Whose brighter future?
Parent-bias and investments in children

Pre-analysis plan.

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This document presents the pre-analysis plan of a lab-in-the-field experiment that will be conducted in Salima district of Malawi. This experiment aims at documenting a new form of time-inconsistency: parent-bias. While present-bias characterizes individuals who are over-optimistic about their willingness to allocate resources to delayed consumption in the future, parent-bias characterizes individuals who are over-optimistic about their willingness to allocate resources to their children in the future.
The present document outlines the theoretical model, the experimental design and the econometric methods we will use to document parent-bias as well as its joint distribution with present-bias. Moreover, for each bias, we document the extent to which individuals are sophisticated, or cognizant about their preference reversals and their demand for commitment. Even though both biases predict preference reversals over time, theory predicts that each disease requires a very different remedy. We investigate the extent to which framing interventions – such as labeling consumption – are able to mitigate parent-bias.

I. Introduction

The inability to invest in children's health and education has dramatic consequences on children's lives in developing countries. Under-five mortality rates are still dramatically high in Sub-Saharan Africa, where children are 15 times more likely to die before the age of five than children in developed countries. More than half of these early child deaths are due to conditions that could be prevented or treated if parents invested in preventative health products for their children (WHO, 2017). Nevertheless, households in developing countries typically do not access preventive health care, even when available at low cost (Glennerster and Kremer, 2012). In Malawi for instance, only 8% of children between 6 and 23 months old are fed a diet meeting the minimum acceptable dietary standards (DHS, 2017). 13.5% of children between 6 and 17 years old in poor Malawian households were temporarily withdrawn from school during the 2012-2013 academic year and non-illness related health care was purchased for only 0.7% of

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Malawian children under 10 years old (UNC-CH, CSR-UNIMA and UNICEF, 2014).

Parents' time-preferences seem to be a key mechanism behind under-investment in children's health (Glennerster and Kremer, 2012) and education. While parents' present-biases influences how much they invest in their children's human capital (Ringdal and Sjursen, 2017)) or preventative health care (Tarozzi and Mahajan, 2011; Dupas and Robinson, 2013), there are reasons to believe that other dimensions of time-preferences may have similarly crucial effects. In particular, one tends to have different time-preferences when making decisions for oneself than for others (Barton, 2015). Is it the case that such differences also arise when parents evaluate their own future consumption in contrast to that of their children?

This issue has not been investigated to date. It matters because, even if parents do not display present-bias, they can still display parent-bias: when parents discount children's future consumption by a higher factor than their own future consumption, they plan to allocate a higher share of the household budget to their children's consumption in the future, but systematically reverse those plans when such future arises.

How common is parent-bias? Are parents sophisticated about it? Is there demand for commitment? Do parents choose to involve their children in the decision to counterweight parent-bias? What is the joint distribution of present bias and parent bias? Can behavioral interventions such as labeling overturn preference reversals?

We depart from a simple theoretical model to study those questions. If parents discount their utility of future consumption to a greater extent than that of their children, they will systematically reverse plans to invest more in their children in the future.

This study will document whether parents make plans to invest in their children's in the future, but are tempted to reverse them at the moment the investment needs to be done, favoring their own consumption at the expense of investments in their children. Additionally, we will measure whether parents, at the time of making investment decisions, are aware of the risk that they could change their mind in the future, and demand commitment devices to help them stick to their plans. Answering these questions could contribute to explain why investments in children's health and education are so low. Moreover, it would produce important insights to design cost-effective interventions, such as commitment devices, to reduce the temptation to divert resources away from children.

We present here the design of a lab-in-the-field experiment designed to test the following hypotheses:

1) Do parents discount their own future consumption and that of their children differently?

2) Does this differential discounting give rise to within-household inconsistencies (parent-bias)?

3) Is there demand for commitment devices to help mitigate parent-bias, above and beyond demand for commitment devices that help mitigate classical present-bias?

4) Do parents demand to involve their children in future decisions as a commitment device?

5) Is the demand for commitment explained by parents' beliefs that they might be tempted to change their plans in the future?

6) Can labeling mitigate parent-bias?

7) Can encouraging children to participate in household decisions increase investments in children and mitigate parent-bias?

II. Model

A. General setting

Our intuition departs from a simple three-period model of parental utility maximization. At time $t = 1$, parents do not make any decision but make plans for two future time-periods, $t = 2$ and $t = 3$. At time $t = 2$, parents chose how much to consume (x_2), how much to save (s_2) and how much their children consume (z_t). At $t = 3$, parents chose how much to consume (x_3) and how much their children consume (z_3). This model differs from previous models of parental investments in children in the sense that parents discount their future consumption and that of their children's differently. To illustrate the dynamics of our model in a simplified way, let's start by assuming that the parents make two separate decisions:

- (1) *Inter-temporal decision for oneself*: How much parents want to consume themselves at $t = 2$ and $t = 3$,

- (2) *Within-household allocation*: How parents want to split a given amount of resources in a given time-period between themselves and their child.

Parents have the following discount functions:

- $(1, \beta_a\delta_a, \beta_a\delta_a^2...)$ for their own consumption;

- $(1, \beta_c\delta_c, \beta_c\delta_c^2...)$ for their child's consumption.

Parents have beliefs over their future discount functions:

- $(1, \hat{\beta}_a \delta_a, \hat{\beta}_a \delta_a^2 ...)$;

- $(1, \hat{\beta}_c \hat{\delta}_c, \hat{\beta}_c \hat{\delta}_c^2 ...)$.

Those beliefs imply that parents can have different levels of naiveté:

- Parents can be sophisticated: $\hat{\beta}_a = \beta_a$, $\hat{\beta}_c = \beta_c$, $\hat{\delta}_c = \delta_c$;

- Parents can be fully naive: $\hat{\beta}_a = 1$, $\hat{\beta}_c = 1$, $\delta_a = \hat{\delta}_c$;

- Parents can be partially naive and under-estimate the extent of their time-inconsistencies: $1 > \hat{\beta}_a > \beta_a$, $1 > \hat{\beta}_c > \beta_c$, $\delta_c > \hat{\delta}_c > \delta_a$.

B. *First decision: Inter-temporal decision for oneself*

At $t = 1$ parents optimize:

$$\underset{(x_t)_{t=2,3}, s_2}{\text{Max}} \beta_a \delta_a u(x_2^1) + \beta_a \delta_a^2 u(x_3^1)$$
$$\text{s.t.}$$
$$\begin{cases} x_2 + s_2 \leq y_2 \\ x_3 \leq (1+r) s_2 \\ y_2 = y \end{cases}$$

Where:

$u(x_t)$: parent's utility of consumption at time t;
β_a: quasi-hyperbolic discount factor that the parent uses towards her future consumption;
δ_a : discounting factor that the parent uses towards her future consumption;
r: interest rate on savings.
At $t = 2$ they optimize:

$$\underset{(x_t)_{t=2,3}, s_2}{\text{Max}} u(x_2^2) + \beta_a \delta_a u(x_3^2)$$

Comparing $t = 1$ and $t = 2$ FOCs brings to light time inconsistencies:

- $t = 1$ FOCs: $\frac{u'(x_2^1)}{u'(x_3^1)} = \delta_a (1 + r)$
- $t = 2$ FOCs: $\frac{u'(x_2^2)}{u'(x_3^2)} = \beta_a \delta_a (1 + r)$

If $\beta_a < 1$, respondents will save less for their $t = 3$ consumption when making the choice at $t = 2$ ("x_2^2") than when making the choice at $t = 1$ ("x_2^1"). Those are traditional *present-biases*, emerging from quasi-hyperbolic discounting (Laibson, 1997).

Depending on their level of sophistication,$t = 1$ parents have different beliefs concerning their future allocations, $\hat{x}_2^2$ and $\hat{x}_3^2$. They believe that their $t = 2$ FOCs will be: $\frac{u'(\hat{x}_2^2)}{u'(\hat{x}_3^2)} = \hat{\beta}_a\delta_a(1 + r)$.

- For naive parents: $\hat{\beta}_a = 1$, so $\hat{x}_2^2 = x_2^1$ and $\hat{x}_3^2 = x_3^1$;
- For sophisticated parents:$\hat{\beta}_a = \beta_a$ and $\frac{u'(\hat{x}_2^2)}{u'(\hat{x}_3^2)} = \beta_a\delta_a(1 + r)$;
- For partially naive parents:$1 > \hat{\beta}_a > \beta_a$ and $\frac{u'(\hat{x}_2^2)}{u'(\hat{x}_3^2)} = \hat{\beta}_a\delta_a(1 + r)$.

Would those parents demand commitment to stick to their $t = 1$ plans? Let's assume there exists a commitment contract with direct implementation price p_s which would allow parents to stick to the plans they made at $t = 1$.

$t = 1$ parents will chose to commit to their $t = 1$ plan if:

$$\beta_a\delta_a(u(x_2^1) - u(\hat{x}_2^2)) + \beta_a\delta_a^2(u(x_3^1) - u(\hat{x}_3^2)) > p_s$$

It is easy to see that the right hand side of this equality is equal to 0 for naive parents: they will never chose to commit to their $t = 1$ allocation at a positive price. The WTP for commitment of sophisticated and partially naive parents depends on the shape of their utility function, the value of their discount factors and their beliefs over future discount factors.

If we assume a functional form for the parents' utility function, $u(x) = log(x)$, then the parents' WTP for commitment is given by the following condition:

$$\iff \frac{(1-\hat{\beta_a}\delta_a)^{\delta_a+1}}{\hat{\beta_a}^{\delta_a}} > e^{\frac{p_s}{\beta_a\delta_a}}(1 - \delta_a)^{1+\delta_a}$$

For partially naive parents, the higher $\hat{\beta}_a$, the lower the WTP for commitment. We can identify a cut-off price for sophisticated parents:

$$\frac{(1-\beta_a\delta_a)^{\beta_a\delta_a+\beta_a\delta_a^2}}{\beta_a^{\beta_a\delta_a^2}(1-\delta_a)^{\beta_a\delta_a+\beta_a\delta_a^2}} > e_s^p$$

C. Second decision: Within-household allocation

Parents have to make a plan to split income y_2 and y_3 with their child at $t = 2$ and $t = 3$ but do not have access to a technology to smooth consumption across time-periods. Parents can make this choice at $t = 1$ and $t = 2$, but the choice they make at $t = 2$ is binding for $t = 3$.

At $t = 1$ parents optimize:

$$\underset{(z_t)_{t=2,3},(x_t)_{t=2,3}}{\text{Max}} \beta_a\delta_a u(x_2^1) + \beta_a\delta_a^2 u(x_3^1) + \alpha\beta_c\delta_c v(z_2^1) + \alpha\beta_c\delta_c^2 v(z_3^1)$$

s.t.

$$\begin{cases} z_2 + z_2 \leq y_2 \\ z_3 + z_3 \leq y_3 \\ y_3 = y_2 = y \end{cases}$$

Where:

$v(z_t)$: child's utility of consumption at time t;
α : utility weight that the parent attributes to child's utility (imperfect altruism);
δ_c : discounting factor that the parent uses towards her child's future consumption;
β_c: quasi-hyperbolic discount factor that the parent uses towards her child's future consumption.

At $t = 2$ the parents optimize:

$$\underset{(z_t)_{t=2,3},(x_t)_{t=2,3}}{\text{Max}} u(x_2^1) + \beta_a\delta_a u(x_3^1) + \alpha v(z_2^1) + \alpha\beta_c\delta_c v(z_3^1)$$

Comparing $t = 1$ and $t = 2$ FOCs brings to light time inconsistencies: The $t = 1$ FOCs are:

$$-\ \frac{u'(x_2^1)}{v'(z_2^1)} = \frac{\alpha\beta_c\delta_c}{\delta_a\beta_a} \qquad\qquad -\ \frac{u'(x_3^1)}{v'(z_3^1)} = \frac{\alpha\beta_c\delta_c^2}{\delta_a^2\beta_a}$$

The $t = 2$ FOCs are:

$$-\ \frac{u'(x_2^2)}{v'(z_2^2)} = \alpha \qquad\qquad -\ \frac{u'(x_3^2)}{v'(z_3^2)} = \frac{\alpha\beta_c\delta_c}{\delta_a\beta_a}$$

Comparing those FOCs lead us to make the following observations:

1) The parents' preferred allocation will vary across time as long as $\delta_c \neq \delta_a$, even if $\beta_a = \beta_c = 1$, i.e. even if parents are not present-biased. If $\delta_a < \delta_c$, parents, will plan to allocate more to their children in later time periods and more to themselves in nearer time frames.
2) Even if $\beta_a = \beta_c$, if $\delta_c \neq \delta_a$, parents will renege on their round 1's preferred allocation when making the choice in round 2 again. In particular, if $\delta_a < \delta_c$, they will reallocate more towards their own consumption in round 2 and 3 than what they had initially planned to do. This is what we call *parent-bias*.
3) If $\beta_a \neq \beta_c$: the gap between round 2 and 3 allocations will increase. The reason for this increased gap is that in round 1, parents make decisions for two future allocations, rounds 2 and 3; while in round 2 this decision is made for a decision for a present and a future allocation. This is what we call *within-household present-biases*.

All parents have correct beliefs about their $t = 2$ within-household allocations:

- For all parents: $\frac{u'(\hat{x}_2^2)}{v'(\hat{z}_2^2)} = \frac{u'(x_2^2)}{v'(z_2^2)} = \alpha$

But, parents can have different beliefs about the $t = 3$ allocation they would chose at $t = 2$:

- $\frac{u'(\hat{x}_3^2)}{v'(\hat{z}_3^2)} = \frac{\alpha\hat{\beta}_c\hat{\delta_c}}{\delta_a\hat{\beta}_a}$

For this decision, we assume that parents can be sophisticated along two dimensions:

- They can be sophisticated regarding their present-biases: $\hat{\beta}_c = \beta_c$ and $\hat{\beta}_a = \beta_a$;

- They can be sophisticated regarding the difference between the factors with which they discount their own and their child's future consumption : $\hat{\delta_c} = \delta_c$ and $\hat{\delta_a} = \delta_a$;

Let's assume that for each future period, parents can commit to their $t = 1$ planned allocation for prices p_{w2} and p_{w3} respectively.

$t = 1$ parents will chose to commit to their $t = 2$ planned allocations if:

$$\beta_a\delta_a(u(x_2^1) - u(\hat{x}_2^2)) + \alpha\beta_c\delta_c(v(z_2^1) - v(\hat{z}_2^2)) > p_{w2}$$

Note that this price holds for all parents, irrespective of their sophistication.

Assuming the same marginal utility of consumption for the parent and the child: $u(a) = v(a) = log(a)$, we can derive a willingness to pay for commitment for the second time period:

$$(\frac{(1+\alpha)}{\delta_a\beta_a+\alpha\beta_c\delta_c})^{\beta_a\delta_a+\alpha\beta_c\delta_c}(\delta_c\beta_c)^{\alpha\beta_c\delta_c}(\delta_a\beta_a)^{\beta_a\delta_a} > e^{p_{w2}}$$

If $\delta_c = \delta_a$, the parents are unwilling to pay for commitment.

$t = 1$ parents will chose to commit to their $t = 3$ planned allocations if:

$$\beta_a\delta_a^2(u(x_3^1) - u(\hat{x}_3^2)) + \alpha\beta_c\delta_c^2(v(z_3^1) - v(\hat{z}_3^2)) > p_{w3}$$

Assuming the same marginal utility of consumption for the parent and the child: $u(a) = v(a) = log(a)$, we can derive a willingness to pay for commitment when parents are fully sophisticated regarding their preferences :

$$\delta_a^{\delta_a^2\beta_a}\delta_c^{\delta_c^2\beta_c}(\frac{\delta_c\beta_c\alpha+\delta_a\beta_a}{\delta_c^2\beta_c\alpha+\delta_a^2\beta_a})^{\delta_a^2\beta_a+\alpha\delta_c^2\beta_c} > e^{p_{w3}}$$

Parents who are sophisticated regarding β_a and β_c have the following WTP for commitment to the $t = 3$ allocation:

$$\frac{\delta_a^{\beta_a\delta_a}\delta_c^{2\alpha\beta_c\delta_c}}{\hat{\delta_c}^{\alpha\beta_c\delta_c}}(\frac{\delta_a\beta_a+\alpha\beta_c\hat{\delta_c}}{\delta_a^2\beta_a+\alpha\hat{\delta_c^2}\beta_c})^{\beta_a\delta_a+\alpha\beta_c\delta_c} > e^{p_{w3}}.$$

The WTP for commitment of parents who are sophisticated regarding δ_c but quasi-naive when it comes to β_a decreases the more naive the parents are (ie. the higher $\hat{\beta_a}$):

$$\delta_a^{\beta_a\delta_a}\delta_c^{\alpha\beta_c\delta_c}(\frac{\beta_a}{\hat{\beta}_a})^{\beta_a\delta_a}(\frac{\delta_a\hat{\beta}_a+\alpha\beta_c\delta_c}{\delta_a^2\beta_a+\alpha\delta_c^2\beta_c})^{\beta_a\delta_a+\alpha\beta_c\delta_c} > e^{p_{w3}}.$$

The table below summarizes the WTP for commitment for the inter-temporal and the within-household choices:

$\hat{\beta}_a$ \ $\hat{\delta}_c$	Fully naive	Partially naive	Sophisticated
Fully naive	$p_s = 0$, $p_{w2} > 0$, $p_{w3} = 0$	$p_s = 0$, $p_{w2} > 0$, $p_{w3} > 0$ ($p_{w3} \downarrow$ if $\hat{\delta}_c \downarrow$)	$p_s = 0$, $p_{w2} > 0$, $p_{w3} > 0$ (but low)
Partially naive	$p_s > 0$ ($\downarrow$ if $\hat{\beta}_a \uparrow$), $p_{w2} > 0$, $p_{w3} = 0$	$p_s > 0$ ($\downarrow$ if $\hat{\beta}_a \uparrow$) , $p_{w2} > 0$, $p_{w3} > 0$ ($p_{w3} \downarrow$ if $\hat{\delta}_c \downarrow$)	$p_s > 0$ ($\downarrow$ if $\hat{\beta}_a \uparrow$), $p_{w2} > 0$($\downarrow$ if $\hat{\beta}_a \uparrow$), $p_{w3} > 0$
Sophisticated	$p_s > 0$, $p_{w2} > 0$, $p_{w3} = 0$	$p_s > 0$,$p_{w2} > 0$, $p_{w3} > 0$ ($p_{w3} \downarrow$ if $\hat{\delta}_c \downarrow$)	$p_s > 0$, $p_{w2} > 0$, $p_{w3} > 0$

III. Sample selection

This experiment will be conducted in 80 villages of Salima district in Malawi, with 2,400 participants. As this experiment will be conducted alongside another project's baseline survey, this sample size was based on the power calculations for our other project.

Within each village, our sample is built using a random walk approach: the enumerators assess the eligibility of every 5th or 4th house they encounter in the village while following a pre-determined path.

The households are considered eligible to participate in the experiment if:

1) There is at least one child aged 3-12 in the household,
2) Both parents live in the household,
3) Nobody is allergic to peanuts in the household.

The second criteria was added to guarantee that households in which we interrogate fathers are not on average different from households in which we interrogate mothers.

Only mothers are invited to take part in the experiment in 64 villages. In the remaining 16 villages, we randomly select whether the mother or the father, within the eligible household, will be invited to participate in the experiment. In those villages, we over-sample fathers to ensure that we will have a large enough number of fathers in our experiment. We aim to have 360 fathers in our sample.

If the household has more than one child aged 3-12, we will randomly select which child will be invited to take part in the experiment.

IV. Experimental design

To be able to document the joint distribution of "Traditional" and "Within-household" time-inconsistencies, our experiment follows a three-step data collection process. We ask the parents to split the consumption of a tempting, non-fungible and immediately consumable good (peanuts) between them and their children and across time, cross-randomizing the type of commitment devices which are made available to the households. Our design allows us to observe the parents' plan at $t = 1$, its potential revision at $t = 2$ and the consumption of the good. Peanuts have been chosen because they are a nutritious food that Malawians are familiar with and because they are consumed by both parents and children in Malawi. The experiment took place during the lean season, when the stock of peanuts that households may have had at home from the previous harvest has been depleted. This timing ensures that peanuts are a tempting good.

A. Structure of the experiment

The date of the first visit is randomly assigned to villages. A respondent speaks to a different experimenter in each visit and the visits have been scheduled to take place at a similar time of the day. At the beginning of the first and second visits, the surveyor tells the parents that they are interested in learning about peanut consumption in Malawi and that, depending on the choices they make and a random implementation rule, they and their child may be invited to consume some peanuts and share their thoughts about their experience with the team. Note that informing the respondents from the onset that the peanuts will be consumed in front of the enumerator inform them that, depending on the random implementation rule, the decisions they make are binding.

The respondents are first invited to taste a small quantity of peanuts to ensure that they are making those decisions in a "hot" state.

The respondents are then presented with two different scenarios. The order in which the respondents are presented with the different scenarios will randomly vary.

In scenario Blue, the respondent allocates 3 packets of 15 grams of peanuts between $t = 2$ and $t = 3$, that they will consume themselves. Each packet of groundnuts whose consumption is delayed from $t = 2$ to $t = 3$ yields an interest rate of r. The team presents the different possible allocations to the respondent, who picks one. The respondent has to make this choice for three interest rates: 0.5, 1 and 1.5. A picture of the possible allocations is presented to the respondent to facilitate comprehension. In the framework of our model, this relates to the parent' first decision: they have to chose how much to consume at $t = 2$ and $t = 3$: x_2^1 and x_3^1.

In scenario Red, the respondent allocates 5 packs of groundnuts between themselves and their child to be consumed at $t = 2$ and $t = 3$. This relates to our model's second decision: the parents have a trade-off between their consumption and that of their children at $t = 2$ (x_2^1 and z_2^1) and at $t = 3$ (x_3^1 and z_3^1). To help with this decision, the parents are invited to share 5 packets of peanuts between two plates, one entitled "you, in two days", the other one "Your child in two days". The enumerator records this decision. Then the parents are invited to do the same thing for the $t = 3$ allocation.

In the second visit, the respondents and the children are invited to meet the surveying team separately from the rest of the family. The respondents are invited to taste a small quantity of peanuts first and then asked how they would like to act in both scenarios.

At the end of the second visit, one of those scenarios is implemented according to the following random implementation rule:

1) Scenario Red or Blue is randomly picked,
2) $t = 1$ or $t = 2$ decision is randomly chosen to be executed,
3) If Scenario Blue is chosen, the interest rate that counts is randomly selected.

If scenario Blue is picked: the respondent is given the packets for the day.
If scenario Red is picked: the respondent and the child are given the packets for the day according to the chosen split.

While they eat the peanuts, they are asked a series of questions about peanuts and whether they are appreciating eating them. This ensures that the enumerator will observe the actual peanut consumption and that the respondent's decision has been followed-through.

During the third visit, the peanuts that were allocated to be received on that day are distributed to the respondents and they are asked a series of questions about their peanut consumption to ensure that they are consuming the peanuts in front of the enumerator. At the end of the visit, the parents are also asked a series of survey questions about investments in children and whether they would be interested in a series of commitment devices, such a safe-boxes or a separate meal plan for their child.

V. Treatment arms

The subjects are randomized across treatment arms in two steps:

- They are first allocated to be offered different commitment devices: a "Probabilistic commitment" or "Child's participation (chosen)".

	Type of Commitment *Number of respondents*	
	Probabilistic	Child's participation (chosen)
Total	*2000*	*400*
Women	*1740*	*300*
Men	*260*	*100*

- Subjects allocated to being offered a probabilistic commitment device are then allocated to different framings of choice at $t = 2$:

	Framing *Number of respondents*			
	Baseline	Labeling	Random Anchoring	Child's participation (imposed)
Total	*800*	*400*	*400*	*400*
Women	*696*	*348*	*348*	*348*
Men	*104*	*52*	*52*	*52*

A. Commitment devices

Probabilistic commitment devices

We offer the respondents in those treatment arms a probabilistic commitment device (following Augenblick, Niederle and Sprenger (2015)), which decreases the likelihood that the $t = 2$ allocation is chosen over the $t = 1$ allocation. In other treatment arms or if the respondents do not wish to take up a commitment device, the $t = 1$ decision will be executed with a 10% probablity. If the respondents take up a commitment device, the probability that the $t = 1$ decision will be executed increases to 90%. This allows us to observe both $t = 1$ and $t = 2$ decisions for all respondents, irrespective of commitment and guarantees the credibility of both decisions because the respondents are aware in each round that their decision can be selected to be executed.

The respondents are offered to take up a probabilistic commitment device after making a decision for each scenario during the first visit. We randomly vary the price of the commitment device: to purchase the commitment device, the respondent will have to forego 0.5/1/1.5 packets of peanuts at $t = 3$.

Child's participation (chosen)

We ask respondents in this subsample whether they would like to invite their child to make the $t = 2$ decision for part Red with them. This could be a way for $t = 1$ parents to force their $t = 2$ self to stick to the plan they had made for their child.

We randomly vary the price of this commitment device: to purchase the commitment device, the respondent will have to forego 0/0.5/1/1.5 packets of peanuts at $t = 3$.

B. Framing of choices

Baseline

The enumerators speak to the respondents alone during the second visit. The respondents are invited to taste a small quantity of peanuts at the beginning of the interview, explained the rules of the experiment one more time and asked how they would like to act in each scenario.

Labeling treatment

The enumerators speak to the respondents alone during the second visit. The respondents are invited to taste a small quantity of peanuts at the beginning of the interview, explained the rules of the experiment one more time, presented with the allocation choice they have made in scenario Red at $t = 1$ and asked how they would like to act in each scenario.

Random Anchoring treatment

The enumerators speak to the respondents alone during the second visit. The respondents are invited to taste a small quantity of peanuts at the beginning of the interview, explained the rules of the experiment one more time, presented with a random allocation in scenario Red and asked how they would like to act in each scenario. This treatment arm enables us to distinguish between the effect of labeling itself and of anchoring.

Child's participation (imposed)

During the second visit, the children are asked to participate in part Red decision in this treatment arm. The respondents and the children are invited to taste a small quantity of peanuts at the beginning of the interview, explained the rule of the experiment. The respondent makes a decision on part Blue alone and on part Red jointly with the child. This treatment arm enables us to measure the impact of an increase in the child's bargaining power on parent-bias, without the self-selection inherent to parents having chosen to involve their child as a commitment device.

C. Survey instruments

Naive and sophisticates

Understanding how sophisticated individuals are with regards to their future behavior is key to interpreting the demand for commitment devices. However, incentivizing questions eliciting beliefs about one's own future behavior can lead to changes in this future behavior (Acland and Levy, 2015) or can encourage individuals to use predictions about their own behavior as a commitment device (Augenblick and Rabin, Forthcoming).

To circumvent this problem, we adopt a strategy following closely that of Toussaert (2018). After making a choice for each scenario, respondents are asked an incentivized question eliciting their beliefs about others' behavior:

- *Scenario Blue:* We are asking many other households to make those decisions. Do you think that two days from now most other people will...
  - Choose to receive MORE peanuts immediately than they did today?
  - Choose to receive LESS peanuts immediately than they did today?
  - Choose to receive the same amount of peanuts immediately as they did today?
- *Scenario Red:* We are asking many other households to make those decisions. Do you think that two days from now most other people will...
  - Choose to give LESS peanuts to the child than they did today?
  - Choose to give MORE peanuts to the child than they did today?
  - Choose to give the same amount of peanuts to the child as they did today?

Correctly predicting the behavior of the majority of the population will earn the respondents one additional packet of peanuts at the end of round three.

Those questions are motivated by research that shows that people use information about their own behavior to inform their beliefs about the behavior of others.

People's beliefs about others' future behavior has been proven to correlate highly with beliefs about one's future behavior (Toussaert, 2018).

To assess this last claim in our sample, our survey instruments include unincentivized questions in which the respondent is asked to make prediction about her own behavior. For our incentivized question to be a valid measure of one's sophistication, the answers to both sets of questions must be correlated.

VI. Empirical analysis

1. Do parents discount their own future consumption and that of their children differently?

Hypothesis 1a: Parents discount their own future consumption more than that of their children.

In terms of our model, this is equivalent to testing $\delta_a < \delta_c$. Parents who exhibit such preferences will choose to allocate more to their children in later time-periods. This is equivalent to testing H_0 vs. $H_A : \beta > 0$ in the following regression:

$$s^1_{ji} = \alpha + \beta * Thirdvisit_j + \epsilon_i$$

Where:

- s^1_{ji}, the share of peanuts to be consumed by respondent i's child at $t = j$ ($j \in \{2, 3\}$), when making the decision at $t = 1$;
- $Thirdvisit_j$: Dummy variable equal to 1 if the decision concerns the $t = 3$ allocation, 0 otherwise.

We will pool the observations from all our subsamples except "Child's participation (imposed)" to conduct this analysis. This would allow us to detect a 0.0886 s.d. difference in the share of peanuts allocated to the child at $t = 2$ and $t = 3$. For consistency with the rest of our analyses, we will also conduct the same regression in the "Probabilistic commitment device × Baseline" sample, which would allow us to detect a 0.1402 s.d. difference.

2. Does this differential discounting give rise to within-household inconsistencies (parent-bias)?

Hypothesis 2a: Parents exhibit parent-bias.

If $\delta_c > \delta_a$, parents will reallocate more peanuts towards their own consumption in round 2 than what they had initially planned to do. We will test the presence of parent-bias in our sample by testing $H_0 : \beta = 0$ vs. $H_A : \beta < 0$ in the following regression:

$$s_{2i}^k = \alpha + \beta * Secondvisit_k + \epsilon_i \text{ Where:}$$

- s_{2i}^k, the share of peanuts to be consumed by respondent i's child at $t = 2$, when making the decision at $t = k$, $k \in \{1, 2\}$;
- $Secondvisit_k$: Dummy variable equal to 1 if the decision is taken at $t = 2$, 0 otherwise.

We are testing whether parents allocate a smaller share of peanuts for their children to consume at $t = 2$ when making the decision at $t = 2$ rather than at $t = 1$. We will conduct this regression in the "Probabilistic commitment device $\times$ Baseline" sample, which would allow us to detect a 0.1402 s.d. difference.

Hypothesis 2b: Parents exhibit Within-household Present-Bias.

In terms of our model, if $\beta_a \neq \beta_c$: the gap between round 2 and 3 allocations will increase, depending on whether the parents' decision is made at $t = 1$ or $t = 2$. The reason for this increased gap is that in round 1, parents make decisions for two future allocations, rounds 2 and 3; while in round 2 this decision is made for a present and a future allocation.

We will measure the presence of within-household present-biases by testing $H_0 : \beta = 0$ vs. $H_A : \beta > 0$ in the following equation:

$$\Delta^k s_i = \alpha + \beta * Secondvisit_k + \epsilon_{ik} \text{ Where:}$$

- $\Delta^k s = s_3^k - s_2^k$: the difference between the share of peanuts allocated to be consumed by the child at $t = 3$ and $t = 2$ while making the decision at $t = k$
- $Secondvisit_k$: Dummy variable equal to 1 if the decision was taken at $t = 2$, 0 otherwise.

Additional descriptive statistics: Different types of within-household time-inconsistencies.

We allow for the presence of three different types of parents:

- Parent-biased parents who reallocate more towards their own consumption than they had originally planned, that is, for whom: $s_2^1 > s_2^2$;

- Consistent parents for whom: $s_2^1 = s_2^2$;
- Child-biased parents who reallocate more towards their child's consumption than they had originally planned, that is, for whom: $s_2^1 < s_2^2$.

We will plot the distribution of those three types of parents in our sample.

Additional descriptive statistics: Joint distribution of present-bias and within-household time-inconsistencies.

If $\beta_a < 1$, respondents will choose to receive more peanuts at $t = 2$ when making the choice at $t = 2$ than at $t = 1$ in scenario Blue. To understand the distribution of traditional present-biases, we will test $H_0 : \beta = 0$ vs. $H_A : \beta > 0$ in the following regression:

$$\bar{x}_{2i}^k = \alpha + \beta * Secondvisit_k + \epsilon_i \text{ Where:}$$

- $\bar{x}_{2i}^k = \frac{1}{3} \sum_{r=0.5}^{1.5} x_{2r}^k$, where x_{2r}^k is the number of peanuts allocated to be received in the earlier time period by respondent i when the choice is made at $t = k$ for interest r in scenario Blue.
- $Secondvisit_k$: Dummy variable equal to 1 if the decision is taken at $t = 2$, 0 otherwise.

We will pool the observations from all our subsamples except "Child's participation (imposed)" to conduct this analysis. This would allow us to detect a 0.0886 s.d. difference in the share of peanuts allocated to the earlier time period at $t = 1$ and $t = 2$. For consistency with the rest of our analyses, we will also conduct the same regression in the "Probabilistic commitment device × Baseline" sample, which would allow us to detect a 0.1402 s.d. difference.

We will define a present-biased respondent as a respondent for whom $\bar{x^k}_{2i} > 0$ and will plot the joint distribution of the present-biased and parent/child-biased respondents.

3. Is there demand for commitment devices to help mitigate parent-bias, above and beyond demand for commitment devices that help mitigate present-bias?

Hypothesis 3a: Parents demand commitment devices to help them stick to their within-household allocation plans.

2,000 respondents in our sample are offered a probabilistic commitment device to help them stick to their planned within-household allocation. They are offered this probabilistic commitment device at 3 different prices: 0.5/1/1.5 packets of peanuts. We will plot the demand curve for this commitment device, at different prices.

Hypothesis 3b: The demand for commitment devices to help parents stick to their within-household allocation plans is smaller than the demand for commitment devices to help them stick to their inter-temporal allocations.

The respondents are also offered a probabilistic commitment device to help them stick to their inter-temporal allocation. We will compare the demand for both types of devices by testing $H_0 : \beta = 0$ in the following regression:

$$TookUp_{ci} = \alpha + \beta WithinHousehold_c + \gamma PresentedFirst_{ci} + \epsilon_{ci}$$ Where:

- $TookUp_{ci}$: Dummy variable equal to 1 if respondent i took up commitment device c, 0 otherwise;
- $WithinHousehold_c$: Dummy variable equal to 1 if the commitment device targets the within-household allocation, 0 if it targets the inter-temporal allocation;
- $PresentedFirst_{ci}$: Dummy variable equal to 1 if commitment device c was the first commitment device to be offered to the respondent, 0 otherwise.

We will pool the observations from all our "Probabilistic commitment devices" subsamples except "Child's participation (imposed)" to conduct this analysis. This would allow us to detect a 0.0991 s.d. difference between the take-up of both types of commitment devices. For consistency with the rest of our analyses, we will also conduct the same regression in the "Probabilistic commitment device $\times$ Baseline" sample, which would allow us to detect a 0.1402 s.d. difference.

4. Do parents demand to involve their children in future decisions as a commitment device?

Hypothesis 4: Parents demand to involve their children in future decisions as a commitment device.

400 respondents in our sample are offered the possibility to involve their child in the second round's decision to help them stick to their planned within-household allocation. They are offered this probabilistic commitment device at 4 different prices: free/0.5/1/1.5 packets of peanuts. We will plot the demand curve for this commitment device, at different prices.

5. Is the demand for commitment explained by parents' beliefs that they might be tempted to change their plans in the future?

We will rely on our incentivized measure of beliefs regarding others' behavior to study whether sophistication is driving the demand for different commitment devices.

Hypothesis 5a: Parents who are aware of their own time inconsistencies will have a higher demand for the probabilistic commitment device than parents who are not.

Testing this hypothesis is equivalent to testing $H_0 : \beta_0 = \beta_1 = \beta_2 = \beta_3 = 0$ in the following specification:

$$TookUp_{wi} = \alpha + \beta_0 BeliefParentBias_i + \beta_1 Price_i * BeliefParentBias_i + \beta_2 BeliefChildBias_i + \beta_1 Price_i * BeliefChildBias_i + \beta_4 Price_{ci} + \epsilon_i$$ Where:

- $TookUp_{wi}$: Dummy variable equal to 1 if respondent i took up the within-household probabilistic commitment device ;
- $BeliefParentBias_i$: Dummy variable equal to 1 if respondent i believes that most others will choose to allocate LESS peanuts to their children at $t = 2$ than they did today;
- $BeliefChildBias_i$:Dummy variable equal to 1 if respondent i believes that most others will choose to allocate MORE peanuts to their children at $t = 2$ than they did today;
- $Price_i$: price of the commitment device.

Hypothesis 5b: Parents who are aware of their own parent-bias will have a higher demand to involve their child in the $t = 2$ decision than parents who are not.

Testing this hypothesis is equivalent to testing $H_0 : \beta_0 = \beta_1 = 0$ in the following specification:

$$TookUp_{pi} = \alpha + \beta_0 BeliefParentBias_i + \beta_1 Price_{pi} * BeliefParentBias_i + \beta_2 Price_{pi} + \epsilon_i$$

Where:

- $TookUp_{pi}$: Dummy variable equal to 1 if respondent i chose to involve the child in the $t = 2$ decision;

- $BeliefParentBias_i$: Dummy variable equal to 1 if respondent i believes that most others will choose to allocate LESS peanuts to their children at $t = 2$ than they did today.

6. Can labeling mitigate time-inconsistencies?

Hypothesis 6: Reminding parents of their past choices will decrease time inconsistencies.

Pooling samples from the "Baseline" and "Labeling" treatment arms, we will measure whether labeling help mitigate time-inconsistencies, by testing the null hypothesis $H_0 : \beta = 0$ vs. $H_A : \beta < 0$ in the following econometric specification:

$$\Delta s_{2i} = \alpha + \beta * Labeling_i + \gamma * X_i + \epsilon_i$$

Where:

- $\Delta s_{2i} = s^2_{2i} - s^1_{2i}$: the difference between the share of peanuts allocated to be consumed by the child at $t = 2$ while making the decision at $t = 1$ and $t = 2$;
- $Labeling_i$: Dummy variable equal to 1 if the respondent is in the labeling treatment, 0 otherwise;
- X_i: demographic variables: gender and age of the respondent and of the child.

This sample size enables us to detect a 0.1717 standard deviation decrease in the change of the share of peanuts allocated to the child following the introduction of labeling.

We will also look at the impact of labeling on the prevalence of Parent-bias and Child-bias separately.

Distinguishing between the role of labeling and anchoring

We will distinguish between the role played by labeling and anchoring, by testing the null hypothesis $H_0 : \beta = 0$ in the following econometric specification in the pooled "Labeling" and "Anchoring" samples:

$$\Delta^A s_{2i} = \alpha + \beta * Anchoring_i + \gamma * X_i + \epsilon_i$$

Where:

- $\Delta^A s^2_{2i} = s^2_{2i} - s^A_{2i}$: Value of the difference between the share of peanuts allocated to the child at $t = 2$ and in the allocation presented to the parents;

- $Anchoring_i$: Dummy variable equal to 1 if the respondent is in the anchoring treatment, 0 otherwise;
- X_i: as defined above.

This sample size enables us to detect a 0.1983 standard deviation difference in the distance between the amount of peanuts allocated to the child by the parents at $t = 2$ and in the allocation presented to them.

7. Can encouraging children to participate in household decisions increase investments in children and mitigate parent-bias?

Hypothesis 7a: Making children participate in household decisions increases investments in children We will test this hypothesis by pooling the "Baseline"

and "Child's decision (imposed)" samples and testing $H_0 : \beta = 0 vs. H_A : \beta > 0$ in the following econometric specification:

$$s^2_{2i} = \alpha + \beta_1 * ChildDecision_i + \gamma * X_i + \epsilon_i$$

Where:

- s^2_{2i}: share of peanuts respondents i allocated to be received by the child at $t = 2$ while making the decision at $t = 2$;
- X_i as defined above;
- $ChildDecision_i$: dummy variable equal to 1 if the respondents are allocated to the "Child's decision (imposed)" sample.

This sample size enables us to detect a 0.1717 standard deviation increase in the share of peanuts allocated to the child following the increase in child's bargaining power.

Hypothesis 7b: Making children participate in household decisions decreases reallocation towards parents

We will test this hypothesis by pooling the "Baseline" and "Child's decision (imposed)" samples and testing $H_0 : \beta = 0 vs. H_A : \beta < 0$ in the following econometric specification:

$$\Delta s_{2i} = \alpha + \beta_1 * ChildDecision_i + \gamma * X_i + \epsilon_i$$

Where:

- $\Delta s_{2i} = s_2^2 - s_2^1$, where Δs_2 is the difference between the share of peanuts allocated to the child in the earlier time period when the choice is made at $t = 1$ and $t = 2$;
- X_i as defined above;
- $ChildDecision_i$: dummy variable equal to 1 if the respondents are allocated to the "Child's decision (imposed)" sample.

This sample size enables us to detect a 0.1717 standard deviation decrease in the change in the share of peanuts allocated to the child following the increase in child's bargaining power.

We will also look at the impact of the child's bargaining power on the prevalence of Parent-bias and Child-bias separately.

8. Heterogeneity analysis: do mothers and fathers discount the future differently?

We will look at whether mothers and fathers differ in terms of investments in children on different dimensions:

1) Do mothers plan to invest more in their children in the future? We will test $H_0 : \beta = 0$ in the following specification:

$$s_{2i}^1 = \alpha + \beta * Mother_i + \epsilon_i \text{ Where:}$$

   - s_{2i}^1, the share of peanuts to be consumed by respondent i's child at $t = 2$, when making the decision at $t = 1$;
   - $Mother_i$: Dummy variable equal to 1 if the respondent is a mother, 0 otherwise.

   We will test this hypothesis in our baseline subsample. Our sample size allows us to detect a 0.2949 s.d. difference in the share of peanuts mothers and fathers plan to allocate for their child's $t = 2$ consumption, when making the decisionplan at $t = 2$.

2) Do mothers invest more in the children when the time comes? We will test $H_0 : \beta = 0$ in the following specification:

$$s_{2i}^2 = \alpha + \beta * Mother_i + \epsilon_i \text{ Where:}$$

   - s_{2i}^1, the share of peanuts to be consumed by respondent i's child at $t = 2$, when making the decision at $t = 2$;

- $Mother_i$: Dummy variable equal to 1 if the respondent is a mother, 0 otherwise.

We will test this hypothesis in our baseline subsample. Our sample size allows us to detect a 0.2949 s.d. difference in the share of peanuts mothers and fathers plan to allocate for their chil's $t = 2$ consumption, when making the decision at $t = 2$.

3) Are fathers more time-inconsistent than mothers? We will test $\beta = 0$ in the following specification:

$$\Delta s_2 = \alpha + \beta * Mother_i + \epsilon_i \text{ Where:}$$

- $\Delta s_2 = s_2^2 - s_2^1$, where Δs_2 is the difference between the share of peanuts allocated to the child in the earlier time period when the choice is made at $t = 1$ and $t = 2$.

We will test this hypothesis in our baseline subsample. Our sample size allows us to detect a 0.2949 s.d. difference in the change in the share of peanuts mothers and fathers plan to allocate for their child's $t = 2$ consumption, when making the decision plan at $t = 2$ and $t = 1$.

4) Do mothers demand more commitment devices to stick to their within-household allocation plans? We will test $\beta = 0$ in the following specification:

$$TookUp_{wi} = \alpha + \beta_0 Mother_i + \beta_1 Price_{wi} * Mother_i + \beta_2 Price_{wi} + \epsilon_i$$

Where:

- $TookUp_{wi}$ is equal to 1 if the respondent took up a probabilistic commitment device, 0 otherwise.

We will test this hypothesis in our "probabilistic commitment devices" subsamples. Our sample size allows us to detect a 0.2084 s.d. difference in the take-up of the probabilistic commitment device between mothers and fathers.

5) Do mothers demand to let their children participate in the $t = 2$ decision more? We will test $\beta = 0$ in the following specification:

$$TookUp_{pi} = \alpha + \beta_0 Mother_i + \beta_1 Price_{pi} * Mother_i + \beta_2 Price_{pi} + \epsilon_i \text{ Where:}$$

- $TookUp_{pi}$ is equal to 1 if the respondent took up the child participation commitment device, 0 otherwise.

We will test this hypothesis in our "Child's commitment (chosen)" subsample. Our sample size allows us to detect a 0.3243 s.d. difference in the willingness to let the child participate between mothers and fathers.

VII. Relationship between investments in children and time inconsistencies

This experiment is conducted alongside a baseline survey which enables us to measure investments in children's health and education. In particular, we are interested in the correlation between traditional present-biases and parents-biases with the following indicators of investments in children:

- Index of investments in children's health based on the equally weighted average of z-scores of the following variables:
  - Mean expenses on preventative health-care for children aged 0-12 years old in the 4 weeks before the experiment,
  - Dummy equal to 1 if the child has been vaccinated during the measles and rubella immunization campaign in July 2017,
  - Dummy equal to 1 if the child was given any drug for intestinal worms in the 6 months before the experiment,
  - Dummy equal to 1 if the child was given Multiple Micronutrient powder in the 7 days before the experiment,
  - Dummy equal to 1 if the child was given iron supplements in the 7 days before the experiment,
  - Dummy equal to 1 if the child was given therapeutic food in the 7 days before the experiment,
  - Dummy equal to 1 if the child was given supplementary food in the 7 days before the experiment,
  - Dummy equal to 1 if the child was given a vitamin A dose in the 3 months before the experiment,
  - Dummy equal to 1 if the child has been taken to a well-baby or under-5 clinic for a health check up in the 3 months before the experiment,
  - Dummy equal to 1 if the child has been taken to a well-baby or under-5 clinic for a growth check up in the 3 months before the experiment.
- Index of investments in children's education based on the equally weighted average of z-scores of the following variables:
  - Mean expenses on education for children aged 2-12 years old,
  - Attendance to Early Childhood Development Programmes for children under 6,
  - For children aged 6-18: numbers of days the child attended school in the month before the experiment.

We will look at the average of those two summary variables among present-biased and parent-biased parents.

A. *Randomization and attrition balance*

The variables that will be used in tests of randomization balance and survey attrition are:

1) Gender of the respondent;
2) Religion of the household;
3) Number of children in the household;
4) Household's credit constraints;
5) Age of the selected child;
6) Mean expenses on preventative health-care for children aged 0-12 years old in the 4 weeks before the experiment;
7) An index of investments in children's health (see section VII);
8) An index of investments in children's education;
9) Share of peanuts allocated to children at $t = 2$ in section blue ($t = 1$ decision).

B. *Addressing attrition*

We define attrition, $Attrition_i$, as the fact that a respondent is surveyed at $t = 1$, but not at $t = 2$ or $t = 3$. In the case of survey attrition, all the analyses described in section VI will be restricted to respondents that we observe in all three visits.

We will check for differential attrition using the variables listed above. All our attrition analyses exclude respondents from the "No first visit" treatment arm. Following Gerber and Green (2012), we want to check whether missingness is independent of potential outcomes (MIPO). In that case, our estimates would be unbiased, but our power would be lower. We will investigate whether MIPO holds, conditional on variables 1 to 10 listed above, testing the null hypothesis $H_0 : \beta = 0$ in the following equation:

$$Y_{i1} = \alpha + \beta * Attrition_i + \gamma * X_{i1} + \epsilon_i$$

Where:

- Y_{i1}: baseline outcome variable:

  - Quantity of peanuts choosen to be received at $t = 2$ in section A ($t = 1$ decision);
  - Quantity of peanuts choosen to be received at $t = 2$ in section B ($t = 1$ decision);
  - Share of peanuts allocated to parents at $t = 2$ in section C ($t = 1$ decision).

- X_{i1}: vector of respondent's characteristics: variables 1-10 listed above.

To evaluate whether the magnitude of attrition differs according to treatment arms, we test the null hypothesis : $H_0 : \beta_1 = ... = \beta_4 = 0$ in the following econometric specification:

$$Attrition_i = \alpha + \sum_{j=1}^{4} \beta_j * Treatment_j + \epsilon_i$$

Where:

- $Treatment_1$= 1 if the respondent is allocated to treatment arm " Child's participation (chosen)", 0 otherwise;
- $Treatment_2$= 1 if the respondent is allocated to treatment arm "Probabilistic $\times$ Baseline", 0 otherwise;
- $Treatment_3$= 1 if the respondent is allocated to treatment arm "Probabilistic $\times$ Labeling", 0 otherwise;
- $Treatment_4$= 1 if the respondent is allocated to treatment arm "Probabilistic $\times$ Random anchoring", 0 otherwise;

Finally, we will test whether attrited households had different baseline characteristics in different treatment groups. We will test the null hypothesis: $H_0 : \beta_1 = ... = \beta_4 = 0$ in the following econometric specification among attrited households :

$$Y_i|_{Attrition_i=1} = \alpha + \sum_{j=1}^{4} \beta_j * Treatment_j + \epsilon_i$$

If we find that attrition is non-negligible, we will use bounds following the methodology described in Lee (2009) in our assessment of the impact of labeling and all the regressions described above.

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