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RELATIVE DEPRIVATION AND SCHOOL ENROLMENT. EVIDENCE FROM MEXICO

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Using a large dataset (2.9 million households), we provide solid evidence of relative deprivation as being a negative correlate of school enrolment in Mexico, absolute standard of living being controlled for. This result is robust to a number of specifications, and to the use of linear and less than linear indices of relative deprivation. In addition, we find that marginal effects of relative deprivation are stronger at higher standards of living and for older children.

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1. Introduction

The idea that in a context of economic inequality interpersonal comparisons may affect our lives has long been considered by a variety of disciplines, ranging from economics (Duesenberry 1949) to anthropology (Foster *et al*., 1972), political science (Gurr 1970), psychology (Bradburn 1969) and sociology (Stouffer *et al*., 1949). *Relative deprivation* refers to the detrimental implications arising from the inability to achieve as much as the people we compare with in society (the so-called reference group).[1] The economics literature has engaged with both the theoretical and empirical analyses of relative deprivation. Theoretical models

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[1]We abstract from potentially positive implications of relative deprivation, arising in particular in dynamic contexts where others' advancements may boost expectations e.g. Hirschman and Rothschild's (1973) tunnel effect.

comprising a relativistic specification of utility have been developed for the study of consumption, risk, economic growth, taxation schemes, educational subsidies, labor supply, etc.—see Esposito (2017) for a review. Empirical studies have focused on the investigation of the (typically negative) relationship between relative deprivation and subjective wellbeing, life satisfaction or happiness—see Clark *et al*. (2008), D'Ambrosio and Clark (2015) and Verme (2017) for thorough examinations of the existing evidence.

Empirical research on the potential role of relative deprivation as an explanatory variable for other social outcomes is scarcer within the economics discipline. Expanding the range of social outcomes of interest is listed by D'Ambrosio and Clark (2015) as one of the "outstanding issues" for the understanding of how the "haves" and the "have-nots" affect our societies. In addition, while a certain amount of multi-disciplinary literature does exist across the social and medical sciences, results are less univocal compared to the case of the subjective wellbeing literature. This can be seen in Smith *et al*.'s (2012) meta-analytic review of studies on the relationship between relative deprivation and a wide array of social outcomes, where the authors conclude that "results are often weak and inconsistent" (p. 203).

In this paper, we explore the association between relative deprivation and school enrolment in Mexico. Using data from the extended-questionnaire section of the 2010 Mexican census, which is statistically representative at municipal level and covers around 2.9 million households, we provide robust evidence of relative deprivation as a negative correlate of school enrolment for children of 6–18 years of age. Children in more (affluent) relatively deprived households are (more) less likely to be enrolled in school. In addition to these results, we find that the association between relative deprivation and school enrolment is stronger for older children and at higher standards of living, and situate these findings within the relevant literatures. Finally, we show that if the index of relative deprivation is calculated using the whole country as a reference group rather than the municipality, relative deprivation becomes insignificant; this points to the importance of some sort of geographical proximity for the definition of the reference group, at least in the case of a large country such as Mexico. The above results are confirmed for both distribution-sensitive (Esposito 2010) and linear (Yitzhaki 1979) indices of relative deprivation. A limitation to our analysis is that the census does not contain information on potential confounders such as children's abilities.

The remainder of the paper develops as follows. In section 2 we review the literature to identify the possible mechanisms through which relative deprivation may matter for educational outcomes. In section 3 we present the index of relative deprivation used in the main analysis and situate it in the measurement literature. In section 4 we present the data and outline our empirical strategy. Section 5 contains our results and robustness checks. Section 6 concludes.

2. Relative Deprivation and Education

There is a large body of literature showing the relationship between socioeconomic gradients and academic achievement, dropout rates and cognitive

development in both high- and low-income countries—*inter alia*, see McLoyd (1990), Duncan *et al*. (1994), Bradley and Corwyn (2002), Engle *et al*. (2011), Fernald *et al*. (2011) and Walker *et al*. (2011). The evidence that children in better off households have better educational outcomes, however, offers little help in terms of disentangling the potential separate roles of the *absolute* standard of living and the *relative* deprivation experienced by the household. There are good reasons for associating both to educational outcomes. Absolute standards of living first of all relate to the ability of households to afford education—according to Basu and Van's (1998) "luxury axiom", education is a good that poorer households are less likely to be able to afford. In addition, having a better standard of living allows households to endow the child with an array of inputs which enhance educational achievements—e.g. better nutrition, see Grantham-McGregor *et al*. (1991), Glewwe *et al*. (2001), Engle *et al*. (2007) and Jackson (2015).

Relative deprivation can be hypothesized to matter for educational outcomes through a number of mechanisms. These relate to both the relative deprivation experienced personally by the child and to the effect of relative deprivation on their parents or carers. Relative deprivation is indeed a phenomenon which affects not only adults but also children, who suffer from the comparison of their living standards with those of their more affluent peers (Scott, 2014). The influential sociological work of Mayer (2001) maintains that these comparisons are detrimental to educational outcomes—"If children feel relatively deprived, they may be less inclined to study or stay in school" (p. 4). Kearney and Levine (2016) propose a model in which this mechanism operates within a standard human capital formation framework where perceived returns to education become altered. Economically disadvantaged children may develop a sense of socioeconomic marginalization and a decrease in aspirations, which would lead them to underestimate returns to education and hence lower investment in human capital formation. Unfavorable social comparisons may also affect the extent to which parents consider their offspring to have a real chance to improve their standards of living and move up the social ladder. In Mayer's (2001) words, "Relative deprivation can also make parents feel stressed and alienated, lowering their expectations for their children or reducing the quality of their parenting" (p. 4). These perceptions may be reinforced by the objective lower intergenerational mobility in areas with greater economic inequality (Chetty *et al*., 2014).

The theory of identity-based motivation offers a nuanced perspective for hypothesizing a relationship between relative deprivation and educational outcomes—see Destin and Oyserman (2009, 2010) and Oyserman and Destin (2009), who expound this conceptual framework and provide experimental evidence supporting it. The idea is that people tend to pursue long- and short-term goals which they find to be congruent to their relevant identities. The difference in life experiences of higher and lower social class students leads the latter to develop identities which may conflict with academic goals (i.e. "my future is in the production line") and consequently decrease their motivation towards the pursuit of academic attainments. The motivational mechanism seems even more important if one considers it in conjunction with other detrimental effects of relative deprivation on factors which affect the ability to sustain investment in human capital formation, such as impulsivity, low self-control, susceptibility to boredom, alcohol

consumption, smoking and extreme future discounting (i.e. the tendency to prefer smaller, immediate rewards to larger ones accruing later)—see Callan *et al*. (2011), Balsa *et al*. (2014) and Mishra and Novakowski (2016).

Another way in which relative deprivation can influence education is through its effect on health, whose importance for educational outcomes is paramount (Currie, 2009). A recent body of literature on the determinants of health for children and adolescents finds that relative deprivation (McLaughlin *et al*. 2012, Elgar *et al*., 2013, 2016) and subjective socioeconomic status (Karvonen and Rahkonen, 2011, Quon and McGrath, 2014) exert a specific effect (beyond the absolute standard of living) on an array of health domains, ranging from long-standing illnesses, to mental health issues, sleeping disorders, obesity, etc. Destin *et al*. (2012) conceptualize an explicit pathway for adolescents which links perceived position in the social ladder to academic achievement through health outcomes. They provide evidence that students' low standing in the socioeconomic hierarchy triggers depressive symptoms and emotional distress, which negatively affect their school engagement and ability to study in a consistent and organized way. Currie (2009) suggests also that relative deprivation can affect child health through detrimental maternal stress responses. Lhila and Simon (2010) find that relative deprivation increases the likelihood that mothers smoke during pregnancy and give birth to low birthweight children, a condition which has been long known to jeopardize cognitive outcomes—see Record *et al*. (1969), Hack *et al*. (1995), Richards *et al*. (2001) and Ulker (2016). Eibner and Evans (2005) shows that relative deprivation jeopardizes adults' health and Bratti and Mendola (2014) find that parents' health is crucial for sustaining children's school enrolment.

Wilkinson and Pickett (2007) suggest that relative deprivation is harmful for educational outcomes not only through distress and health-related outcomes, but also via feelings of disenfranchisement and social distance arising from occupying a low rank in the social hierarchy. In this respect, Mayer (2001) maintains that relative deprivation can lead to isolation and alienation from societal norms and values and Fischer and Torgler (2013) offer cross-country evidence of "a deleterious positional income effect for persons below the reference income, particularly for their social trust and confidence in secular institutions" (p. 1542). In addition, relative deprivation has been shown to increase children's tendency to feel anger, engage in normless and antisocial behaviors, commit crimes and be involved in passive as well as active bullying at school—see Bernburg *et al*. (2009), Napoletano *et al*. (2016), Odgers *et al*. (2015) and Vogel and South (2016). Not only do these feelings, behaviors and attitudes are likely to act as obstacles for the pursuit of academic achievements in students' everyday life, but they are also likely to decrease the perceived value of education and hence its demand. This is because the value attributed to education by parents and students is not driven merely by instrumental motivations (e.g. finding a job) but also by intrinsic motivations such as becoming a better person and playing a positive role in society (Reid 1998, Saito 2003).

Another channel through which relative deprivation can influence educational outcomes relates to dynamics at a classroom level stemming from the interplay between socioeconomic standing and academic performance. A body of work

suggests that pupils' concept of the academic self is deflated in presence of higher achieving peers—see frame of reference and peer effects models in the economics literature (Pop- Eleches and Urquiola, 2013; Angrist and Pathak, 2014; Bui *et al*., 2014), as well as the so-called "big fish little pond" education literature (Marsh, 1987; Zeidner and Schleyer, 1999; Marsh and Hau, 2003). The sociological work of Crosnoe (2009) explicitly extends the "pond" framework directly to characteristics perceptually linked to achievement such as socioeconomic status, and finds that the academic attainments of low-income students decrease as the percentage of middle- and high-income students increases. Psychological research provides interesting insights in this regard. Subjective socioeconomic status influences negatively students' self-esteem (Chen and Paterson, 2006) and poorer students tend to overestimate their richer peers' real academic abilities (Régner *et al*. 2002). Economic disadvantage leads poorer children to internalize the achievement gap and this, as a self-fulfilling prophecy, impairs their actual academic performance (Croizet and Claire, 1998; Désert *et al*., 2009; Wiederkehr *et al*., 2015).

A final potential mechanism relates to parents' direct involvement in educational activities. This is suggested by the evidence that lower subjective socioeconomic status influences negatively adults' self-assessed intelligence (Kudrna *et al*., 2010), coupled with the evidence that parents' perceived self-efficacy determines the level of involvement in children education (Green *et al*., 2007). It seems reasonable to hypothesise that lower self-assessed intelligence may undermine parents' confidence in the efficacy of their involvement in educational practices, in particular for those practices (helping children with homework, engaging in intellectually enriching activities, etc.) which are shown to improve pupils' learning (Kim and Hill, 2015).

3. Measuring Relative Deprivation

Relative deprivation indices intend to quantify how the existence of more successful others impinges on the individual. They do this by modelling individual *i*'s one-to-one economic disadvantage with respect to each member of the reference group; this is achieved through an individual deprivation function which provides the magnitude of individual *i*'s disadvantage relative the j^{th} member of the reference group—the value is positive if *j* is better off than *i* and zero otherwise. The normalized sum of these values represents individual *i*'s total relative deprivation.

More formally, let $\mathbb{N}$, $\mathbb{R}_+$ and $\mathbb{R}_{++}$ denote the sets of positive integers, non-negative and positive real numbers, respectively. For $n \in \mathbb{N}$, $\mathbb{R}^n_{++}$ is the positive orthant of the Euclidean *n*-space $\mathbb{R}^n$. Individual *i*'s reference group consists of the fixed set of *n* individuals, where $y=(y_1, y_2, \ldots, y_n) \in \mathbb{R}^n_{++}$ is the vector describing the distribution of the economic variable of interest (income, consumption, wealth, etc.), with elements of this vector being arranged in strictly increasing order –i.e. y_1 refers to the poorest individual. The relative deprivation felt by individual *i* when she compares with *j* is quantified by the individual deprivation function $IDF(y_i, y_j) : \mathbb{R}_{++} \times \mathbb{R}_{++} \rightarrow \mathbb{R}_+$, which maps to zero for non-richer individuals while for richer individuals it becomes the function $D(y_i, y_j) : \mathbb{R}_{++} \times \mathbb{R}_{++} \rightarrow \mathbb{R}_{++}$:

$$IDF(y_i, y_j) = \begin{cases} D(y_i, y_j) & if\ y_j > y_i \\ 0 & if\ y_j \leq y_i \end{cases} \tag{1}$$

The individual relative deprivation magnitudes deriving from one-to-one comparisons are then combined in the index $RD(y_i, y) : \mathbb{R}_{++} \times \mathbb{R}^n_{++} \rightarrow \mathbb{R}_+$, which yields individual *i*'s total relative deprivation and can be written as follows:

$$RD = \frac{1}{n} \sum_{j=1}^{n} IDF(y_i, y_j) \tag{2}$$

The index of relative deprivation we employ in our main empirical analysis is the one axiomatically characterized by Esposito (2010), whose functional form over the $y_j > y_i$ domain reads as follows:

$$D^E(y_i, y_j) = \left[(y_j)^\beta - (y_j)^\beta \right] / (y_j)^\beta = 1 - (y_i / y_j)^\beta, \beta \in \mathbb{R}_{++} \tag{3}$$

This index follows the tradition of normalized utility gaps which are typical of Dalton-type indices (Hagenaars, 1987; Vaughan 1987). It can be easily seen that the Esposito index is a concave function of reference incomes and therefore it is sensitive to distributional changes[2] among better-off individuals ($\partial D^E / \partial y_j > 0$ and $\partial^2 D^E / \partial y_j^2 < 0$, with the degree of concavity increasing with parameter β).[3] The motivation for concavity resides in the well-established belief in sociological theory that individuals are more sensitive to advancements achieved by members of the reference group who are closer to their condition (Festinger, 1954). Other concave indices have been proposed by Paul (1991), Chakravarty and Chattopadhyay (1994); Podder (1996), more recently, Bossert and D'Ambrosio (2014) characterized a generalization of individual deprivation functions based on income differences in order to account for distribution sensitivity.

Indices of relative deprivation where the function $D(y_i, y_j)$ is not sensitive to distributional changes affecting better off individuals are based on the seminal work of Yitzhaki (1979)—see also Hey and Lambert (1980) and Yitzhaki (1980), and the alternative characterizations by Ebert and Moyes (2000) and Bossert and D'Ambrosio (2006).[4] This index is linear in the reference income, reflecting the intuition that the marginal increase in individual *i*'s relative deprivation is constant over the $y_j > y_i$ domain. Contributions based on the Yitzhaki index and

[2]This clearly excludes the trivial cases where individuals just swap their incomes. Technically speaking, transfers bringing about distributional changes of interest are the so-called mean-preserving and non-re-ranking transfers.

[3]As β increases, so does the importance of individuals who are closer to *i*'s situation relative to further ones; in other words, the marginal increase in relative deprivation over the $y_j > y_i$ domain decreases more quickly. The motivations for this functional forms range from an understanding of relative deprivation as social exclusion to the ability to account for Runciman's (1966) notion of "fantasy wishes"—see Esposito (2010).

[4]Other contributions based on the Yitzhaki index and its relationship with the Gini coefficient include Chakravarty and Chakraborty (1984), Berrebi and Silber (1985) and Chakravarty (1997).

expounding its relationship with the Gini coefficient include Chakravarty and Chakraborty (1984), Berrebi and Silber (1985) and Chakravarty (1997).

While the contributions referred to above quantify relative deprivation adopting a unidimensional approach and looking at one point in time, others have taken a different approach. For example, Bossert *et al*. (2007) focused on the intertemporal aspect of interpersonal comparisons and on how persistent deprivation over time is linked to the concept of social exclusion. Bellani (2013) develops a multidimensional index of relative deprivation where each dimension receives a weight which depends on the importance the reference group attaches to it; this approach enables the researcher to account for multiple reference groups which may be valuable for the individual.

4. Data and Empirical Strategy

We use data from the extended-questionnaire section of the 2010 Mexican census. This module is administered to 10 percent of the population following a stratified clustered sampling design which covers around 2.9 million households and grants statistical representativeness at municipal level. As can be seen in Table A1 in the Appendix, this sample contains 2.7 million children aged 6–18; 49.5 percent of these children are females, a fifth is indigenous, 1.9 percent suffers from a disability and mean adult education in the household is just above seven years of schooling. Given the lack of income data at household level, our economic variable is household wealth. The extended questionnaire contains a wide range of variables about the quality of the dwelling, durable goods ownership and access to basic utilities that allows us to compute a household asset index in the fashion of Filmer and Pritchett (1999, 2001). This method is based on principal component analysis and enables the researcher to reduce this multiple information to a single scalar quantifying household wealth (Vyas and Kumaranayake, 2006; Howe *et al*., 2009, Deon Filmer and Scott, 2012). In particular, given the discrete nature of this kind of data, we follow the approach developed by Kolenikov and Angeles (2004, 2009).[5] Different operationalizations of asset indices have been used to study school enrolment and other educational outcomes, consistently finding a positive relationship between absolute wealth and school enrolment (Filmer and Pritchett, 2001; Mier *et al*., 2003; McKenzie, 2005; Kabubo-Mariara and Mwabu, 2007). Finally, the correlation between our municipality mean asset index and the official municipality mean income estimated by CONEVAL (2013) is high (0.81 for linear correlation and 0.91 for rank correlation), giving some validation to our measure.

Children living in the same municipality share ecological level factors which are potentially relevant for school enrolment and which may well differ from those factors children living in different municipalities are exposed to (e.g. cost of schooling, quality of education, schooling norms, etc.). In order to account for

[5]Standard Principal Components Analysis (PCA) assumes that the variables are multivariate normal. Following Kolenikov and Angeles (2009), we run PCA using polychoric correlations to better approximate the normality assumption and estimate the amount of variation explained by the first component. Finally, it should be noted that financial assets are not included in our measure of wealth.

this clustering, we employ multilevel models which allow us to estimate individual outcomes while accounting for systematic unexplained variation among the over 2,400 Mexican municipalities. This choice is supported by the log-likelihood test for multilevel models described by Gutiérrez *et al.* (2001); Rodríguez and Elo (2003) and Rodríguez (2007). The test compares the log-likelihood from an ordinary logit model against the log-likelihood from multilevel models. The null hypothesis that the level 2 (municipal) standard deviation is zero, or, more precisely, that the ordinary logit and multilevel logit perform equally, is rejected for all of our specifications, indicating that clustering is relevant and that multilevel techniques should be used.

The dependent variable of our multilevel logit models is the dichotomous status of being enrolled/not being enrolled in school for children aged 6–18. Formally, we consider the probability of enrolment as a random variable with a binomial distribution:

$$Y_i \sim B(n_i, \pi_i) \tag{4}$$

with binomial denominator n_i and a probability of success of π_i. The probability of enrolment is estimated as the logit of the underlying probability π_i as a linear function of the regressors:

$$logit(\pi_i) = \alpha + \varphi RD_h + \delta I_i + \gamma H_h + \eta A_a + \zeta_a + \mu_{iha} \tag{5}$$

where α is the national intercept, RD_h is the relative deprivation of the household the child lives in, I_i is a vector of individual level characteristics of the child, H_h a vector of household level variables and A_a a series of aggregate level characteristics of the municipality the child lives in. φ, δ, γ and η are the estimated linear coefficients and μ_{iha} is the composite uncorrelated error. The municipal specific intercepts are given by $\alpha+\zeta_a$ with $\zeta_a \sim (0, \psi)$.

We include a set of regressors which are typically used in literature on school enrolment in developing countries—see the work by Connelly and Zheng (2003); Dostie and Jayaraman (2006); Bhalotra (2007); De Carvalho Filho (2012) and Gumus (2014), as well as work on school enrolment in Mexico by López Acevedo (2004) and De la Cruz Tovar and Díaz González (2010). As we discussed in section 2, absolute standard of living is well-known to be a strong determinant of school enrolment. The inclusion of absolute wealth as an explanatory variable enables us to disentangle the role of relative deprivation from that of absolute wealth; in other words, absolute wealth being controlled for, we analyze how school enrolment is associated with relative deprivation. Additional regressors are: child's gender, age, whether she is indigenous, whether she has a physical or mental disability, whether the household is a beneficiary from a social program, gender, age and age squared of the household head, number of children in the household, and ecological variables such as municipality size, number of schools per child, educational expenditure per student, percentage of rural population in the municipality and migration intensity.

As to the choice of reference group, we at first follow a simple geographical criterion based on municipality (the lowest political and administrative aggregate in

Mexico)—results are unaffected whether we control for heterogeneity in municipality size through a continuous variable or categorical variables; in this way, we do not introduce assumptions about reference group formation other than the relevance of the disadvantage relative to people living in the same municipality. Next, in subsection 5.2 we present results for alternative approaches—in particular, the inclusion of household education as a criterion for the specification of the reference group and the extension of the geographical criterion to the whole country.

5. Results

5.1. *Relative deprivation and school enrolment*

Table 1 shows our main results. In specifications (1) we have all our regressors but relative deprivation is left out, and in specification (2) we add the Esposito index of relative deprivation.[6] While specifications (1) and (2) are based on pooled data, in order to detect potential heterogeneity in the role of relative deprivation between compulsory school age and high-school age, we estimate specifications (3) and (4) using the subsamples of children in age brackets 6–15 and 16–18, respectively.[7] Coming to our main explanatory variables of interest, there is a consistent pattern of household wealth being positively significant and relative deprivation being negatively significant (in both cases $p<0.01$), with average marginal effects also being highly significant.

In Table 2 it can be noticed that marginal effects of relative deprivation are larger for the high-school aged subsample. This result is in line with child development literature, for which the extent to which relative deprivation impinges on children is believed to increase with age. At older ages the awareness of relative status as well as the propensity to make interpersonal comparisons are stronger, and as a consequence lagging behind others becomes more painful—in the words of Levine (1983), "Social comparison information begins to influence 7 and 8 year old children and increases dramatically thereafter" (p. 29). Butler (1990) and Butler and Ruzany (1993) show that children's tendency to judge own achievements in relative terms increases with age and that low relative performance reduces motivation. In addition, Hustinx *et al.* (2009) find that sensitivity to peers' judgements is stronger among older children compared to younger ones; this may be relevant if one considers that relatively deprived children fare lower than their peers in a number of areas (e.g. clothing, leisure activities, etc.) and hence may be exposed to mockery or negative comments. We investigate this issue further by examining the marginal effects of relative deprivation at different ages. As can be seen in Figure 1, marginal effects are always negative and statistically

[6]We display results with the Esposito index for parameter $\beta=10$ because these have the best fit with the data; there is no qualitative difference in results if models are estimated using values of parameter $\beta=1$, 2 or 5.

[7]It should be noted that the 6–15 and 16–18 age brackets correspond to the compulsory and non-compulsory education categories at the time of the survey (high school was made compulsory in Mexico in 2012). At the same time, since the census does not ask about types of schools, this split is only indicative and does not assume that all children aged 16–18 are in in fact in high school; for example, as noted by the Mexican Secretariat of Public Education, some students enter school late or repeat years (SEP, 2012).

TABLE 1

MULTILEVEL MODELS ON SCHOOL ENROLMENT. POOLED AND BY SCHOOLING AGE

	Pooled Sample				Basic Education Age		High School Age	
	(1)		(2)		(3)		(4)	
	Wealth	AME	Wealth +RD	AME	Wealth +RD	AME	Wealth +RD	AME
Asset Index	0.233***	0.024***	0.128***	0.013***	0.085***	0.005***	0.157***	0.031***
	(0.002)	(0.000)	(0.004)	(0.000)	(0.005)	(0.000)	(0.006)	(0.001)
Relative Deprivation			−0.570***	−0.058***	−0.709***	−0.044***	−0.581***	−0.115***
			(0.020)	(0.002)	(0.026)	(0.002)	(0.030)	(0.006)
Female	0.036***	0.004***	0.036***	0.004***	0.017***	0.001***	0.074***	0.015***
	(0.004)	(0.000)	(0.004)	(0.000)	(0.005)	(0.000)	(0.006)	(0.001)
Age	−0.480***	−0.049***	−0.481***	−0.049***	−0.305***	−0.019***	−0.548***	−0.108***
	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.004)	(0.001)
Mental or Physical Disability	−1.327***	−0.160***	−1.327***	−0.159***	−1.670***	−0.174***	−0.502***	−0.097***
	(0.012)	(0.002)	(0.012)	(0.002)	(0.014)	(0.002)	(0.022)	(0.004)
Indigenous	−0.051***	−0.005***	−0.066***	−0.007***	−0.059***	−0.004***	−0.034**	−0.007**
	(0.009)	(0.001)	(0.009)	(0.001)	(0.012)	(0.001)	(0.013)	(0.003)
HH Female	−0.226***	−0.024***	−0.220***	−0.023***	−0.289***	−0.019***	−0.166***	−0.033***
	(0.005)	(0.001)	(0.005)	(0.001)	(0.008)	(0.001)	(0.008)	(0.002)
Adults Mean Years of Education	0.150***	0.015***	0.151***	0.015***	0.158***	0.010***	0.166***	0.033***
	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)
Social Program	0.247***	0.025***	0.238***	0.024***	0.299***	0.018***	0.164***	0.032***
	(0.005)	(0.000)	(0.005)	(0.000)	(0.007)	(0.000)	(0.008)	(0.001)
Household Head Age	0.074***	0.001***	0.074***	0.001***	0.021***	0.000***	0.116***	0.004***
	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)
Household Head Age Squared	−0.001***		−0.001***		−0.000***		−0.001***	
	(0.000)		(0.000)		(0.000)		(0.000)	
Individuals 0–18 in HH	−0.065***	−0.007***	−0.066***	−0.007***	−0.065***	−0.004***	−0.083***	−0.016***
	(0.001)	(0.000)	(0.001)	(0.000)	(0.002)	(0.000)	(0.002)	(0.000)
Expenditure per Student	0.053***	0.005***	0.044***	0.004***	0.030***	0.002***	0.048***	0.009***
	(0.004)	(0.000)	(0.004)	(0.000)	(0.004)	(0.000)	(0.004)	(0.001)

Table 1 *Continued*

	Pooled Sample				Basic Education Age		High School Age	
	(1)		(2)		(3)		(4)	
	Wealth	AME	Wealth +RD	AME	Wealth +RD	AME	Wealth +RD	AME
Municipality Size (Pop 1000s)	−2.66e-07***	−2.72e-08***	−1.14e-07*	−1.16e-08*	−1.89e-07**	−1.18e-08**	−9.32e-08	−1.84e-08
	(7.47e-08)	(7.69e-09)	(6.81e-08)	(6.94e-09)	(7.69e-08)	(4.86e-09)	(8.00e-08)	(1.58e-08)
Percentage of Rural Pop in Mun	0.485***	0.050***	0.253***	0.026***	0.340***	0.021***	0.187***	0.037***
	(0.031)	(0.003)	(0.030)	(0.003)	(0.035)	(0.002)	(0.034)	(0.007)
Municipal Migration Rate	−0.079***	−0.008***	−0.061***	−0.006***	−0.043***	−0.003***	−0.093***	−0.018***
	(0.004)	(0.000)	(0.004)	(0.000)	(0.004)	(0.000)	(0.004)	(0.001)
Total Supply of Basic Education	0.000	0.000	−0.004	−0.000	0.004*	0.000*		
	(0.003)	(0.000)	(0.002)	(0.000)	(0.003)	(0.000)		
Total Supply of High Schools	0.141***	0.014***	0.137***	0.014***			0.182***	0.036***
	(0.009)	(0.001)	(0.008)	(0.001)			(0.009)	(0.002)
Constant	3.305***		4.338***		4.392***		3.665***	
	(0.058)		(0.065)		(0.077)		(0.106)	
Obs.	2,664,762	2,664,762	2,664,762	2,664,762	2,057,206	2,057,206	611,450	611,450
Level 2 SD	0.421	0.421	0.381	0.381	0.426	0.426	0.445	0.445
Log-Likelihood	−875,583		−873,398		−496,615		−358,038	
Log-Lik. Ratio test, p-value	0.000		0.000		0.000		0.000	

Note: *, ** and *** denote statistical significance at $p<0.1$, $p< 0.05$ and $p<0.01$ levels, respectively

TABLE 2
Wealth Interactions and Alternative Reference Groups

	RD and standard of living		Alternative reference groups	
	(5) Interaction Wealth	(6) Interaction Top 50%	(7) Municipal + Edu	(8) National + Edu
Asset Index	0.128***		0.189***	0.236***
	(0.004)		(0.003)	(0.003)
Asset Index*RD	−0.039***			
	(0.003)			
Top 50%		0.144***		
		(0.010)		
Top 50%*RD		−0.426***		
		(0.019)		
RD (municipal)	−0.461***	−1.052***		
	(0.022)	(0.011)		
RD (municipal + education)			−0.345***	
			(0.022)	
RD (national + education)				0.025
				(0.024)
Constant	4.396***	5.424***	3.650***	3.288***
	(0.065)	(0.054)	(0.061)	(0.061)
Obs.	2,664,762	2,664,762	2,664,762	2,664,762
Level 2 SD	0.378	0.365	0.403	0.421
Log-Likelihood	−873,282	−873,347	−873,781	−875,578
Log-Lik. Ratio test, p-value	0.000	0.000	0.000	0.000

Note: *, ** and *** denote statistical significance at p<0.1, p< 0.05 and p<0.01 levels, respectively.

All controls included in each model.

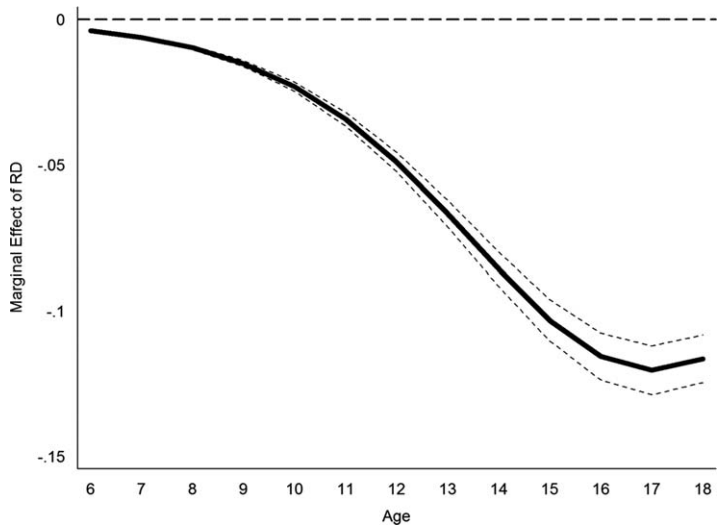

Figure 1. Average marginal effects of RD at different ages

significant, but they are small for young children and their intensity grows considerably with the child's age.

Looking at our control variables, the additional insights which emerge from our regressions relate to both the demand and supply of education. Having a disability decreases the probability of being enrolled in school, as is the case for being indigenous, being older (due to higher opportunity costs of staying in school) having a female as household head (in Mexico this is often equivalent to being a single-mother family), and living in areas with high outward migration (which is likely to decrease the investment in home education); another negative correlate is the number of children in the household, which decreases the amount of resources available for investing in education. Positive correlates are instead mean education in the household, variables related to education supply (expenditure per student and overall schools per child in own and in neighboring municipalities, in particular high schools) and being a girl—which is consistent with the reversal of the educational gender gap in Latin America, see World Bank (2012).

The positive sign for age of the household head with a negative quadratic term suggests that the probability of enrolment increases with age, although at decreasing rates. Using a different nationally representative dataset for Mexico *et al*. (2014) also find that the probability that a child is in school rather than works increases with the age of the household head. The explanation for this evidence lies possibly in the fact that older parents are more mature, or in the longer time older parents spend engaging in educational activities with their children (McWayne and Melzi, 2014). At the same time, this evidence is at odds with the consideration that younger parents are likely to experience the need for an education in the labor market more strongly than older parents, and therefore may be expected to care more about education.

The positive sign for degree of rurality of the municipality suggests that, everything else being equal, the probability of school enrolment increases with the percentage of rural population. This pattern can be made sense of considering the specific focus on rural areas which characterized the educational expansion Mexico went through in the 1970s and 1980s (Santibañez *et al*., 2005),[8] as well as by the significant effects on school enrolment of the Progresa conditional cash transfer program, which starting in 1998 disproportionally targeted rural areas (Attanasio *et al*., 2012). This also tallies with the statistics in UNESCO (2007) for Mexico, showing that for primary schooling there is a higher enrolment rate, as well as a higher annual growth rate of net school enrolment, for rural areas compared to urban areas; as to secondary schooling, enrolment is reported to be higher in urban areas than in rural areas but net enrolment in the latter growing 7.49 percent faster per year.

5.2. *Relative deprivation at different standards of living and for different reference groups*

In this section we provide empirical evidence with respect to two issues discussed in the literature. The first issue relates to the potentially different

[8]In addition to the creation of multi-shift schools and incentives for teachers to increase their salaries, specific actions to boost rural enrolment were also implemented. Multi-grade schools and long-distance "tele-secundarias" were created in the most rural and segregated parts of the country.

importance of relativist concerns at different levels of standards of living. Echoing Maslow's (1943) idea of a hierarchy of needs, relativist concerns have been considered as a sort of luxury good demanded more strongly once a certain level of absolute standards of living is met. This view is supported by a number of empirical studies including Didier and Didier (1995), Ravallion and Lokshin (2010); Corazzini *et al*. (2011, 2012); Akay *et al*. (2012) and Castilla (2012). However, notable exceptions to this evidence are the works of Carlsson *et al*. (2008) and Clark and Senik (2010). As can be seen in Table 2, we explore this issue by interacting relative deprivation first with household wealth and then with a dummy for belonging to the richest 50 percent of the population—specification (5) and (6), respectively. Wealth and relative deprivation keep their previous signs and significance levels. Interaction terms are also highly significant and they are negative, which indicates that the coefficient of relative deprivation becomes increasingly negative at higher standards of living, in accordance with the majority of the literature mentioned above.

The second issue relates to the criteria for the specification of the reference group. Since Hyman (1942), the reference group has been regarded as the set of people exerting a relevant influence on the individual because they are taken as a reference point for evaluating their own situation. Beyond geographical proximity, other criteria adopted for the demarcation of reference groups are socio-demographic lines and "similarities" such as race, gender, religion, education, etc.—see Eibner and Evans (2005) and Bylsma and Major (2010). This is because the sharing of certain socio-demographic characteristics may trigger those mechanisms through which the reference group affects the individual, as described by Deutsch and Gerard (1955); among these are the desire to conform to the expectations of the reference group and the acceptance of the information derived from the reference group as reality. The dynamics leading to the formation of reference groups are complicated—for experimental evidence see McDonald *et al*. (2013) and for survey evidence see Clark and Senik (2010) and Mangyo and Parker (2011) and Serajuddin and Verme (2015). We recalculate the index of relative deprivation according to two alternative specifications of the reference group; first by augmenting the geographical criterion adopted so far with an educational criterion based on average years of schooling for adults in the household, specification (7), and then keeping this educational criterion but removing the geographical one—the geographical scope of the index used in specification (8) is therefore the whole country. Results show that relative deprivation maintains its significance in specification (7), but becomes insignificant in specification (8). This result suggests that adopting reference groups which territorially extend to the whole country may be inappropriate, in particular for large countries such as Mexico.

5.3. *Robustness checks using the Yitzhaki index of relative deprivation*

In this section we run robustness checks using the Yitzhaki index rather than the Esposito index. For the Yitzhaki index, the functional form over the $y_j > y_i$ domain is as follows:

TABLE 3

ROBUSTNESS CHECKS USING THE YITZHAKI INDEX

	(2′) Pooled	(3′) Basic Education Age	(4′) High School Age	(5′) Interaction Wealth	(6′) Interaction Top 50%	(7′) Mun+Edu	(8′) Nat+Edu
Asset Index	0.191***	0.118***	0.239***	0.184***		0.213***	0.234***
	(0.004)	(0.005)	(0.005)	(0.004)		(0.003)	(0.003)
Asset Index * RD Yitzhaki				−0.012***			
				(0.001)			
Top 50%					0.150***		
					(0.009)		
Top 50% * RD Yitzhaki					−0.287***		
					(0.008)		
RD Yitzhaki (municipal)	−0.078***	−0.173***	−0.042***	−0.055***	−0.340***		
	(0.006)	(0.008)	(0.010)	(0.007)	(0.004)		
RD Yitzhaki (municipal + education)						−0.042***	
						(0.006)	
RD Yitzhaki (national + education)							0.003
							(0.005)
Constant	3.700***	4.014***	2.837***	3.795***	5.297***	3.463***	3.297***
	(0.065)	(0.075)	(0.103)	(0.065)	(0.054)	(0.062)	(0.060)
Obs.	2,664,762	2,057,206	611,450	2,664,762	2,664,762	2,664,762	2,664,762
Level 2 SD	0.401	0.432	0.472	0.396	0.373	0.411	0.421
Log-Likelihood	−874,307	−496,934	−358,643	−874,143	−874,594	−873,892	−875,573
Log-Lik. Ratio test, p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Note: *, ** and *** denote statistical significance at $p<0.1$, $p< 0.05$ and $p<0.01$ levels, respectively.
All controls included in each model.

$$D^Y(y_i, y_j) = y_j - y_i. \tag{6}$$

It easy to see that for the Yitzhaki index the magnitude of relative deprivation between individuals i and j is equal to the gap in their achievements. For this index, $\partial D^Y / \partial y_j > 0$ and $\partial^2 D^Y / \partial y_j^2 = 0$, meaning that the marginal effect of an additional unit of income in the reference income is constant at any level of relative deprivation.

As can be seen in Table 3, the behavior of relative deprivation as a correlates of school enrolment found using the Esposito index is confirmed also when the Yitzhaki index is adopted. Relative deprivation is negative and highly significant in specifications (2′)-(7′), but it is not significant in specification (8′) when the reference group is extended to the whole country rather than the municipality.

6. Conclusion

The offer of this paper is twofold. First, we contribute to the study of the relationship between relative deprivation and social outcomes other than subjective wellbeing, happiness or life satisfaction. Using a very large dataset, we present solid evidence of relative deprivation as a negative correlate of school enrolment in Mexico—in this way also contributing to enriching the study of relative deprivation in developing countries. Second, we provide insights on *how* the formation of human capital may be related to distributional issues. In particular, we show how disparities in the distribution of wealth can decrease school enrolment at both low and high levels of absolute wealth, and how these disparities may be particularly detrimental to older children and adolescents. These results hold for indices based on a linear as well as on a less than linear deprivation functions—the latter never used so far as an explanatory variable for social outcomes. While our dataset does not allow us to control for children's abilities or pursue an identification strategy, our literature review illustrates an array of mechanisms suggesting direct and indirect causal effects of relative deprivation on educational outcomes. It is hoped that this work will encourage researchers to shed light on those mechanisms through research designs or panel data enabling a formal study of causation.

Our paper also sends clear messages to policymakers. A specific message is that the role of relative deprivation seems stronger at higher standards of living, and this may potentially offset some of the educational gains related to larger absolute wealth and economic growth. An additional specific message is that the educational toll due to the divide between the "haves" and the 'have-nots' may be greater for teenagers and adolescents, a cohort needing particular attention and possibly tailored socio-educational programs addressing exclusion and isolation. The overall message is, more simply, that an increase in economic disparities is likely to lead to an increase in school dropout rates. This means lower human capital in society, and a bleaker future for us all.

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Supporting Information

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TABLE A1: Descriptive statistics