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Nutritional and Schooling Impact of a Cash Transfer Program in Ethiopia: A Retrospective Analysis of Childhood Exposure

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Abstract

The rate of malnutrition among under-five children in Ethiopia is among the highest in Sub-Saharan Africa and in the world. Since 2005, the Government of Ethiopia has been implementing a nation-wide social protection program, with the aim to improve nutrition and food security, decrease poverty and enhance human capital accumulation. This paper investigates the direct impact of this program on long-term anthropometric measures of nutritional status and the indirect effects on enrollment delay and educational attainment. Our research design uses unique admnistrative data on the regional coverage of the program and combines differences in program intensity across regions with differences across cohorts induced by the timing of the program. Findings show that early childhood exposure to the program leads to better nutritional status and hence higher human capital accumulation. Results are robust to different measures of program intensity, estimation samples, empirical models and some placebo tests.

JEL codes: J15; D85; C45

Keywords: Cash Transfers, Social Protection, Nutrition, Primary Education, Ethiopia

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1 Introduction

Social protection programs, which include cash transfers and social support services, are increasingly implemented as a key policy tool for reducing poverty and increasing the accumulation of human capital in developing regions, including Africa. In 2005, the Ethiopian Government launched its social protection program, which is one of the largest in the region. The Productive Safety Nets Programme (PSNP) was introduced by joint efforts of the Government of Ethiopia and international donors through a multi-trust fund managed by the World Bank (Ministry of Agriculture and Natural Resource, 2015). The overall goal of the program is to provide a long-term solution to the chronically food insecure households found in poor regions in Ethiopia, which is the second country with the highest rate of malnutrition in Sub Saharan Africa (World Bank 2010). Malnutrition and starvation have devastating direct effects on children, adults and especially on pregnant women. They also have severe and far-reaching indirect socio-economic impacts, in terms of low human capital, productivity and well-being (Alderman et al. 2001a, 2006; Glewwe et al. 2001; Cunha et al. 2006; Yamauchi 2008).

The PSNP was first targeted to five major regions in Ethiopia, while later on it scaled up to the rest of the country. This program included both cash-for-work, cash-for-food as well as other welfare (assistance) measures. As of 2005, the PSNP was designed to address food insecurity by providing transfers to over 5.5 million targeted beneficiaries throughout the country. The programme has completed three phases now and it is currently under its fourth phase to last until 2020. To date PSNP reached over 10 million rolling rural poor and vulnerable beneficiaries, hence being the second largest safety net programme in Africa, after South Africa. The question of whether social protection programs, by reducing poverty through transfers, improve nutrition, food security and human capital accumulation, especially of children, is a long lasting concern for both development economists and policy makers (Hanna and Olken, 2008; World Bank 2010).

While the fact that the program started due to external support from the World Bank reduces endogeneity issues, a major methodological problem when carrying out an impact assessment is that the allocation of the program (and of beneficiaries) is not random across geographical areas. The bias in estimates that treat policy intervention as exogenous is likely to be significant in developing countries. Areas more intensively treated than other may have some (observable and unobservable) characteristics that may be correlated with final individual outcomes. Moreover, if more affluent regions are able to allocate higher local financing to the social protection program or to target more households, then comparing individuals living in 'treated' vs 'untreated' areas will deliver upward biased results. Likewise, in a more centralized system, governments may allocate more fundings to poorer regions (as it is the case in Ethiopia), where nutrition and schooling may be particular lacking, so that in this case the estimation bias would be downward. In the absence of a policy experiment, which is difficult to develop when the program is nation-wide, a possible source of exogenous (natural) variation comes from targeted interventions. In particular, our identification strategy relies on the fact that the exposure to the nation-wide program varied by region of birth and date of birth. By gathering data from official governmental sources, we show that there is substantial variation in program intensity across Ethiopian regions, due to the government effort to allocate more social protection fundings to regions where initial food security was low. Moreover, we leverage variation in individual's age at the time of the program kick-off and focus on the first two years of a child's life as primary setting for the program impact. Several influential studies argue that nutritional deficiencies that occur early in childhood persistent effectsin in terms of adult health and achievement (Victora et al., 2008, 2010; Almond and Currie, 2011; Case and Paxson, 2002). According to the medical literature, nutrition at a very early age, i.e. in utero and by age 2, has long-lasting effects on child height and indeed on adult health (Barker, 1990; Martorell et al., 1994; Scrimshaw, 1997). The possibility to catch-up skeletal growth after an episode of low growth in infancy is limited, while most stunting[1] and catch-up occurs between 6 and 24 months of age.[2] Those who where young enough (i.e. the first two years window) to be in regions when the program started are expected be better off in terms of health and nutrition than older individuals in all regions, but these difference should be larger in regions that were more heavily targeted from the program. This is so as children who are undernourished during childhood are at high risk for impaired cognitive development, which adversely affect school achievement and individual productivity (Victora et al., 2008).

Our study design exploits the combination of variation in year and region of birth to employ a difference-in-difference strategy. Hence, we estimate the impact of PSNP exposure on child nutrition, as measured by a long-term antrophometric indicator of nutritional status, i.e. Height-

[1]Stunting reflects a failure to receive adequate food intake over a long period of time, and is, therefore, a measure of chronic malnutrition.

[2]Stunting after 24 months of age generally reflects the interaction of nutrition and infection at earlier ages (Martorell and Habicht,1986).

for-age Z-score (HAZ). An additional goal of our analysis is to identify the effect that childhood exposure to PSNP has on subsequent school entry and achievement. While direct effects of social protection programs on both adults and children can be partially measured with higher earnings from cash (-for-work) and higher school attendance/achievement respectively, little is known about effects that persist from better nutrition early in life, such as school achievement and attainment (e.g. years of schooling). Hence, we estimate the shift in the relationship between educational attainment, enrollment delay and program intensity that coincides with childhood exposure to the PSNP intensity in the first 1000 days in life. As pointed out by several scholars, understanding the drivers of impact assessments is a necessary condition to inform policy (Deaton, 2010).

For our empirical analysis, we use a large individual-level data set on native-born males and females from all over the country to construct a panel data of cohorts by birth year and birthplace. Hence, we build a year-of-birth-varying indicator of childhood exposure to the program, i.e. our 'treatment dummy', which we then interact with program intensity indicators at the regional level. In our difference-in-difference estimation strategy, identification comes both from individual's spatial variation and time variation in the year of birth, while controlling for systematic variation across regions and cohorts through fixed effects. Indeed, being born after the program and in areas with higher intensity treatment implies more benefits from exposure to the program. A similar strategy has been used to estimate the effect of school quantity on (returns to) education in Indonesia (Duflo, 2001) and the effect of big health improvement programs such as malaria eradication on labor productivity in North ans South America (Bleakely, 2010).

Our findings show that exposure to the PSNP early in life led to an increase in both Heigh-for-age Z-scores (HAZ) and primary educational attainment as measured by years of schooling, while it decreases enrollment delay in primary school entry. On average, one extra million Birr PSNP budget (about 35,000USD) allocated per 1000 children in birth regions increases child height-for-age Z-score by 0.1. As a result, an increase in the intensity of the program increase completed years of primary schooling by about 0.7. Results, which are robust to different ways in measuring program intensity and different estimation sample, seem to be increasing with the time of exposure (i.e. measured by year of birth and age). The estimation of fully flexible models in years of birth or age ensures the non-violation of common trend assumptions. Moreover, results of some placebo tests performed using only pre-program cohorts suggests that results can be interpreted as causal.

The remainder of the paper is organized as follows. Section 2 provides a description of the Productive Safety net Program (PSNP) as well as the research design of the study. In Section 3, we report a review of the related literature in economics. Section 4 describes the data sources used in the empirical analysis while Section 5 illustrates the econometric model and identification strategy. In Section 6, we present the results ad discussion. Finally, Section 7 concludes.

2 The program

The Productive Safety Net Program (PSNP) is a development-oriented large scale social protection program. In Ethiopia, it started in 2005, aiming at improving food security and stabilizing asset levels. The PSNP contains a mix of public works employment and unconditional cash and food transfers. It is a well-targeted program, even though several years passed before payment levels reached the intended amounts. It was introduced by joint efforts of the Government of Ethiopia and donors in an attempt to provide a long-term solution to the chronically food insecure households found in poor regions of the country. It aims at covering more than 263 woredas (districts) and 1.6 million households in five major regions in Ethiopia (which correspond to roughly 10 million individuals), namely Tigray, Amhara, Oromiya, Somali and SNNP . However, later it extended to cover other regions such as Afar, Dire dawa, and Harari (Bethelhem et al., 2014). While the program builds on the experiences of the earlier emergency relief program, it has distinct characteristics in its long-term nature. It provides a predictable amount of transfers (cash or food) for a predictable period of time (at least five years) (Bethelhem et al., 2014). Able-bodied adults are required to work five days per month in community infrastructure development in return for food (mainly wheat and cooking oil) or cash. Elderly, disabled, sick or mentally challenged individuals, pregnant and best-feeding women, and orphaned teenagers receive free food or cash without a work requirement. The former is the public work (food-for-work or cash-for-work) component and the latter is the direct support component.

The PSNP kicked-off as a food "safety net" that would provide food or cash for food insecure households during the "hungry" seasons of the year in exchange for public works through the Ministry of Agriculture. Although it began as a household food security program it has, for all practical purposes, evolved into a broader package of social protection, now comprising four components: social protection, livelihoods, disaster risk management, and nutrition and climate resilience/green economy. During its following up stages, the program was made more nutrition-sensitive through the incorporation of additional nutrition provisions, “soft conditionality” exemptions from physical labor for pregnant and breast-feeding women with a child under 1 and for mothers with a severely malnourished child under 5. These mothers are provided with “temporary transition to direct support” (i.e., cash or food). Instead of participating in public works, they engage in community based nutrition activities, such as social and behavioral change communication and growth monitoring and promotion sessions. A process of “co-responsibility” helps ensure their participation in these activities.

A new phase of PSNP (PSNP4) began in 2015, with the objective of supporting the transition towards a social protection system. PSNP4 will achieve this by ensuring that poor and vulnerable households benefit from an essential suite of services, including safety net transfers, livelihood interventions, key health and nutrition services, community assets constructed through public works and support to households up to, during and beyond safety net graduation. By mainstreaming nutrition throughout the programme implementation, PSNP4 will address some determinants of malnutrition, including maternal and child health, vaccinations, infant and young child feeding practices, dietary diversity, women empowerment and water, sanitation, and hygiene. Demand for health services will further be promoted through the introduction of soft conditionalities within the PSNP, which are linked to the health-seeking behaviour of temporary direct support clients. Under the PSNP4 umbrella, an Integrated Nutrition and Social Cash Transfer (IN-SCT) pilot is ongoing, enabling the trial of an integrated system of social cash transfers and the promotion of linkages with basic social services. The Urban Food Security and Job Creation Strategy and Programme has been gradually implemented starting from 2016, and is supported by an Urban Productive Safety Net Programme (UPSNP) (UNICEF/ETHIOPIA, 2016). Recognizing of the fact that social programs in Ethiopia have not been given in harmonized way, Ethiopia launched its National Social Protection Policy (NSPP) in 2014. The policy introduces the concept of a ‘sustainable social protection system’. Various strategies and programmes are underway to support the implementation of the NSPP, but often these are still implemented in a fragmented manner (UNICEF/ETHIOPIA, 2016).

2.1 Research Design

The PSNP was launched due to donor’s support and international aid, which are substantially external factors that are uncorrelated with cross-regional heterogeneity. This reduces concerns about potential policy endogeneity and reverse causality in its impact assessment. Moreover, different regions across the country have different intensity of the program, which we can measure with both budget allocation and targeted beneficiaries. Finally, the timing of the program roll-out induces variation in childhood nutrition that has a clear pattern across year-of-birth cohorts. Cohorts that were already 'old' enough before the PSNP started, could not have an early-life exposure to better nutrition. Thus, we compare cohorts based on (i) the program intensity in their place of birth and (ii) their year of birth relative to the PSNP kick-off. The kick-off of the PSNP combined with cross-area differences in program intensity form the core of our research design. Since the analysis considers the effect of childhood exposure to the program on later-life outcomes, it is useful to characterize the 'exposure rule' as in Bleakly (2010). The program started in 2005 and the treatment or exposure assignment is defined by year of birth. In our impact assessment, we use early childhood as being the cut-off for the treatment effect, being the first 2 years of life particularly important for child development. Hence, children born more than 2 years before the program are considered as 'untreated'.[3]

A child born in 2003 or before cannot benefit from the PSNP program, launched in 2005, in his key early months of life. A child born later, instead, is fully exposed to the treatment early in life so that s/he is considered as treated. In particular those born between 2003 and 2004 are only partially treated while those born between 2004 and 2005 are fully exposed also while in utero (see the empirical section for more details on identification). Moreover, most of a person's human-capital and physiological development happens in childhood (Bleakley, 2010). On both human-capital side and physiological side, being exposed to improved food security, and accumulation of asset during childhood period might mean that the individual is more robust as an adult, with concomitant increases in educational achievement. Thus, we argue that an intervention, such as social protection program, aiming to improve food security and reduce poverty is expected to have indirect influence on socioeconomic outcomes such as educational attainment. We further assess the impact of early childhood exposure to the program on years of schooling of individuals aged 13 years or more. Normally, Ethiopian children start primary schooling at age of 7 and are supposed to complete

[3] By postulating uniform effects of malnutrition per years of childhood exposure, the formula for exposure is *max(min(2, k-(y-2)),0)/2*, where k is the year of birth and y is a starting year (see Bleakly, 2010).

this cycle 7 years later [4]. Yet, while primary enrollment is about 90% of 7 years old Ethiopians, only half of them complete the entire educational cycle. The differential incidence of the program implementation across regions joint with the use of non-exposed children as comparison group, combine to form the research design of our analysis.

3 Background and context

Ethiopia is the second country with the highest rate of malnutrition in Sub Saharan Africa, facing the four major forms of malnutrition, i.e. growth failure malnutrition, acute malnutrition or wasting, chronic malnutrition or stunting and micro-nutrient malnutrition (Dube et al, 2017). Child malnutrition is one of the many challenges that pose a threat to economic growth in developing countries, as it undermines educational attainment, lowers non-cognitive skills, leads to low labor productivity during adulthood and ultimately boosts inter-generational poverty (World Bank, 2010; Save the Children, 2012). Since nutrition is an indicator of the quality of human capital of a country, addressing chronic malnutrition is recognized as key for socioeconomic development. Cash transfers and social protection programs have been targeted to reduce poverty and improve standards of living across a variety of developing settings and intervention designs (Batagli et al., 2018). In many of the poor and targeted regions, children typically make up the highest share of local poorest people because of high fertility rates, inequality and deep-seated privation in low-income settings. Poverty in childhood has been shown to impact on children's physical, cognitive and social development, potentially placing them on a lifelong trajectory of low education, low productivity and perpetuating inter-generational cycles of poverty (e.g. Cunha F, Heckman, 2008; Dahl and Lochner, 2012). In particular, there is now abundant evidence showing that human capital accumulation is shaped by physical and mental abilities as well as cumulated health and nutritional inputs, those received early in life being particularly important (Alderman et al. (2001a, 2006); Glewwe et al. (2001); Cunha et al. (2006) and Yamauchi (2008).

Global evidence shows that social protection can support, directly or indirectly, the realization of children's rights in a number of ways, for example by enabling children and their families to access

[4] There are three years of pre-primary school in Ethiopia, which has an official entry age of 4 and is referred to as Kindergarten. Primary school has an official entry age of 7 and ends at age of 14 (a duration of eight grades). At the end of the cycle, students sit for a national examination that results in the Grade 8 Completion Certificate. Secondary school is divided into two cycles: lower secondary (length of program 2 years, and age ranges from 15 to 16) and upper secondary (length of program 2 years, and age ranges from 17 to 18).

health care, early childhood nutrition, and primary and secondary education programmes. However, the evidence relating to effectiveness of these programmes on child wellbeing is significantly plagued by different empirical approaches and methodological issues (Ravallion, 2009; Deaton, 2010). Moreover, both programs and findings (and contexts) are mixed by their own nature. Seminal and influential work by Kremer & Miguel (2004) use a randomized control and data collected from primary schools in Kenya to show that deworming programs reduce child school absenteeism by 25%. They did not find an improvement in academic attainment, but they did find that deworming substantially improved health and school participation among untreated children in both treatment schools and neighbouring schools, via spillover effects. In the absence of a randomized control trial, Duflo (2001) leverages exogenous natural variation in combination with statistical modeling strategy to evaluate the impact of a large School Construction Program in Indonesia. By combining differences across regions in the number of new schools with difference across cohorts induced by the timing of the program, she finds that exogenous school supply lead to a significant increase in education and earnings of program exposed children. Similarly, Bleakly (2010) use early-life exposure to large malaria eradication programs in different countries to show that cohorts born after eradication have higher income as adults than the preceding generation. These cross-cohort changes coincided with childhood exposure to the campaigns rather than to pre-existing trends. Cutler et al. (2010), Cecilia et al. (2017), and Mark et al. (1993) use similar identification strategies to examine the influence of social program on different socioeconomic outcomes.

Other related works include Ponce and Bedi (2010), which use a regression discontinuity strategy to identify the impact of a cash transfer program (the Bono de Desarrollo Humano) in Ecuador on student's cognitive achievements, and find no impact of the program on test scores. While analyzing the impact of the Indonesian Social Safety Net health card program on public health care demand, Pradhan et al. (2007) also find that most of the benefits go to the non-poor, even though distribution of the health cards was pro-poor. Conversely, Antonio et al. (2005) note that Colombia's subsidized insurance program greatly increased medical care utilization among the country's poor and uninsured. By using variation in ownership of water provision across time and space as a result of a large privatization program in Argentina, Galiani et al.(2003) find that child mortality falls by 8 percent upon the program, and the impact is larger in the poorest areas.

Prior empirical works on impact of social protection programs in Ethiopia also show diversified and mixed results. For instance, using nationally representative data, Yamano et al. (2005) find that while harvest failure leads to child growth faltering, food aid affected child growth positively and offset the negative effects of shocks in communities that received food aid. Similarly, Yablonski and Woldehanna (2008) note that different social protection programmes in Ethiopia have had unexpected impacts on girls' and boys' participation in school, and in paid and unpaid work. Gilligan et al. (2009) also find little evidence of improvements in consumption among targeted households. Using a longer time-period of evaluation, Berhane et al. (2014) find improvements in food security for households that received PSNP for more than four years. Bethelhem et al. (2014), taking one region in Ethiopia, also demonstrate that the PSNP is providing positive short-term nutritional benefits for children, especially in those households that can leverage underemployed female labor. Furthermore, using Young Lives data, Porter and Goyal (2016) find a significant positive medium-term impact of the PSNP on the nutrition of children aged 5 to 15 years.

4 Data sources and descriptive statistics

This study uses repeated cross-sectional data from three rounds (2005, 2011, 2016) of the Ethiopian Demographic Household Survey (EDHS) to build synthetic cohorts of exposed vs non-exposed individuals to the PSNP. The EDHS is a large nationally--representative repeated household survey collected by the Central Statistics Agency of Ethiopia in collaboration with the United States Agency for International Development (USAID), the World Bank LSMS group and the United Nations Children's Fund (UNICEF).[5] The EDHS include standard individual demographics and socio-economic characteristics, including anthropometric measures on both children (0-5 years of age) and adults (15 years of age and above) as well as educational attainment of all individuals. Our outcome of interest is child nutrition as measured by the anthropometrics indicator Height-for-Age Z-scores (HAZ). This is constructed for any age by standardizing height measurement to a reference group of well-nourished children using the recent WHO (2006) standard child growth reference

[5] In all rounds, the EDHS sample is stratified and selected in two stages. In the first stage, Enumeration Areas (EAs) are selected with probability proportional to the EA size and with independent selection in each sampling stratum. EA is a geographic area that covers an average of 181 households. In the second stage, a fixed number of households per cluster are selected with an equal probability systematic selection from the newly created household listing.

data.[6] The second outcome of interest is primary education attainment, which we measure with numbers of completed years of primary schooling of individuals 13 or older. We further use an indicator of delayed primary school enrollment, which is defined as current child age minus completed years of schooling minus official primay school starting age (e.g. Glewwe and Jacoby. 1995; Alderman et al.2001).[7]

Importantly, EDHS include the indicator of each respondent's region of birth in Ethiopia, which we match with regional level data on the intensity of PSNP.[8] Hence, we use official administrative data at regional level from 2005 to 2016 to measure (ii) the amount of PSNP resources allocated to each region and (ii) the number of household beneficiaries.[9] We further use administrative data, as well as aggregated EDHS survey data, to measure other time-varying factors at regional-level that may influence child nutrition and development such as health-related infrastructure, health facilities/coverage (including immunization/vaccination coverage), child and maternal health service coverage (antenatal, and postnatal care delivery), improved water and sanitation coverage, aggregate primary school attendance, enrollment ratio, school drop rate, number of primary and secondary schools, public expenditure in education (for details, see Appendix I).

Our estimation sample consists of males and females in the EDHS data sets, born between 1992 and 2016 in different regions in Ethiopia. The date and region of birth jointly determine an individual degree of exposure to the PSNP treatment. A child born in 2003 or before was 2 or older in 2005, when the PSNP was launched. Hence, this child did not benefit from the program in his key 1000 days of of life. A child born in 2003 or later, instead, was partially or fully exposed to the treatment

[6]Z-score is the deviation of an individual's value from the median value of the global reference population, divided by the standard deviation of the global reference population (the global reference population is a population with a distribution of heights, weights, ages, or related measures that is considered normal by international standards). The Z-score indicates where one observation lies in reference to the global population. A Z-score of –2 or less (that is, equal to or smaller than two standard deviations below the median of the global reference population) is considered very low. The World Health Organization recommends the use of Z-scores, because they are the most age-independent method of presenting indexes. Hence, if height-for-age z-score is less -2, child is considered as stunt (WHO, 2006).

[7]Here we assume no grade repetition and exclude children who are out of school. Primary grade repetition is rather uncommon in Ethiopia, as everywhere.

[8]The use of region of birth instead of residence as matching unit directly address the potential problem of selective internal migration. By using this information, though, our analysis resambles an intention-to-treat design.

[9]These data has been gathered by one of the author in Ethiopia through an official request to different institutional bodies including the Ministry of Agriculture, Ministry of Health, Ministry of Economic and Development Cooperation, Central Statistical Agency (CSA), National Emergency Relief and Preparedness Commission, and Regional State's Agricultural Bureaus.

early in life so that s/he is considered as treated. In particular, those born between 2003 and 2004 are partially treated (so that considering them as treated may bias results downward). Exposure in utero, instead, could lead those born between 2004 and 2005 from partially to fully benefit from the program, such that the treated group may be measured with some minor error (which would still bias our results downward). To sum up, in our benchmark specifications we consider children 2 or older in 2005 as non-exposed to the program while for children born after 2003, the treatment effect is expected to be positive (possibly increasing with age, i.e. higher exposure).

When analysing the nutritional impact, we focus on individuals of any age with years of birth ranging from 1992 to 2016. When assessing the impact of the program on educational attainment instead, we restrict this same sample to individuals of 13 years of age or older, which ensures that youngest individuals in the sample are close to complete primary school (first and second cycle) in 2016. The official primary school entrance age is 7 in Ethiopia and the system is structured in two primary school cycles, lasting 4 years each, but we are forced to use 7 rather than 8 years due to the last available survey year that is 2016.[10] In a robustness check, we include children 11 or older (i.e. we enlarge our estimation sample), where 11 is when children are supposed to finish the first cycle of primary school in Ethiopia (when we do this, we measure years of first-cycle primary schooling as our outcome variable).

Using this large cross-section of males and females born between 1992 and 2016 from the different survey years of EDHS, we therefore link each individual's antrophometric and educational indicators with regional level data on budget allocation and PSNP beneficiaries between 2005 and 2016 in her/his region of birth. Analogously, we do the same for other regional level control variables (for detailed description, see Appendix I).

4.1 Descriptive statistics

Table 1 report the program intensity across regions, both in terms of average budget and number

[10] The oldest individuals in the sample (those born in 1992) are 13 years of age in 2005, i.e. our first survey year (and 24 years old in 2016, our last survey year). The youngest instead (those born in 2003) are 13 years old in 2016. Given the program treatment cut-off (2003) and our last survey year available (2016), we are forced to include children 13 years of age – instead of 14 – or older in our sample.

Table 1: PSNP intensity and Emergency relief aid across regions in Ethiopia (average between 2005 and 2016)

Region	PSNP		Emergency relief aid	
	PSNP- budget (in million Birr)	PSNP- beneficiary (household n. in '000')	Aid-food (in ' 000' metric tons)	Aid- beneficiary (household n. in '000')
Tigray	292.91	1246.27	55.85	459.83
Amhara	708.14	2145.81	93.92	730.05
Afar	28.00	480.40	14.48	121.17
Oromia	365.84	1349.65	107.28	943.29
Somali	39.81	698.16	116.34	1015.25
SNNPR	483.24	1210.12	32.99	280.89
Harari	5.58	15.94	28.69	199.03
Dire Dawa	6.54	52.20	24.67	174.25

Source: Ministry of Agriculture, and National Emergency Relief and Preparedness Commission, Ethiopia

of beneficiaries. With respect to PSNP budget allocating, the average budget between 2005 and 2016 is 241,7 million Birr (which corresponds to about 8.5 million USD), but a lot of variation emerges across regions. The highest and lowest program intensity is recorded in Amhara (708.14 million Birr) and Harari (5.58 million Birr) regions respectively. Moreover, number of beneficiary households also vary across regions. We further report descriptive statistics on different emergency relief aid programs across regions, which do not present strong systematic correlation with PSNP intensity.

In Table 2 we report descriptive figures of stunting, as a measure of chronic malnutrition, across regions and time in Ethiopia. While average height-for-age Z-score is -1.25 in our sample, stunting is defined as a height that is more than 2 standard deviations below the World Health Organization (WHO) child growth standard median (WHO, 2006). Although there is a falling tendency in malnutrition in all regions over time, there is still high prevalence of child malnutrition in the country that also varies across regions. Many regions still record a prevalence of stunting greater than 40%, that is when stunting is considered as a severe public health problem in a community.

As far as education is concerned, primary school in Ethiopia has an official entry age of 7 and ends with either Grade 5 (first cycle) or Grade 8 (second cycle) at age of 14. Table 3 report different educational indicators gathered from the Ministry of Education for primary schooling between

Table 3: Primary Education indicators (grades 1-8)

Indicators in % /Year	2005/06			2013/14			2015/16		
	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total
General Enrollment Rate (GER)	98.6	83.9	91.3	105	98	101.2	102	93	97.5
Net Enrollment Rate (NER)	81.7	73.2	77.5	95	90	92.5	95	91	93
Drop-out rate	12.6	12.1	12.4	11	11	11	10	10	10
Repetition rate	6.4	5.7	6.1	9	8	8.5	7	7	10

Source: Ministry of Education, Ethiopia (2005-2015)

2005 and 2016. While enrollment rates have been growing over time, drop-out rates and repetition rates are still as high as 10 percent as far as primary education is concerned. Actually, educational records in our survey sample are slightly lower that official statistics. The average number of years of primary education in our sample is about 4.5 (about 10 percent of the whole sample report zero years of schooling) and this is in line with official UNESCO statistics for Ethiopia recording 32% of children of official primary school ages are out of school, more concentrated among boys and the poorest children.[11]

Table 2: Prevalence of malnutrition (stunting) by region and year

Region/Year	2000	2005	2011	2016
Tigray	55.3	41	51.4	39.3
Amhara	57	57	52	46.3
Afar	47.6	41	50.2	41.1
Oromia	47.2	41	41.4	36.5
SNNP	46.4	45	33	27.4
Somali	55.4	52	44.1	38.6
Harari	37.3	39	29.8	32
Dire -Dawa	30.5	31	36.3	40.2
Ben-Gumuz	41.3	40	48.6	42.7
Gambella	37	29	27.3	23.5
AddisAbaba	26.8	18	22	14.6
National	58	52	44.4	38.4

Source : Ethiopian Demographic Household Survey (EDHS) of various rounds (2000-2016)

Eventually, in Table 4 we report mean differences by cohort and program intensity in the region of

[11] https://www.epdc.org/sites/default/files/documents/EPDC%20NEP_Ethiopia.pdf

Table 4: Difference-in-Difference using mean difference by cohort and PSNP intensity level

Variable	Height-for-Age-Z-score			Years of schooling		
	PSNP intensity			PSNP intensity		
Cohort/PSNP	High	Low	Diff	High	Low	Diff
Exposed	-1.34	-1.66	0.32	4.85	4.34	0.51
	(0.01)	(0.02)	(0.01)	(0.04)	(0.03)	(0.07)
Non-exposed	-2.12	-2.05	-0.07	4.26	4.55	-0.29
	(0.05)	(0.06)	(0.04)	(0.07)	(0.06)	(0.03)
Diff-in-Diff	0.78	0.38	0.40	0.59	0.20	0.80
estimates	(0.05)	(0.06)	(0.05)	(0.08)	(0.07)	(0.09)

Note: PSNP is program intensity in region of birth

birth. Our hyphotesis is that the average impact of the program on nutrutional status of exposed children (those young enough at the time of the program) is higher than it is the case for control chidren. The mean difference-in-difference in both height-for-age z-score and completed primary years of schooling suggest that the difference by cohort and program intensity in region of birth is positive as per our hypothesis. Hence, this unconditional descriptive analysis show the existence of difference in our outcome of interest due to variation in program intensity across regions. However, individual's nutrition as well as education achievement are the outcome of the interaction of several factors (e.g. individual, cohort-level and locality-specific characterstics) that, if not control for (especially if not fully balanced across treated and control groups), may confound the estimate of the our treatment, i.e. exposure-intensity interaction. We thus turn to our empirical strategy in the next section.

5 Empirical model and identification strategy

The empirical strategy exploits two sources of variation, namely time variation coming from the individual age at the beginning of the program and cross-sectional variation arising from asymmetric regional coverage as well as intensity of the PSNP program. In a difference-in-difference framework, then, nutritional and educational outcomes of exposed *vs* non-exposed individuals in their childhood are compared across regions with different intensity of the treatment. The introduction of year of birth and region fixed effects controls for all time-invariant differences of both cohorts and regions. The identification strategy relies on the absence of any other shock occurred around early childhood of individuals (happening at the same time of the PSNP program launching) and correlated with the budget allocation and number of program beneficiaries across regions. The latter identification concern is addressed by controlling for region-specific factors that may bias the estimates, such as access to health and education facilities as well as aggregated health and human capital indicators.

Hence, we hypothesize that nutritional status of children who were young enough to be in age of 0 to 2 years old when the program started, will be higher than the nutritional status of older children with an age above 2 years in all regions. Put it differently, nutritional status of children who were exposed to the program in early childhood (i.e. the critical first 1000 days of life, during which the intervention is likely to have more nutritional impact) would be higher owing to the program intervention[12]

Most of a person's human-capital and physiological development happens in childhood (Bleakley, 2010). On both human-capital side and physiological side, being exposed to improved food security, and accumulation of asset during childhood period might mean that the individual is more robust as an adult, with concomitant increases in educational achievement. Thus, an intervention (such as social protection program) aiming at reducing both malnutrition and poverty is expected to have *indirect* influence on socioeconomic outcomes such as educational achievement.

We start by estimating the equation that follows:

$$y_{ijk} = \alpha_0 + \alpha_j + \alpha_k + \gamma_1 \left(PSNP_j * Young_i\right) + \gamma_2 \left(X_j * Young_i\right) + \varepsilon_{ijk} \tag{1}$$

Where y_{ijk} is the individual outcome, i.e. height-for-age Z-score, completed years of primary schooling and delayed primary enrollment. Here, we assume that no grade repetition and children who are at school only, i.e.we excluded those not go school at all., for the individual i born in region j and cohort k. While α_0 is a constant, α_k is a cohort of birth fixed effect, capturing the effects of time-invariant unobservable characteristics specific to the cohort and α_j is birth place fixed effect (the main effects of the area-of-birth and exposure controls are therefore absorbed by

[12]The nutrition literature also has a clear focus on the importance of the first 1000 days of life (from conception to age 24 months) (Victora et al., 2010).

these fixed effects).[13] $Young_i$ is the 'treatment dummy' indicating whether the individual belong to the 'young' cohort (i.e. born after 2003), $PSNP_j$ denotes the intensity of the program (PSNP) in the region of birth j, and X_{jk} is a vector of region-specific time-variant variables (controls) including human capital and health service coverage in 2000s. $PSNP_j * Young_i$, represents the variable of interest, i.e. the interaction effect of program intensity and childhood exposure. ε_{ijk} is the error term.

Results from Equation 1 relies on the identification assumption that there is no omitted time-varying and region specific effects correlated with the program by cohort. Our parameter interest, γ_1 captures the differential impact of the PSNP on our interest outcomes considered in this study. Put it differently, the exogenous variable is the interaction of the treatment status with the intensity of the program in region of birth. A similar strategy has been used by Duflo (2001) and Bleakely (2010).

The identification assumption would be violated if other regional-specific programs were correlated with the allocation of the PSNP efforts. Thus, we present specifications that control for the interactions of a vector of regional-specific variables, including the allocation of water and sanitation facilities, aggregate health status and school enrollment rate, with the cohort dummy.

Following Duflo (2001), we can test the identification assumption by exploiting the availability of more than two pre- and post-periods, which allow us to estimate cohort-by-cohort contrasts through a more flexible nutrition specification. We start with the nutrition specification as follows:

$$y_{ijk} = \alpha_0 + \alpha_j + \alpha_k + \gamma_1 \sum_{t}^{t+5} (PSNP_j * Birthyear_{it}) + \gamma_2 \sum_{t}^{t+5} (X_j * Birthyear_{it}) + \varepsilon_{ijk} \tag{2}$$

where every thing is defined as above, with the exception that the treatment effect is identified in each cohort ($Birthyear_i$) going from 2001 (with t=2001 being the reference category) to 2005.

[13] Cohort effects reflect secular trends that lead to different positions of age profiles for different cohorts. They typically embody a number of unobserved effects, including cohort size effects, generational differences in attitudes and cohort-specific government policies.

Equation 2 does not impose a parametric assumption on the pre-treatment dynamics such that it allows for a test of the null hypothesis of no pre-treatment trends (i.e. since individuals born before 2003 are not exposed to the program, we expect no systematic difference across cohorts before 2003). Moreover, it also allows for checking the dynamics of the treatment effect in that we can test whether the effect is different across the post-treatment periods.

Similarly, we run the following regression for the education equation:

$$y_{ijk} = \alpha_0 + \alpha_j + \alpha_k + \gamma_1 \sum_{l=1}^{13} (PSNP_j * Age_{il}) + \gamma_2 \sum_{t}^{t+13} (X_j * Birthyear_{it}) + \varepsilon_{ijk} \tag{3}$$

Where y_{ijk} is the individual outcome, i.e. completed years of primary schooling, for the individual i born in region j and cohort k. Age_{il} is the age of individuals in 2005, with $l \in [1, 13]$ (13 being the reference category), and $Birthyear_i$ is individual's birth year. Here, while using the interaction between program intensity and age of individuals in 2005, we test the time dimension of exposure to the program with 13 age dummies (for being 1 to 13 in 2005). Each coefficient of interest, γ_1, can be interpreted as an estimate of the impact of the program on a given cohort.

6 Results

This section presents the results of the effects of the PSNP on nutrition (Height-for-Age Z-score, HAZ) and educational attainment (completed years of primary schooling), following the empirical strategy outlined above and using two indicators of treatment intensity. Table 5 reports results by estimating Equation 1 on heigh-for-age Z-score. Each row in the table corresponds to a different estimation (using two different program intensity indicators respectively). Morevoer, while column (1) and (2) report results using the whole sample (i.e. comparing children born in different cohorts between 1992 and 2016), in column (3) and (4) we only focus on children between 0 and 5 years old observed in the survey year 2005 (i.e. we compare young kids born right before and after 2003).[14]

[14] In the full sample estimation, the treatment group include children from all survey rounds born in or after 2004. Controls are those born between 1992 to 2003. Yet, in the 2005 restricted sample estimation, the treated group

Results point to a positive and statistically significant effect of PSNP on Z-score. One extra million Birr PSNP budget (about 35,000USD) allocated per 1000 children in birth regions increases child height-for-age Z-score by 0.07 to 0.13 in the full sample target. The effect is bigger in magnitude when we consider only the sample of young kids born right before and after the program (2005 DHS survey). Analogously, an increase in the number of beneficiary households by 1000 (per 1000 children) increase Z-score by 0.1 to 0.6. The magnitude of the impact across different indicators of PSNP intensity is not so different in both estimation samples considered.

Table 5: PSNP effect on Height-for-Age Z-score

	Full sample		Kids 0-5 (2005 survey)	
Program intensity indicator employed:	(1)	(2)	(3)	(4)
(a) PSNP budget*young	0.077**	0.135*	0.515**	1.13***
	(0.031)	(0.069)	(0.190)	(0.343)
(b) PSNP n. beneficiary households *young	0.101**	0.673**	0.480**	0.840***
	(0.049)	(0.321)	(0.177)	(0.254)
Cohort FE	yes	yes	yes	yes
Birth place FE	yes	yes	yes	yes
Regional controls:				
Child/mother health service coverage * young	yes	yes	yes	yes
Improved water use coverage*young	yes	yes	yes	yes
Health extension program coverage*young	no	yes	no	yes
Emergency humanitarian aid*young	no	yes	no	yes
Observations (N)	25,304	25,304	2,841	2,841
R^2(a)	0.1765	0.1765	0.1097	0.1097
R^2(b)	0.177	0.177	0.110	0.110

Note : This table reports diff-in-diff estimates of Equation 1. Each row corresponds to a different estimation equation. Outcome variable is individual's height-for-age z-score. In the full sample regressions (columns 1 and 2) all DHS rounds (2005, 2011 and 2016) are included. Coefficients of interest are interaction terms between treatment dummy and the amount of PSNP resource allocated (in million Birr) or PSNP beneficiary household (thousand) per 1000 children in the region of birth. All specifications include region of birth, year of birth dummies. Among region-specific controls, child/mother health service coverage includes immunization, antenatal, and postnatal service coverage, wile emergency-humanitarian aid includes both number of beneficiaries and amount of food (in metric tons) distributed across regions. In all regression, we consider sampling weight for national inferences. Standard errors are in parentheses are clustered at enumeration areas. Significance level as *** p<0.01, ** p<0.05, * p<0.1

Similarly, we employ Equation 1 to examine program impact on completed years of primary school-

includes those born in 2004 or after while cotrols are those born between 2000 to 2003 only (those born between 1992 to 1999 are not included as in full sample cases becauase the 2005 DHS survey only collected antropometric information for childern under five years).

ing. In Table6, we report results while using a sample of individuals who have potentially completed all cycle of primary education (13 years of age or older, in columns 1-2) and while using those who have finished the first cycle only (11 years of age or older) (columns 3 and 4). Results exhibit a positive and statistically significant effect in all specifications and estimation samples. The magnitude of program effect coefficients across the estimation sample is almost the same. One extra million Birr PSNP budget allocated per 1000 children in birth region increases years of primary schooling by about 0.7 (results are similar across estimation samples). Similarly, an increase in 1000 household beneficiaries (for 1000 children) increases years of schooling by 1.2 to 1.4. These are sizable effects provided that the average years of schooling in our sample is about 3. Overall, it is noteworthy that results are robust across both different measures of PSNP intensity and estimation sample. Moreover, controlling for extra region-specific programs, such as emergency humanitarian aid, make the PSNP impact estimation higher, suggesting that the estimates are not biased upward by mean reversion or omitted programs. [15]

[15]In Appendix II we report two sensitivity checks wheile using different years as treatment cut-offs.

Table 6: PSNP Effect on Years of Primary Schooling

	Age>=13		Age>=11	
Program intensity indicator employed:	(1)	(2)	(1)	(2)
(a) PSNP budget*young	0.641***	0.727***	0.620***	0.701***
	(0.137)	(0.159)	(0.102)	(0.116)
(b) PSNP n. beneficiary hhs *young	1.41***	1.41***	1.22 ***	1.23***
	(0.341)	(0.335)	(0.244)	(0.240)
Cohort FE	yes	yes	yes	yes
Birth place FE	yes	yes	yes	yes
Regional controls:				
Enrollment rate in primary school*young	yes	yes	yes	yes
Improved water use coverage *young	yes	yes	yes	yes
Emergency humanitarian aid *young	no	yes	no	yes
Observations (N)	7,487	7,487	9,724	9,724
R^2(a)	0.0744	0.0748	0.1806	0.1811
R^2(b)	0.073	0.073	0.178	0.178

Note This table reports diff-in-diff estimates of Equation 1. Outcome variable is individual's completed years of primary schooling. Coefficients of interest are interaction terms between treatment dummy and the amount of PSNP resource allocated (in million Birr) or PSNP beneficiary household (thousand) per 1000 children in the region of birth. All specifications include region of birth, year of birth dummies. Among region-specific controls, child/mother health service coverage includes immunization, antenatal, and postnatal service coverage, wile emergency-humanitarian aid includes both number of beneficiaries and amount of food (in metric tons) distributed across regions. In all regression, we consider sampling weight for national inferences. Standard errors are in parentheses are clustered at enumeration areas. Significance level as *** p<0.01, ** p<0.05, * p<0.1

Table 7 report findings when the dependent variable is delayed primary school enrollment. Results exhibit a negative and statistically significant effect in all specifications and estimation samples. This entails that those children who are exposed to the program during their critical two early-years of life are more likely to enter primary school on time, and delayed entry is reduced. This is consistent with previous findings in low-income countries that early childhood malnutrition causes delayed school enrollment (Glewwee and Jacoby, 1995).

Table 7: PSNP Effect on Delayed Primary School Enrollment

	Age>=13		Age>=11	
Program intensity indicator employed:	(1)	(2)	(1)	(2)
(a) PSNP budget*young	-.0.526***	- 0.628***	-0.454***	-0.541***
	(0.111)	(0.127)	(0.093)	(0.105)
(b) PSNP n. beneficiary hhs *young	-1.310***	- 1.304***	-1.047***	-1.044***
	(0.298)	(0.294)	(0.232)	(0.229)
Cohort FE	yes	yes	yes	yes
Birth place FE	yes	yes	yes	yes
Regional controls:				
Enrollment rate in primary school*young	yes	yes	yes	yes
Improved water use coverage *young	yes	yes	yes	yes
Emergency humanitarian aid *young	no	yes	no	yes
Observations (N)	7,071	7,071	9,125	9,125
R^2(a)	0.655	0.656	0.696	0.697
R^2(b)	0.655	0.655	0.696	0.696

Note This table reports diff-in-diff estimates of Equation 1. Outcome variable is individual's years of delayed entry. Coefficients of interest are interaction terms between treatment dummy and the amount of PSNP resource allocated (in million Birr) or PSNP beneficiary household (thousand) per 1000 children in the region of birth. All specifications include region of birth, year of birth dummies. Among region-specific controls, child/mother health service coverage includes immunization, antenatal, and postnatal service coverage, wile emergency-humanitarian aid includes both number of beneficiaries and amount of food (in metric tons) distributed across regions. In all regression, we consider sampling weight for national inferences. Standard errors are in parentheses are clustered at enumeration areas. Significance level as *** p<0.01, ** p<0.05, * p<0.1

6.1 Program impact by gender

The PSNP is primarily designed to ensure that both male and female benefit equally from the programme, i.e. in principle ensuring gender equity.[16] Hence, we test the program impact by gender, since unequal resource allocation is very common in most developing countries, including Ethiopia. Using Equation 1 above, we thus run regressions within sub-sample of males and females respectively. Results on height-for-age are reported in Table 8 and show that PSNP has a significant impact on males' Z-score while we consider the full sample. Yet, the impact is mostly significant for both males and females if sample from 2005 DHS round only is taken into account.

[16] Gender equity is one of the eight principles that have guided PSNP implementation.

We run the same impact estimation equation on schooling and results reported in Table 9 show a significant positive effect on both females and males. Yet, the magnitude of the effect is slightly higher for males across all specifications and sample, suggesting that there may be a tendency to favor males against females upon having extra resources to invest in child human capital. Similarly, we test the impat of PSNP on delayed school entry by gender. Results on Table 10 show a negative significant effect across both males and females, supporting then the a priori PSNP principle of gender equity.

It may be argued that the effects of the program may also depend on the gender of the household head, who receives the cash and, most of the times, is the main decision-maker over resource allocation. Yet, the nature of our data does not allow us to retrieve the gender of the household head at the time the cash (and the program) was actually received and spent, i.e. when the relevant child was two years of age or less. Claiming houehold head is persistent over time is a strong assumption in poor contexts due to houehold recompostion patterns, migration and deaths.[17]

[17] We yet run regressions by gender of the household head at the time of the survey and results are available upon request.

Table 8: PSNP effect on Height-for-Age Z-score by gender

	Full sample				Kids 0-5 (2005 survey)			
Program intensity indicator employed:	Male		Female		Male		Female	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(a) PSNP budget*young	0.129***	0.206**	-0.016	0.081	0.629**	0.993**	0.318	1.150**
	(0.044)	(0.089)	(0.088)	(0.035)	(0.273)	(0.474)	(0.454)	(0.248)
(b) PSNP n. beneficiary hhs *young	0.128*	0.963**	-0.023	0.379	0.585**	0.736**	0.296	0.853**
	(0.413)	(0.070)	(0.409)	(0.056)	(0.352)	(0.254)	(0.336)	(0.231)
Cohort FE	yes	yes	yes	yes	yes	yes	yes	yes
Birth place FE	yes	yes	yes	yes	yes	yes	yes	yes
Regional controls:								
Child/mother health service coverage * young	yes	yes	yes	yes	yes	yes	yes	yes
Improved water use coverage*young	yes	yes	yes	yes	yes	yes	yes	yes
Health extension program coverage*young	no	yes	no	yes	no	yes	no	yes
Emergency humanitarian aid*young	no	yes	no	yes	no	yes	no	yes
Observations (N)	12,264	12,264	13,040	13,040	1,442	1,442	1,399	1,399
R^2(a)	0.333	0.333	0.117	0.117	0.123	0.123	0.109	0.109
R^2(b)	0.333	0.333	0.117	0.117	0.123	0.123	0.109	0.109

Note : This table reports diff-in-diff estimates of Equation 1 by gender. Outcome variable is individual's height-for-age z-score. In the full sample regressions (columns 1-4) all DHS rounds (2005, 2011 and 2016) are included. Coefficients of interest are interaction terms between treatment dummy and the amount of PSNP resource allocated (in million Birr) or PSNP beneficiary household (thousand) per 1000 children in the region of birth. All specifications include region of birth, year of birth dummies. Among region-specific controls, child/mother health service coverage includes immunization, antenatal, and postnatal service coverage, wile emergency-humanitarian aid includes both number of beneficiaries and amount of food (in metric tons) distributed across regions. In all regression, we consider sampling weight for national inferences. Standard errors are in parentheses are clustered at enumeration areas. Significance level as *** p<0.01, ** p<0.05, * p<0.1

Table 9: PSNP Effect on Years of Primary Schooling by gender

	Age>=13				Age>=11			
Program intensity indicator employed:	Male		Female		Male		Female	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
(a) PSNP budget*young	0.619***	0.720***	0.621***	0.692***	0.683***	0.781***	0.530***	0.593***
	(0.222)	(0.190)	(0.200)	(0.172)	(0.156)	(0.135)	(0.157)	(0.137)
(b) PSNP n. beneficiary hhs *young	1.620***	1.619***	1.136**	1.143**	1.451***	1.461***	0.955***	0.966***
	(0.443)	(0.453)	(0.443)	(0.450)	(0.305)	(0.309)	(0.317)	(0.323)
Cohort FE	yes	yes	yes	yes	yes	yes	yes	yes
Birth place FE	yes	yes	yes	yes	yes	yes	yes	yes
Regional controls:								
Enrollment in primary school*young	yes	yes	yes	yes	yes	yes	yes	yes
Improved water use coverage *young	yes	yes	yes	yes	yes	yes	yes	yes
Emergency humanitarian aid *young	no	yes	no	yes	no	yes	no	yes
Observations (N)	3,895	3,895	3,592	3,592	5,085	5,085	4,639	4,639
R^2(a)	0.098	0.098	0.064	0.064	0.196	0.196	0.176	0.176
R^2(b)	0.098	0.098	0.062	0.062	0.192	0.192	0.174	0.174

Note This table reports diff-in-diff estimates of Equation 1 by gender. Outcome variable is individual's completed years of primary schooling. Coefficients of interest are interaction terms between treatment dummy and the amount of PSNP resource allocated (in million Birr) or PSNP beneficiary household (thousand) per 1000 children in the region of birth. All specifications include region of birth, year of birth dummies. Among region-specific controls, child/mother health service coverage includes immunization, antenatal, and postnatal service coverage, while emergency-humanitarian aid includes both number of beneficiaries and amount of food (in metric tons) distributed across regions. In all regression, we consider sampling weight for national inferences. Standard errors are in parentheses are clustered at enumeration areas. Significance level as *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 10: PSNP Effect on Delayed Primary School Enrollment by gender

	Age>=13				Age>=11			
Program intensity indicator employed:	Male		Female		Male		Female	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
(a) PSNP budget*young	-	-0.671***	-	-	-0.562***	-	-	-0.386***
	0.548***	(0.183)	0.462***	0.540***	(0.118)	0.674***	0.321***	(0.131)
	(0.156)		(0.136)	(0.159)		(0.137)	(0.114)	
(b) PSNP n. beneficiary hhs *young	-	-1.602***	-	-	-1.431***	-	-0.621**	-0.616**
	1.618***	(0.395)	0.922***	0.918***	(0.303)	1.428***	(0.284)	(0.278)
	(0.405)		(0.394)	(0.387)		(0.297)		
Cohort FE	yes	yes	yes	yes	yes	yes	yes	yes
Birth place FE	yes	yes	yes	yes	yes	yes	yes	yes
Regional controls:								
Enrollment in primary school*young	yes	yes	yes	yes	yes	yes	yes	yes
Improved water use coverage *young	yes	yes	yes	yes	yes	yes	yes	yes
Emergency humanitarian aid *young	no	yes	no	yes	no	yes	no	yes
Observations (N)	3,664	3,664	3,407	3,407	4,762	4,762	4,363	4,363
R^2(a)	0.652	0.652	0.666	0.667	0.695	0.695	0.704	0.704
R^2(b)	0.652	0.652	0.666	0.666	0.694	0.694	0.704	0.704

Note This table reports diff-in-diff estimates of Equation 1 by gender. Outcome variable is individual's years of delayed entry. Coefficients of interest are interaction terms between treatment dummy and the amount of PSNP resource allocated (in million Birr) or PSNP beneficiary household (thousand) per 1000 children in the region of birth. All specifications include region of birth, year of birth dummies. Among region-specific controls, child/mother health service coverage includes immunization, antenatal, and postnatal service coverage, wile emergency-humanitarian aid includes both number of beneficiaries and amount of food (in metric tons) distributed across regions. In all regression, we consider sampling weight for national inferences. Standard errors are in parentheses are clustered at enumeration areas. Significance level as *** p<0.01, ** p<0.05, * p<0.1

7 Generalized results and identification tests

In order to give a causal interpretation to the effect of the PSNP program, regions with different intensity of the treatment must have similar pre-program trend in the outcome variables. We test this hypothesis by estimating fully flexible models for each cohort as expressed in Equation 2 and 3 above. Results of the flexible impact estimates on height-for-age Z-scores, while using the 2005 survey round (i.e. kids born right before and after the program) are reported in Table 11. In both specifications (column 1 and 2), the coefficient associated with the pre-treatment years (i.e. those born before 2003) are small and non significantly different from zero. Conversely, there is a positive and significant effect in the post-treatment years of birth. Remarkably, the size and significance of the coefficient slightly decreases with age, which seems to suggest that fully exposure to the treatment (both in utero and in the first year of life) is fundamentally important for child nutritional outcomes. Table 12 reports fully flexible impact estimates on years of primary schooling. Here, again, coefficient associates with kids not exposed to the program (i.e. those too old in 2005 to be exposed, that is older than 2 years old in 2005) are small and not statistically significant. The impact of the program on years of primary schooling is significantly only for kids exposed to the program, i.e. those 1 or 2 years old in 2005 (who are 12 or 13 years old in 2016). Remarkably, the size of the impact is similar across the two years of exposure we can exploit.

Table 11: Fully flexible impact estimates on Height-for-Age Z-score

	Kids 0-5 (2005 survey)	
	(1)	(2)
PSNP budget*2005	0.396*	0.312*
	(0.219)	(0.184)
PSNP budget*2004	0.527**	0.506***
	(0.244)	(0.213)
PSNP budget*2003	-0.062	-0.080
	(0.187)	(0.206)
PSNP budget*2002	0.218	0.166
	(0.216)	(0.201)
Cohort FE	yes	yes
Birth place FE	yes	yes
Regional controls:		
Child related health service coverage*year of birth	yes	yes
Improved water use coverage*year of birth	yes	yes
Mother related health service coverage*year of birth	no	yes
Observations (N)	2,841	2,841
R^2	0.111	0.112

Note : This table reports diff-in-diff estimates of Equation 2. Outcome variable is individual's height-for-age z-score. The estimation sample include kids born between 2005 and 2005 observed drawn from survey year 2005. Coefficients of interest are interaction terms between year of birth and the amount of PSNP resource allocated (in million Birr) per 1000 children in the region of birth. All specifications include region of birth, year of birth dummies. Among region-specific controls, child/mother health service coverage includes immunization, antenatal, and postnatal service coverage, wile emergency-humanitarian aid includes both number of beneficiaries and amount of food (in metric tons) distributed across regions. In all regression, we consider sampling weight for national inference. Standard errors are in parentheses are clustered at enumeration areas. Significance level as *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 12: Fully flexible impact estimates on Years of Primary Schooling

	Age in 2005	Age >=13 (1)	(2)
PSNP budget*age	*1*	0.613***	0.551***
		(0.122)	(0.112)
PSNP budget*age	*2*	0.574***	0.478***
		(0.131)	(0.155)
PSNP budget*age	*3*	0.239	0.100
		(0.151])	(0.176)
PSNP budget*age	*4*	0.218	0.062
		(0.149)	(0.185)
PSNP budget*age	*5*	-0.187	-0.361*
		(0.170)	(0.205)
PSNP budget*age	*6*	-0.163	-0.330
		(0.211)	(0.245)
PSNP budget*age	*7*	-0.073	-0.231
		(0.158)	(0.193)
PSNP budget*age	*8*	-0.244	-0.477
		(0.273)	(0.317)
PSNP budget*age	*9*	-0.118	-0.320
		(0.170)	(0.213)
PSNP budget*age	*10*	-0.393	-0.580*
		(0.263)	(0.303)
PSNP budget*age	*11*	-0.391	-0.633**
		(0.240)	(0.283)
PSNP budget*age	*12*	-0.046	-0.243
		(0.288)	(0.336)
Cohort FE		yes	yes
Birth place FE		yes	yes
Regional controls:			
Total enrollment in primary school*year of birth		yes	yes
Improved water use coverage *year of birth		yes	yes
Emergency humanitarian aid * year of birth		no	yes
Observation (N)		8,524	8,524
R^2		0.141	0.142

Note This table reports diff-in-diff estimates of Equation 3. Outcome variable is individual's completed years of primary schooling. Coefficients of interest are interaction terms between treatment dummy and the amount of PSNP resource allocated (in million Birr) or PSNP beneficiary household (thousand) per 1000 children in the region of birth. All specifications include region of birth, year of birth dummies. Among region-specific controls, child/mother health service coverage includes immunization, antenatal, and postnatal service coverage, wile emergency-humanitarian aid includes both number of beneficiaries and amount of food (in metric tons) distributed across regions. In all regression, we consider sampling weight for national inferences. Standard errors are in parentheses are clustered at enumeration areas. Significance level as *** p<0.01, ** p<0.05, * p<0.1

As an extra robustness, we test the identification assumption by exploiting the multiple control groups formed by the successive cohorts that are not exposed to the program. Hence, in Table 13, we report results of Equation 1 on height-for-age Z-score while comparing two sub-samples of untreated children. In other words, we run a 'control experiment' by using as young cohorts those born between 2000 and 2003, and as older cohorts those born between 1992 and 1999. Results show a difference-in-difference coefficient close to zero (this table is comparable with Table 5 above). We run a similar 'control experiment' on years of schooling and in this case, we compare those born between 1980 and 1987 to born between 1971 and 1979. Both these groups are non-exposed to the program (and are old-enough to have potentially finished primary education). Results in Table 14 show again that the difference-in-difference results are not significantly different from zero (to be compared with Table 6 above).

Table 13: PSNP effect on Height-for-Age Z-score: Control Experiment

	Full sample		Kids 0-5 (2005 survey)	
Program intensity indicator employed:	(1)	(2)	(3)	(4)
(a) PSNP budget*young	-0.047	-0.060	0.015	0.000
	(0.038)	(0.039)	(0.140)	(0.000)
(b) PSNP n. beneficiary hhs *young	-0.107*	-0.098	0.014	0.000
	(0.056)	(0.059)	(0.131)	(0.000)
Cohort FE	yes	yes	yes	yes
Birth place FE	yes	yes	yes	yes
Regional controls:				
Child/mother health service coverage * young	yes	yes	yes	yes
Improved water use coverage*young	yes	yes	yes	yes
Health extension program coverage*young	no	yes	no	yes
Emergency humanitarian aid*young	no	yes	no	yes
Observations (N)	25,304	25,304	2,841	2,841
R^2(a)	0.1765	0.1765	0.1097	0.1097
R^2(b)	0.189	0.175	0.033	0.037

Note : This table reports diff-in-diff estimates of Equation 1. Outcome variable is individual's height-for-age z-score. The estimation sample include two groups of children born before 2003. Coefficients of interest are interaction terms between treatment dummy and the amount of PSNP resource allocated (in million Birr) or PSNP beneficiary household (thousand) per 1000 children in the region of birth. All specifications include region of birth, year of birth dummies. Among region-specific controls, child/mother health service coverage includes immunization, antenatal, and postnatal service coverage, wile emergency-humanitarian aid includes both number of beneficiaries and amount of food (in metric tons) distributed across regions. In all regression, we consider sampling weight for national inferences. Standard errors are in parentheses are clustered at enumeration areas. Significance level as *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 14: PSNP Effect on Years of Primary Schooling: Control Experiment

	Age>=13	
Program intensity indicator employed:	(1)	(2)
(a) PSNP budget*young	0.158	0.111
	(0.138)	(0.134)
(b) PSNP n. beneficiary hhs *young	0.588	0.592
	(0.465)	(0.451)
Cohort FE	yes	yes
Birth place FE	yes	yes
Regional controls:		
Enrollment rate in primary school*young	yes	yes
Improved water use coverage *young	yes	yes
Emergency humanitarian aid *young	no	yes
Observations (N)	7,487	7,487
R^2(a)	0.0744	0.0748
R^2(b)	0.019	0.019

Note: This table illustrates diff-in-diff estimates of Equation 1. Outcome variable is individual's completed years of primary schooling. Coefficients of interest are interaction terms between treatment dummy and the amount of PSNP resource allocated (in million Birr) or PSNP beneficiary household (thousand) per 1000 children in the region of birth. All specifications include region of birth, year of birth dummies. Among region-specific controls, child/mother health service coverage includes immunization, antenatal, and postnatal service coverage, wile emergency-humanitarian aid includes both number of beneficiaries and amount of food (in metric tons) distributed across regions. In all regression, we consider sampling weight for national inferences. Standard errors are in parentheses are clustered at enumeration areas. Significance level as *** p<0.01, ** p<0.05, * p<0.1

8 Robustness checks on the transfer scheme

According to PSNP principles, cash should be the primary form of transfer, i.e "cash first principle". This is consitent with the aim of market stimulation – since people spend their cash in local markets – while moving away from food aid.[18] Food transfers are provided at times and places when food is not available in the market, or where market prices for food are very high. This protects PSNP clients from food shortages and asset depletion[19]. Hence, the proportion of in-kind PSNP transfers is rather small (almost more than 85% of total transfer is in cash). Moreover, even

[18] This relates to a long-lasting debate about the efficiency os transfer schemes. Since in-kind transfers are not fungible, they are typically associated with potential welfare losses as compared to cash-equivalent transfers. Moreover, they usually have larger administrative costs as compared to cash. Despite this criticism, in markets that are not well-integrated in-kind transfers might be more cost-efficient than cash (e.g. Gentilini 2007; Hidrobo et al., 2014)

[19] A transfer is appropriate if it meets the needs of households: cash is provided in settings where markets

though the program was launched in 2005, in-kind transfer started in 2006 and from 2007 to 2014 no food transfers was delivered in some regions (Harari, Diredawa, Somali, and Afar) (Ministry of Agriculture and Natural Resource, 2015). In-kind transfers are concentrated in Tigray, Amhara, Oromia and SNNP regions, and are mainly given in the form of wheat, maize and cooking oil. These products are directly consumed by adults and children, with no specific food items to be consumed only by children. Hence, we test whether there is any asymmetric effect of the social protection program on nutrition and schooling across the different transfer schemes. Table 15 and Table 16 report results, which show that the program has a significant effect on both height-for-age z-score and years of schooling only when it is delivered cash. Yet, the lack of a significant effect of in-kind transfer may be related to caveats (small share) mentioned above. Yet, findings are consistent with previous evidence showing that cash transfers may be more effective with respect to in-king ones (Gentilini 2007; Lentz et al forthcoming), even though comparisons on the impact are subject to differences in program design, magnitude of the transfer, and frequency of the transfer (Hidrobo et al 2014).

function well, while food is provided in areas where there is no food to purchase or food prices are extremely high. An appropriate transfer also has the same value whether it is provided in cash or food.

Table 15: PSNP effect on Height-for-Age Z-score: Cash vs Food transfer

Estimation sample:	Full sample	
	(1)	(2)
PSNP cash-transfer*young	0.116**	0.173*
	(0.057)	(0.102)
PSNP in kind-transfer*young	-0.081	-0.246
	(0.116)	(0.228)
Cohort FE	yes	yes
Birth place FE	yes	yes
Regional controls:		
Child/mother health service coverage * young	yes	yes
Improved water use coverage*young	yes	yes
Health extension program coverage*young	no	yes
Emergency humanitarian aid*young	no	yes
Observations (N)	25,304	25,304
R^2	0.1765	0.1765

Note : This table reports diff-in-diff estimates of Equation 1. Outcome variable is individual's height-for-age z-score. In the full sample regressions (columns 1 and 2) all DHS rounds (2005, 2011 and 2016) are included. Coefficients of interest are interaction terms between treatment dummy and the amount of PSNP resource allocated (in million Birr) or PSNP kind/food/ (thousand metric ton) per 1000 children in the region of birth. All specifications include region of birth, year of birth dummies. Among region-specific controls, child/mother health service coverage includes immunization, antenatal, and postnatal service coverage, wile emergency-humanitarian aid includes both number of beneficiaries and amount of food (in metric tons) distributed across regions. In all regression, we consider sampling weight for national inferences. Standard errors are in parentheses are clustered at enumeration areas. Significance level as *** p<0.01, ** p<0.05, * p<0.1

Table 16: PSNP Effect on Years of Primary Schooling: Cash vs Food transfer

Estimation sample:	Age>=13		Age>=11	
	(1)	(2)	(1)	(2)
PSNP cash-transfer*young	0.673***	0.713***	0.668***	0.743***
	(0.163)	(0.178)	(0.124)	(0.134)
PSNP in kind-transfer*young	0.030	0.067	-0.303	-0.271
	(0.353)	(0.355)	(0.265)	(0.264)
Cohort FE	yes	yes	yes	yes
Birth place FE	yes	yes	yes	yes
Regional controls:				
Enrollment rate in primary school*young	yes	yes	yes	yes
Improved water use coverage *young	yes	yes	yes	yes
Emergency humanitarian aid *young	no	yes	no	yes
Observations (N)	7,487	7,487	9,724	9,724
R^2	0.0744	0.0748	0.1806	0.1811

Note This table reports diff-in-diff estimates of Equation 1. Outcome variable is individual's completed years of primary schooling. Coefficients of interest are interaction terms between treatment dummy and the amount of PSNP resource allocated (in million Birr) or PSNP kind/food/ (thousand metric ton) per 1000 children in the region of birth. All specifications include region of birth, year of birth dummies. Among region-specific controls, child/mother health service coverage includes immunization, antenatal, and postnatal service coverage, wile emergency-humanitarian aid includes both number of beneficiaries and amount of food (in metric tons) distributed across regions. In all regression, we consider sampling weight for national inferences. Standard errors are in parentheses are clustered at enumeration areas. Significance level as *** p<0.01, ** p<0.05, * p<0.1

The effect of the program may also depend on the definition and measurement of the program intensity we consider. It a is fact that the average nutrition or educational attainment in the child population depends on how inclusive is the program i.e. program coverage (i.e. the extensive margin) and how intense the program is per treated person (the intensive margin). Hence, using equation 1, we estimate the PSNP impact as a function of the interaction between the program intensity, as measured by average PSNP budget per treated household (and not per capita) and the year of exposure. This enables us to compare the role of the intensive margin on the treated with results in Tables 5 and 6. Results are reported in Table 17 and 18 and show a positive and significant effect on both height-for-age z-score and years of schooling.Yet, as expected, the magnitude of the impact of program intensity per treated is higher compared to that of program intensity per 1000 children. We interpret this as an indirect test of the fact that our results on both nutrition and shooling are indeed due to the actual access to the PSNP program, and not to other factors, and the higher the tranfer per beneficiary the higher the impact on treated children.

Table 17: PSNP effect on Height-for-Age Z-score: Program intensity per treated beneficiary

Estimation sample:	Full sample		Kids 0-5 (2005 survey)	
	(1)	(2)	(3)	(4)
PSNP- budget per treated beneficiary*young	0.336***	0.543*	0.140*	1.597***
	(0.086)	(0.316)	(0.075)	(0.371)
Cohort FE	yes	yes	yes	yes
Birth place FE	yes	yes	yes	yes
Regional controls:				
Child/mother health service coverage * young	yes	yes	yes	yes
Improved water use coverage*young	yes	yes	yes	yes
Health extension program coverage*young	no	yes	no	yes
Emergency humanitarian aid*young	no	yes	no	yes
Observations (N)	25,304	25,304	2,841	2,841
R^2	0.1765	0.1765	0.1097	0.1097

Note : This table reports diff-in-diff estimates of Equation 1. Outcome variable is individual's height-for-age z-score. In the full sample regressions (columns 1 and 2) all DHS rounds (2005, 2011 and 2016) are included. Coefficients of interest are interaction terms between treatment dummy and the amount of PSNP resource allocated (in million Birr) or PSNP beneficiary household (thousand) per 1000 children in the region of birth. All specifications include region of birth, year of birth dummies. Among region-specific controls, child/mother health service coverage includes immunization, antenatal, and postnatal service coverage, wile emergency-humanitarian aid includes both number of beneficiaries and amount of food (in metric tons) distributed across regions. In all regression, we consider sampling weight for national inferences. Standard errors are in parentheses are clustered at enumeration areas. Significance level as *** p<0.01, ** p<0.05, * p<0.1

Table 18: PSNP Effect on Years of Primary Schooling: Program intensity per 1000 children population Vs program intensity per treated (beneficiaries)

Estimation sample:	Age>=13		Age>=11	
	(1)	(2)	(1)	(2)
PSNP- budget per treated beneficiary*young	0.428***	0.453***	0.454***	0.395***
	(0.103)	(0.104)	(0.080)	(0.080)
Cohort FE	yes	yes	yes	yes
Birth place FE	yes	yes	yes	yes
Regional controls:				
Enrollment rate in primary school*young	yes	yes	yes	yes
Improved water use coverage *young	yes	yes	yes	yes
Emergency humanitarian aid *young	no	yes	no	yes
Observations (N)	7,487	7,487	9,724	9,724
R^2	0.0744	0.0748	0.1806	0.1811

Note This table reports diff-in-diff estimates of Equation 1. Outcome variable is individual's completed years of primary schooling. Coefficients of interest are interaction terms between treatment dummy and the amount of PSNP resource allocated (in million Birr) or PSNP beneficiary household (thousand) per 1000 children in the region of birth. All specifications include region of birth, year of birth dummies. Among region-specific controls, child/mother health service coverage includes immunization, antenatal, and postnatal service coverage, wile emergency-humanitarian aid includes both number of beneficiaries and amount of food (in metric tons) distributed across regions. In all regression, we consider sampling weight for national inferences. Standard errors are in parentheses are clustered at enumeration areas. Significance level as *** p<0.01, ** p<0.05, * p<0.1

9 Conclusion

By using exogenous variation provided by the combination of year and region of birth, this paper studies the direct and indirect effects of a large-scale social protection program implemented in Ethiopia since 2005. The introduction of the reform has been supported by international donors, led by the World Bank. According with the budgeting and roll-out of the program, there is variation across regions in the share of resources and beneficiaries devoted to the program. This cross-sectional variation provides differences in program intensity across regions, which we combine with differences in exposure to the program across cohorts induced by the individual year of birth. In line with the medical literature, we postulate that the two first years of life are a critical setting for the impact of the program on nutritional and long-term anthropometric outcomes and, thereby, on human capital accumulation. Hence, we employ a difference-in-difference strategy in our empirical analysis and the exogenous treatment variable is the interaction of the year of birth with the intensity of the program in the region of birth. We find that exposure to the PSNP led to an increase in both Heigh-for-Age Z-scores (HAZ) and primary educational attainment as measures by years of schooling. Childhood exposure to the program further decreases children's delay in primary school enrollment. On average, one extra million Birr PSNP budget (about 35,000USD) allocated per 1000 children in birth regions increases child height-for-age Z-score by 0.1. As a result, an increase in the intensity of the program rises completed years of primary schooling by about 0.7. Results are are robust to different ways in measuring program intensity and different estimation sample. The estimation of fully flexible models in years of birth or age ensures the non-violation of common trend assumptions. Moreover, they point to increasing effects with the time of exposure (i.e. measure by year of birth and age). Our results are also robust to the inclusion of important regional-level controls which could lead to omitted variable bias. We finally show that changes between cohorts in both height-for-age and primary education are not systematically different in low- and high-program intensity regions before the program started.

Our findings show that in Ethiopia an unusually large government-administrated social protection program, which includes both cash-transfer and social assistance, has been effective in increasing both nutritional status and educational outcomes. While we can measure the impact on the quantity of education (measured by years of primary schooling), we have no information to dig deeper into the impact on the quality of that. However, positive results on the combination of both nutrition and years of schooling of individuals exposed to the program early in life is evidence in favor of an increase in human capital of future adults, which is a key input for productivity and well-being, having both private and social positive returns. Impact evaluations are usually of specific interventions in a specific context. It remains possible that these results cannot be generalized to different contexts. Yet, they contribute to provide systematic and causal evidence on the effectiveness of national and international efforts to reduce poverty and deprivation in Ethiopia, which is a country with one of the highest prevalence of (child) malnutrition and stunting in the world.

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Appendix

A. Control variables for Nutrition

- Full immunization coverage (child health service): proportion of surviving infants who receive all doses of infant antigens before their first birthday. The Infant Antigens are: BCG, Pentavalent (DPT-HepB, Hib), doses 1 -3; OPV, doses 1—3; and Measles.

- Maternal Health service indicators coverage: It includes antenatal, delivery and postnatal care. In addition, this section also encompasses the health care dimensions of family planning.

- Postnatal care (PNC) coverage: proportion of women who seek care, at least once during postpartum (42 days after delivery), from a skilled health attendant, including Health extension workers, for reasons relating to post-partum.

- Antenatal care (ANC) coverage: proportion of pregnant women attended, at least once during the current pregnancy, by a health professional, for reasons related to pregnancy. It is also defined as percentage of women who utilized antenatal care provided by skilled birth attendance for reasons related to pregnancy at least once during pregnancy as a percentage of live births in a given time period

- Number of health Facilities: the total number of health facilities (Hospitals, Health clinics, and Health posts) disaggregated by type and ownership while health facility over population coverage includes ratio of number of hospital, health center, and health post to the corresponding population.

- Primary health care coverage: Proportion of population living within 2 hours walking distance. It is a proxy indicator of equity in service access, estimated that a Health post covers 5,000 persons and Health center 25,000 persons, and minus the population covered by Health post.

- Functional facility to population ratio: reflects the number of persons served by each facility, by facility type.

- Potential health service coverage: The population covered in percentage based on the existing health centres and health stations in catchment's area.

- Health service coverage and Utilization: Health system indicators include: Outpatient (OPD) attendance per capita: average number of outpatient visits (including first and repeat visits) per person per year.

- Health infrastructure (Potential health service coverage):-The population covered in percentage based on the existing health centres and health posts in catchments' area.

- Health Extension Program (HEP) is an innovative community-based strategy to deliver preventive and promotive services and selected high impact curative interventions at community level. It brings community participation through creation of awareness, behavioural change, and community organization and mobilization. It also improves the utilization of health services by bridging the gap between the community and health facilities through the deployment of Health Extension Workers (HEW). The main objective is to improve access to essential health services provided at village and household levels, contributing to the improvement of the health status of the families, with their full participation, using local technologies and the skill and wisdom of the communities. In this context, with the aim to promote community mobilization and adoption of healthy lifestyles, a major initiative undertaken by the Ethiopian Government is the implementation of the Health Development Arm (HDA).

B. Control variables for Education outcome

- Total enrollment rate : The number of children enrolled in current year out of the total population of children in schooling age.

- Net Enrollment Rate (NER) is the best measuring organized on-time school participation and is a more refined indicator of school and enrollment coverage in terms of explaining the proportion of puplis enrolled from the official age group. NER is calculated by dividing the number of properly aged primary students (for Ethiopia ages 7-14) by the number of children of school ageing (7-14). NER is usually lower than the GER since it excludes over-aged and under-aged pupils.

- Water and sanitation coverage : Percentage of population using any improved source of drink water and an improved sanitation, not shared facility

Table 19: PSNP effect on Height-for-Age Z-score: Different treatment cut-offs

	Kids 0-5 (2005 survey)	
	(1)	(2)
PSNP budget*young(2005)	0.267***	0.321***
	(0.068)	(0.091)
PSNP budget*young(2004)	0.189**	0.245***
	(0.083)	(0.106)
PSNP budget*young(2002)	0.119	0.039
	(0.076)	(0.095)
PSNP budget*young(2001)	0.131	0.087
	(0.083)	(0.101)
Cohort FE	yes	yes
Birth place FE	yes	yes
Regional controls:		
Child and mother related health service coverage*year of birth	yes	yes
Improved water use coverage*year of birth	no	yes
Observations (N)	2,841	2,841
R^2	0.1063	0.1086

Note : This table illustrates diff-in-diff estimates of Equation 1 with different treatment cut-offs (each line report the result of a different regression). Outcome variable is individual's height-for-age z-score. The estimation sample include kids born between 2001 and 2005 observed in survey year 2005. Coefficients of interest are interaction terms between year of birth and the amount of PSNP resource allocated (in million Birr) per 1000 children in the region of birth. All specifications include region of birth, year of birth dummies. Among region-specific controls, child/mother health service coverage includes immunization, antenatal, and postnatal service coverage, wile emergency-humanitarian aid includes both number of beneficiaries and amount of food (in metric tons) distributed across regions. In all regression, we consider sampling weight for national inference. Standard errors are in parentheses are clustered at enumeration areas. Significance level as *** p<0.01, ** p<0.05, * p<0.1

Table 20: PSNP Effect on Years of Primary Schooling: Different treatment cut-offs

	Age in 2005	Age>=13 (1)	(2)
PSNP budget*age in 2005	*1*	0.209**	0.198*
		(0.084)	(0.112)
PSNP budget*age in 2005	*2*	0.200***	0.198*
		(0.043)	(0.056)
PSNP budget*age in 2005	*3*	0.030	-0.012
		(0.040)	(0.045)
PSNP budget*age in 2005	*4*	0.042	0.043
		(0.028)	(0.036)
PSNP budget*age in 2005	*5*	-0.001	-0.019
		(0.025)	(0.029)
PSNP budget*age in 2005	*6*	0.036	0.043
		(0.025)	(0.029)
PSNP budget*age in 2005	*7*	-0.004	-0.003
		(0.020)	(0.027)
PSNP budget*age in 2005	*8*	-0.001	-0.016
		(0.028)	(0.040)
PSNP budget*age in 2005	*9*	0.028*	0.030
		(0.015)	(0.020)
PSNP budget*age in 2005	*10*	-.0006	0.010
		(0.022)	(0.026)
PSNP budget*age in 2005	*11*	-0.0007	-0.002
		(0.016)	(0.022)
PSNP budget*age in 2005	*12*	-0.007	-0.008
		(0.018)	(0.022)
PSNP budget*age in 2005	*13*	0.008	0.003
		(0.017)	(0.021)
Cohort FE		yes	yes
Birth place FE		yes	yes
Regional controls:			
Total enrollment in primary school*year of birth		yes	yes
Improved water use coverage *year of birth		yes	yes
Emergency humanitarian aid * year of birth		no	yes
Observation (N)		1,344	1,344
R^2		0.0551	0.0551

Note This table illustrates diff-in-diff estimates of Equation 1 with different treatment cut-offs (each line report the result of a different regression). Outcome variable is individual's completed years of primary schooling. Coefficients of interest are interaction terms between treatment dummy and the amount of PSNP resource allocated (in million Birr) or PSNP beneficiary household (thousand) per 1000 children in the region of birth. All specifications include region of birth, year of birth dummies. Among region-specific controls, child/mother health service coverage includes immunization, antenatal, and postnatal service coverage, wile emergency-humanitarian aid includes both number of beneficiaries and amount of food (in metric tons) distributed across regions. In all regression, we consider sampling weight for national inferences. Standard errors are in parentheses are clustered at enumeration areas. Significance level as *** p<0.01, ** p<0.05, * p<0.1