	Any Post-secondary Enrollment	University or Collage Enrollment	Welfare Recipiency	Employed	Employed or Study	Annual Months Worked	Monthly Earnings (NIS)	Monthly Earnings if Worked	Married	Any Children
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Panel A. Females										
Weeks in utero in Israel	0.004	0.003	-0.0002	0.004***	0.003***	0.061***	14.80*	-3.272	-0.0008	-0.003
	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.015)	(7.755)	(9.598)	(0.002)	(0.003)
Panel B. Males										
Weeks in utero in Israel	-0.0008	0.001	0.001	-0.001	-0.0003	-0.020	-0.274	5.637	0.001	0.001
	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.019)	(9.666)	(7.576)	(0.001)	(0.001)
Panel C. P-value for Difference in the Coefficient between Females and Males										
	0.475	0.403	0.686	0.045	0.086	0.002	0.233	0.458	0.488	0.164

Notes: Standard errors reported in parentheses are clustered at week of pregnancy. The table reports estimates of equation (1) with weeks in utero in Israel as the main explanatory variable instead of the the trimester indicators, estimated for females and males separately as a system of seemingly unrelated regressions. Panel A reports estimates for females and Panel B reports estimates for males. Panel C reports p-values from F-tests that check the difference between coefficients of females and males. All specifications control for both parents' years of schooling, mother's age at birth and parents' age gap and number of siblings. Columns 4–8 also include age dummies. The sample includes 557 individuals (271 females and 286 males). All individuals were born between May 27, 1991, and February 15, 1992. Monthly earnings are measured in Shekels in nominal terms.

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

Table A6. Estimated Effect of Prenatal Environment Excluding Low Birth Weight Children

	Females		Males	
	1st-trimester	2nd-trimester	1st-trimester	2nd-trimester
	(1)	(2)	(3)	(4)
Panel A. High School Outcomes				
No grade repetition (6th–12th grade)	0.153***	0.101**	0.006	-0.031
	(0.050)	(0.047)	(0.068)	(0.059)
Completed 12th grade	0.052	0.023	-0.006	-0.027
	(0.045)	(0.044)	(0.064)	(0.054)
Obtained a matriculation diploma	0.170*	0.101	0.039	-0.002
	(0.090)	(0.098)	(0.056)	(0.053)
Total Matriculation units	4.324***	3.149*	0.435	-0.309
	(1.684)	(1.649)	(1.391)	(1.267)
Math Matriculation units	0.603**	0.334	0.063	0.082
	(0.253)	(0.246)	(0.221)	(0.211)
English Matriculation units	0.727**	0.571**	-0.019	-0.162
	(0.285)	(0.241)	(0.218)	(0.163)
Panel B. Early Life Health Outcomes				
Birth weight (*gr*)	115.8*	70.15	89.90	150.8***
	(59.40)	(47.73)	(60.66)	(58.01)
Child mortality (by age 6)	0.005	-0.003	-0.026	-0.015
	(0.005)	(0.003)	(0.020)	(0.018)

Notes: Standard errors reported in parentheses are clustered at week of pregnancy. Panel A replicates the results of the odd columns in Table 5 and Panel B replicates the results of Table 8, excluding observations with low birth weight (i.e., less than 2500 *gr*) or missing birth weight. The sample includes 520 individuals (250 females and 270 males).
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A7. Estimated Effect of Prenatal Environment by Month of Arrival in First Trimester

	Females				Males			
	1st-month	2nd-month	3rd-month	2nd-trimester	1st-month	2nd-month	3rd-month	2nd-trimester
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A. High School Outcomes								
No grade repetition (6th–12th grade)	0.064	0.178***	0.217***	0.102**	0.058	-0.011	0.052	-0.023
	(0.117)	(0.038)	(0.047)	(0.044)	(0.105)	(0.103)	(0.069)	(0.058)
Completed 12th grade	-0.020	0.085***	0.128***	0.038	-0.010	-0.036	0.044	-0.019
	(0.128)	(0.033)	(0.041)	(0.042)	(0.105)	(0.102)	(0.053)	(0.048)
Obtained a matriculation diploma	0.134	0.192**	0.072	0.103	0.162*	0.004	0.068	0.016
	(0.133)	(0.087)	(0.135)	(0.092)	(0.091)	(0.060)	(0.065)	(0.051)
Total matriculation units	3.855	5.525***	3.093	3.455**	1.985	1.048	1.303	0.450
	(3.816)	(1.415)	(2.818)	(1.556)	(2.000)	(1.774)	(1.388)	(1.176)
Math matriculation units	0.514	0.819***	0.235	0.376	0.300	0.005	0.243	0.166
	(0.458)	(0.230)	(0.313)	(0.233)	(0.263)	(0.301)	(0.218)	(0.207)
English matriculation units	0.606	0.914***	0.508*	0.647***	0.389	0.295	0.019	-0.024
	(0.818)	(0.271)	(0.276)	(0.227)	(0.383)	(0.282)	(0.278)	(0.152)
Panel B. Early Life Health Outcomes								
Birth weight (*gr*)	107.5	68.59	129.6	30.71	151.0	92.29	70.82	171.8**
	(81.49)	(82.65)	(105.03)	(59.75)	(177.47)	(73.84)	(78.61)	(74.44)
Low birth weight	0.080	0.052	0.023	0.036	-0.091**	-0.001	-0.027	-0.046
	(0.064)	(0.046)	(0.063)	(0.040)	(0.035)	(0.058)	(0.036)	(0.038)
Child mortality (by age 6)	0.009	-0.002	-0.045*	-0.007	-0.052**	-0.022	-0.031**	-0.019
	(0.026)	(0.010)	(0.023)	(0.013)	(0.025)	(0.029)	(0.015)	(0.017)
Panel C. GEMS Outcomes								
GEMS test scores	0.535**	0.530***	0.898***	0.300**	0.549**	0.434	0.001	-0.089
	(0.250)	(0.198)	(0.303)	(0.143)	(0.240)	(0.311)	(0.240)	(0.204)
Own behavior at school	0.317***	0.229**	0.164	0.000	0.502***	0.318**	0.001	-0.034
	(0.123)	(0.097)	(0.122)	(0.074)	(0.156)	(0.137)	(0.116)	(0.108)
Panel D. Long-Term Human Capital Outcomes								
Any post-secondary Enrollment	0.031	0.118*	0.221***	0.084	0.122**	0.082*	-0.045	0.096*
	(0.162)	(0.069)	(0.082)	(0.057)	(0.054)	(0.046)	(0.033)	(0.054)
University & college enrollment	0.039	0.085	0.206*	0.118**	0.089	0.028	-0.038	0.070*
	(0.119)	(0.059)	(0.107)	(0.053)	(0.068)	(0.039)	(0.032)	(0.040)
Welfare recipiency	0.104	0.032	-0.066	-0.001	-0.001	0.078**	0.014	0.043
	(0.083)	(0.054)	(0.055)	(0.051)	(0.050)	(0.036)	(0.035)	(0.032)
Employed	0.065	0.113***	0.062	0.061*	0.040	0.000	-0.038	-0.000
	(0.063)	(0.029)	(0.050)	(0.034)	(0.036)	(0.070)	(0.030)	(0.035)
Employed or studying	0.035	0.105***	0.038	0.050	0.043	-0.002	-0.038	0.013
	(0.057)	(0.024)	(0.047)	(0.031)	(0.038)	(0.070)	(0.031)	(0.031)
Annual months worked	1.298**	1.708***	1.097	0.620	-0.612	0.011	-0.964*	-0.309
	(0.599)	(0.419)	(0.688)	(0.488)	(0.831)	(0.628)	(0.501)	(0.481)
Monthly earnings (NIS)	471.8	546.2**	221.3	236.1	250.3	218.2	-170.9	-324.8
	(340.8)	(225.8)	(369.8)	(216.7)	(307.3)	(328.7)	(296.0)	(259.4)
Monthly earnings conditional	116.0	12.9	-127.3	-49.80	240.0	349.0	-8.550	-294.6
on employment (NIS)	(398.8)	(257.7)	(343.8)	(216.4)	(258.6)	(258.2)	(354.8)	(216.4)
Panel E. Marriage and Childbearing by Age 26								
Married	-0.038	-0.098**	0.135*	-0.024	-0.021	0.050	0.013	0.065***
	(0.103)	(0.043)	(0.078)	(0.042)	(0.016)	(0.035)	(0.027)	(0.024)
Any children	-0.016	-0.117**	-0.014	-0.015	0.030	0.025	0.014	0.032
	(0.145)	(0.055)	(0.073)	(0.053)	(0.053)	(0.037)	(0.034)	(0.031)

Notes: Standard errors reported in parentheses are clustered at week of pregnancy. The table reports estimates of equation (1) while stratifying the first trimester into three variables: 1st month is an indicator for immigrating to Israel during weeks 2–4 of gestation, 2nd month is an indicator for immigrating to Israel during weeks 5–8 of gestation, and 3rd month is an indicator for immigrating to Israel during weeks 9–12 of gestation. Panel A replicates the results of the odd columns in Table 5, while Panel B replicates the results of Table 8. Panel C replicates the results of Table 6, and Panels D and E replicate the results of Table 7. Monthly earnings are measured in Shekels in nominal terms.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A8. Estimated Effect of Prenatal Environment for Females, Excluding the First Two Weeks of Each Trimester Group

	Excluding the First Two Weeks of 1st Trimester		Excluding the First Two Weeks of 2nd Trimester		Excluding the First Two Weeks of 3rd Trimester		Excluding First Two Weeks of All Trimesters	
	1st-trimester	2nd-trimester	1st-trimester	2nd-trimester	1st-trimester	2nd-trimester	1st-trimester	2nd-trimester
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A. High School Outcomes								
No grade repetition (6th–12th grade)	0.181***	0.102**	0.167***	0.116**	0.162***	0.105**	0.180***	0.116**
	(0.040)	(0.045)	(0.046)	(0.047)	(0.048)	(0.049)	(0.043)	(0.051)
Completed 12th grade	0.091***	0.038	0.074*	0.046	0.101**	0.067	0.119***	0.073
	(0.033)	(0.042)	(0.043)	(0.042)	(0.045)	(0.045)	(0.038)	(0.045)
Obtained a matriculation diploma	0.134	0.103	0.140	0.111	0.188*	0.152	0.159	0.153
	(0.089)	(0.093)	(0.090)	(0.094)	(0.101)	(0.103)	(0.102)	(0.107)
Total matriculation units	4.409***	3.461**	4.428***	3.798**	5.312***	4.451**	4.984***	4.710***
	(1.571)	(1.563)	(1.709)	(1.553)	(1.887)	(1.742)	(1.804)	(1.767)
Math matriculation units	0.604**	0.372	0.581**	0.416*	0.751***	0.549**	0.721***	0.572**
	(0.238)	(0.234)	(0.244)	(0.233)	(0.262)	(0.244)	(0.256)	(0.248)
English matriculation units	0.668***	0.650***	0.731**	0.665***	0.730**	0.675**	0.633**	0.684**
	(0.250)	(0.229)	(0.287)	(0.234)	(0.314)	(0.265)	(0.289)	(0.275)
Panel B. Early Life Health Outcomes								
Birth weight (*gr*)	97.63	30.75	90.45	8.64	109.70	48.32	112.67	26.79
	(76.76)	(59.92)	(71.44)	(59.82)	(79.21)	(66.43)	(85.65)	(67.14)
Low birth weight	0.035	0.036	0.051	0.050	0.032	0.018	0.019	0.034
	(0.045)	(0.041)	(0.044)	(0.041)	(0.047)	(0.043)	(0.050)	(0.045)
Child mortality (by age 6)	-0.008	-0.007	-0.011	-0.006	-0.016	-0.011	-0.014	-0.011
	(0.014)	(0.013)	(0.014)	(0.014)	(0.015)	(0.014)	(0.015)	(0.014)
Panel C. GEMS Outcomes								
GEMS test scores	0.685***	0.304**	0.599***	0.283**	0.650***	0.333**	0.548***	0.300**
	(0.206)	(0.146)	(0.205)	(0.140)	(0.225)	(0.159)	(0.203)	(0.143)
Own behavior at school	0.228**	0.001	0.212**	0.010	0.312***	0.072	0.248***	0.007
	(0.100)	(0.075)	(0.098)	(0.073)	(0.103)	(0.074)	(0.094)	(0.074)
Panel D. Long-Term Human Capital Outcomes								
Any post-secondary enrollment	0.125**	0.076	0.121*	0.085	0.130**	0.093	0.113	0.077
	(0.062)	(0.057)	(0.064)	(0.064)	(0.063)	(0.058)	(0.069)	(0.057)
University & college enrollment	0.108*	0.110**	0.100*	0.122**	0.100*	0.114*	0.096	0.108**
	(0.059)	(0.053)	(0.056)	(0.059)	(0.060)	(0.059)	(0.060)	(0.053)
Welfare recipiency	-0.012	0.003	0.022	0.007	0.012	-0.007	0.038	-0.002
	(0.043)	(0.052)	(0.045)	(0.055)	(0.048)	(0.054)	(0.048)	(0.052)
Employed	0.080**	0.062*	0.088**	0.066*	0.085**	0.058	0.091**	0.063*
	(0.036)	(0.034)	(0.035)	(0.035)	(0.036)	(0.036)	(0.036)	(0.034)
Employed or studying	0.066**	0.051*	0.071**	0.056*	0.071**	0.050	0.073**	0.052*
	(0.033)	(0.031)	(0.031)	(0.032)	(0.033)	(0.033)	(0.032)	(0.031)
Annual months worked	1.392***	0.616	1.472***	0.654	1.309***	0.494	1.608***	0.647
	(0.464)	(0.484)	(0.473)	(0.522)	(0.428)	(0.467)	(0.467)	(0.490)
Monthly earnings (NIS)	293.4	194.5	422.4*	331.0	370.7*	196.8	520.5**	219.4
	(235.7)	(222.4)	(220.6)	(218.9)	(216.7)	(229.8)	(208.4)	(219.1)
Monthly earnings conditional	-113.80	-92.29	-21.23	27.94	-29.53	-54.82	68.72	-76.87
on employment (NIS)	(256.6)	(246.4)	(243.5)	(240.8)	(287.2)	(290.4)	(234.0)	(242.1)
Panel E. Marriage and Childbearing by Age 26								
Married	-0.028	-0.028	-0.027	-0.052	-0.019	-0.022	-0.063	-0.031
	(0.054)	(0.042)	(0.052)	(0.042)	(0.053)	(0.043)	(0.045)	(0.042)
Any children	-0.092	-0.015	-0.074	-0.023	-0.089	-0.037	-0.063	-0.019
	(0.058)	(0.054)	(0.063)	(0.056)	(0.065)	(0.055)	(0.068)	(0.054)

Notes: Standard errors reported in parentheses are clustered at week of pregnancy. The table reports estimates of equation (1) based on samples that exclude births from the first two weeks of each trimester group separately, and all together. Panel A replicates the results of the odd columns in Panel A of Table 5. Panel B replicates the results of in Panel A of Table 8. Panel C replicate the results in Panel A of Table 6, and Panels D and E replicate the results in Panel A of Table 7. Monthly earnings are measured in Shekels in nominal terms.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A9. Estimated Effect of Prenatal Environment for Females, Excluding the Last Two Weeks of Each Trimester Group

	Excluding the Last Two Weeks of 1st Trimester		Excluding the Last Two Weeks of 2nd Trimester		Excluding the Last Two Weeks of 3rd Trimester		Excluding the Last Two Weeks of All Trimester	
	1st-trimester	2nd-trimester	1st-trimester	2nd-trimester	1st-trimester	2nd-trimester	1st-trimester	2nd-trimester
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A. High School Outcomes								
No grade repetition (6th–12th grade)	0.157***	0.105**	0.163***	0.108**	0.167***	0.107**	0.158***	0.113**
	(0.047)	(0.045)	(0.046)	(0.043)	(0.046)	(0.046)	(0.048)	(0.044)
Completed 12th grade	0.066	0.041	0.073*	0.049	0.075*	0.040	0.064	0.052
	(0.044)	(0.042)	(0.042)	(0.039)	(0.043)	(0.043)	(0.044)	(0.040)
Obtained a matriculation diploma	0.137	0.109	0.152*	0.101	0.149*	0.106	0.143	0.111
	(0.091)	(0.092)	(0.090)	(0.095)	(0.089)	(0.093)	(0.094)	(0.095)
Total matriculation units	4.247**	3.566**	4.539***	3.612**	4.694***	3.652**	4.434**	3.947**
	(1.778)	(1.547)	(1.700)	(1.574)	(1.696)	(1.568)	(1.807)	(1.575)
Math matriculation units	0.606**	0.394*	0.606**	0.379	0.609**	0.394*	0.624**	0.418*
	(0.253)	(0.231)	(0.250)	(0.239)	(0.246)	(0.234)	(0.260)	(0.237)
English matriculation units	0.742**	0.655***	0.735***	0.662***	0.781***	0.690***	0.777***	0.716***
	(0.297)	(0.227)	(0.283)	(0.230)	(0.284)	(0.229)	(0.301)	(0.236)
Panel B. Early Life Health Outcomes								
Birth weight (*gr*)	73.91	35.67	90.80	60.58	92.94	29.15	68.98	62.90
	(68.00)	(60.08)	(71.68)	(59.48)	(71.37)	(60.01)	(68.61)	(60.76)
Low birth weight	0.048	0.034	0.051	0.018	0.047	0.033	0.047	0.014
	(0.043)	(0.040)	(0.043)	(0.039)	(0.044)	(0.041)	(0.043)	(0.040)
Child mortality (by age 6)	-0.007	-0.009	-0.011	-0.017	-0.011	-0.007	-0.007	-0.018
	(0.013)	(0.013)	(0.014)	(0.011)	(0.014)	(0.013)	(0.014)	(0.011)
Panel C. GEMS Outcomes								
GEMS test scores	0.555***	0.293**	0.622***	0.298**	0.657***	0.321**	0.453**	0.299**
	(0.201)	(0.139)	(0.214)	(0.150)	(0.227)	(0.158)	(0.212)	(0.150)
Own behavior at school	0.213**	-0.020	0.269***	0.044	0.288***	0.072	0.252***	0.017
	(0.097)	(0.071)	(0.098)	(0.072)	(0.107)	(0.074)	(0.096)	(0.071)
Panel D. Long-Term Human Capital Outcomes								
Any post-secondary enrollment	0.119*	0.112*	0.119*	0.082	0.146**	0.096	0.118*	0.113*
	(0.063)	(0.058)	(0.064)	(0.058)	(0.064)	(0.063)	(0.069)	(0.058)
University & college enrollment	0.103*	0.141**	0.106*	0.120**	0.109*	0.120*	0.103*	0.141***
	(0.056)	(0.056)	(0.056)	(0.054)	(0.064)	(0.063)	(0.061)	(0.054)
Welfare recipiency	0.013	-0.029	0.013	-0.007	-0.019	0.005	0.029	-0.035
	(0.045)	(0.045)	(0.046)	(0.052)	(0.046)	(0.057)	(0.049)	(0.045)
Employed	0.093***	0.077**	0.093***	0.067*	0.079**	0.062*	0.097***	0.081**
	(0.034)	(0.033)	(0.035)	(0.035)	(0.040)	(0.037)	(0.036)	(0.034)
Employed or studying	0.076**	0.066**	0.076**	0.056*	0.068*	0.054	0.079**	0.070**
	(0.030)	(0.029)	(0.031)	(0.032)	(0.037)	(0.034)	(0.033)	(0.030)
Annual months worked	1.546***	0.931*	1.545***	0.713	1.289***	0.485	1.705***	0.972**
	(0.460)	(0.486)	(0.472)	(0.502)	(0.477)	(0.501)	(0.475)	(0.494)
Monthly earnings (NIS)	416.8*	316.338	400.5*	217.4	309.5	280.7	523.8**	301.6
	(215.8)	(218.8)	(225.4)	(228.7)	(254.5)	(239.0)	(214.7)	(226.5)
Monthly earnings conditional	-49.76	-39.12	-69.38	-96.42	-61.61	22.47	41.29	-74.15
on employment (NIS)	(242.0)	(244.1)	(250.9)	(251.5)	(309.2)	(295.6)	(239.2)	(251.6)
Panel E. Marriage and Childbearing by Age 26								
Married	-0.029	-0.030	-0.030	-0.034	-0.022	-0.045	-0.070	-0.037
	(0.051)	(0.046)	(0.052)	(0.042)	(0.056)	(0.044)	(0.045)	(0.047)
Any children	-0.076	-0.030	-0.076	-0.024	-0.114*	-0.038	-0.071	-0.035
	(0.062)	(0.056)	(0.064)	(0.055)	(0.061)	(0.058)	(0.068)	(0.057)

Notes: Standard errors reported in parentheses are clustered at week of pregnancy. The table reports estimates of equation (1) based on samples that exclude births from the last two weeks of each trimester group separately, and all together. Panel A replicates the results of the odd columns in Panel A of Table 5. Panel B replicates the results in Panel A of Table 8. Panel C replicates the results in Panel A of Table 6, and Panels D and E replicate the results in Panel A of Table 7. Monthly earnings are measured in Shekels in nominal terms.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A10. Estimated Effect of Prenatal Environment for Females, with Trimester Reassignments (Arrival in First or Last Two Weeks of Each Trimester Reassigned to Previous or Next Trimester)

	First Two Weeks Reassigned to Previous Trimester		Last Two Weeks Reassigned to Next Trimester	
	1st-trimester	2nd-trimester	1st-trimester	2nd-trimester
	(1)	(2)	(3)	(4)
Panel A. High School Outcomes				
No grade repetition (6th–12th grade)	0.160***	0.104**	0.100*	0.102**
	(0.047)	(0.049)	(0.053)	(0.043)
Completed 12th grade	0.111***	0.087**	0.025	0.055
	(0.043)	(0.042)	(0.052)	(0.039)
Obtained a matriculation diploma	0.125	0.133	0.155*	0.098
	(0.096)	(0.097)	(0.089)	(0.091)
Total matriculation units	4.044**	4.115**	4.569***	3.618**
	(1.680)	(1.628)	(1.628)	(1.461)
Math matriculation units	0.612**	0.539**	0.631***	0.338
	(0.253)	(0.234)	(0.244)	(0.223)
English matriculation units	0.591**	0.519*	0.740***	0.596***
	(0.252)	(0.266)	(0.261)	(0.216)
Panel B. Early Life Health Outcomes				
Birth weight (*gr*)	125.2	27.67	102.3	102.9*
	(77.96)	(66.85)	(66.48)	(58.34)
Low birth weight	0.000	0.021	0.017	-0.008
	(0.048)	(0.045)	(0.045)	(0.042)
Child mortality (by age 6)	-0.015	-0.013	-0.014	-0.029**
	(0.014)	(0.014)	(0.016)	(0.014)
Panel C. GEMS Outcomes				
GEMS test scores	0.650***	0.306**	0.378*	0.342**
	(0.211)	(0.146)	(0.209)	(0.136)
Own behavior at school	0.228**	0.096	0.219**	-0.005
	(0.103)	(0.073)	(0.088)	(0.068)
Panel D. Long-Term Human Capital Outcomes				
Any post-secondary enrollment	0.088	0.067	0.201***	0.140**
	(0.055)	(0.060)	(0.072)	(0.055)
University & college enrollment	0.078	0.103*	0.161***	0.153***
	(0.053)	(0.056)	(0.058)	(0.050)
Welfare recipiency	-0.023	0.004	0.006	-0.066
	(0.046)	(0.054)	(0.055)	(0.052)
Employed	0.052	0.035	0.083**	0.082**
	(0.035)	(0.034)	(0.033)	(0.032)
Employed or studying	0.044	0.034	0.072**	0.073**
	(0.033)	(0.031)	(0.030)	(0.029)
Annual months worked	1.131***	0.343	1.239**	1.114**
	(0.391)	(0.469)	(0.554)	(0.445)
Monthly earnings (NIS)	195.7	273.1	423.3*	311.3
	(262.8)	(234.5)	(236.3)	(204.3)
Monthly earnings conditional	-59.70	141.5	-6.500	-67.50
on employment (NIS)	(304.1)	(281.4)	(240.0)	(234.2)
Panel E. Marriage and Childbearing by Age 26				
Married	0.012	-0.020	-0.006	-0.009
	(0.051)	(0.040)	(0.055)	(0.043)
Any children	-0.116**	-0.063	-0.018	-0.046
	(0.056)	(0.060)	(0.064)	(0.051)

Notes: Standard errors reported in parentheses are clustered at week of pregnancy. The table reports estimates of equation (1) based on a sample where births from the first (last) two weeks of each trimester group are reassigned to the previous (next) trimester. Panel A replicates the results of the odd columns in Panel A of Table 5. Panel B replicates the results in Panel A of Table 8. Panel C replicates the results in Panel A of Table 6, and Panels D and E replicate the results in Panel A of Table 7. Monthly earnings are measured in Shekels in nominal terms.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A11. Estimated Effect of Mothers' Length of Residence in Israel Before the Birth on High School Outcomes and Early Life Health Outcomes

	No Grade Repetition (6th–12th Grade)	Completed 12th Grade	Obtained a Matriculation Diploma	Total Matriculation Units	Math Matriculation Units	English Matriculation Units	Birth Weight	Low Birth Weight	Child Mortality
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A. Females									
Weeks in Israel	-0.0009	-0.0010**	-0.0002	-0.0212	-0.0020	-0.0011	0.5320	0.0001	-0.0002
	(0.0007)	(0.0006)	(0.0011)	(0.0232)	(0.0030)	(0.0031)	(0.9679)	(0.0006)	(0.0002)
Panel B. Males									
Weeks in Israel	-0.0002	0.0002	0.0004	0.0077	0.0021	-0.0005	-1.2156*	0.0003	-0.0001
	(0.0008)	(0.0007)	(0.0007)	(0.0201)	(0.0024)	(0.0035)	(0.6413)	(0.0003)	(0.0001)

Notes: Standard errors reported in parentheses are clustered at week and year of birth. The table reports estimates of equation (1) with the number of weeks since the mother's immigration to Israel when the child was born (ranging from 43 to 127) as the main explanatory variable instead of the trimester indicators. The equation is estimated for females and males separately as a system of seemingly unrelated regressions. Panel A reports estimates for females and Panel B reports estimates for males. All specifications control for both parents' years of schooling, mother's age at birth, parents' age gap, SES of first locality in Israel and birth order. The sample includes 962 individuals (479 females and 483 males) born between March 1992 and October 1994.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A12. Estimated Effect of Prenatal Environment on High School Outcomes by Gender Among Former Soviet Union Immigrants

	No Grade Repetition (6th–12th Grade)	Completed 12th Grade	Obtained a Matriculation Diploma	Total Matriculation Units	Math Matriculation Units	English Matriculation Units
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Females						
1st-trimester	0.024	-0.004	0.022	-0.177	0.092	-0.027
	(0.030)	(0.020)	(0.035)	(0.806)	(0.133)	(0.133)
2nd-trimester	0.035	-0.003	-0.024	-0.529	0.011	0.051
	(0.030)	(0.020)	(0.035)	(0.808)	(0.134)	(0.133)
P-value: 1st = 2nd	0.721	0.962	0.241	0.692	0.587	0.591
3rd-trimester Mean and SD	0.715	0.92848	0.374	22.23	2.751	3.648
	[0.452]	[0.258]	[0.484]	[10.93]	[1.816]	[1.807]
Panel B. Males						
1st-trimester	-0.015	0.014	0.008	0.679	0.048	0.097
	(0.037)	(0.030)	(0.038)	(0.969)	(0.150)	(0.160)
2nd-trimester	0.053	0.020	0.023	0.943	0.059	0.272*
	(0.033)	(0.028)	(0.036)	(0.940)	(0.145)	(0.158)
P-value: 1st = 2nd	0.078	0.844	0.722	0.802	0.948	0.314
3rd-trimester Mean and SD	0.643	0.837	0.385	18.17	2.348	3.041
	[0.480]	[0.370]	[0.487]	[12.98]	[1.967]	[2.182]

Notes: Standard errors reported in parentheses are clustered at week of pregnancy. The table reports estimates for β_1 and β_2 of equation (1), estimated for females and males separately. Panel A reports estimates for females and Panel B reports estimates for males. All specifications control for both parents' years of schooling, number of siblings, year of birth fixed effects and month of birth fixed effects. The baseline sample includes 2039 individuals (915 females and 1128 males) born between 1990 and 1992. The baseline category is immigration in the third trimester of pregnancy.

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