Weather Shocks and Self Esteem *

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February 28, 2019

Abstract

Individual self-esteem levels were elicited in three rounds of panel data in the Nile Basin region of Ethiopia to determine whether droughts (i.e., income shocks) during the growing season affect self-esteem. We find that negative rainfall shocks have a negative and significant affect on levels of self-esteem. Results are robust and consistent across different specifications. Concerning the impact of poverty on self-esteem, we observe that farm revenue, instrumented by weather shocks, has a significant affect on self-esteem levels. Additionally, droughts experienced during the adolescent years of farmers within our sample has a persistent affect on current self-esteem levels. These results emphasize the important role of economic adversity on psychological constructs.

Keywords: Development; panel data; shocks; self-esteem; behaviour
JEL Classification: C93; D01; D91; O12

*Working title, comments welcome. We would like to thank Giacomo De Giorgi, Michele Pellizzari, and Marie-Claire Villeval for helpful comments and suggestions. The usual disclaimer applies. The data collection for this study was financed by the International Development Research Centre (IDRC) under the project "Adaptation to Increase Resilience to Climate Change in Ethiopian Agriculture (IDRC Project Number: 107745-001)." Logistical support for this study from the Environment and Climate Research Center (ECRC) at the Ethiopian Development Research Institute (EDRI) is also gratefully acknowledged.

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1 Introduction

The importance of self-esteem towards well-being is well documented and discussed within the psychological literature. There is evidence on its association with general health, emotional stability (Veselska et al., 2009), depression (Sowislo and Orth, 2013), criminal behaviour (Trzesniewski et al., 2006) earnings (Drago, 2011) and academic achievement (Booth and Gerard, 2011). Within economics literature, non-cognitive skills such as self-esteem have been proven to have a significant impact on labour market outcomes, and future earnings; Heckman et al., 2006, find that non-cognitive skills, including self-esteem, have a significant affect on schooling, occupational choice, and work experience. Given the knowledge we have from the psychological literature on the importance of self-esteem, and the research within labour economics on the importance of non-cognitive skills for labour market outcomes, within the development literature there is still a persistent question of whether poverty itself has a causal impact on non-cognitive skills. Given the importance of non-cognitive skills on labour market outcomes, and the importance of labour market outcomes concerning exiting the poverty trap, understanding whether poverty itself affects these skills is imperative towards our understanding of the poverty trap, and how to create relevant policies in order to break it. The correlation between poverty and well-being has generally been cited as negative, with recent literature considering the difficulties in determining a causal relationship. Understanding how poverty affects non-cognitive skills (if at all), and general psychological well-being, has oftentimes been puzzling, due to the lack of data which allowed for causal inference. As such, there if currently little literature which observes this. Equally so, behavioural variables such as self-esteem, are recurrently modelled as time invariant. As such, understanding whether income shocks on poor households affect non-cognitive skills, and the potential mechanisms through which this may happen, has important theoretical implications, as well as policy implications, relating to how policies could be formed in order to break the poverty cycle.

As economic literature has broadened and crossed borders with various fields of research, and as part of the recently burgeoning literature on the causal links of poverty and psychological well-being, we aim to tie such psychological questions to persistent queries within the environmental and development economics fields. This paper answers the question of whether income shocks on poor households affect non-cognitive skills, namely, self-esteem. In order to answer this, our research question can be divided into two parts. Focusing on poor households, we first observe how recent income shocks affect self-esteem. Our sample of interest are subsistence level small-holder farmers in the Nile-Basin region of Ethiopia. As such, our income shock of interest is weather shocks (i.e., droughts). Here, we observe whether drought in the previous growing season has a causal affect on self-esteem levels. Tying in the effect of poverty, we question the mechanism through which drought may have an affect on the self-esteem levels of individuals living close to subsistence. We purport that drought, which has an effect on farm output (i.e., farm-revenues), affects self-esteem levels; income shocks incurred by small-holder farmers would have a more devastating impact than to large, commercial farmers. We therefore instrument farm-revenues with drought, to observe this effect, and additionally resolve the issue of endogeneity which has plagued the

question of the causal impact of poverty of non-cognitive skills, and well-being. The second part of our question observes whether income shocks during different periods of an individual's life has a persistent effect on adult-hood self-esteem levels. Here, we discuss the experience hypothesis theory. The past experience we observe are weather shocks during the Ethiopian famine in the 1980s. Traditional theory assumes time-invariance of psychological variables. Our research will determine whether the first section of the "feedback loop" referred to in Haushofer and Fehr, 2014, exists. The authors describe "a feedback loop in which poverty reinforces itself through exerting an influence on psychological outcomes, which may then lead to economic behaviors that are potentially disadvantageous" (Haushofer and Fehr, 2014, p.866). The authors discuss the difficulty in proving causality of such a relationship; our paper, to our knowledge, is the first to test this theory with a unique panel data set.

Within economics literature, the affect of crop shocks (e.g., due to weather shocks) on outcomes is quite prevalent (Di Falco and Bulte, 2013; Di Falco and Veronesi, 2012; Kochar, 1999). Here, we branch the literature of behavioural and environmental economics, in order to understand if outcomes affect self-esteem. Our approach of observing weather shocks is similar to that of Chemin et al., 2013, (who observed stress levels of farmers and metal workers in Kenya), though we exploit the use of a panel data set in order to observe changes over time, and observe how individuals with varying levels of self-esteem react to a weather shock. Within the supplementary information of the work of Haushofer and Fehr, 2014, the authors tested the correlation of various well-being measures, including the Rosenberg self-esteem scale (or RSE, our employed measure of self-esteem), the CES depression questionnaire, Cohen's Perceived Stress Scale, a Locus of Control Index, trust, happiness, and life-satisfaction questions from the World Values Survey, and Scheier's optimism scale, and find a close relationship between the survey questions (p.3, supplementary information); as such, and given the use of the RSE in the work of Heckman et al., 2006, as a measure of non-cognitive skills, we also use the RSE as our measure of non-cognitive skills (and overall psychological well-being).

Our sample consists of subsistence farmers in the Nile Basin region of Ethiopia, spanning three years (2015, 2016, and 2017). In order to elicit self-esteem, each farmer was asked questions on the Rosenberg self-esteem scale (further discussed in section 2.3, a measure commonly used and tested within the field of psychology). Preliminary results from our reduced-form estimation indicate that negative rainfall shocks in the previous harvesting season have a negative and significant impact on self-esteem levels; self-esteem is, in fact, time variant. In order to understand the potential mechanisms through which this happens, we instrument revenue with weather shocks, and find that revenue has a positive and significant affect on self-esteem, as hypothesised. As a last step, we observe the affect of past shocks during the 1980s famine on current levels of self-esteem; past weather shocks on adolescents prove to have persistent negative affects on levels of self-esteem during adult life.

Some literature within behavioural economics classifies variables such as self-esteem as a "good" itself, which an individual tries to optimise. In this case, self-esteem would enter the utility function

directly (Zhang, 2009). Zhang, 2009, highlight that an "exchangability" between self-esteem and money may exist, after subsistence levels of living are met. This would imply that self-esteem would enter the utility function, and also determine the shape of the function. Our findings show that rainfall shocks in the growing season do in fact lower self-esteem levels; therefore, self-esteem is time variant, and an updating process may take place.

The work of Easterlin on income and happiness are seminal papers within the realm of poverty and well-being (Easterlin, 1974, Easterlin, 1995). The author first found that within countries, happiness and income have a positive correlation, but this does not necessarily hold across poorer and wealthier countries (Easterlin, 1974). He later noted that increasing happiness should not only be linked to increasing incomes, but access to social safety nets and full-time employment are also important economic factors which would contribute to increasing individual well-being (Easterlin, 2013). G. Gurin and P. Gurin, 1970, assert through their research that individuals living in poverty who have low expectations of themselves could raise these expectations through positive and successful experiences (if the success is coming from themselves). Through their qualitative study of residents in impoverished British neighbourhoods, they highlighted that self-esteem and the assessment of oneself is often driven from factors other than an individual's finances. Lever et al., 2005, also cite the importance of social and psychological factors when understanding poverty and an individual's subjective well-being. Zhang, 2009, purports that an exchangeability between self-esteem and money exists, advocating that self-esteem should in fact enter the utility function on its own as a good which individuals try to maximise. This would of course have implications concerning how self-esteem has been traditionally modelled theoretically. She highlights three "exchange principles": augmentation, substitution, and competition. Zhang, 2009, also explains that the source of income has varying affects on self-esteem (i.e., money earned through working may have a positive effect on self-esteem, while money from, for example, unemployment insurance, may in fact have a negative impact on self-esteem, even though the amount of money an individual has increases in the absolute).

Economic literature tackling the relationship between poverty and well-being has been increasing. Haushofer and Fehr, 2014, discuss this work through their extensive review of existing literature. There is significant literature which focuses on income and discount rates, many of which take place in lab settings (Haushofer et al., 2013). Kling et al., 2007, find that five to seven years after a voucher program in the U.S. targeting households living in poverty, female youth and adults experience considerable benefits concerning their mental health, and families who were offered vouchers live in safer neighbourhoods. Other research has found a similar positive correlation with increased incomes, and increased levels of well-being (Gardner and Oswald, 2007, Ssewamala et al., 2009, Kuhn et al., 2011, Devoto et al., 2012). Thompson et al., 2015, reference the idea of an individual's aspirations window with their study in rural Nepal. They identify the difference between an aspirations window, gap, and failure; an aspirations window is formed from the people around an individual, which determines the bounds of an individual's aspirations. The aspirations gap is the difference between the standard of living an individual aspires to, and their actual standard of

living. Lastly, an aspirations failure "is a function of their aspirations gap, but the function is not monotonic. If the gap is very small, the individual does not need to do much to bridge it so they do not invest much. If the gap is too large, it may seem impossible to bridge resulting in frustration and no investment at all" (Thompson et al., 2015, p.2). Through surveys focusing on the female population, the authors found that the assets of peers which are observable by the individual play an important role in the formation of an individual's wealth aspirations. The income of peers, which is harder to determine, played less of a factor. Here, we observe the importance of one's surroundings when determining their aspirations (i.e., the observed economic outcomes of other individuals have a significant role on peers' aspirations). It must be stated that we will focus on self-esteem in our research, rather than aspirations.

Both Haushofer and Shapiro, 2016, and Chemin et al., 2013, tackle the question of economic shocks on well-being. Through a randomised controlled trial (RCT), Haushofer and Shapiro, 2016, determine the impact of unconditional cash transfers (i.e., an unanticipated positive income shock) on a set of psychological variables and consumption levels in rural Kenya. Randomisation was done at both the village and household level. The treatment group was further randomised, based on the magnitude of the cash transfer, timing of the transfer, and the gender of the recipient. After nine months, those who received a transfer exhibited increased consumption. Transfers to females increased their self-esteem and lowered their cortisol levels (stress hormone) but not to the overall sample. Their "results suggest that cortisol and measures of psychological well-being are useful complements to traditional measures of economic welfare, and may in some cases reflect aspects of welfare that are not well captured by more traditional measures" (Haushofer and Shapiro, 2016, p.2015). Chemin et al., 2013, also focused on the affect of income shocks on stress levels, but similar to our methodology, focused on negative income shocks via decreased rainfall. The authors used self-reported stress levels, and cortisol samples of respondents to assess stress levels after low rainfall levels of farmers in rural Kenya, and metal workers in Nairobi. They find that low rainfall levels increase stress levels of farmers, and have no effect on metal workers, agreeing with their intuition that a rainfall shock led to income shocks for the farmers in their sample. We add to this work by observing how self-esteem changes over time, whether individuals with different levels of self-esteem are affected in differing ways by income shocks, test the mechanism through which droughts may affect well-being, and observe whether past shocks have an affect on current levels of well-being.

The remainder of the paper is as follows: Section 2 discusses our data and main variables of interest (i.e., weather shocks and self-esteem); section 3 gives our identification strategy and preliminary results; and section 4 discusses conclusions and policy implications.

2 Data and Descriptive Statistics

2.1 Ethiopian Nile-Basin Survey

Our data comprises of a three-year panel survey of Ethiopian farmers within the Nile Basin region, which took place in 2015, 2016, and 2017. Data collection for the study was financed by the International Development Research Centre (IDRC) under the project "Adaptation to Increase Resilience to Climate Change in Ethiopian Agriculture". Households from twenty Woredas (an administrative district) were sampled. Approximately 1000 households were interviewed. Only household heads were asked self-esteem related questions; our panel is therefore at the household level. After only including households which have answered all of the relevant questions, our sample decreases to approximately 836.

The majority of our sample are males (84.27%), with an average age of about 53. Average farm revenue per hectare in 2001 Birr is 1703.62 (about 60 USD, 2018). Revenue is right-skewed; median revenues are 1263.98 Birr (about 45 USD). The aim of the IDRC project was to help small-scale farmers adapt to the increased risk of climate-change; consequently, the farmers selected were amongst those on the lower end of the income distribution. The World Bank's World Development Indicators (WDI) estimates income per capita in Ethiopia in 2015 to be 3.7 USD (2011 PPP) per day (Bank, 2019). Considering revenues from the previous harvesting season, divided by the number of household members in each of our households, we observe an average income per household member per day of our sample of 1.30 Birr (0.05 USD), with a median result of 0.82 Birr (0.03 USD), highlighting that the majority of our sample is living below the World Bank definition of poverty (i.e., living with under $1.90 USD a day (Bank, 2018), when we consider farm revenues only. 10.58% of our sample have stated that they have used remittances from emigrated relatives to finance adaptation strategies, with 19.16% having at least one household member earning income from non-own farm or non-farm employment during the last one year, which is often used for poverty alleviation. Note, though, that the majority of the households in our sample's main income source is through their farm revenues.

2.2 Weather Shocks: Drought

Rainfall is a nonlinear variable which is heavily correlated to our time dimension. In order to tackle this, we create a weather shock variable for the growing season(s). Farmers were asked about their output in the previous growing season. As such, shocks in the previous season are considered in our model (i.e., weather shocks from the 2015 growing season are used for the 2016 survey).

Our exogenous variable of interest is negative weather shocks, i.e., drought. Various measures have been used to measure weather shocks within the environmental economics literature, such as the amount of rainfall and temperature. As we will not be observing long-term changes (i.e., 40 years or more), we will focus on weather shocks, rather than climate change. Rainfall data was collected via the CHIRPS dataset, using latitude, longitude, and elevation information from the IDRC survey. We use millimetres of rainfall and rainfall shocks as our exogenous variable of

interest. In order to compute our drought measure (rainfall shocks), we normalise rainfall within the different growing seasons, over averaged long-term rainfall (i.e., spanning 35 years, 1981-2016). The two growing seasons within our region are the spring season (Belg, in March, April, May), and the longer summer season (Meher, in June, July, August). We calculate the following drought variable for the Belg, Meher, and combined growing season ($Harvest$ in our estimations):

$$D_{it} = \frac{Rainfall_t - (Avg.LongRain)}{SD_t} \tag{1}$$

We then create a binary variable in order to test weather shocks, equalling one if the amount of rainfall during the specific season is more than a specific threshold (we test thresholds -0.5, -1 and -1.5 standard deviations away from the long-term mean, as is displayed in Table 10 in Appendix A. Our overall shock variable for our main estimations is -1 standard deviations away from the long-term mean, and zero otherwise. Due to the low variation in the number of positive shocks during the studied time period, we focus on droughts.

Figures 1 and 2 display Meher and Belg rainfall patterns, respectively (it should be noted that about 90% of harvests are garnered from the Meher season within our sample, as this is the main harvesting season in the region). It is clear that the 2014 and 2015 Meher seasons were particularly dry, as is reflected in events during that period in Ethiopia. As has been evidenced in the news, Ethiopia suffered one of its worst droughts in 30 years in 2015. We will compare the effect of this economic shock to a past economic shock, the 1980s famine, on self-esteem, in section 3.4.

Figure 1: Normalised Meher Rainfall (Kernel Density)

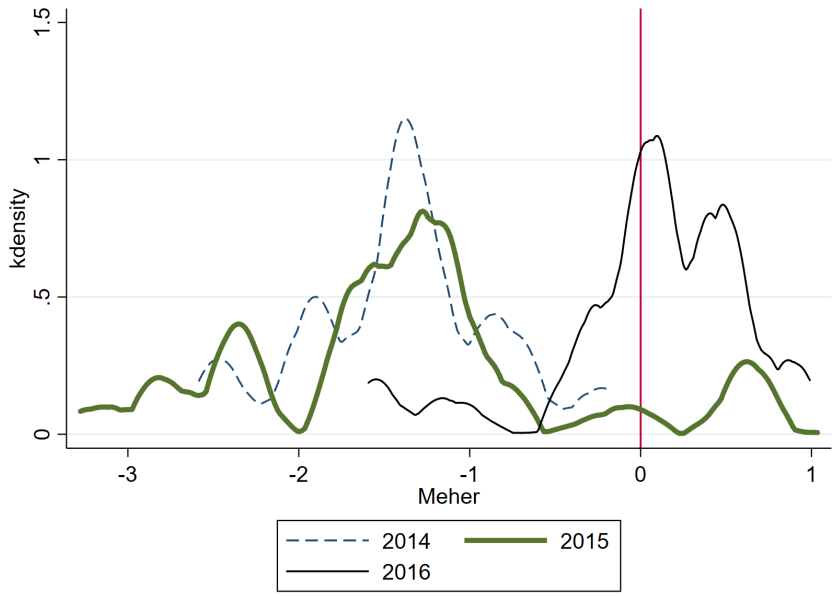


Figure 2: Normalised Belg Rainfall (Kernel Density)

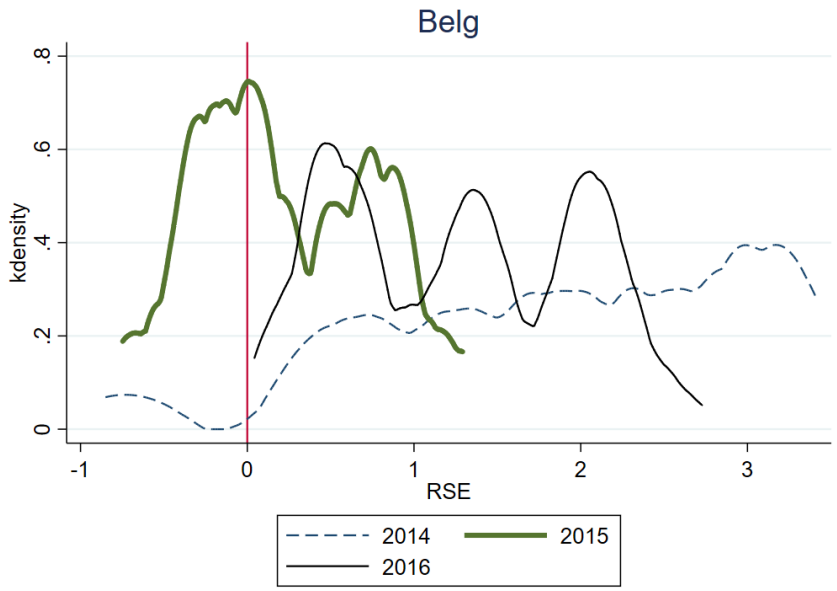
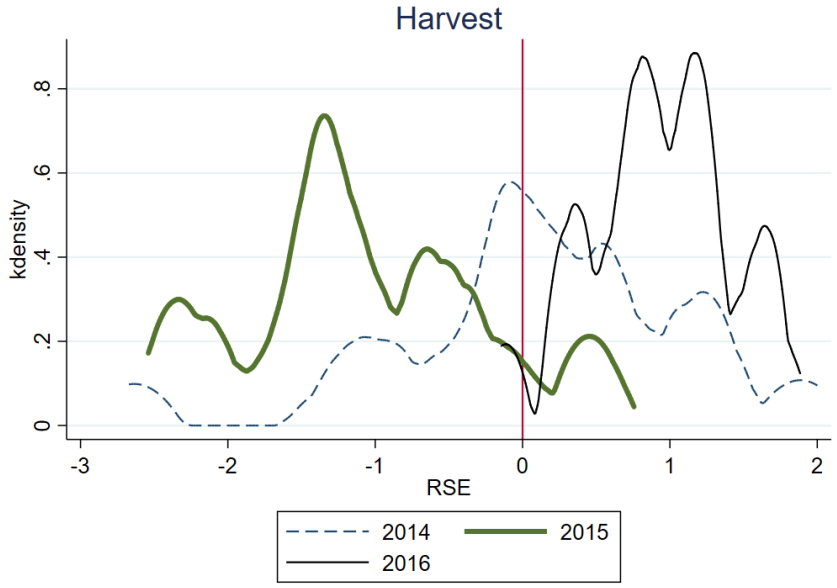


Figure 3: Normalised Harvest Rainfall (Kernel Density)



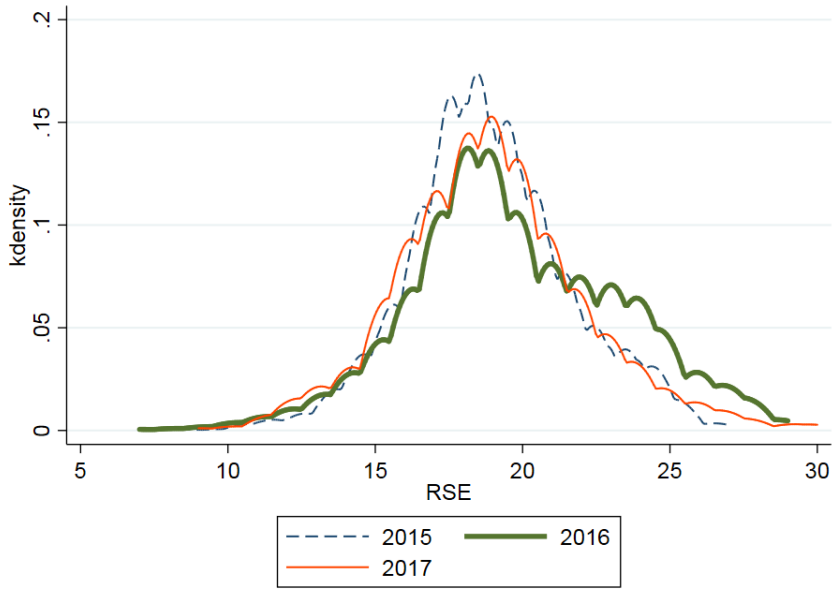
2.3 Self-Esteem

First, let us define self-esteem as the "positive or negative attitude toward a particular object, namely, the self" (Rosenberg, 1965). The Rosenberg Self-Esteem Scale (RSE) is a well-known and widely used measure of self-esteem within the social sciences. This 10-question scale elicits positive and negative response feelings from the individual. Respondents choose whether they strongly

agree, agree, disagree, or strongly disagree with a statement, which is then scored to create an index ranging from 0-30, with higher levels indicating higher levels of self-esteem. Most individuals score within the bounds of 15 to 25 (Heatherton et al., 2003). Within the psychological/sociological realms, there is a significant amount of research assessing various types of self-esteem measures, as well as the validity of the RSE (e.g., Robins et al., 2001). There is also research specifically related to its validity when used in different country contexts; Schmitt and Allik, 2005, translated the RSE into 28 languages, and administered the test in 53 countries, finding that, across countries, the outcome structure of the RSE displayed little variance. Both Demo, 1985, and Crandall, 1973, determined that the RSE was amongst one of the best measures of self-esteem. Similar to identifying an appropriate measure for weather shocks in the environmental economics realm, the RSE does not come without its flaws. The RSE is a global measure of self-esteem, which is not directly related to, for example, an individual's confidence in their ability to farm. As such, it may be the case that the RSE is picking up other underlying latent characteristics, or preferences of the individual(s) in the sample. Beyond entering into the neuroeconomic realm, we believe that the RSE is one of the better measures that can be used, without designing an experiment to specifically measure self-esteem. Though the RSE is one of the mainstream measures used in psychology and sociology, it has rarely been used within an economic context, to evaluate the causal affect of income shocks on self-esteem, an important non-cognitive skill; within the economics literature that observe self-esteem, both Heckman et al., 2006, and Haushofer and Shapiro, 2016, employ the RSE.

The self-esteem variable displays similar patterns to what is stated in the RSE literature, with most individuals scoring between 15 and 25 points. We observe fewer individuals at the extreme ends of the scale, as expected (Figure 4).

Figure 4: Self-Esteem Trend



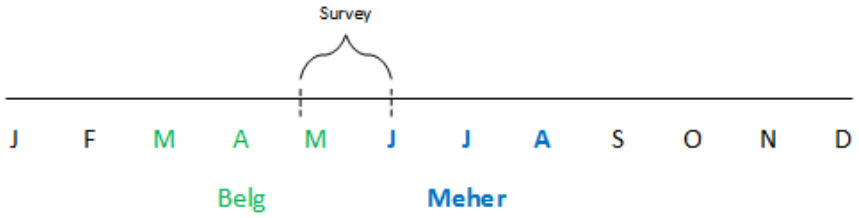
We observe that self-esteem does change over time (though the variation does not jump from one extreme end to another). Therefore, it may be possible that we cannot assume that self-esteem is time-invariant. As such, we aim to determine how weather, which directly affects the economic outcome of our sample of crop-based farmers, affects self-esteem, reflecting the causal relationship of poverty on well-being.

3 Results

3.1 Identification Strategy

Our first research question relates to the causal impact income shocks have on psychological well-being; i.e., whether weather shocks, which affect farm revenues, have any effect on self-esteem levels. In order to do so, the timing of when the self-esteem responses were elicited is crucial.

Figure 5: Survey Timing



As is displayed in Figure 5, surveys were conducted in May and June, and therefore during the spring harvesting season. Respondents were asked about harvest levels in the past 12 months (i.e., the previous Belg and Meher seasons). The majority of crops grown by our sample of farmers are during the Meher season, which is common within the region. One of our goals is to evaluate temporal changes in self-esteem; as we are assuming that self-esteem is time varying, we are interested in determining whether the past harvesting season had any causal affect on self-esteem. Therefore, we estimate the following:

$$RSE_{it} = \alpha + \beta D_{i,t-1} + \zeta X_{it} + \gamma_i + \delta_t + \epsilon_{it} \tag{2}$$

With RSE representing the Rosenberg self-esteem scale at the time of the interview for individual i at time t, D relating to drought (i.e., negative weather shocks) from the past harvesting season, X being a set of individual characteristics at time t, and γ and δ represent individual and time fixed-effects, respectively. We hypothesise that negative outcomes due to poor weather may have a negative effect on self-esteem levels.

3.2 Recent Shocks

As was aforementioned, we are interested in observing the causal affect of income shocks due to drought on self-esteem levels, and thus first concentrating on furthering our understanding of the

causal impact of poverty on psychological well-being. We first directly observe the effect of drought on self-esteem. Table 9 in the appendix tests the effect mm of total rainfall; we observe that *Rain* is positive and significant, and $Rain^2$ is negative and significant for the previous Meher, and overall previous harvest season estimations. This is likely due to the fact that the Meher season is the most economically important season for farmers in this region. Here, we already observe rainfall during specific periods have an impact on self-esteem levels. We highlight that $Rain^2$ is significant, but close to 0. Rather than concluding that rainfall has a non-linear relationship with RSE, this is likely capturing the limited positive variation within this variable during the time-period studied, as is displayed in Figure 1. The lack of significant results for the Belg period may highlight the potential mechanism through which rainfall would effect RSE to be that of farm-revenues. Table 10 in Appendix A tests different thresholds of our drought variable, to test this hypothesis further.

Table 10 displays 3 shock strengths: -0.5 (Drought 1), -1 (Drought 2), and -1.5 (Drought 3) standard deviations away from 0. As is observed in columns 1 and 2, stronger shocks are positive and significant, and have a higher magnitude - stronger shocks have a larger and more significant impact on RSE, which agrees with intuition. Notably in column 2, we observe that there are no shocks -1 standard deviations or lower during the Belg period - this may be one of the causes for the lack of significance of Belg rainfall in Table 9. Given that, from here on out, we display results for our combined Harvest shock variable (i.e., Meher and Belg), with our *Drought* variable representing shocks -1 standard deviations away from 0 or higher.

Our main results observing shocks during the last growing season are displayed in Table 1. We observe that a drought during the previous season decreases RSE by 0.788 points (including controls); weather shocks during the previous growing season has a negative affect on current levels of self-esteem. Economic theory traditionally dictates that variables such as risk, or psychological variables such as self-esteem, are time-invariant. As such, there is a lack of literature that would indicate what a "significant" movement along the RSE would be. Similarly, the psychological literature also lacks this information. As such, evidence of any change of self-esteem would garner an interesting result, in terms of adding to the existing literature, which is what we observe. In terms of our sample, figure 6 demonstrates how RSE has changed over time, controlling for individual fixed effects, with the 2015 survey year as our base year. Here, we observe that the average level of self-esteem has changed by about 1 point between the two drought years. Thus, *Drought* explains 78.8% of this movement - the majority of the movement of RSE is explained by an income shock in the previous growing season. Overall, our results indicate that a poor growing season negatively affects self-esteem.

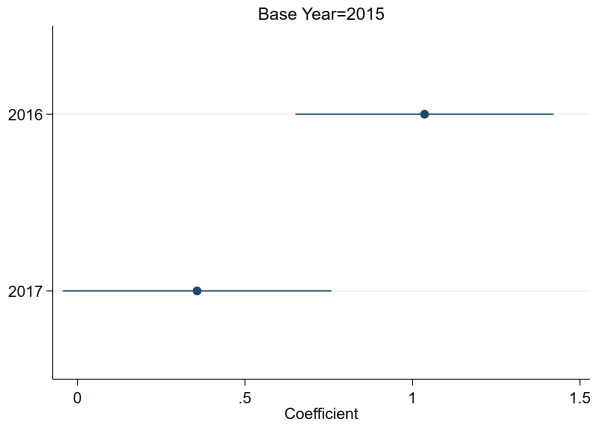
Additional to the effect of drought on self-esteem, we explore whether an individual's placement in the distribution of the RSE has an impact on how drought affects them. In order to do so, the robust quantile-regression is estimated; the graphic results are displayed in Figure 7, with the red vertical line representing the OLS estimated coefficient. *Drought* in all quantiles are negative and significant (see Table 11 in Appendix B). Within the legend, q represents the specific quantile (i.e., $q1$=10th quantile, $q9$=90th quantile). Overall, the quantile regression results are close to the

Table 1: Drought on RSE

	(1)	(2)
Drought	-0.733**	-0.788**
	(0.325)	(0.301)
Observations	2510	2510
R^2	0.469	0.477
Standard errors in parentheses		
* p<0.1, ** p<0.05, *** p<0.01		

Column 2 controls for age, plot area, social network, number of household members, and farm assets (i.e., animal assets). Both columns controlling for household and time fixed effects, standard errors clustered by climatic zone.

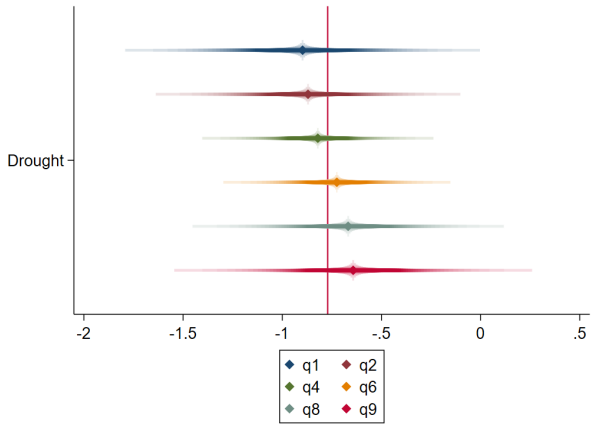
Figure 6: RSE by Year



Controlling for household and year fixed effects, clustered by ecological zone.

estimated OLS results, with all coefficients negative and significant, and individuals with lower self-esteem having a slightly higher coefficient than those with high levels of self-esteem.

Figure 7: Quantile Regression Results



Estimation controlling for age, plot area, social network, number of household members, and farm assets (i.e., animal assets). Controlling for household and year fixed effects.

Our evidence points to the fact that rainfall, which effects economic output, does indeed have an effect on self-esteem levels; this causal impact of income shocks on non-cognitive skills aligns with the findings of Chemin et al., 2013. We go a step further though, illustrating the temporal effect of income shocks, through the use of our panel data set. Additionally, we observe that individuals at different points of the RSE distribution are affected by drought at different magnitudes. Next, we discuss the potential mechanism through which droughts may have an affect on self-esteem.

3.3 Mechanism

In order to understand how weather shocks affect self-esteem, it is necessary to test the potential mechanisms. As was aforementioned, one potential mechanism is through income - weather shocks affect farm revenues, which may than affect self-esteem. As our sample consists of small-holder farmers whose sole/main employment is farming, with the majority of our sample living at or under the poverty line, this mechanism would reflect part of the psychological poverty trap discussed by Haushofer and Fehr, 2014. Once again, the authors state that living in poverty can have psychological consequences (such as higher discount rates, more risk-aversion), which can than affect decision-making, making it more difficult to exit poverty.

We test this by observing the affect of revenues on RSE. Revenues of the top six crops (teff, wheat, barley, sorghum, maize, millet) are calculated, based on crop price data and yields, and are reported in logs. In order to absolve our revenue variable from the affect of weather shocks on prices, 2001 crop price data is used. OLS results are displayed in column 2 of table 2; log_rev is not statistically significant. This estimation, though, is endogenous - one cannot conclude a causal affect, due to reverse causality. We thus use weather shocks to instrument revenues, a common instrumental variable used in development and agricultural economics literature, due to its direct impact on crop production, especially given that our sample of farmers are engaged in rain-fed agriculture. First stage results in column 1 indicate that weather shocks cause a decrease in revenues, as expected. The IV results in column 3, contrasting the OLS results, are now positive and significant - as revenue per hectare increases, self-esteem on the RSE increases. The magnitude of this coefficient is also larger than that in the reduced form estimation in Table 1.

IV results in Table 3 control for individuals who have received remittances for adaptation, and households where at least one individual is engaged in off-farm employment, with similar positive and significant results. Additionally, columns 2 and 3 consider those who we classify as *Farm Poor*; households with farm revenues under the extreme poverty line. Considering this sample, and controlling for remittances and off-farm employment in column 3, we still have evidence of income's causal affect on self-esteem. Additionally, by instrumenting revenue with weather shocks, and observing individuals living in poverty, we provide evidence of the first leg of the feedback loop discussed by Haushofer and Fehr, 2014; poverty, exacerbated by income shocks (i.e., weather shocks), does, in fact, have an impact on non-cognitive skills.

It should be noted that other mechanisms may exist. Individual's may compare themselves to others (as a reference point), or to how they performed in the previous year's harvest. Concerning

Table 2: Farm Revenues on RSE

	(1) Stage1	(2) OLS	(3) IV
Drought	-0.228*		
	(0.123)		
Log_rev		-0.056	3.603***
		(0.116)	(1.377)
Observations	2345	2345	2345
R^2	0.560	0.459	0.092
F-stat	17.698		

Standard errors in parentheses
* p<0.1, ** p<0.05, *** p<0.01

All estimations controlling for age, plot area, social network, number of household members, and farm assets (i.e., animal assets). Controlling for household and time fixed effects, standard errors clustered by climatic zone in column 1.

Table 3: Farm Revenues on RSE - Further income controls

	(1) IV	(2) IV	(3) IV
Log_rev	3.905***	3.303***	3.588***
	(1.434)	(1.187)	(1.222)
Observations	2329	2315	2298
Remittances	Yes	No	Yes
Off-Farm empl.	Yes	No	Yes
Farm Poor	No	Yes	Yes
R^2	0.030	0.216	0.171
F-stat	17.356	24.625	24.403

Standard errors in parentheses
* p<0.1, ** p<0.05, *** p<0.01

All estimations controlling for age, plot area, social network, number of household members, and farm assets (i.e., animal assets). Controlling for household and time fixed effects.

the former, individuals in the same area would suffer from the same weather shocks, so this is less likely. Concerning the latter, testing lags of weather shocks, we observe no effect on self-esteem (table 4). Additionally, weather shocks may have a psychological impact on self-esteem other than a purely economic channel (farm revenues) - this could be tantamount to the effect of an individual becoming unemployed. It is clear, though, that at least one mechanism of weather shocks on self-esteem is through output during the harvesting season (i.e., farm revenues).

3.4 Past Shocks

Sections 3.2 and 3.3 demonstrate the affect of recent drought, which affects farm revenues, on self-esteem. We also aim to determine how previous experience with income shocks affect current-day levels of self-esteem. As such, we follow the intuition behind the "experience hypothesis". The idea of past experiences influencing psychological well-being has been studied at length within psychology, observing, for example, past experience of abuse (Aguilar and Nightingale, 1994) and

Table 4: Lagged Drought

	(1)	(2)
Drought	-1.098*	-1.266*
	(0.638)	(0.639)
Drought_{t-1}	-0.350	-0.558
	(0.552)	(0.569)
Observations	1430	1430
R^2	0.579	0.591

Standard errors in parentheses
* p<0.1, ** p<0.05, *** p<0.01

Column 2 controls for age, plot area, social network, number of household members, and farm assets (i.e., animal assets). Both columns controlling for household and time fixed effects, standard errors clustered by climatic zone.

school experience (Hoge et al., 1990), on self-esteem and mental health. Within economics, recent literature has discussed past experience on current current choices (Osili and Paulson, 2008, Alesina and Fuchs-Schündeln, 2007, Guiso et al., 2004).

In the work of Malmendier and Nagel, 2011, the authors test the experience hypothesis, observing whether historical macroeconomic shocks experienced by individuals affect their willingness to take financial risks. The authors describe the "key implication of the experience hypothesis is that differences in the level of risk taking between individuals should be correlated with differences in life-time experiences" (Malmendier and Nagel, 2011, p.374). They test this hypothesis with survey data from 1970-2007 (repeated cross-sections) to form their risk variable, which takes four forms: "(i) willingness to take financial risk as indicated in a survey question, (ii) stock market participation, (iii) bond market participation, and (iv) the proportion of liquid assets invested in stocks" (Malmendier and Nagel, 2011, p.375). Their risk data is then correlated with historical stock and bond returns, dating back to birth for each household, and therefore commencing at the late nineteenth century. Weights are used depending on the age of the household head at the time of the experience. The authors determine that past experience with macroeconomic shocks cause lower financial risk-taking behaviour.

3.4.1 Ethiopian Famine

In our paper, the past shock of interest is the Ethiopian famine. The 1980s famine is considered one the worst humanitarian crises, with some estimates of the death toll reaching over one million by 1986 (Keller, 1992). As much of the literature points out, famines do not only occur solely due to poor harvest, but also unstable institutions. During the famine years, Ethiopia was embroiled in a civil war between the then communist regime, and anti-government groups, lasting from 1974-1994. During the 80s, the country also suffered a severe drought. Poor harvest due to drought, coupled with conflict led to the famine. Keller, 1992 describes the following four phases of the Ethiopian famine:

1. 1982: Poor Belg and Meher rains

2. 1983: Poor Belg rains (poor Meher in certain regions), intensification of conflict

3. 1984: Late and erratic Meher rains

4. 1985: Good Meher rains

3.4.2 Past Shocks: Results

In order to determine whether past experience with income shocks have an impact on current levels of self-esteem, we focus on drought during the famine years. Following Keller, 1992, we focus on the first three phases of the famine (1982-1984). Using CHIRPS data, we create our drought variable, identical to the structure of that used for recent shocks. We note that drought was not the sole cause of the famine, so our results are likely an underestimation. However, due to lack of reliable data during this period in Ethiopia, weather data is our best choice to test the exogenous effect of income shocks during the famine on current self-esteem levels. Table 5 shows the first estimations with our 80s shock variable.

Table 5: Famine Drought

	(1) OLS	(2) OLS	(3) OLS
Drought	-0.813**	-0.807**	
	(0.310)	(0.309)	
Drought_{80s}	0.210		
	(0.210)		
S.Drought_{80s}		0.133	0.068
		(0.210)	(0.210)
Observations	2510	2510	2510
R^2	0.478	0.477	0.474

Standard errors in parentheses
* p<0.1, ** p<0.05, *** p<0.01

All estimations controlling for age, plot area, social network, number of household members, and farm assets (i.e., animal assets). Controlling for household and time fixed effects, standard errors clustered by climatic zone.

Columns 1 and 2 of Table 5 once again show that recent droughts have a negative and significant affect on self-esteem. As was demonstrated in section 3.3, one of mechanisms through which this happens is the direct affect of drought on farm revenues. Observing our 80s shock variables, neither $Drought_{80s}$ or $S.Drought_{80s}$ (strong droughts, less than -1.5 standard deviations away from 0) are statistically significant. As was aforementioned, the famine was not solely caused by drought - drought, coupled by political instability and conflict caused the famine. As such, using rainfall shocks during this period does not fully capture the economic shock the famine would have caused. Given the average age of our sample (about 53 years), our next step involves observing age effects. The age at which an individual lived throughout the famine may have an affect on their current self-esteem. Some of the cited fundamental years, in terms of mental health and the development of non-cognitive skills, are for children and adolescents. UNICEF

reports on the importance of early childhood development, and how "250 million children under five in low-and middle-income countries risk not reaching their development potential because of extreme poverty and stunting" (UNICEF, 2017). The World Health Organisation (WHO) also states that the adolescent years (ages 10-19) are formative years, "when the maximum amount of physical, psychological and behavioural changes taking place" (Organisation, 2003). Following the literature on age effects on non-cognitive skills such as self-esteem, we observe two different age groups during our famine years: farmers who children aged between 0-5, and adolescents between1 10-19 (we also test those who were aged 0-19, to observe whether an overall child and adolescent effect exists). As such, dummy variables are created for each age group, representing the sample of individuals who were within that age bracket during the famine. We fix these age groups to an individual's age in 1982, in order to observe the effect of being in each given age group, excluding anyone who enters/exits that group. Table 6 illustrates, similar to Table 5 that $Drought_{80s}$ is not significant; considering age, *Ado* is now negative and significant. Observing stronger shocks, table 7, demonstrates a similar effect, with a larger coefficient value for the *Ado* interaction term. Drought experienced during the famine have a negative and significant impact on self-esteem levels of adults who were adolescents during that period.

Table 6: Famine Drought: 80s Drought and Age Effects

	(1)	(2)
Drought	-0.772**	-0.826***
	(0.334)	(0.310)
$Drought_{80s}$	0.420	0.405
	(0.266)	(0.264)
$Drought_{80s}\times$ Child	-0.237	-0.272
	(0.341)	(0.339)
$Drought_{80s}\times$ Ado	-0.621*	-0.620*
	(0.365)	(0.371)
Observations	2510	2510
Controls	No	Yes
R^2	0.471	0.479

Standard errors in parentheses
* p<0.1, ** p<0.05, *** p<0.01

All estimations controlling for age, plot area, social network, number of household members, and farm assets (i.e., animal assets). Controlling for household and time fixed effects, standard errors clustered by climatic zone.

We have evidence that shocks during adolescence, the formative years of behavioural change as purported by the WHO, lead to persistent effects of adult-hood non-cognitive skills.

Another possible explanation for the significant affect of shocks during the famine on adolescents is conscription during the conflict. During the civil war, males were conscripted into the Ethiopian army. Additionally, there are records of male children being illegally conscripted, with buses pulling up to schools, and rounding up all of the male children. Given that our sample is mostly males (about 84%), the impact that the war had on this group in particular may add another layer of explanation to our significant results. Unfortunately due to the lack of variation in gender, it is

Table 7: Famine Drought: 80s Strong Drought and Age Effects

	(1)	(2)
Drought	-0.754**	-0.806**
	(0.329)	(0.307)
S.Drought$_{80s}$	0.409	0.390
	(0.288)	(0.295)
S.Drought$_{80s}$× Child	-0.420	-0.437
	(0.319)	(0.328)
S.Drought$_{80s}$× Ado	-0.767*	-0.789*
	(0.428)	(0.439)
Observations	2510	2510
Controls	No	Yes
R^2	0.471	0.479

Standard errors in parentheses
* p<0.1, ** p<0.05, *** p<0.01

All estimations controlling for age, plot area, social network, number of household members, and farm assets (i.e., animal assets). Controlling for household and time fixed effects, standard errors clustered by climatic zone.

difficult to truly test for gender effects. Table 8 though, shows our interaction effects on the male sample only (i.e., minus 110 individuals). We observe that most of the *Ado* interactions have a slightly higher magnitude than that including the full sample of individuals.

Table 8: Famine Drought: 80s Strong Drought and Age Effects: Males Only

	(1)	(2)	(3)	(4)
Drought	-0.670**	-0.709**	-0.651**	-0.686**
	(0.324)	(0.302)	(0.321)	(0.299)
Drought$_{80s}$	0.373	0.340		
	(0.290)	(0.288)		
Drought$_{80s}$× Child	-0.352	-0.349		
	(0.430)	(0.430)		
Drought$_{80s}$× Ado	-0.671*	-0.684*		
	(0.368)	(0.378)		
S.Drought$_{80s}$			0.382	0.344
			(0.294)	(0.308)
S.Drought$_{80s}$× Child			-0.641	-0.605
			(0.405)	(0.412)
S.Drought$_{80s}$× Ado			-0.759*	-0.802*
			(0.445)	(0.460)
Observations	2080	2080	2080	2080
Controls	No	Yes	No	Yes
R^2	0.444	0.452	0.444	0.452

Standard errors in parentheses
* p<0.1, ** p<0.05, *** p<0.01

All estimations controlling for age, plot area, social network, number of household members, and farm assets (i.e., animal assets). Controlling for household and time fixed effects, standard errors clustered by climatic zone.

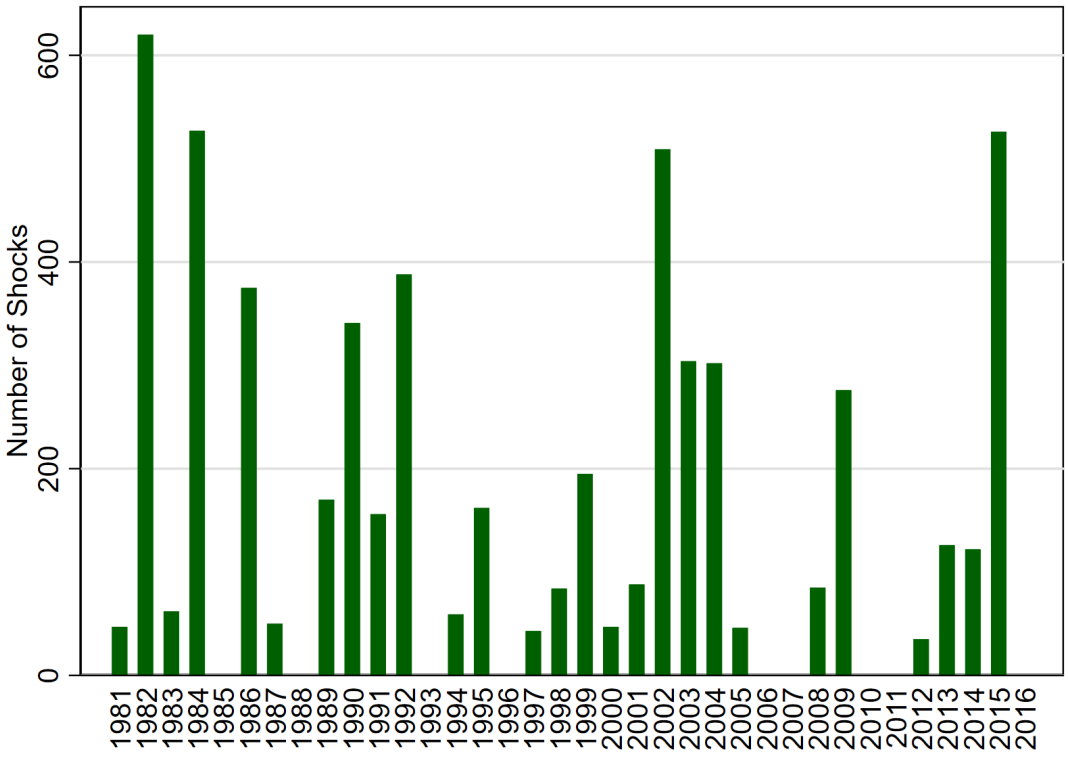
Due to a severe lack of reliable data during the famine years, and lack of farm revenue infor-

mation during that time period, we are unable to test the mechanism through which this result may occur. We do observe, though, that past shocks have an affect on current non-cognitive skills, aligning with the literature on past experiences.

3.4.3 Prevalence of Drought

Our research shows causal evidence of income shocks (droughts) on self-esteem. Given our context of linking income shocks to weather events, the question of the prevalence of such shocks in this region remains. Figure 8 below illustrates the frequency of shocks for the location of our households from 1981-2016.

Figure 8: Frequency of Negative Weather Shocks



No negative shocks are displayed within only 9 years of the 35 year time horizon. Even with the frequency of negative weather shocks, our results still indicate a causal effect of drought on self-esteem (i.e., we do not observe that individuals are used to these negative shocks, concerning their effect on self-esteem). The prevalence of negative weather shocks within this region clearly highlights the frequency at which income shocks occur, which decrease self-esteem levels.

4 Conclusions

The causal effect of poverty on behaviour has recently been discussed and researched within empirical literature. Empirical analysis related to the interplay of non-cognitive skills and economic outcomes has often been linked to the decision-making realm. The increased prevalence of behavioural economic research has allowed for the fusion of psychology and economics, and how to potentially model these latent variables. It has been difficult though, due to endogeneity issues, to understand the direction of the effect of economic outcomes on behaviour, which then, in turn, may effect decision-making. With a unique data-set, our results allow us to disentangle the effect of droughts, which effect economic outcomes, on non-cognitive skills, namely, self-esteem. We observe that drought during the previous growing season has a significant impact on self-esteem levels. This effect is, in fact, persistent until the start of the next growing season. One mechanism is likely through drought's effect on farm revenues, as is demonstrated in our IV results. We also show that past drought during the famine years has a negative effect on adult self-esteem levels for individuals who were adolescents during the famine.

It may be the case that such shocks have an additional psychological effect on self-esteem, outside of the pure revenue effect. As further research, this mechanism should be further studied, in order to disentangle the economic effect (i.e., effect on crop revenues during the growing season), and a potential pure psychological effect (similar to the findings of Cohn et al., 2015). As Easterlin, 2013, points out, we cannot solely rely on economic growth for the increase of well-being, and factors such as full-employment are essential considerations. It could be the case that in addition to having an income shock, drought periods may render similar negative impacts to well-being tantamount to becoming unemployed. These effects on psychological well-being should be extended further. Policy formation relating to adaptation to climate change should take into account the negative effects of shocks on not only income, but non-cognitive skills. Our findings add to the literature which highlight the importance of considering non-cognitive skills, relating to welfare, within economic theory and policy-making.

Our results highlight the direct effect of income shocks on individuals living in poverty on self-esteem, and further highlight the importance of the formation of non-cognitive skills during adolescent years, and the persistence of shocks during adolescence into adult life. This has important implications concerning policy surrounding adolescents living in poverty - if the feedback loop of Haushofer and Fehr, 2014, exists, living in poverty, especially during adolescent years, could render it even more difficult for individuals to leave the poverty trap. With the importance of non-cognitive skills for labour market outcomes, aid policies which also involve the development of these skills may be crucial, especially for youth living in poverty. Before advocating any policy relating to self-esteem, it is important to also further our understanding of any other preferences the RSE may be picking up (e.g., risk, time preferences, anxiety).

Given our findings, as a next step in this line of research, the affect of self-esteem on decision-making should be tested. This idea relates to that proposed by Haushofer and Fehr, 2014, of the feedback loop; while this paper tackles the first part of the feedback loop, the second relationship,

between the affect of psychological consequences (on non-cognitive skills) caused by poverty on decision-making, should also be tested. It is clear that future research must test the causal link of poverty on these skills which may in turn effect decision-making, even further.

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A Rainfall on different harvesting seasons

Table 9: Total rainfall (mm) on RSE

	(1) Meher	(2) Belg	(3) Harvest
Rain	0.009***	0.001	0.008***
	(0.003)	(0.004)	(0.002)
$Rain^2$	-0.000005*	0.0000002	-0.000003**
	(0.00000267)	(0.000005)	(0.000001)
Observations	2510	2510	2510
R^2	0.476	0.474	0.478

Standard errors in parentheses statistics in parentheses
* p<0.1, ** p<0.05, *** p<0.01

All estimations controlling for age, plot area, social network, number of household members, and farm assets (i.e., animal assets). Controlling for household and time fixed effects, standard errors clustered by climatic zone.

Table 10: Shock levels on RSE

	(1) Meher	(2) Belg	(3) Harvest
Drought1	-0.083	-0.220	0.462
	(0.513)	(0.278)	(0.342)
Drought2	-0.472*		-0.476
	(0.264)		(0.364)
Drought3	-0.771**		-0.797**
	(0.376)		(0.397)
Observations	2510	2510	2510
R^2	0.476	0.474	0.479

Standard errors in parentheses
* p<0.1, ** p<0.05, *** p<0.01

All estimations controlling for age, plot area, social network, number of household members, and farm assets (i.e., animal assets). Controlling for household and time fixed effects, standard errors clustered by climatic zone.

B Quantile Regression

Table 11: Drought on RSE Quantiles

	(1) OLS	(2) Q1	(3) Q2	(4) Q4	(5) Q6	(6) Q8	(7) Q9
Drought	-0.771***	-0.898***	-0.870***	-0.821***	-0.725***	-0.668**	-0.642*
	(0.237)	(0.347)	(0.298)	(0.226)	(0.222)	(0.305)	(0.350)
Observations	2519	2531	2531	2531	2531	2531	2531
R^2	0.477						

Standard errors in parentheses
* p<0.1, ** p<0.05, *** p<0.01

Estimation controlling for age, plot area, social network, number of household members, and farm assets (i.e., animal assets). Controlling for household and time fixed effects.

C Rosenberg Self-Esteem Scale Survey Question

Figure 9:

12.2. For each statement below, tick the box to indicate whether you strongly agree, agree, disagree or strongly disagree.

Statement	**Strongly Agree**	**Agree**	**Disagree**	**Strongly Disagree**
1. I feel that I am a person of worth, at least on an equal plane with others				
2. I feel that I have a number of good qualities.				
3. All in all, I am inclined to feel that I am a failure				
4. I am able to do things as well as most people				
5. I feel I do not have much to be proud of.				
6. I take a positive attitude to ward myself.				
7. On the whole, I am satisfied with myself				
8. I wish I could have more respect for myself.				
9. I certainly feel use less at times.				
10. At times I think that I am no good at all.				