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August 2022

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Robert Lensink



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Belief-based poverty traps and the effects of material and psychological development interventions

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Belief-based poverty traps and the effects of material and psychological development interventions

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We study how development interventions can affect economic outcomes via agency beliefs. We model an agent who is uncertain about her agency, and focus on the situation that the agent underestimates her agency. Material development interventions increase the agent's initial wealth, but may negatively affect her beliefs about her agency, thus decreasing effort and final wealth, and potentially generating a belief-based poverty trap. Instead, psychological interventions can increase beliefs about agency, thus turning the effect on effort and final wealth. A combination of both interventions can combine the positive effects of increased initial wealth and increased agency beliefs. (*JEL* O12, D91, F35)

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I. Introduction

While the number of people living in poverty has dropped in the last decade, still approximately 10% of the world population is suffering from extreme poverty by surviving on less than \$1.90 per day (Development Initiatives, 2021). In several regions, especially in South Asia and sub-Saharan Africa, poverty has persisted and has remained a wide-spread and enduring problem.

Consequently, studies that examine the causes of poverty and/or suggest appropriate policies to reduce poverty in the world continue to be a top priority. The empirical literature on aid effectiveness is highly controversial, though. Some studies point at positive effects of aid (e.g. Arndt, et al., 2010; Qian, 2015; Galiani et al., 2016; Addison et al., 2017). Several studies suggest that many development interventions do not reach their intended results (e.g. Rajan and Subramanian 2008; Doucouliagos and Paldam, 2009; Easterly, 2009). Some papers even suggest that foreign aid has negative effects, using macro level explanations, such as corruption and the existence of an “aid curse” (e.g. Djankov et al., 2008).

The aim of the paper is to theoretically study the effectiveness of development interventions from a micro-level, behavioral perspective. We develop a model in which agents are uncertain about their own abilities to realize better outcomes, henceforth referred to as agency, and we focus on the situation that they underestimate their agency. We distinguish between the impact of material development interventions and psychological development interventions, and examine how these policies affect effort¹ and wealth. Material development interventions relieve constraints that are “external” to the individual, for example by providing cash, but may

¹ In this paper, we broadly interpret effort as the amount or intensity of non-monetary investments in producing better economic outcomes. Examples may include the level of education completed, the hours worked, the number of business ideas explored or the amount of preventative health measures taken.

be interpreted by recipients as a negative signal about their own agency. In this way, material interventions may negatively affect the individual's beliefs in agency, and consequently negatively affect effort and final wealth. While evidence on the (negative) psychological consequences of material development interventions is still limited, an increasing amount of studies indicate that material interventions can negatively affect beliefs and/or related psychological outcomes. For example, giving children shoes that were not directly needed led to feelings of dependency on aid from outsiders (Wydick et al, 2018), and receiving money from a higher socio-economic status individual led to feelings like embarrassment and shame (Sandstrom et al., 2019). Instead, a (costly) psychological development intervention that does not relieve “external” constraints, but aims to reduce constraints that are “internal” to the individual, may be interpreted as a signal that actual agency is higher than expected, and therefore positively affect the individual's agency beliefs, and consequently effort. For example, a self-efficacy training led to increased self-efficacy and employment among women in India (McKelway, 2021); a psychological training program designed to improve self-image among sex workers in India increased their self-efficacy, health-seeking behavior and savings (Ghosal et al., 2022); and an intervention that explicitly addressed aspirations, perceived pathways and perceived agency increased perceived agency 12 months after the intervention (Rojas Valdes et al., 2022).² We also show that psychological interventions can undo the negative effects of material interventions, so that a combination of material and psychological interventions can lift both material and psychological constraints, which becomes important if lifting just psychological constraints improves outcomes insufficiently.

² In a different context, Darolia and Wydick (2011) show that altruistic parents affect their children's self-esteem, effort and performance by providing encouragement and assistance.

The idea that agency beliefs can be distorted is central to this paper. We argue that learning about agency can be limited, and that agency beliefs may be distorted as a result, for a number of reasons. First, poor households typically have limited resources to experiment with new options and risk losing investments (Bryan, Chowdhury and Mobarak, 2014). Second, the effects of effort may not be immediate, but may take years. This holds, for example, for the returns to education (Jensen, 2010). Third, it may be challenging for people to keep track of outcomes, for example for microenterprises operating in cash environments (De Mel, McKenzie and Woodruff, 2009). Fourth, there may be barriers to the use of information, for example because individuals are illiterate, innumerate or unable to use information technology (Aker, Ksoll and Lybbert, 2012). Fifth, it may be difficult to causally attribute changes in outcomes to investments. In agriculture, for example, it is often challenging to distinguish the result of efforts from the impacts of weather conditions on a specific plot. Sixth, agency beliefs may be distorted due to psychological factors like depression (de Quidt and Haushofer, 2016, 2019). Finally, even if one has learned the results of effort, contexts are changing, so that previous results may not be valid anymore (Lobell, Schlenker and Costa-Roberts, 2011).

The results of this study imply that it is crucial to assess the psychological effects of material development interventions. One way to avoid negative psychological effects may be to focus on interventions that do not directly improve the beneficiaries' situations, but improve the conditions for them to improve their situations themselves (Bernard et al., 2017); or prevent their situations to degrade after a crisis (O'Toole et al., 2004). However, in case the psychological effects of a material interventions are negative, one may supplement the intervention with a psychological intervention that turns the negative signal of the material intervention into a positive signal of the combined intervention. This may involve, for example, providing information about actual agency (Dupas, 2011; Jensen, 2010), where relevant specifically tailored to the individual's situation (Jalan and Somanathan, 2008; Tjernström);

allowing self-experimentation (Lybbert, Frattarola Hernández and Correa, 2021); helping to process information (Hanna, Mullainathan, Schwartzstein, 2014); priming with good experiences (Munro, D’Exelle and Verschoor, 2019); helping to recall personal experiences that made people feel successful (Hall, Zhao and Shafir, 2014); or providing an aspirational intervention that also addresses perceived agency (Rojas Valdes et al., 2022). In combination with a material intervention, a psychological intervention may also involve using agency-strengthening framing of the material intervention (Thomas et al. 2020) or explicitly allowing the talents and efforts of beneficiaries to flourish (Blattman, Fiala and Martinez, 2014). Importantly, according to our model’s logic, the recipient should believe that she³ is offered this psychological intervention, because she actually has higher agency than previously believed.

This paper contributes to three literatures. First, this paper builds on various strands of literatures on the importance of internal, psychological constraints to development, both in economics and psychology (Duflo, 2012, 2013). Appadurai (2004) and Ray (2006) introduced the importance of aspirations in the economic literature. Appadurai (2004) argued that aspirations are determined in interaction with others. Ray (2006) developed the idea of an *aspirations window*, i.e. the standard of living that an individual aspires. He also argued that the difference between the aspired and current standard of living, the so-called *aspirations gap*, affects behavior. Increasing aspirations can spur development and help people escape from a poverty trap (Dalton, Ghosal and Mani, 2016), but if they are raised too much they may become frustrated (Ray, 2006; Genicot and Ray, 2017; La Ferrara, 2019). Indeed, both positive economic effects and frustration effects have been found in empirical studies on aspirational

³ While our model is not specific to one gender, for ease of expression and because this paper is the result of a project on women empowerment, we consistently refer to a female agent.

interventions (Bernard et al. 2014; Aguinaga et al., 2019; Lubega et al. 2021; McKenzie et al. 2022; Riley, 2022). Our paper contributes to this literature by studying the economic effects that development interventions may indirectly have via beliefs about agency, a complementary psychological aspect that may drive economic outcomes – even when increasing aspirations would lead to aspirations failure.

An influential strand of literature in psychology derives from Snyder (2000, 2002). Snyder has developed hope theory that emphasizes that a determined movement towards a goal or aspirations requires that an individual (i) visualizes *pathways* towards this goal, and (ii) believes to have agency to follow the pathways towards the goals. Lybbert and Wydick (2018) used Snyder’s theory to construct an economic model, in which aspirations form a reference point in the utility function, and pathways and agency are modelled by means of (constraints on) a production function. While this model provides a valuable framework to analyze psychological and economic interventions, aspirations, pathways and agency are all exogenous. Our paper contributes by zooming in on the role of agency, and fundamentally differs from Lybbert and Wydick (2018) by making agency endogenous with respect to development interventions.

An even older strand of literature in psychology developed the notion of “self-efficacy”. Self-efficacy refers to “*the beliefs in one’s capabilities to organize and execute the courses of action required to produce given attainments*” (Bandura 1997, p.3), and is consistently shown by a vast amount of empirical studies to contribute to aspirations, motivations and performance (Bandura and Locke, 2003).⁴ Self-efficacy, based on cognitive psychology, is defined as a

⁴ Bandura (1997) points at four sources of self-efficacy: (1) Mastery Experiences: self-efficacy may increase if somebody is successful in completing a task; (2) Vicarious Experiences: self-efficacy can be increased by observing role models with a similar cultural and/or economic background; (3) Verbal Persuasion: self-efficacy

cognitive bias, and thus differs from one’s actual ability to deal with a task or situation. Actual and perceived abilities may even diverge enormously, which is signaled by the fact that behavior of capable and competent people may be constrained by feelings of inefficacy, an issue we will explicitly address in our model. A major assumption in our model is that perceived abilities may differ from actual abilities: the agent is uncertain about her abilities, and forms expectations about them. We argue that development interventions can affect the agent’s perceived abilities if the agent perceives the intervention as a signal about her abilities, and thus may induce an update of the recipient’s belief about her uncertain abilities. The adjustment of these beliefs will affect effort and final wealth. Like perceived agency, self-efficacy refers to a perception about one’s own abilities, but self-efficacy is typically assumed to be more domain-specific (Wuepper and Lybbert, 2017). Since in our model beliefs about ability are not specific to one domain, we will henceforth consistently use the term “perceived agency” to refer to one’s perceived abilities, and “expected agency” when we explicitly refer to beliefs in the context of uncertainty about abilities. However, as our model can also be applied to a specific domain, one may also read “self-efficacy” instead.

Secondly, this paper contributes to the literature on poverty traps, which argues that households for a variety of reasons can be *trapped* in a low poverty equilibrium (Ravallion, 2016, Box 1.6; Barrett et al., 2019).⁵ Economists have considered a wide range of constraints that may create

may be increased by important people in somebody’s life; and (4) Emotional & Physiological States: self-efficacy can be affected by your own situation, e.g. if somebody is depressed, her self-efficacy may be negatively affected.

⁵ In the literature there is a discussion about the empirical existence of poverty traps. Kraay and McKenzie (2014) argue that the evidence suggests that in practice poverty traps are rare. However, they acknowledge that even if poverty traps are rare in practice, they can exist. Moreover, poverty traps may be very difficult to detect with quantitative economic data: “Just because you can’t see it does not mean it is not there” (Ravallion, 2016, Box 8.16). Most importantly, even if in practice poverty traps are not that prevalent, poverty trap models have been

poverty traps at the individual level, such as malnutrition (Dasgupta and Ray, 1986), credit market imperfections combined with technological non-convexity (Banerjee and Newman, 1991, 1993; Galor and Zeira, 1993; Barham et al., 1995), and geographic externalities (Jalan and Ravallion, 2002), all of which are external to the individual.⁶ The studies that are most relevant for our study are exploring “behavioural” poverty traps, where poverty reduces some aspects of the cognitive and socioemotional skills that determine decisions of the agent, which in turn perpetuates the situation of poverty. These studies are very much influenced by the anthropological and psychological literature surveyed above, and primarily focus on constraints that are “internal” to the agent. Banerjee and Mullainathan (2010), for instance, explain a poverty trap by assuming that the fraction that is spent on temptation goods, rather than on nontemptation goods, is declining in the level of consumption. They show that the implication may be that the poor stay poor as they are present-biased and not willing to invest in high-return investments. Bernheim et al. (2015) develop a model to show that poverty traps may be related to self-control problems. The model suggests that self-control problems are related to low initial wealth, while high initial wealth may induce self-control. Moav and Neeman (2012) explain the existence of a poverty trap by arguing that poor people spend a higher fraction of their income on conspicuous consumption than rich people in order to signal success. The papers that are most related to our model are Dalton et al. (2016) and De Quidt and Haushofer (2016, 2019). Dalton et al. (2016) present a theoretical framework in which poverty may cause an aspiration failure, and consequently a behavioral poverty trap. De Quidt

extremely useful to better understand what the returns are of different types of interventions, and which barriers cause low growth. The existence of poverty traps is not necessary for our results on the impacts of aid.

⁶ There are also papers that explain poverty traps at the *country level* such as Bardhan (1997) who surveys the literature on corruption and growth.

and Haushofer (2016, 2019) argue that poverty traps can be caused by pessimistic beliefs (depression) about returns to individual efforts. Our study differs from these studies by arguing that agency may be distorted for a variety of reasons, and that development interventions may affect agency beliefs, and even exacerbate behavioral biases. Thus, our paper sheds further light on belief-based behavioral poverty traps, and studies how such a poverty trap may be sustained or even be created by material development interventions, although in our model negative effects of aid can also occur outside poverty traps. Our behavioral poverty model is unique in showing that externally increasing wealth may under certain conditions actually hurt development.

Finally, this paper builds on the literature on informational frictions about the returns to investments. Such frictions have been found for the returns to, amongst other things, preventative health measures (Dupas, 2011; Jalan and Somanathan, 2008); education (Jensen, 2009; Dizon-Ross 2019); labor (Chetty and Saez, 2013; Wiswall and Zafar); and agricultural technology (Magruder, 2018; Tjernström, Lybbert, Frattarola Hernández and Correa, 2021). Our paper links informational frictions to poverty traps, and argues that material development interventions may provide signals about actual returns to investments, either unintentionally or intentionally, and either negative or positive. Material development interventions may thus increase or decrease informational frictions.

We proceed as follows. Section II introduces a model in which effort, agency and initial wealth are complements, and in which the agent is uncertain about her agency. It then derives the baseline equilibrium, and shows how low agency beliefs can cause a behavioral poverty trap. Section III analyzes how material and psychological development interventions can affect effort and final wealth via an individuals' belief in her agency. Section IV concludes.

II. Agency beliefs and poverty

In this Section, we will introduce a model in which effort, material endowments and agency are strategic complements. The agent is uncertain about her actual agency. We focus on the situation that the agent underestimates her agency, and derive baseline levels of effort and final wealth.

Basic model

Following Dalton, Ghosal and Mani (2016) we assume that utility is increasing in final wealth and decreasing in effort:

$$u(e, \pi, \theta) = \theta(e, \pi) - c(e) \quad (1)$$

Where e represents effort, π denotes agency, θ represents final wealth and $c(e)$ is the cost of effort.⁷

We continue to follow Dalton, Ghosal and Mani (2016) by assuming that final wealth θ is proportional to initial wealth θ_0 , where the factor of proportionality is determined by effort. In addition, we follow Sachs (2005), and assume that final wealth will decrease with the basic needs of living $K \geq 0$:⁸

$$\theta(e, \pi) = (1 + \pi(e))\theta_0 - K \quad (2)$$

where $\pi(e)$ measures how an agent's effort affects final wealth.

⁷ Dalton, Ghosal and Mani (2016) also include a term for aspirations. We do not need aspirations in our model, so we left this out.

⁸ Since the basic needs reduce final wealth, they allow the agent to end up in a poverty trap. Alternative ways to model poverty traps would be to assume depreciation of wealth or discrete effort choice (Dalton, Ghosal and Mani, 2016). With either of these options, our model yields similar results.

We differentiate between actual and perceived agency to change final wealth. We assume that actual agency (henceforth, the actual agency function) is linearly increasing in effort, i.e.

$$\pi_a(e) = \pi_H e \quad (3)$$

where π_H denotes high agency.

We also assume that perceived agency (henceforth, the perceived agency function) is linearly increasing in effort. However, we follow Lybbert and Wydick (2018) and assume that the agent beliefs that there may be a kink at some effort level $e_0 \geq 0$:

$$\pi_p(e) = \begin{cases} \pi_H e & \text{if } e \leq e_0 \\ \pi_H e_0 + \pi_1(e - e_0) & \text{if } e > e_0 \end{cases} \quad (4)$$

where π_1 is the agency beyond the effort level e_0 .

We assume that the parameters π_H and e_0 are fixed and known to the individual, so that actual and perceived agency match until the point e_0 . The motivation for this is that until some effort level e_0 , the agent may have obtained decent information from their own past experiences and those of their peers. However, beyond common effort levels, the agent may not have such information and is uncertain about her abilities:⁹

$$\pi_1 \in \{\pi_L, \pi_H\} \quad (5)$$

with $\pi_H > \pi_L \geq 0$ and prior belief $0 < \Pr[\pi_1 = \pi_H] < 1$, so that at effort level e_0 the perceived agency function becomes less steep in expectation, meaning that the agent underestimates her actual agency.

⁹ The kink in the perceived agency function (i.e. $e_0 > 0$) is not necessary to obtain our results.

We assume that $c(e)$ is continuously differentiable, strictly increasing and convex in effort e , and $c(0) = 0$.

We define $e_a^* \equiv \arg \max_{e \geq 0} u(e, \pi_a, \theta)$ as the optimal effort level given the actual agency function. We further define $e_p^* = \arg \max_{e \geq 0} E[u(e, \pi_p, \theta)]$ as the optimal effort level given the perceived agency function and the prior belief $0 < \Pr[\pi_1 = \pi_H] < 1$, and $\theta^* \equiv \theta(e_p^*, \pi_a)$ as the actual final wealth given e_p^* .

Finally, we want to focus on situations where beliefs about π_1 are relevant. In our set-up, beliefs are relevant if and only if optimal effort $e_a^* > e_0$. For $e \leq e_0$, the marginal final wealth equals $\pi_H \theta_0$ and the marginal cost of effort equals $c'(e) \leq c'(e_0)$. To make the model interesting, we thus assume that $\pi_H \theta_0 > c'(e_0)$.

Baseline levels of effort and final wealth

Given this set-up, the agent faces the following optimization problem:

$$\max_{e \geq e_0} E[u(e, \pi_p, \theta)] = E[\theta(e, \pi_p)] - c(e) = (1 + \pi_H e_0 + E[\pi_1](e - e_0))\theta_0 - c(e) \quad (6)$$

Setting the first-order derivative with respect to e equal to zero yields the following first-order condition:

$$E[\pi_1]\theta_0 = c'(e) \quad (7)$$

If the marginal expected final wealth $E[\pi_1]\theta_0$ exceeds the marginal cost of effort in point e_0 , then there is a unique interior solution $e_p^* > e_0$ (see Figure 1). Otherwise, there is a unique corner solution $e_p^* = e_0$.

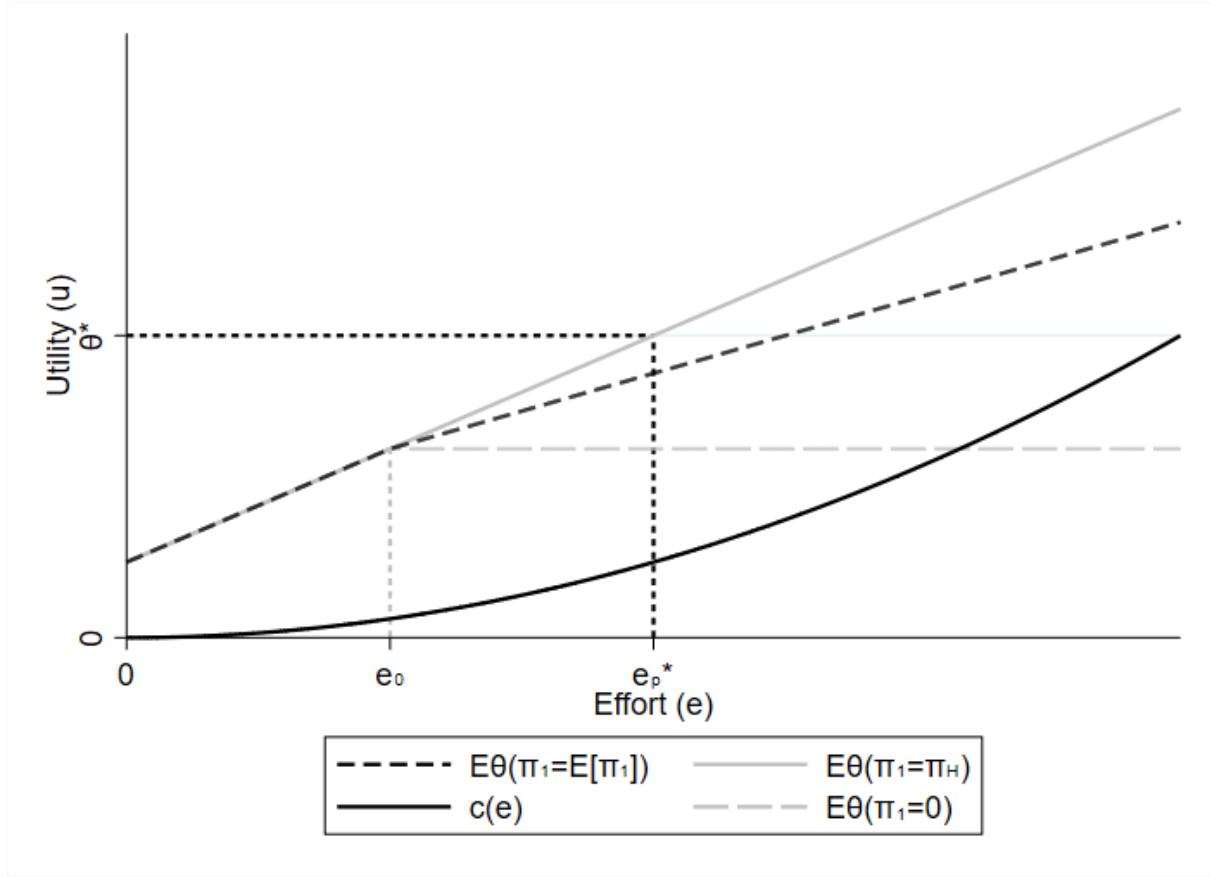


Figure 1. Maximizing expected utility, while underestimating agency.

Note: The individual's expected agency $E[\pi_1]$ with $\pi_0 > E[\pi_1] > \pi_L = 0$ is indicated by the black dashed line, and actual agency π_1 is indicated by the grey solid line. For ease of representation, but without loss of generality, we assume in this and other figures that the basic costs of living $K = 0$. The individual maximizes her expected utility where marginal expected final wealth (the slope of the black dashed line) equals the marginal cost of effort (the slope of the black solid curve). Actual final wealth can be found by going up to the solid grey line.

Belief-based poverty traps

Like aspirations in Dalton, Ghosal and Mani (2016), low agency beliefs can catch poor individuals in a behavioral poverty trap, in our case belief-based. We will now show how.

An external poverty trap occurs if initial wealth θ_0 is so low that final wealth is lower than initial wealth if one chooses the $e = e_a^*$:

$$\theta(e_a^*, \pi_a) < \theta_0 \quad (8)$$

$$(1 + \pi_H e_a^*)\theta_0 - K < \theta_0 \quad (9)$$

$$\theta_0 < \frac{K}{\pi_H e_a^*} \quad (10)$$

Thus, agents with low initial wealth θ_0 are caught in an external poverty trap that can be relieved only by exogenously increasing initial capital.

However, even if inequality (10) does not hold, the agent's final wealth will be lower than initial wealth given $e = e_p^*$ if:

$$\theta(e_p^*, \pi_a) < \theta_0 \quad (11)$$

$$(1 + \pi_H e_p^*)\theta_0 - K < \theta_0 \quad (12)$$

$$\theta_0 < \frac{K}{\pi_H e_p^*} \quad (13)$$

In this case, we have that a combination of low expected agency $E[\pi_1]$ and intermediate initial wealth θ_0 causes the agent to exert low effort $e_p^* < e_a^*$ and stay with low final wealth $\theta(e_p^*, \pi_a) < \theta_0$. The agent is now caught in a belief-based poverty trap, because high effort is optimal and higher expected agency $E[\pi_1]$ would lead the agent to choose high effort and reach better outcomes.

This belief-based equilibrium may be sustained by limited updating of beliefs, which may occur for a few reasons. First, as long as the agent does exert low effort, she will not observe the effects of higher effort. Second, a rational agent with sufficient available resources could sometimes try higher effort levels in order to learn about its effects, but then faces the same

challenges that caused beliefs to be distorted in the first place (see Introduction), so that learning is difficult and experimenting may not be worth the risk of losing investments. Third, even if learning would be possible, previous bad experiences may lead people to stop exploring, a phenomenon that is called learned helplessness (de Quidt and Haushofer, 2016).

III. Effects of development interventions

In this section, we revert back to our basic model. We will study how development interventions affect aspirations and final wealth. We will first study the effects of material interventions that increase the initial wealth, but may decrease expected agency. We then study the effects of psychological interventions that increase expected agency. Finally, we study under what conditions a combination of both interventions combines the best of both.

We argue that development interventions can affect the agent's beliefs about her agency if the agent perceives the intervention as a signal about her agency. Such a signal might be hidden in the targeting or the nature of the intervention. Specifically, the agent may believe that she is either more or less likely to receive the intervention if she has high agency.

Material interventions

First, consider a material intervention M that increases the endowment θ_0 . Such an intervention has three effects on final wealth:

1. It directly increases final wealth via θ_0 in equation (6) (the level of the solid line in the graphs).
2. It increases the marginal effect of effort via θ_0 in equation (7) (the slope of the solid line in the graphs), and thus increases effort and final wealth.
3. It may affect perceived agency, either decreasing or increasing effort and final wealth.

We discuss this third mechanism in more detail. Conditional on receiving the material intervention M , the posterior expected agency $E[\pi_1|M]$ equals:

$$E[\pi_1|M] = \pi_L + (\pi_H - \pi_L)\Pr[\pi_1 = \pi_H|M] \quad (14)$$

Following de Quidt and Haushofer (2016) and Wuepper and Lybbert (2017), we use Bayesian updating to obtain the posterior agency beliefs, and have that the posterior probability $\Pr[\pi_1 = \pi_H|M]$ equals:

$$\Pr[\pi_1 = \pi_H|M] = \frac{\Pr[M|\pi_1 = \pi_H]\Pr[\pi_1 = \pi_H]}{\Pr[M|\pi_1 = \pi_L]\Pr[\pi_1 = \pi_L] + \Pr[M|\pi_1 = \pi_H]\Pr[\pi_1 = \pi_H]} \quad (15)$$

If the individual is more likely to receive the material intervention if she has high agency than if she has low agency, i.e. $\Pr[M|\pi_1 = \pi_H] > \Pr[M|\pi_1 = \pi_L]$, then the material intervention increases her expected agency $E[\pi_1|M] > E[\pi_1]$, so that effort increases unambiguously.

If, however, the individual is more likely to receive the material intervention if she has low agency than if she has high agency, i.e. $\Pr[M|\pi_1 = \pi_L] > \Pr[M|\pi_1 = \pi_H]$, then the material intervention decreases expected agency, $E[\pi_1|M] < E[\pi_1]$.

Then, we can distinguish three cases for the net effect on effort:

A. If the increase in endowment $\Delta\theta_0$ is large relative to the decrease in expectations

$E[\pi_1] - E[\pi_1|M]$, then we will have a unique interior solution $e_p^{**} > e_p^*$.

B. If the increase in endowment $\Delta\theta_0$ is medium relative to the decrease in expectations

$E[\pi_1] - E[\pi_1|M]$, then we will have a unique interior e_p^{**} with $e_p^* \geq e_p^{**} > e_0$.

C. If the increase in endowment $\Delta\theta_0$ is small relative to the decrease in expectations

$E[\pi_1] - E[\pi_1|M]$, then we will have a unique corner solution $e_p^{**} = e_0$ and $\theta^{**} \equiv$

$\theta(e_p^{**}, \pi_a) = (1 + e_0)(\theta_0 + \Delta\theta_0)$.

This leads us to distinguish three cases for the total effect on final wealth:

- I. The direct effect of the increase in endowment (1) and the net effect of the two indirect effects via effort (2 and 3) are both positive ($\Pr[M|\pi_H] > \Pr[M|\pi_L]$ or case A), so that final wealth $\theta^{**} \equiv \theta(e_p^{**}, \pi_a) > \theta^* \equiv \theta(e_p^*, \pi_a)$.
- II. The direct effect of the increase in endowment (1) dominates the negative net effect of the two indirect effects via effort (2 and 3, case B or C), so that we still have that $\theta^{**} \equiv \theta(e_p^{**}, \pi_a) > \theta^* \equiv \theta(e_p^*, \pi_a)$.
- III. The direct effect of the increase in endowment (1) is dominated by the negative net effect of the two indirect effects via effort (2 and 3, case B or C), so that final wealth $\theta^{**} \equiv \theta(e_p^{**}, \pi_a) < \theta^* \equiv \theta(e_p^*, \pi_a)$.

Case III is an important insight of our model: even though a material intervention M increases the initial wealth, its total effect on final wealth can be negative if the intervention undermines the agent's belief in her own agency. An example of this case is illustrated in Figure 2 with $\Delta\theta_0 \rightarrow 0$ and $E[\pi_1|M] \rightarrow \pi_L = 0$. We provide an example of cases I and II with large $\Delta\theta_0$ in Figure 3.

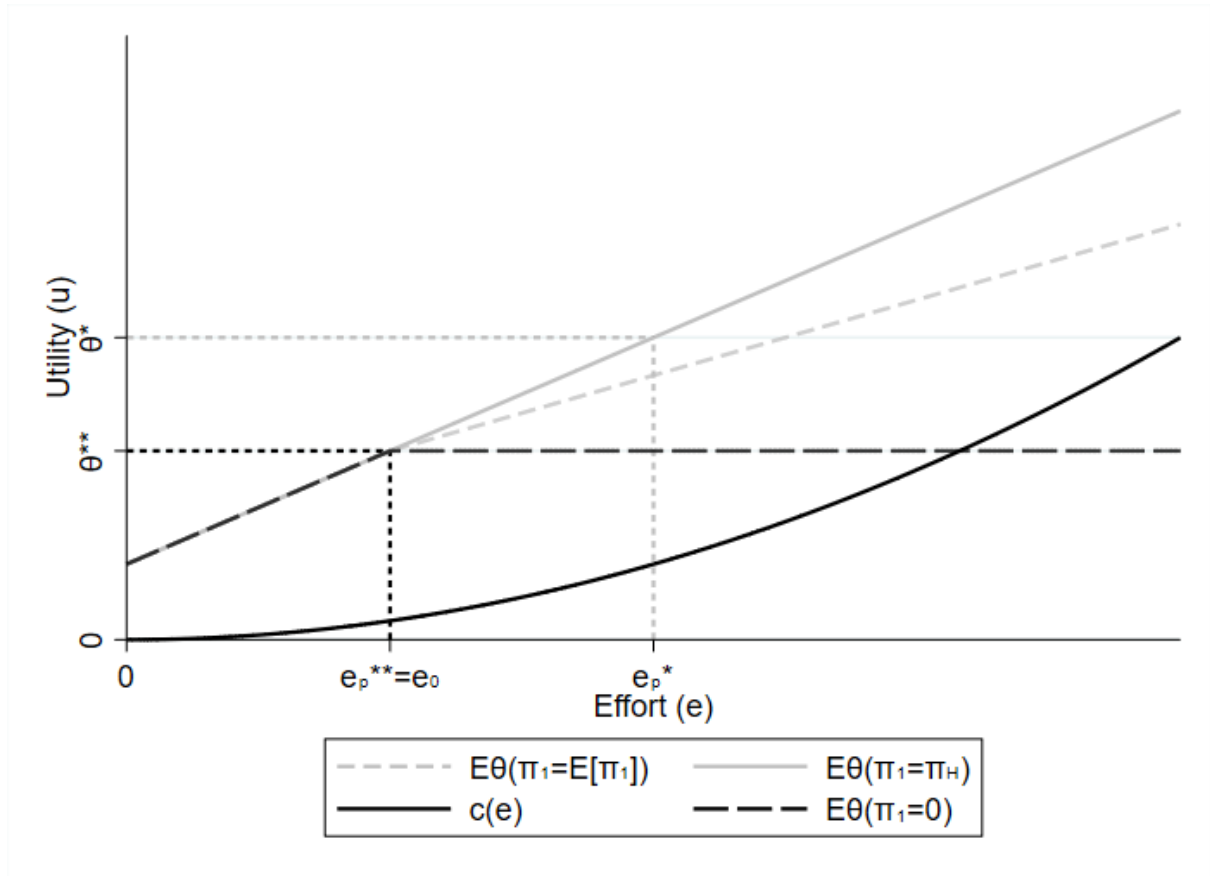


Figure 2. The effects of a negligible material intervention that undermines beliefs in agency.

Note: Compared to the baseline situation in Figure 1, expected agency $E[\pi_1]$ has dropped to $\pi_L = 0$ (indicated by the black long-dashed line). The individual now maximizes her expected utility at the kink point e_0 .

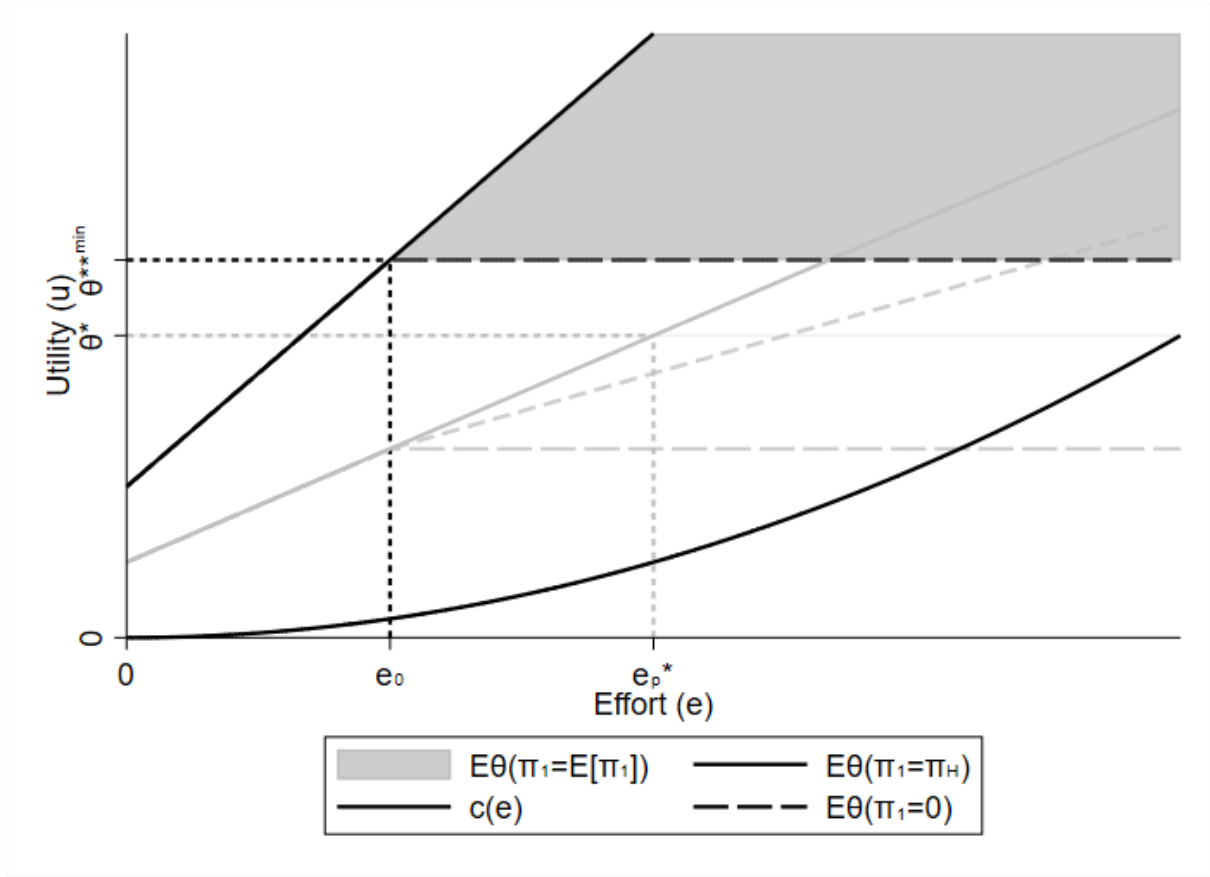


Figure 3. Effects of a sizable material intervention.

Note: Compared to the baseline situation in Figure 1, the endowment θ_0 has increased. The increase in endowment $\Delta\theta_0$ is large, so that the actual final wealth (here indicated by the black solid line) starts at a higher level and is steeper. The expected final wealth starts in the usual kink point and lies somewhere in the grey area. For all $E[\pi_1]$, effort is at least $e^{**} \geq e_0$, so that final wealth $\theta^{**} \geq \theta^{**min} \equiv (1 + e_0)(\theta_0 + \Delta\theta_0) > \theta^*$.

Psychological interventions

Now, consider a psychological intervention or signal P that does not increase the endowment θ_0 , but does affect the expected agency of an agent positively.

A psychological intervention P can be directed at those that underestimated their agency, such that, like before, conditional on receiving the psychological intervention P , the posterior expected agency $E[\pi_1|P]$ equals:

$$E[\pi_1|P] = \pi_L + (\pi_H - \pi_L)P[\pi_1 = \pi_H|P] \quad (16)$$

Using Bayesian updating, we have that the posterior probability $\Pr[\pi_1 = \pi_H|P]$ equals:

$$\Pr[\pi_1 = \pi_H|P] = \frac{\Pr[P|\pi_1 = \pi_H]\Pr[\pi_1 = \pi_H]}{\Pr[P|\pi_1 = \pi_L]\Pr[\pi_1 = \pi_L] + \Pr[P|\pi_1 = \pi_H]\Pr[\pi_1 = \pi_H]} \quad (17)$$

If the individual is more likely to receive the psychological intervention or signal if she has high agency than if she has low agency, i.e. $\Pr[P|\pi_1 = \pi_H] > \Pr[P|\pi_1 = \pi_L]$, then the psychological intervention increases her expected agency, $E[\pi_1|P] > E[\pi_1]$, so that effort increases unambiguously (see Figure 4).

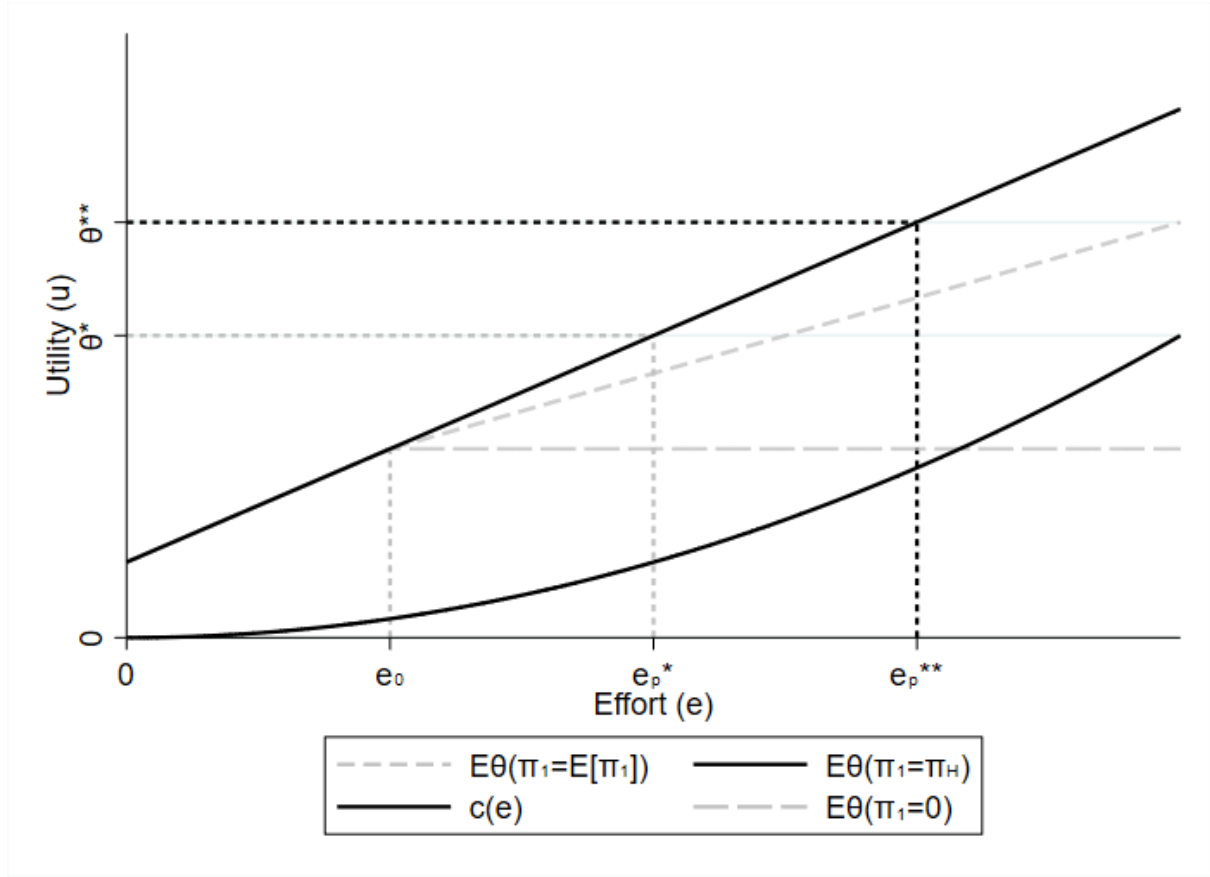


Figure 4. Effects of a psychological intervention that strengthens beliefs in agency.

Note: Compared to the baseline situation in Figure 1, expected agency $E[\pi_1]$ has increased to π_H (here indicated by the black solid line). The individual maximizes her expected utility where the marginal final wealth (the slope of the black solid line) equals marginal cost of effort (the slope of the black solid curve).

Combining material and psychological interventions

Ideally, development interventions lift both material and psychological constraints. We argue that a combination of a material intervention and a psychological intervention may do so. Specifically, we would need to combine a material intervention M with a psychological intervention P that gives a strong or even perfect signal about the agent's agency. The psychological intervention P can then turn a potentially negative signal of the material intervention M into a positive combined signal. We will now formalize this idea.

Conditional on receiving both a material intervention M and a psychological intervention P , the posterior expected agency $E[\pi_1|M \cap P]$ equals:

$$E[\pi_1|M \cap P] = \pi_L + (\pi_H - \pi_L)\Pr[\pi_1 = \pi_H|M \cap P] \quad (18)$$

Using Bayesian updating, we have that the posterior probability $\Pr(\pi_H|P)$ equals:

$$\Pr[\pi_1 = \pi_H|M \cap P] = \frac{\Pr[M \cap P|\pi_1 = \pi_H]\Pr[\pi_1 = \pi_H]}{\Pr[M \cap P|\pi_1 = \pi_L]\Pr[\pi_1 = \pi_L] + \Pr[M \cap P|\pi_1 = \pi_H]\Pr[\pi_1 = \pi_H]} \quad (19)$$

The psychological intervention increases her belief about her agency $E[\pi_1|M \cap P] > E[\pi_1]$ if the individual is more likely to receive the combination of interventions or signals if she has high agency than if she has low agency:

$$\Pr[M \cap P|\pi_1 = \pi_H] > \Pr[M \cap P|\pi_1 = \pi_L] \quad (20)$$

$$\Pr[M|\pi_1 = \pi_H]\Pr[P|\pi_1 = \pi_H \cap M] > \Pr[M|\pi_1 = \pi_L]\Pr[P|\pi_1 = \pi_L \cap M] \quad (21)$$

$$\frac{\Pr[P|\pi_1 = \pi_H \cap M]}{\Pr[P|\pi_1 = \pi_L \cap M]} > \frac{\Pr[M|\pi_1 = \pi_L]}{\Pr[M|\pi_1 = \pi_H]} \quad (22)$$

This means that for a combination of a material intervention M and a psychological intervention P to increase expected agency, the overinvolvement ratio of high types of the psychological intervention should exceed the inverse of the overinvolvement ratio of the material intervention. Or, said differently, if a material intervention is more likely to be given to people with low agency, then the psychological intervention should be given at least equally more likely to people with high agency.

Finally, we note that what matters is not the actual targeting, but what agents belief about which types receive which interventions. However, if donors aim to improve the outcomes for the poorest people, it make sense expect that donors will prioritize material resources for those that have low actual agency and therefore cannot improve outcomes by just increasing effort. And

since psychological interventions can improve outcomes specifically if psychological constraints are binding, it seems logical to believe that such interventions will primarily be given to agents with high actual agency.

IV. Discussion

In this paper, we have shown how low agency beliefs can catch people in a behavioral poverty trap. We have subsequently studied the impact of development interventions. We have shown that material development interventions may undermine agency beliefs, and thus sustain or even create such a poverty trap. This may help to explain why many material interventions do not realize their intended effects. We have further shown that by turning negative agency signals into positive ones, complementary psychological interventions can undo the negative effects of material interventions, and thus help to unambiguously improve economic outcomes.

While this paper focused on a situation where the agent underestimates her true agency, we note that the agent can also overestimate her actual agency. Where the first will induce below-optimal effort and final wealth, the latter will induce above-optimal costs of effort. The challenge for development interventions is thus to help people learning about their actual agency.

We finally note that pessimism about agency should not be confused with laziness. In fact, if effort represents the choice of education level, low agency beliefs can cause agents to stay in an equilibrium of heavy physical work for low returns.

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