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**POVERTY AND ASPIRATIONS FAILURE**

By

Patricio S. Dalton, Sayantan Ghosal,  
Anandi Mani

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# Poverty and Aspirations Failure\*

Patricio S. Dalton

*Tilburg University, CentER, Netspar, CAGE*

Sayantana Ghosal

*University of Warwick, CAGE*

Anandi Mani

*University of Warwick, CAGE*

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## Abstract

We develop a theoretical framework to study the psychology of poverty and ‘aspirations failure’. In our framework, the rich and the poor share the same preferences – and also a behavioral bias in setting aspirations. Greater downside risks imposed by poverty exacerbates the effects of this behavioral bias: the poor are more susceptible to both an aspirations failure and pessimism about the likelihood of achieving success. Poverty limits the set of people whose life experiences the poor consider relevant for forming their own beliefs and aspirations. Mitigating behavioral poverty traps require policies which go beyond reducing material deprivation.

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*Keywords:* Reference-dependent Preferences, Aspirations, Persistent Poverty, Locus of control, Similarity and Belief Formation.

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# 1 Introduction

Persistent poverty is a condition that requires an understanding of a multidimensional process which makes people poor and keeps them poor.<sup>1</sup> The Chronic Poverty Report (2008-2009) estimates that 320 to 443 million people will live trapped in chronic poverty: i.e., these people will remain poor for much or all of their lives and their children are likely to inherit their poverty as well.<sup>2</sup> An influential literature on poverty traps argues that such persistent poverty prevails due to constraints that are *external* to the individual.<sup>3</sup> Examples of such constraints are credit or insurance market imperfections (e.g. Loury, 1981; Galor and Zeira, 1993; Banerjee and Newman, 1991, 1993), coordination problems (e.g. Kremer, 1993), institutional or governmental failures (e.g. Bardhan, 1997), malnutrition (e.g. Dasgupta and Ray, 1986), neighborhood effects (Hoff and Sen, 2005) or even the family system (Hoff and Sen, 2006). Implicit in this world view is the belief that the poor are perfectly rational individuals making optimal choices in the face of these externally imposed constraints: they are "poor but rational".

An alternative view is that poverty is the outcome of constraints *internal* to individuals who end up poor: they are "irrational, hence poor". Behavioral biases such as myopia and lack of self-control are often cited as traits that the poor likely suffer from<sup>4</sup> and have been identified as possible explanations for poverty traps.<sup>5</sup> However, influential psychologists like Bandura have persuasively argued that the capacity for self-regulation (or the lack of it) is itself influenced by the *belief* in one's 'self-efficacy' – i.e. the capacity to achieve desired outcomes through one's effort. In the words of Bandura (1991, p. 257) "People's beliefs in their efficacy influence the choices they make, their aspirations, how much effort they mobilize in a given endeavor, how long they persevere in the face of difficulties and setbacks...". Indeed, as the evidence in the next section shows, pessimistic beliefs are often associated with the poor, as is a lack of aspirations. Appadurai (2004, p. 59) notes that poor people may lack the *capacity to aspire* to "contest and alter the conditions of their own poverty." However, unlike with external constraints, it is not clear whether such internal constraints

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<sup>1</sup>Persistent poverty is defined by the incapability to fulfill basic needs during a period greater than 5 years. For evidence on persistent poverty see Jalan and Ravallion (1998), Fouarge and Layte (2003), Biewen (2003), Duncan et. al. (1993), among others.

<sup>2</sup>About 40% of the poverty in Sub-Saharan Africa and 35% of the poverty in South Asia is persistent. The probability of remaining poor over a 5-year period is about 50% in Vietnam, 40% in Ethiopia and Philippines and 35% in India and Bangladesh.

<sup>3</sup>See, for example, Azariadis and Stachurski (2004) or Azariadis (2004) for a literature review on Poverty Traps due to such external constraints.

<sup>4</sup>Data from the World Values Survey show that 60 percent of Americans think that the poor "are lazy or lack willpower" (Alesina et al., 2001).

<sup>5</sup>See Banerjee and Mullainathan (2010) for the implications of temptation and imperfect self-control on the behavior of the poor. Bernheim et al. (2011) examine how capital market imperfections may accentuate the self-control problems of the poor.

are the cause of poverty – or its consequence. Do the poor remain deprived because they lack hope, motivation and aspirations – or, in the words of Bertrand et al. (2004), is it that ‘the poor may exhibit the same basic weaknesses and biases as do people from other walks of life, except that in poverty, ...the same behaviors ...lead to worse outcomes’?

In this paper, we examine this latter view of internal constraints and poverty traps rigorously. To understand the psychology of poverty and low aspirations, we examine an important behavioral bias (or ‘internal constraint’) that individuals suffer from, in setting life goals or aspirations: they underestimate how their aspirations evolve over their lifetime, as a consequence of their effort. Both the rich and the poor suffer from this bias, but poverty imposes an additional constraint on the poor: they face much greater downside risk in their lives.<sup>6</sup> Such risk greatly exacerbates the adverse effects of the behavioral bias in setting aspirations. By affecting the effort choices of the poor, it makes them more susceptible to an *aspirations failure*, i.e. a failure to aspire to, and achieve, their own best possible outcome.

To understand the behavioral bias in aspirations, perhaps we can consider the familiar example of academics. When students apply for a graduate program, their only aspiration is to get into a good program. Little do they anticipate that once they get there, they will then want to write a great job market paper and get a good job. And once they have the job, that they will want to work towards good publications, and after the publications, lots of citations, and so on. In the ladder of their life’s aspirations, they are typically able to visualize only one rung above at a time – but not the entire pathway of how far they can travel.

This bias does not operate very differently among the poor, at their own level. However, greater downside risk lowers their expected benefit of investing effort towards any goal: when you’re worried about whether you will get a good crop to have enough to eat, and your child is performing at a mediocre level in school, it makes you think twice about whether its worth hiring a remedial teacher to help him along. But lower effort increases the odds of low performance — and feeds into lower aspiration and achievement in the long run. As Banerjee and Duflo (2011, p. 92), talking about the reasons for poor education outcomes in developing countries, put it "...The teacher ignores the children who have fallen behind and the parent stops taking interest in their education. But this behavior *creates* a poverty trap even where none exists in the first place. If they give up, they will never find out that perhaps the child could have made it. And in contrast, families that assume that their children can make it, or families that don’t want to accept that a child of theirs will remain uneducated, which tend to be, for historical reasons, more elite families, end up confirmed in their

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<sup>6</sup>As Banerjee and Duflo (2011) put it, "risk is a central fact of life for the poor, who often run small business or farms or work as casual laborers, with no assurance of regular employment. In such lives, a bad break can have disastrous consequences".

‘high’ hopes.”

Our formulation of aspirations is based on three premises well-grounded in the behavioral economics literature, as well as in evidence from across the social sciences (which we present in Section 3). First, a person’s aspirations level is a reference point<sup>7</sup>: other things equal, a (higher) aspirations level (adversely) affects the satisfaction a person receives from a particular outcome.<sup>8</sup> On the flip side, higher aspirations also spur greater effort (see Section 3 for systematic evidence on this).

Choosing a life goal or aspiration is a forward looking exercise. Here, individuals do not choose their effort and aspirations independent of each other. In other words, aspirations are *endogenous* reference points. This is our second key premise.<sup>9</sup> This endogeneity is because of a two-way feedback: achieving higher aspirations requires greater effort – but higher effort spurs greater aspirations too, through the outcomes achieved. In the words of Aldous Huxley: “every ceiling, when reached, becomes a floor...”

If individuals were fully rational, they would recognize how their aspirations shift with every achievement, and would choose their effort level accordingly. In practice, however, people typically fail to fully recognize this latter feedback; they are only able to see one step above, at a time. This is our third key premise. This behavioral shortcoming can be likened to a form of projection bias (Loewenstein et al., 2003) – inasmuch as people’s current state limits their ability to correctly project their aspirations reference point in a different state.

While both the poor and the rich are equally afflicted by such a bias, the burden of greater downside risk that the poor face makes them more susceptible to an aspirations failure. The intuition underlying this result is as follows. Think of two individuals who have the same initial aspiration level, one rich and the other poor. At this given aspiration level, the poor person would optimally choose a lower effort level than the rich one, due to a lower expected marginal benefit from effort driven by risk. However, the feedback from effort to aspirations implies that the lower effort of the poor person will cause his aspiration level to diverge from that of the rich person. Thus, in equilibrium, the poor person has two reasons to put in low effort: not only are his expected net benefits lower, his aspiration level, i.e. the reference point which determines his marginal benefit of effort, is endogenously lower as well.

The poor end up with lower aspirations and achievements than their best possible outcome, in

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<sup>7</sup>This idea dates back to Simon (1955) and more recently, Selten (1998).

<sup>8</sup>See, for instance, Medvec et al. (1995) who study the expectations and emotions of Olympic athletes and find that bronze medal winners tend to have a higher level of satisfaction than silver medal winners.

<sup>9</sup>Conceptually, our idea of endogenous aspirations is in line with Köszegi’s (2010) concept of personal equilibrium, in which agents derive utility from physical outcomes as well as from rational beliefs about physical outcomes (“anticipation”), and these two payoff components can interact. See also Köszegi and Rabin (2006) on reference-dependent preferences, as well as Shalev (2000) and Dalton and Ghosal (2010).

equilibrium – but also with more pessimistic beliefs about achieving success.<sup>10</sup> An implication of pessimistic equilibrium beliefs of a poor person is that, when he sees a successful individual, he over-attributes that success to high endowment (talent) – rather than realize how it could be the outcome of a process of gradual evolution of aspirations with effort, over time. Hence he infers that he is incapable of achieving such outcomes given his endowment, and aspires lower than the best he is capable of. Indeed, many poor parents regard their children as lacking the intelligence needed to complete school and hence choose not to invest in it (see Section 2 for evidence on this). In this sense, poverty curtails a poor person’s *capacity to aspire*, in the spirit of Appadurai (2004).

Next, we address the issue of belief formation: people’s aspirations choices may be governed not only by objective risk factors, but also by those in their environment. How do people choose this set of individuals whose life outcomes they regard are relevant in forming their own beliefs and aspirations? To put it differently, who do they choose to include in their ‘cognitive window’?<sup>11</sup> The trade-off in choosing the size of this window is between *similarity* of others’ initial condition to one’s own and the likelihood of obtaining new information based on their life choices.<sup>12</sup> Greater risk causes the poor to place a higher premium on similarity and thus shrinks their cognitive window. Such self-imposed ‘ghettoization’ is consistent with findings in the sociology literature that the poor often develop a strong inbred sense of identity – so that certain efficient behaviors may be shunned because they are perceived to be appropriate only for ‘the other’.<sup>13</sup>

Two types of poverty traps emerge from our analysis: standard poverty traps that are driven by external (resource) constraints, but also behavioral poverty traps characterized by low effort, low aspirations and pessimistic beliefs. While external constraints imposed by poverty are a trigger for internal constraints, the latter become an independent source of disadvantage in behavioral poverty traps. Therefore, policy approaches that influence beliefs and aspirations among the poor are essential to break this latter kind of trap.

This paper contributes to the emerging literature that examines the behavioral aspects of poverty. Closely related papers on aspirations include Bogliacino and Ortoleva (2011), Genicot and Ray (2011) and Stark (2006), all of which have a more macro focus than ours. They study the effect of aspirations on income distribution and growth. Moreover, aspirations and cognitive windows in these models are exogenous to the individual. Banerjee and Mullainathan (2010) provide a model to

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<sup>10</sup>This is consistent with the concept of *Learned Helplessness* (Seligman, 1982, Abramson et al., 1978). It also fits with wide-ranging evidence that, as compared to the rich, the poor have a more ‘external’ *Locus of Control* (the belief that external factors control life outcomes more than one’s own effort). See Section 2 for more evidence on this.

<sup>11</sup>See Rao and Walton (2004) for a compelling set of case studies and analyses on this issue.

<sup>12</sup>We provide a formal measure of similarity in Section 5.

<sup>13</sup>See for instance, work by MacLeod (1995), Rainwater (1970) and others on the prevalent culture of disadvantaged neighborhoods.

understand how poverty may persist due to a different behavioral constraints – a lack of self-control in the consumption of certain goods. However, unlike in our framework, they explicitly assume that the poor are more susceptible to this weakness than the rich – and this allows them to explain some seemingly irrational actions of the poor.

The remainder of the paper is organized as follows. Section 2 describes some important patterns associated with the psychology of poverty persistence and discusses alternative explanations. Section 3 presents the formal model of aspirations and effort choice. Section 4 examines the channel through which poverty increases the likelihood of an aspirations failure. Section 5 studies the policy implications of our analysis. Section 6 provides a discussion of our results and concludes. Proofs of all propositions are collected in the appendix.

## 2 The Psychology of Poverty

Persistent poverty is an issue that has been of central focus in economics for several decades. In this section, we discuss evidence that suggests, despite the plausibility of the existing explanations in the economic literature, there are important aspects of this phenomenon that aren't adequately accounted for. We review the existing research on poverty persistence from a range of disciplines in the social sciences, and make our case for the theory presented here.

### Beliefs, Aspirations and Poverty

Social psychologists have extensively documented the psychological traits associated with poverty. The lack of hope and aspirations are a typical characteristic in the personality of the poor population. Moreira (2003), for example, studied the poor in the North-eastern Brazil and pointed out that "as the poor lose their values, they no longer believe in themselves. They go through a process of Nihilism [denial of hope]". Moreira provides evidence that the greatest part of the poor population has these nihilistic characteristics, submitting themselves to the destiny that is 'given by God'.<sup>14</sup> Similar patterns have been found elsewhere, for instance, in the Appalachian folk subculture (Rabow et al., 1983), in low-income urban neighborhoods in America (MacLeod, 1995), among Jamaican male youths (Walker, 1997) and in rural Ethiopian households (Frankerberger et al., 2007). In Ethiopia, for instance, a third of poor households surveyed by Frankerberger et al. (2007) believe that success or failure in life is primarily the result of destiny and/or luck. As a consequence, these households are less likely to take out larger loans and make longer-term investments. Bernard et al. (2011) also report evidence of fatalistic beliefs, low self-efficacy and low aspirations among a substantial group of

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<sup>14</sup> Atkinson (1998) defines social exclusion as a related concept that involves agency (people may exclude themselves) and it implies future hopes and expectations. People are excluded not just because they are currently without a job or an income but because they have little prospects for the future.

rural households in Ethiopia. They also find that such pessimistic beliefs consistently correlates with lower demand for credit, in terms of loan size, repayment horizon and productive purposes. Similar evidence is found in poor people from developed countries. Data from the Longitudinal Study of Young People in England (2006) show that young people from deprived backgrounds believe that external factors have a bigger role to play in their life outcomes than their own efforts (see Cabinet Office, 2008). These poor youth also demonstrate less faith in their own academic abilities, in their overall intelligence and have the lowest academic aspirations across all income quintiles.

The extent to which individuals believe they can control events that affect them has been widely studied in social psychology under the name of "locus of control" (Rotter, 1954). Individuals with "external" locus of control believe that powerful others, fate or chance are the most important determinants of outcomes. Those with "internal" locus of control, however, believe that outcomes result primarily from their own efforts. There is vast evidence showing an income gradient in measures of external locus of control: poor and minorities have higher external locus of control than other more advantaged sections of society (Furnham, 1986; Poortinga et al., 2008). Anthropologist Arjun Appadurai (2004) goes a step further, and argues that not only poor people may have pessimistic beliefs and low aspirations, but they may lack the *capacity to aspire* to "contest and alter the conditions of their own poverty." The capacity to aspire is seen as a cultural capacity related to the way in which people visualize the future and engage in forward looking behavior.

### **Poverty and Low Aspirations: Lack of Opportunity or Information?**

Arguably, such pessimistic beliefs and low aspirations among the poor could be driven purely by a lack of *opportunity*, or a lack of *information* about pathways out of poverty. Consider the opportunity channel: a poor person may not want to aspire to be a lawyer because he wouldn't have the funds to pay his studies. Objectively, being a lawyer is not an achievable status for this person and it is entirely rational not to aspire to it. In this case, enlarging the opportunity set would suffice for the person to aspire higher and eventually become a lawyer. However, this opportunity channel alone is inconsistent with very recent empirical evidence from field experiments. For example, in Kenya, Miguel and Kremer (2004) provide evidence that only 57% of the sample picked-up the free deworming pills, which were shown to greatly improve children's health and school performance. Similarly, Duflo et al. (2010) documented very low rates of fertilizer use take up by maize farmers in Kenya despite being offered convenient opportunities to buy fertilizer at reasonable prices.

A second possible explanation for low aspirations among the poor is that they suffer from an *informational disadvantage*: they simply don't know about the benefits of certain opportunities. However, the available evidence is not fully convincing on this count either. For instance, farmers in Busia, Kenya (mentioned above) had ample opportunity both to learn how to use the fertilizer,

and to realize that the rates of return from its use were as high as 70%. Take up was low despite this. In a somewhat different context, Jensen (2010) reports the results of a field experiment in the Dominican Republic, where students were informed about the actual return differential between primary and secondary/tertiary education, which they had previously underestimated. There was a substantial increase in perceived returns to education – but almost no discernible effect on the actual rates of completion of secondary schooling. Such lack of responsiveness among the poor suggests that constraints imposed by the lack of opportunity or access to information alone do not fully explain the stubborn persistence of poverty – or the psychological traits associated with it.

### **Pessimism and Low Aspirations: Cause or Consequence of Poverty?**

In this paper, we argue that pessimism and low aspirations among the poor are the *consequence* of an interaction between their greater exposure to risk and a commonly prevalent aspiration bias.

Risk is a hard reality of poverty. As Banerjee and Duflo (2011) describe with several vivid case studies, "risk is a central fact of life for the poor, who often run small business or farms or work as casual laborers, with no assurance of regular employment. In such lives, a bad break can have disastrous consequences". For instance, a month-long illness of the breadwinner in a poor household can create multiple negative ripple effects: he may lose his job permanently, debts may mount, the children may have to be pulled out of school – all of which may consign the family to dire poverty for a very long period.

The fragile equilibrium of life riddled with risk lowers the effort that the poor choose to put in towards any goal, other than their immediate needs. Part of this is rational – except that the aspirational bias hinders their ability to foresee how greater investment of effort today could put them on a higher outcome trajectory in the long run. An implication of such aspiration bias, especially when it is compounded by risk, is that the poor over-estimate the initial endowment needed for success. For instance, Banerjee and Duflo (2011) cite the case (among several others) of a poor woman with six children in the village of Naganadgi in India, who explained why she had enrolled only one of her children in school: the rest were not intelligent enough to make it through. Akresh et al. (2010) report that in Burkina Faso, adolescents are more likely to be enrolled in school when they scored high on a test of intelligence – but *less* likely to be enrolled when their siblings scored high. Gutman and Akerman (2008) estimate that parental interest and expectations in the child's education has four times more influence on attainment by age 16 than does socioeconomic background.<sup>15</sup>

To summarize, poverty stifles aspirations of the poor because high risk adversely affects their

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<sup>15</sup> It is not as if parents make such choices about picking only one child to educate, because of credit constraints either. See Ashraf et al. (2008) for evidence on this, based on a randomized experiment offering education lotteries.

effort choices – and hence their *beliefs* about their ability to alter the conditions of their existence. The less effort they invest in getting out of poverty, the more they end up believing that there is little they can do about it. This is the gist of the behavioral bias call "learned helplessness" (Abramson et al., 1978). Hence, providing information or opportunity alone may not be enough to draw out people caught in persistent poverty. We now provide a formal exposition of the ideas expressed above.

### 3 Aspirations and Achievement: Model Outline

#### 3.1 Preferences: Aspirations as Reference Points

We consider an individual characterized by a given initial endowment  $\theta_0$ . He must choose a costly effort  $e \in E$  that will determine the probability distribution over his final outcome  $\theta \in \Theta$ . We assume that  $\Theta$  is a closed bounded interval and  $E$  is a closed, bounded set (possibly finite),  $\Theta \subset \mathfrak{R}$ ,  $E \subset \mathfrak{R}$  and that all payoff relevant functions are continuous. He has an aspiration (or goal)  $g \in \Theta$  with regard to his final outcome. Given his aspiration  $g$ , the payoff he receives from an effort  $e$  equals his expected benefit from this effort, net of his cost of effort – as described by the utility function below:

$$u(e, g, \theta_0) = \int_{\theta \in \Theta} p(\theta, e, \theta_0) b(\theta, g) d\theta - c(e) \quad (1)$$

In the expression above,  $p(\theta, e, \theta_0)$  is the likelihood of a person achieving a particular outcome  $\theta$  for an effort level  $e$ , and it is increasing in  $e$ .  $b(\theta, g)$  is the benefit he obtains from achieving outcome  $\theta$ , which could be affected by his goal  $g$ .  $c(e)$  is the cost of effort  $e$  which is increasing in  $e$  as well.

We now elaborate on the individual arguments of the utility function above, in line with the key premises of our framework, justifying our modeling choices along the way with well-documented evidence.

Our first key premise is that individual aspiration serves as a *reference point* for the benefit he derives from achieving a final outcome. In our framework, this is captured by the feature that the marginal benefit  $b_\theta(\theta, g)$  of a better outcome  $\theta$  is greater for a person with a higher aspiration level  $g$ . Formally, this *complementarity* between  $\theta$  and  $g$  can be stated as follows:

**Assumption 1.**  $b(\theta, g)$  is increasing in  $\theta$  and satisfies increasing differences in  $\theta$  and  $g$  i.e. for  $\theta' \geq \theta$  and  $g' \geq g$ ,

$$b(\theta', g') - b(\theta, g') \geq b(\theta', g) - b(\theta, g).$$

In words, the incremental gain from enhanced social status is greater the higher the aspiration level. When  $b(\theta, g)$  is twice continuously differentiable,  $\frac{\partial}{\partial \theta} b(\theta, g) > 0$  and  $\frac{\partial^2}{\partial \theta \partial g} b(\theta, g) > 0$ . The Kahneman

and Tversky (1979) utility function with loss aversion is a good example of a utility function that satisfies Assumption 1.<sup>16</sup>

A direct implication of this assumption is that a person with a higher aspiration level has an incentive to try harder to achieve a better outcome. Aspirations are, in this sense, motivators of greater effort. This premise is consistent with wide-ranging evidence from psychology and economics. For instance, Heath et al. (1999) present evidence that subjects with high goals exert higher effort and persist more in different physical and cognitive tasks. The Dunedin Longitudinal Study in New Zealand suggests that pessimistic expectations significantly increase the likelihood of low effort even in non-market activities such as personal health maintenance (more frequent smoking and less frequent exercise) (Clark et al., 2003). Abeler et al. (2011) found similar results in the lab: when participants have higher reference points for earnings, they persevere longer at the experimental task. Aspirations also act as reference points for life goals. In a field experiment with female entrepreneurs in India, Field et al. (2009) show that higher aspirations motivate positive changes in women’s financial behavior.

Next, we introduce the assumptions on the other two elements in the utility function:  $p(\theta, e, \theta_0)$  and  $c(e)$ .

### 3.2 How Poverty imposes External Constraints

As we argue in Section 2, one important difference in the external constraints faced by the poor and the rich is that the poor experience considerably greater downside risk in their lives. Such risks adversely affect the probability that their effort leads to success in achieving a particular outcome. In order to capture this, we make the following assumption:

**Assumption 2**

(i) For  $e' \geq e$ ,  $\theta'_0 \geq \theta_0$ ,  $p(\theta, e, \theta_0)$  satisfies the monotone likelihood ratio property in  $(e, \theta_0)$  so that (a)  $\frac{p(\theta, e', \theta_0)}{p(\theta, e, \theta_0)}$  is increasing in  $\theta$  and  $\theta_0$ , and (b)  $\frac{p(\theta, e, \theta'_0)}{p(\theta, e, \theta_0)}$  is increasing in  $\theta$  and  $e$ .

(ii) For each  $e$ ,  $\theta_0$  the support of the distribution  $p(\theta, e, \theta_0)$  is a closed and bounded subset of the interval in  $\mathfrak{R}$ ,  $[\underline{\theta}_0, \theta_0 + K]$  for some  $K > 0$ .

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<sup>16</sup>Formally, we can write the utility function with loss-aversion as  $b(\theta, g) = \beta(\theta) + v(\theta, g)$  where  $\beta(\theta)$  is increasing in  $\theta$  and

$$v(\theta, g) = \begin{cases} \theta - g, & \text{if } \theta < g \\ \alpha(\theta - g), & 0 < \alpha < 1 \text{ if } \theta \geq g, \end{cases}$$

In this example, the DM’s frustration from falling short of her aspiration is greater than her pleasure from exceeding her aspirations – but we can also have utility functions with symmetric effects of gains and losses relative to the reference point, that satisfy Assumption 1. Note that, in the above example,  $b(\theta, g)$  is always decreasing in  $g$  for some values of  $\theta$  so that the assumption is consistent with the idea that a high level of aspiration can induce frustration. An alternative formulation  $b(\theta, g) = \beta(\theta) - K(\theta - g)^2$  (where  $\beta(\theta)$  is increasing in  $\theta$ , and the constant  $K$  is chosen to ensure that  $b(\theta, g)$  is increasing in  $\theta$ ) also satisfies assumption 1 but has the feature that  $b(\theta, g)$  is increasing in  $g$  whenever  $g < \theta$ .

(iii)  $c(e)$  is increasing and continuous in  $e$ .

Assumption 2 (i) states that the rich have a higher likelihood of achieving a higher final outcome  $\theta$  with a given effort level  $e$ . Furthermore, this gap in the success probabilities of the rich and poor increases at higher effort levels.<sup>17</sup> Assumption 2(ii) ensures that a person with a high initial  $\theta_0$  has the incentive to put in higher than the minimum possible effort, to maintain his initial status. Assumption 2(iii) simply states that the cost of effort is increasing in effort  $e$ .

Greater downside risk implies that, for any given aspiration level, the expected outcome that a poor person can achieve for the effort he puts in, is lower.<sup>18</sup> But what determines individual aspirations? No doubt, there could be multiple influences: environmental factors such as a person's family background, the norms of the community in which he lives and the opportunities available, economic or otherwise do matter – as well as traits internal to the individual. To the extent that it is the first set of influences that matter, a person's aspirations may be described as 'exogenous' or independent of his effort choice. We consider this simple (perhaps simplistic) case first.

### 3.3 Effort Choice under Exogenous Aspirations

In principle, it could be argued that if aspirations are life goals, there is no reason why a poor person cannot have the same aspirations as richer individuals. In this case, the exogenous aspiration level  $g_0$  can be treated as common across all individuals, rich or poor. The following proposition clarifies the link between effort and initial status for fixed exogenous aspirations:

**Proposition 1:** *For an exogenously fixed level of aspirations  $g_0$ , under Assumption 2, effort is an increasing function of  $\theta_0$ .*

**Proof:** See appendix. ■

The above proposition implies that for a given aspiration level, the gap between aspiration and achievement will be greater for the poor. This is because greater risk reduces their (expected) net marginal benefit of effort, which lowers their incentive to expend as much effort or resources towards that goal. We could refer to such a gap between aspiration and outcome as *achievement failure*. A poor person is more prone to such achievement failure – but it is perfectly rational for him to choose

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<sup>17</sup>Assumption 2 (i) focuses on the case of greater downside risk for the poor, implying a lower expected outcome of effort for them. Here, we have not considered the case where the poor have the same expected outcome of a given effort level as the rich, but greater *variance* in this outcome, i.e. the poor person's success distribution  $p(\theta, e, \theta_0)$  is a mean preserving spread of the distribution faced by the rich. Our results above are robust to this case, with the additional assumptions that  $Var(e, \theta_0)$  is submodular in  $e, \theta_0$  and  $b(\theta, g)$  is concave in  $\theta$ .

<sup>18</sup>For the purpose of this section, we have taken the probability of success  $p(\cdot)$  to be driven by objective risk alone. However, we recognize that what matters for setting aspirations is an individual's *perceived* probability of success (i.e. his beliefs), which will be shaped by various environmental factors. We discuss this issue of belief formation and the role of social/environmental factors in section 5.

a lower effort level that results in such an outcome.

## 4 Endogenous Aspiration Formation

### 4.1 Aspirations as Endogenous Reference Points

Perhaps it is more natural to think of a case where individuals choose their aspiration level, rather than have it set for them. After all, how far people aspire depends on their own beliefs about what they can achieve with effort. Setting one's aspirations is a forward looking process. Given that aspirations affect the satisfaction from the outcome realized, people would not aspire to an outcome that is perceived as unattainable. Thus, in choosing the effort they want to put in, they implicitly choose what they want to aspire to, i.e. aspirations are endogenous to effort choice, they are endogenous reference points. This is our second key premise. As ethnographer MacLeod's (1995, p.15) points out "aspirations reflect an individual's view of his or her own chances for getting ahead and are an internalization of objective probabilities". With this interpretation in mind, we define an aspirations level  $g$  as the expected outcome, given individual effort:

$$g = \int_{\theta \in \Theta} p(\theta, e, \theta_0) \theta d\theta = \pi(e, \theta_0). \quad (2)$$

Of course, with uncertainty (captured by the probability of achieving a particular outcome  $p(\theta, e, \theta_0)$ ), the individual will to aspire to the *expected* final outcome of his efforts. Our formulation has the desirable feature that, in the absence of uncertainty (i.e., when final status is a deterministic function of effort), the aspiration level of the individual is simply the final outcome he will achieve given his effort.

Of course, the endogeneity of aspirations also implies that they also evolve with our effort choices. When we achieve a particular goal we had set for ourselves, our goals tend to shift too. In the words of Aldous Huxley: "Every ceiling, when reached, becomes a floor...." <sup>19</sup>

### 4.2 Aspiration Choice of a Rational Decision Maker

So far, we have laid out two key premises: (i) that aspirations are reference points that affect our utility from achieving a particular outcome – but (ii) they are endogenous reference points, in that they also evolve with our effort choices. Using these two premises, let us carry out the following thought experiment. Consider a fully 'rational' person, one who internalizes the fact that in choosing an effort level today, he is also affecting his lifetime aspiration, and hence the benefit he will get from the achieved outcome as well. How will such a far-sighted person optimally choose his effort

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<sup>19</sup>Stutzer (2004) also shows that the higher the achievement of an individual, the higher is her aspirations.

and life aspiration level? We formalize the answer in the concept of a *standard* solution, as defined below:

**Definition 1.** A *standard* solution is a pair  $(\hat{e}, \hat{g})$  such that

$$\hat{e} \in \arg \max_{e \in E} s(e, \theta_0) = \int_{\theta \in \Theta} p(\theta, e, \theta_0) b(\theta, \pi(e, \theta_0)) d\theta - c(e) \quad (3)$$

and

$$\hat{g} = \pi(\hat{e}, \theta_0) = \int_{\theta \in \Theta} p(\theta, \hat{e}, \theta_0) \theta d\theta \quad (4)$$

As Definition 1 shows, a rational person recognizes that effort and aspirations feed into each other over the course of his lifetime. Given this positive feedback, he would jointly choose both effort and aspiration levels, so as to achieve his best possible outcome and utility.<sup>20</sup> We certainly do not claim that most individuals are far-sighted enough to recognize this feedback, and make decisions in this manner. Rather, this provides us with a normative benchmark against which we evaluate how most people set their aspirations.

A point to note here is that a fully ‘rational’ poor person would aspire lower than an equally ambitious richer counterpart: at any given effort level, his expected outcome is lower, due to higher downside risk he faces – and setting an aspiration (reference point) that is as high as his richer counterpart would only diminish the utility he would derive from any achievement. Of course, given his weaker initial condition  $\theta_0$ , this more modest aspiration and effort choice of a poorer person *cannot* be regarded as an aspiration failure.

### 4.3 Aspiration Choice of a Behavioral Decision Maker

Admittedly, most people setting their life’s aspirations are not rational in the sense described above. Specifically, in carrying out this forward-looking exercise, they do not fully internalize how their life aspirations are shaped by their effort choices.<sup>21</sup> In the ladder of our life’s aspirations, we are typically able to see only rung above at a time. We refer to decision-makers with such lack of foresight as ‘behavioral’ decision-makers (and that includes most of us!). Our third central premise, then is that while choosing effort  $e$ , a behavioral decision-maker takes his life aspiration  $g$  as fixed (rather than endogenously evolving with effort and outcomes), hence imposing a negative externality on

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<sup>20</sup>Note that  $s(e, \theta_0)$  is continuous in  $e$  and as  $E$  is compact, hence the set of solutions  $S$  is non-empty – and there could be multiple solutions. However, by definition, any two distinct standard solutions must yield the same payoff.

<sup>21</sup>Our framework is also consistent with a scenario where the decision-maker partially internalizes the feedback from actions to aspirations with probability  $\lambda$ . In such scenario, the decision-maker in a behavioral decision chooses effort to maximize  $\tilde{u}(e, g) = \lambda u(e, g) + (1 - \lambda)v(e)$ . This is analogous to the formulation adopted in Lowenstein et al. (2003)’s model of projection bias.

himself.<sup>22</sup>

There is considerable evidence of this kind of behavior in various kinds of life situations. Easterlin (2001), for example, provides evidence that people do not anticipate how their aspirations adapt upwards, as their income rises. In a similar vein, Knight and Gunatilaka (2008) present field evidence of rural migrants settled in urban areas who don't foresee how their aspirations will adapt to their new situation, hence ending up less happy than non-migrants in both locations.

Formally, a behavioral decision-maker (who satisfies our third premise) chooses  $e$ , while taking  $g$  as given, to solve

$$Max_{e \in E} u(e, g, \theta_0) = \int_{\theta \in \Theta} p(\theta, e, \theta_0) b(\theta, g) d\theta - c(e) \quad (5)$$

While his aspiration  $g$  is exogenous to his effort  $e$ , we will require that his aspirations and efforts are mutually consistent, i.e., he has *rational expectations* in choice of aspirations and efforts. Let  $e(g, \theta_0)$  denote the set of payoff maximizing efforts. Formally speaking,

**Definition 2:** A *Behavioral Solution* is a pair  $(e^*, g^*)$  such that (i)  $e^* \in e(g^*, \theta_0)$  and (ii)  $g^* = \pi(e^*, \theta_0)$ .

Intuitively speaking, the outcome of a behavioral decision can be interpreted as the steady state of an adaptive mechanism in which the aspiration level at any given time adapts to efforts chosen in the past via the outcomes  $\pi(e)$  realized. In other words, starting from some initial level of aspirations  $g_0$ , an individual's effort in each period  $t$ ,  $e_t \in e(g_{t-1})$  and his aspiration  $g_t = \pi(e_{t-1})$  – but he doesn't anticipate the feedback of his current efforts on his aspirations *across* periods.

Given this, the following useful result clarifies the structure of  $B$ , the set of behavioral solutions, and provides an explicit characterization of this set.

**Proposition 2:** *Under assumptions 1 and 2, there exists a minimal and maximal effort levels in  $e(g)$ ,  $\underline{e}(g, \theta_0)$  and  $\bar{e}(g, \theta_0)$ , both of which are increasing in  $g$ . Moreover, there exists minimal and maximal elements in the set of behavioral solutions  $B$ ,  $(\underline{e}^*, \underline{g}^*)$  and  $(\bar{e}^*, \bar{g}^*)$ .*

**Proof.** See appendix. ■

Proposition 2 shows that when an individual ignores how his aspirations are influenced by his efforts, there are multiple levels of effort and aspirations that are solutions to his optimization problem. Across these behavioral solutions, higher effort levels are paired with higher aspirations levels. Thus, the lack of foresight in a behavioral decision-maker creates room for the *possibility* that he may choose a lower effort-aspiration pair, than the best possible one he could expect to achieve.

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<sup>22</sup>The premise itself implies that choices and preferences could diverge, hence invalidating the principle of revealed preferences. See Dalton and Ghosal (2010) for generalized, axiomatic characterization of standard and behavioral decisions using choice correspondences alone.

We refer to such a person as being *internally constrained*, and such an outcome as an *aspiration failure*. Formally:

**Definition 3.** An individual is *internally constrained* at a behavioral solution  $(e^*, g^*)$  whenever  $(e^*, g^*) \notin S$ .

When the intersection between the set of behavioral solutions and the set of standard solutions (i.e.  $B \cap S$ ) is empty, the individual is always internally constrained. In principle some of the multiple effort-aspiration solutions  $(e^*, g^*)$  described in Proposition 2 could coincide with the standard (maximal) outcome. Lemma 1 below outlines the necessary and sufficient condition under which this can happen, i.e.  $(e^*, g^*) \in S$ .

**Lemma 1** Consider condition (C): For  $(e, g)$ ,  $(e', g')$  such that  $g = \pi(e, \theta_0)$  and  $g' = \pi(e', \theta_0)$ , if  $u(e, g, \theta_0) \geq u(e', g, \theta_0)$ , then  $u(e, g, \theta_0) \geq u(e', g', \theta_0)$ . A behavioral solution  $(e^*, g^*)$  is also a standard solution if and only if (C) holds.

**Proof:** See appendix. ■

The conditions under which the behavioral decision-maker would end up at his best possible outcome (of the rational individual) are quite stringent: if, and only if the behavioral decision outcome  $(e, g)$  dominates every other consistent outcome pair  $(e', g')$ . If such an effort/expected outcome pair choice does not exist and hence (C) is violated, the individual is internally constrained at a behavioral solution  $(e^*, g^*)$ .

Importantly, when efforts  $e$  are continuous, and the set of efforts  $E$  is convex and compact,<sup>23</sup> the standard solution must satisfy the following first order condition at an interior solution:

$$0 = \partial_e s(\hat{e}, \theta_0) \tag{6}$$

That is, the marginal benefit of additional effort, taking into account that aspirations depend on effort via  $\pi(\cdot)$ , should be zero. A behavioral solution, however, must satisfy the following first order condition at an interior solution:

$$0 = \partial_e u(e^*, g^*, \theta_0), g^* = \left( \int_{\theta \in \Theta} p(\theta, e^*, \theta_0) \theta d\theta \right). \tag{7}$$

That is, the marginal benefit of additional effort, at the aspiration level consistent with chosen effort via  $\pi(\cdot)$ , is equal to zero. These two conditions do not typically overlap. This fact is summarized in Lemma 2 below.

**Lemma 2.** When effort is a continuous variable, the decision maker is, typically, internally constrained.

**Proof:** See appendix. ■

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<sup>23</sup>See appendix for further details.

Thus, when an individual fails to anticipate the positive feedback of his effort choices on his life aspirations, he will end up choosing a suboptimal effort-aspiration pair than the best outcome he can achieve. Consistent with his effort choices, we note that his equilibrium beliefs  $p(\theta, e^*, \theta_0)$  about the likelihood of success based on his own efforts, will be suboptimal as well.

#### 4.4 Poverty and Aspirations Failure

In this sub-section, we examine how the greater downside risk imposed by poverty may exacerbate the likelihood of such aspirations failure. We begin by identifying the effect of an individual's initial status  $\theta_0$  on the solutions to the behavioral decision-making problem.

**Lemma 3** *Under assumptions 1 and 2, the minimal and maximal elements in  $B(\theta_0)$ ,  $(\underline{e}^*(\theta_0), \underline{g}^*(\theta_0))$  and  $(\bar{e}^*(\theta_0), \bar{g}^*(\theta_0))$ , are increasing in  $\theta_0$ .*

**Proof:** See appendix. ■.

Lemma 3 points out that a lower initial endowment status  $\theta_0$  shifts  $B(\cdot)$ , the set of effort-aspiration level choices that a poor behavioral decision-maker would choose from, downwards. This follows from the fact that, for a given aspiration level, effort  $e$  and initial status  $\theta_0$  are complements, i.e. greater risk lowers a poor person's marginal net benefit of effort.

To see how initial conditions may influence the likelihood of aspiration failure, we consider a setting where each person has a finite number of effort choice solutions  $e = \{e_1, \dots, e_N\}$  with  $e_n < e_{n+1}$ ,  $n = 1, \dots, N - 1$ . The decision-maker's initial status lies in the compact interval  $\Theta \equiv [\underline{\theta}, \bar{\theta}]$ . We assume that the lowest effort  $e_1$  will perpetuate the individual's status quo for sure – i.e.  $p(\theta_0, e_1) = 1$  and  $p(\theta', e_1) = 0$  for all  $\theta' \neq \theta_0$  so that  $g_1(\theta_0) = \pi(e_1, \theta_0) = \theta_0$ . We assume that behavioral solutions can be payoff ranked so that the maximal solution (the highest possible effort-aspiration pair  $(e_S(\theta_0), g_S(\theta_0))$ ) dominates all other solutions in  $B(\theta_0)$  and is the unique standard solution.<sup>24</sup>

To see how an equilibrium effort and aspiration level is selected, consider the initial aspiration level  $g_0$  of an individual, which is drawn from a distribution with pdf  $f(\cdot)$  (and cdf  $F(\cdot)$ ) common to the rich and the poor.  $g_0$  is irrelevant for a fully 'rational' (standard) decision-maker, because he internalizes the feedback from efforts to aspirations. Therefore, he will *always* only pick a standard solution  $(e_S, g_S)$  as his effort/aspiration choice, no matter what his  $g_0$  is. A behavioral decision-maker's effort choice will be affected by  $g_0$ , because he takes his aspiration level as given, rather than endogenous to his effort. The selection mechanism involves two stages: (i) an initial aspiration level  $g_0$  generated and given  $g_0$ , the individual chooses an effort level  $e$ ; (ii) given  $e$ , the actual aspiration

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<sup>24</sup>The arguments here can be generalized to the case with continuous effort levels. In this latter case, the standard solution is not assumed to be an element of the set of behavioral solutions.

level (i.e. expected outcome) is realized via the function  $\pi(e) = \int_{\theta \in \Theta} p(\theta, e, \theta_0) \theta d\theta$ . Given the above selection mechanism, Proposition 3 addresses how poverty and initial disadvantage exacerbate the likelihood of aspirations failure in his case.

**Proposition 3:** *Under assumptions 1 and 2, the lower the initial status  $\theta_0$  of an individual, the more likely he is to (a) experience aspirations failure i.e. end up at a suboptimal effort and aspiration level, (b) choose to perpetuate his initial status, and (c) to hold equilibrium beliefs that are more pessimistic about the way his effort can affect outcomes.*

**Proof:** See appendix. ■

Proposition 3 provides an explanation for the empirical observation of poor people holding pessimistic beliefs, external locus of control and low aspirations (as shown in section 2). Far from being innate traits of poor people, these beliefs emerge as an equilibrium outcome as a consequence of their own initial disadvantage. To understand the intuition underlying Proposition 3, think of two behavioral decision-makers who have the same initial aspiration level, one rich and the other poor. There are just two effort levels, high and low effort. At this given aspiration level, the poor person would optimally choose a lower effort level than the rich, due to higher risks involved. However, the feedback from effort to aspirations implies that the lower effort of the poor person will cause his aspiration level to diverge from that of the rich person. Thus, in equilibrium, the poor person has two reasons to put in low effort: not only the risks he faces is higher, his aspiration level, i.e. the reference point which determines his marginal benefit of effort, is endogenously lower as well. In this sense, poverty curtails a poor person's *capacity to aspire*, in the spirit of Appadurai (2004). Then, the complementarity between goals and outcomes implies that poverty raises this threshold level of initial aspirations  $\tilde{g}(\theta_0)$  a poor person must have to choose higher effort. If he is no different from a rich person in this respect (as we have assumed), he converges to a payoff dominated solution more often.

Another point to note here is that, in *equilibrium*, a poor person is likely to perceive a higher downside risk. It is important to distinguish between objective risk faced by a poor person and his subjective equilibrium beliefs here. While greater risk affects his objective probability of success  $p(\theta, e, \theta_0)$  at a given effort level, his effort choices under an aspiration bias skew his equilibrium beliefs about success through effort further downward. This is consistent with a more external locus of control among the poor, as widely documented by the evidence.

An implication of such beliefs in equilibrium, is that the poor tend to over-estimate the role of a high initial endowment  $\theta_0$  in achieving a certain level of success. On observing a successful person, they fail to appreciate how that success could be the result of a gradual evolution of his aspirations and effort over time. Hence they decide that such success is unattainable for themselves, given their

own endowment. As the evidence in Section 2 shows, many poor persons decide that their children are not capable of completing school, because they lack the intelligence to do so.

## 5 Poverty Traps and Beliefs

So far, we have seen how higher exposure to risks faced by the poor interact with their behavioral weaknesses (internal constraints) to make them more susceptible to an aspirations failure. In this section, we relate our analysis so far to poverty persistence and pathways out of it. A positive feature of our model is that it allows us to study, within a unique framework, the effectiveness of multiple kinds of policy interventions – those that aim to relax external constraints, but also those that work on relaxing internal constraints. We begin by clarifying the reasons why both types of interventions are necessary. To do so, we adapt our analysis so far to a simplified framework with two effort levels  $\{\underline{e}, \bar{e}\}$  and corresponding expected outcomes  $\underline{g}(\theta_0) = \int_{\theta \in \Theta} p(\theta, \underline{e}, \theta_0) \theta d\theta$  and  $\bar{g}(\theta_0) = \int_{\theta \in \Theta} p(\theta, \bar{e}, \theta_0) \theta d\theta$ .

### 5.1 Standard versus Behavioral Poverty Traps

Based on our discussion following Proposition 3, two types of poverty traps can arise in our framework. The first is a *standard poverty trap* driven by material deprivation. As pointed out in Section 3, when individuals suffer from an aspirations bias, their initial aspiration level  $g_0$  affects their equilibrium effort and aspirations choice. The lower their initial endowment  $\theta_0$ , the higher is the threshold level of initial aspiration  $\tilde{g}(\theta_0)$  they need to push them towards a high effort choice. However, there could exist wealth levels (and hence, success probabilities) so low that the expected outcome of high effort falls below this threshold i.e.  $\bar{g}(\theta_0) < \tilde{g}(\theta_0)$  (see Figure 1).

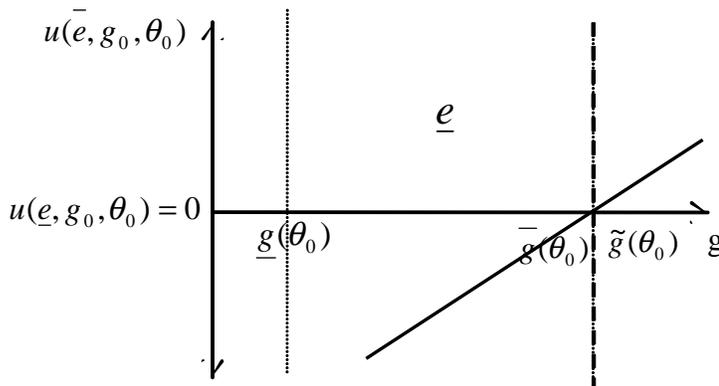


Figure 1: Standard Poverty Trap

In this case,  $(\underline{e}, \underline{g}(\theta_0))$  is both the unique behavioral and standard solution. Consistent with the

conventional view in economics, interventions that solely focus on altering the external constraints (i.e.,  $\theta_0$ ) of individuals caught in this type of poverty trap will be welfare enhancing. However, even when initial material deprivation is less extreme a *behavioral poverty trap* may still arise. As Figure 2 illustrates, the threshold level of initial aspirations required to justify high effort level is lower i.e.  $\underline{g}(\theta_0) \leq \tilde{g}(\theta_0) \leq \bar{g}(\theta_0)$ .

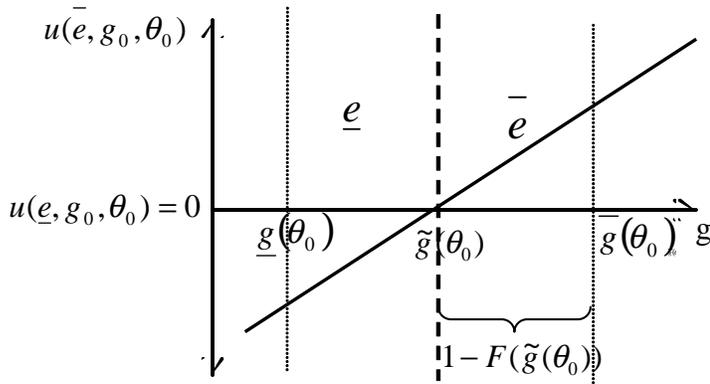


Figure 2: Behavioral Poverty Trap

Here,  $(\underline{e}, \underline{g}(\theta_0))$  and  $(\bar{e}, \bar{g}(\theta_0))$  are both behavioral solutions because effort choice is not constrained by initial material disadvantage  $\theta_0$  but initial aspirations  $g_0$ . If  $g_0 \leq \tilde{g}(\theta_0)$ , the individual is caught in a behavioral poverty trap with low equilibrium effort/aspirations and pessimistic beliefs; the individual escapes a behavioral poverty trap if  $g_0 \geq \tilde{g}(\theta_0)$ .<sup>25</sup> If a person is located in such a behavioral poverty trap, policies that improve his initial condition  $\theta_0$  may succeed in lifting his out of material deprivation, but he could still be caught in an "aspirations trap". For example, lowering the downside risk will mitigate aspirations failure, but for those caught in a behavioral poverty trap, this may not be enough – given their more pessimistic equilibrium beliefs and aspirations.

Thus, the gist of our analysis so far is that, while internal constraints such as pessimistic beliefs originally arise due to external constraints imposed by poverty, in equilibrium they could become an independent source of disadvantage for the poor. The kinds of poverty traps described above have two implications. The first is that, under acute poverty, the effectiveness of policies targeted to relax external constraints will be maximized if they also reduce internal constraints (for example, by reshaping beliefs). The second is that there exist conditions where relaxing internal constraints alone (without altering external ones) can alter behavior and reduce the persistence of poverty. In what follows, we focus on policies that complement the relaxation of external constraints, through direct or indirect effects on individual aspirations.

<sup>25</sup>Therefore, the probability that in equilibrium high effort/aspirations is realized is  $1 - F(\tilde{g}(\theta_0))$ .

## 5.2 Similarity and Belief Formation ( $p$ )

In this sub-section, we concern ourselves with the question of changing pessimistic beliefs  $p(\theta, e, \theta_0)$  among the poor to break poverty traps. So far, we have focused on how objective risks may depress their aspirations. However, it could be argued that aspirations are shaped by subjective beliefs, which are also influenced by the life experiences of those around us. Any discussion on how to change beliefs among the poor must account for these influences as well. This brings us to an important question: how do individuals pick the set of people whose life experiences they regard as relevant in forming their own beliefs and aspirations? We refer to this set of individuals as a person's 'cognitive window'.

It is not as if individuals accord equal weight to all influences in forming their beliefs. For instance, La Ferrara et al. (2009) shows that strong female characters in various soap operas broadcasted by Rede Golbo in Brazil result in higher women's fertility behavior in the country – but soap operas imported from Mexico and the US had little impact. Rao and Walton (2004) describe similar effects on the condom-use policy of sex-workers in Sonagachi, Kolkata's oldest and best established red-light district. The rise in condom use (and through it, a reduction in HIV incidence) occurred only when trained sex-workers themselves provided the information – but not when middle-class bureaucrats did so. Rao and Walton (2004) report that the use of the sex-workers as role-models led to a "metamorphosis" in the sex worker's aspirations, over a period of two or three years. In a randomized experiment conducted in Madagascar, Nguyen (2008) shows that the effect of providing information about the benefits of education on poor children's test scores is positive and significant only when the information is provided by someone from a poor background, but not a person from a rich background. These examples beg the question: how do people pick role models? How do they gauge who is *similar enough* to themselves, to make that person's life experience relevant to their own? The answer to these questions is important to understand how the beliefs of the poor about effort and success can be favorably influenced through this approach. We introduce the concept of role models and similarity into our framework to address these issues.

### 5.2.1 Role Models and Similarity

Consider an internally constrained individual  $i$  located in an aspirations trap. Suppose the individual observes an 'external signal'  $(\theta_0^j, \bar{e}, \theta_1^j = K + \theta_0^j)$  – i.e. information on an individual  $j$  with initial status,  $\theta_0^j$  who chose high effort  $\bar{e}$  and achieved a final outcome  $\theta_0^j + K$ . We say that an external signal belongs to the 'cognitive window' of a person  $i$  if he chooses high effort  $\bar{e}$  after observing the signal. To see when such an outcome is likely, we introduce the notion of *similarity*, and endow the individual with a similarity function  $s : \Theta \times \Theta \rightarrow [0, 1]$  where  $s(\theta_0^j, \theta_0^i) = 0$  denotes no similarity

and  $s(\theta_0^j, \theta_0^i) = 1$  denotes full similarity (Gilboa and Schmeidler, 2001). This function quantifies how similar an individual perceives his own initial status to be, to that of the potential role model.<sup>26</sup> A continuous similarity function consistent with Gilboa and Schmeidler (2001) is:

$$s(\theta_0^j, \theta_0^i) = 1 - \frac{|\theta_0^j - \theta_0^i|}{|\bar{\theta} - \underline{\theta}|} \quad (8)$$

where  $s(\theta_0^j, \theta_0^i) = 1$  when  $\theta_0^j = \theta_0^i$  and  $s(\theta_0^j, \theta_0^i)$  is decreasing in the distance between  $\theta_0^j$  and  $\theta_0^i$ .<sup>27</sup> After observing a signal  $(\theta_0^j, \bar{e}, \theta_1^j = K + \theta_0^j)$  individual  $i$  updates his prior  $p^i$  on the payoffs from choosing high effort  $\bar{e}$ , yielding a posterior expected payoff of  $[s(\theta_0^j, \theta_0^i) [b(K + \theta_0^i, \underline{g}(\theta_0^i)) - c(\bar{e})] + p^i b(K + \theta_0^i, \underline{g}(\theta_0^i)) - c(\bar{e})]$ . This is equivalent to

$$\frac{s(\theta_0^j, \theta_0^i) + p^i}{1 + s(\theta_0^j, \theta_0^i)} b(K + \theta_0^i, \underline{g}(\theta_0^i)) - c(\bar{e}) \quad (9)$$

where  $\frac{s(\theta_0^j, \theta_0^i) + p^i}{1 + s(\theta_0^j, \theta_0^i)} \equiv p_1^i$  are individual  $i$ 's posterior beliefs about the likelihood of changing his (initial) status. Note that his posterior beliefs  $p_1^i$  are increasing in his perceived similarity,  $s(\theta_0^j, \theta_0^i)$ . In choosing the optimal size of his 'cognitive window', the sample of individuals from which a person can potentially draw role models, he faces a trade-off. Ideally, what he wants to observe is someone who is identical (similarity one) to himself in initial status, but with a higher level of aspirations and achievement. However, a person very similar to himself is likely to have the same aspirations, and make the same decisions too. In order to increase the likelihood of observing an individual with higher aspirations and achievement, he has to compromise on similarity, by including some of those with a higher initial status than himself in his cognitive window. The following proposition identifies the factors that affect the width of an individual's cognitive window.

<sup>26</sup>Gilboa and Schmeidler (2001) provide an axiomatic treatment of choice determined by similarity weighted payoff estimation. The problem is familiar from econometrics where one might want to infer the conditional distribution  $p(y \in A | x_0)$  where the sample frequency of  $x_0$  is zero i.e.  $p(x_0) = 0$ . Assume that all variables are unidimensional. In such scenarios, it is standard in econometrics to use a uniform kernel estimate (Hardle, 1990; Manski, 1995) which is an estimate of the sample frequency with which  $y \in A$  amongst those observations  $x_i$  such that  $|x_i - x_0| < d$  (where  $d$  is the sample specific bandwidth chosen to confine attention to those observations in which  $x_i$  is close to  $x_0$ ). In a sample with  $n$  observations, the expression for the uniform kernel estimate is

$$\frac{\sum_{i=1}^N \mathbf{1}(y \in A) \mathbf{1}(|x_i - x_0| < d)}{\sum_{i=1}^N \mathbf{1}(|x_i - x_0| < d)}.$$

Then, the uniform kernel estimate corresponds to a "bandwidth" similarity function where

$$s(\theta'_0, \theta_0) = \begin{cases} 1, & \text{if } |\theta'_0 - \theta_0| \leq d \\ 0, & \text{otherwise} \end{cases}$$

<sup>27</sup>Chung (2000) also proposed a model of role models where individuals are rational Bayesian learners. In contrast to what we do in this paper, Chung assumes that individuals attach a similarity weight of one to the achievement of other individuals.

**Proposition 4.** *Let an individual  $i$  be caught in a aspirations trap. An external signal of a person  $j$  will be included in his cognitive window only if the degree of similarity with person  $j$  is  $s(\theta_0^j, \theta_0^i) \geq \frac{\hat{p}^i(\theta_0^i) - p^i}{1 - \hat{p}^i(\theta_0^i)}$ ,  $\hat{p}(\theta_0) \equiv \frac{c(\bar{e})}{b(K + \theta_0^i, \underline{g}(\theta_0^i))}$ . Thus, the size of his cognitive window is decreasing in  $c(\bar{e})$  and increasing in  $b(K + \theta_0, \underline{g}(\theta_0))$  as well as his prior beliefs  $p^i$ .*

**Proof.** See appendix. ■

Proposition 4 captures the idea that there is a threshold degree of (perceived) similarity needed for a individual to include a person in his cognitive window. It shows that the greater risk a person faces, the narrower is his cognitive window. Thus, poor people who face higher risk may set tighter restrictions on similarity, in choosing the set of people whose experience influences their beliefs. This is consistent with evidence from the sociology literature on poverty, which shows that the poor often tend to develop a strong *inbred sense of identity* that consciously makes them shun actions associated with those regarded as dissimilar to themselves (MacLeod, 1995). Thus, greater risk, by narrowing the set of people who are included in the cognitive window of the poor, they may weaken their perceptions about the link between effort and success, leading to a further reduction in their  $p(\cdot)$ .

### 5.3 Breaking Behavioral Poverty Traps: Policy Implications

Taken together, our description of behavioral poverty traps and the result of Proposition 4 imply that anti-poverty initiatives aiming to tackle persistent poverty need to be mindful of two important issues: (i) the need to reshape beliefs among the poor, in addition to providing resources and (ii) the importance that the poor accord to similarity, in forming their beliefs. To quote Bandura again, "failure to address the psychosocial determinants of human behavior is often the weakest link in social policy initiatives. Simply providing ready access to resources does not mean that people will take advantage of them." (The Psychologist, 2009, p. 505)<sup>28</sup>

Bandura cites the case of a national literacy programme in Mexico, wherein people who were skilled at reading were urged to organize small self-study groups to teach others how to read. It was a good idea – but there were few *takers*. Upon conducting a survey, Bandura’s team identified three beliefs among poor illiterate persons that impeded participation: that reading is learnable only when one is young, that they lacked the ability to master such a complex skill, that an educated person wouldn’t be interested in devoting time to them. In collaboration with the Population Media Centre (PMC), Bandura developed a soap-opera that worked to allay these specific mis-beliefs.<sup>29</sup>

<sup>28</sup>This quote and the material below is based on a lecture by Alberto Bandura to the British Psychological Society of which an edited version was published in The Psychologist (2009).

<sup>29</sup>In the drama, a popular star played the role of the literate person to whom various illiterate characters voice their self-doubts, and the instructor corrects their misbeliefs and persuades them that they have the ability to succeed.

This resulted in a dramatic increase in the take up rates for the program.<sup>30</sup>

The above project in Mexico is part of Bandura's larger multi-country collaboration with the PMC to create soap operas that reshape beliefs among the poor, to help them navigate their way out of poverty.<sup>31</sup> These soap-operas emphasize the similarity between their target audience and the life-experiences of the opera characters.<sup>32</sup> Bandura argues that it is such similarity that has allowed the target audience to identify with the drama characters over the course of the opera series, resulting in a significant change in aspirations and effort.<sup>33</sup>

## 6 Discussion and Conclusion

We have developed a simple framework to study the psychology of poverty and aspirations failure. Influential psychologists such as Bandura (1991) and social psychologists such as Beck (1970) and Seligman (1975) have argued that the belief that one's behavior can effect change is central to the path out of helplessness. Our model shows how well-documented phenomena such as learned helplessness, pessimistic beliefs and an external locus of control among the poor may be a consequence of poverty, rather than a cause. This arises through an interaction between two factors: (i) all individuals, rich or poor, fail to appreciate how their effort choices shape their aspirations over time - but the poor pay a bigger price for this failure because (ii) poverty exposes them to greater downside risk, which further lowers their incentive to put in effort. Their lower effort choices give rise to lower aspirations and more pessimistic equilibrium beliefs.

Here, we have chosen to capture the external constraints imposed by poverty in terms of greater downside risk. Arguably though, higher exposure to risk is not the only factor that can lower the net benefit of effort for the poor, as compared to the rich. This will also happen if the poor face higher cost of effort. For instance, simply saying that one lives in a poor neighborhood may diminish a poor

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<sup>30</sup>The day after one epilogue by an admired movie star, 25,000 people showed up to enrol in the self-study programme. Viewers were more informed than non-viewers about the literacy program. Enrolment rose from 90,000 in the year before the televised series, to one million during the year of the series and an additional 400,000 in the year after.

<sup>31</sup>Soap operas have been created to tackle beliefs and social issues among the poor, in several developing countries: Sudan(forced marriage, genital mutilation), Kenya(property rights for women), India (gender inequality in child-rearing, education for girls), Tanzania (family planning, AIDS).

<sup>32</sup>In Bandura's words: "these dramatic productions are not just fanciful stories. The plotlines portray people's everyday lives, and the impediments they face. ...They also model how to manage setbacks and recover from failed attempts....Seeing similar others succeed through perseverance strengthens staying power." (The Psychologist, 2009, p. 504)

<sup>33</sup>A drama for India (with an audience of about 125 million) that addresses the issue of girls education, with a mother who challenges restrictive cultural norms for her daughter Taru. Taru raised the academic aspirations and pursuits of teenage listeners, who had little access to education. One viewer wrote "There are moments when I feel that Taru is directly talking to me. She is telling me, 'Usha, you can follow your dreams'." (The Psychologist, 2009, p. 504)

person's chances of getting a job. Lack of easy access to bank branches can considerably increase the cost of savings for the poor – which may trigger multiple inefficiencies in their choices, financial and otherwise (see for example, Bertrand et al., 2004). Our model generates similar predictions with respect to equilibrium outcomes, when the external constraint faced by the poor is in terms of such higher marginal costs of effort, where effort may be a scalar or a vector of mutually complementary inputs.

A poor person could also receive a lower marginal benefit of effort, simply because the aspiration reference points in his social environment are lower. In our analysis here, we have consciously chosen to focus on the role of factors internal to an individual, to explain the psychology of poverty and aspiration failure. However, the process of aspiration formation and its evolution over time is inherently a dynamic one. For instance, Hirshman's "tunnel effect" refers to the phenomenon whereby others success may influence an individual's aspirations and beliefs about their own success over time. Incorporating these two key elements into the study of poverty and aspirations offer the promise of interesting avenues for future research.

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## 7 Proofs

*Proof of Proposition 1:*

We will show that  $u(e, g, \theta_0)$  satisfies supermodularity in  $(e, \theta_0)$  under Assumption 2 i.e. for  $e' \geq e$  and  $\theta'_0 \geq \theta_0$ ,  $u(e', g, \theta_0) \geq u(e, g, \theta_0)$  implies  $u(e', g, \theta'_0) \geq u(e, g, \theta'_0)$ . By adding a positive constant, if necessary, without loss of generality, assume that  $b(\theta, g) > 0$  for all  $\theta, g$ . For  $e' \geq e$  and  $\theta'_0 \geq \theta_0$ , let

$$\begin{aligned} f_1(\theta) &= p(\theta, e, \theta_0) b(\theta, g), & f_2(\theta) &= p(\theta, e', \theta_0) b(\theta, g), \\ f_3(\theta) &= p(\theta, e, \theta'_0) b(\theta, g), & f_4(\theta) &= p(\theta, e', \theta'_0) b(\theta, g). \end{aligned}$$

By assumption 2(i),

$$f_1(\theta) f_2(\theta) \leq f_3(\theta) f_4(\theta)$$

and therefore, by Ahlswede and Daykin (1979) and Karlin and Rinott (1980),

$$\left( \int_{\theta \in \Theta} f_1(\theta) d\theta \right) \left( \int_{\theta \in \Theta} f_2(\theta) d\theta \right) \leq \left( \int_{\theta \in \Theta} f_3(\theta) d\theta \right) \left( \int_{\theta \in \Theta} f_4(\theta) d\theta \right)$$

so that

$$B(e, g, \theta_0) = \int_{\theta \in \Theta} p(\theta, e, \theta_0) b(\theta, g) d\theta$$

is log supermodular in  $e, \theta_0$ . It follows that

$$u(e, g, \theta_0) = \int_{\theta \in \Theta} p(\theta, e, \theta_0) b(\theta, g) d\theta - c(e)$$

is a sum of a log supermodular function,  $B(e, g, \theta_0)$ , in  $(e, \theta_0)$  and an increasing function,  $c(e)$ , of  $e$ . By first-order stochastic dominance of  $p(\theta, e, \theta_0)$  in respectively  $e$  and  $\theta_0$ , note that for  $e' \geq e$ ,  $\theta'_0 \geq \theta_0$ ,  $B(e, g, \theta'_0) \geq B(e, g, \theta_0)$ ,  $B(e', g, \theta_0) \geq B(e, g, \theta_0)$ ,  $B(e', g, \theta'_0) \geq \max\{B(e, g, \theta'_0), B(e', g, \theta_0)\}$  and  $B(e', g, \theta'_0) \geq B(e, g, \theta_0)$ . Therefore,

$$\min\{B(e, g, \theta'_0), B(e', g, \theta_0)\} \geq \min\{B(e', g, \theta'_0), B(e, g, \theta_0)\}.$$

Assume without loss of generality that  $\max\{B(e, g, \theta'_0), B(e', g, \theta_0)\} = B(e', g, \theta_0)$ . As  $B(e, g, \theta_0)$  is log supermodular, it follows that

$$B(e', g, \theta'_0) - B(e, g, \theta'_0) \geq B(e', g, \theta_0) - B(e, g, \theta_0).$$

Suppose, to the contrary

$$B(e', g, \theta'_0) - B(e, g, \theta'_0) < B(e', g, \theta_0) - B(e, g, \theta_0).$$

As the log is an increasing function,

$$\log B(e', g, \theta'_0) - \log B(e, g, \theta'_0) < \log B(e', g, \theta_0) - \log B(e, g, \theta_0)$$

a, contradiction. Therefore,  $u(e, g, \theta_0)$  supermodular in  $(e, \theta_0)$ . ■

*Proof of Proposition 2:*

By continuity of  $u(e, g, \theta_0)$  in  $e$  and by the compactness of  $e$ ,  $e(g, \theta_0)$  is non-empty. For  $e' \geq e$  and  $g' \geq g$ , note that

$$\begin{aligned} & [u(e', g', \theta_0) - u(e, g', \theta_0)] - [u(e', g, \theta_0) - u(e, g, \theta_0)] \\ &= \int_{\theta \in \Theta} [p(\theta, e', \theta_0) - p(\theta, e, \theta_0)] [b(\theta, g') - b(\theta, g)] d\theta \\ &= \int_{\theta \in \Theta} p(\theta, e', \theta_0) [b(\theta, g') - b(\theta, g)] d\theta - \int_{\theta \in \Theta} p(\theta, e, \theta_0) [b(\theta, g') - b(\theta, g)] d\theta \\ &\geq 0. \end{aligned}$$

The first two equalities follows by computation. The third inequality follows as (a)  $b(\theta, g)$  satisfies increasing differences in  $\theta, g$  so that  $[b(\theta, g') - b(\theta, g)]$  is an increasing function of  $\theta$ , and (b)  $\frac{p(\theta, e', \theta_0)}{p(\theta, e, \theta_0)}$  is increasing in  $\theta$  so that  $p(\theta, e', \theta_0)$  first order stochastically dominates  $p(\theta, e, \theta_0)$ .

By continuity  $e(g, \theta_0)$  is non-empty and as payoffs satisfy increasing differences in  $(e, g)$ , it follows that there exists a maximal and minimal element in  $e(g, \theta_0)$  which is increasing in  $g$ .

Finally,  $p(\theta, e', \theta_0)$  first order stochastically dominates  $p(\theta, e, \theta_0)$  for  $e' \geq e$ ,  $\pi(e, \theta_0)$  is increasing in  $e$ . Therefore, by Tarski's fix point theorem,  $B$  is non-empty and there exists a maximal and minimal element in  $B$ . ■

*Proof of Lemma 1:*

By definition,  $(e^*, g^*)$ , for all  $e' \in e$ ,  $u(e, g, \theta_0) \geq u(e', g, \theta_0)$  for  $g = \pi(e, \theta_0)$ . By (C), for all  $e' \in e$ ,  $u(e, g, \theta_0) \geq u(e', g', \theta_0)$ ,  $g' = \pi(e', \theta_0)$ . It follows that  $(e^*, g^*) \in M$ .

Next, suppose, by contradiction,  $(e^*, g^*) \in M$  but (C) doesn't hold. As  $(e^*, g^*) \in B$ , for all  $e' \in e$ ,  $u(e, g, \theta_0) \geq u(e', g, \theta_0)$  for  $g = \pi(e, \theta_0)$ . As, by assumption, (C) doesn't hold there exists  $e' \in e$  such that  $u(e, g, \theta_0) \geq u(e', g, \theta_0)$  but  $u(e, g, \theta_0) < u(e', g', \theta_0)$ ,  $g' = \pi(e', \theta_0)$ . But, then,  $(e^*, g^*) \notin M$ , a contradiction. ■

*Proof of Lemma 2:*

A set of decision problems is *diverse* if and only if for each  $(e, g) \in e \times \Theta$  it contains the decision problem with utility function and feedback effect defined, in a neighborhood of  $(e, g)$ , by

$$u + \lambda g$$

for parameters  $\lambda$  in a neighborhood of 0.

A property holds generically if and only if it holds for a set of decision problems of full Lebesgue measure within the set of diverse smooth decision problems.

By computation, the first order condition<sup>34</sup> characterizing an interior standard solution is

$$0 = \left\{ \begin{array}{l} \left( \int_{\theta \in \Theta} \partial_e p(\theta, \hat{e}, \theta_0) b(\theta, \hat{g}) d\theta \right) - \partial_e c(\hat{e}) \\ + \left( \int_{\theta \in \Theta} p(\theta, \hat{e}, \theta_0) \partial_g b(\theta, \hat{g}) d\theta \right) \left( \int_{\theta \in \Theta} \partial_e p(\theta, \hat{e}, \theta_0) \theta d\theta \right) \end{array} \right\}$$

while the first order condition characterizing a behavioral solution is

$$\begin{aligned} 0 &= \left\{ \left( \int_{\theta \in \Theta} \partial_e p(\theta, e^*, \theta_0) b(\theta, g^*) d\theta \right) - \partial_e c(e^*) \right\} \\ g^* &= \left( \int_{\theta \in \Theta} p(\theta, e^*, \theta_0) \theta d\theta \right) \end{aligned}$$

Consider a decision problem with  $(e^*, g^*) = (\hat{e}, \hat{g})$ . Then, in this smooth setting, condition (C) is equivalent to requiring that

$$0 = \{ \partial_g u(e^*, g^*, \theta_0) \partial_e \pi(e^*, \theta_0) \}$$

or equivalently,

$$0 = \left\{ \left( \int_{\theta \in \Theta} p(\theta, e^*, \theta_0) \partial_g b(\theta, g^*) d\theta \right) \left( \int_{\theta \in \Theta} \partial_e p(\theta, e^*, \theta_0) \theta d\theta \right) \right\}.$$

Perturbations of the utility function do not affect the first order conditions characterizing the outcome of a behavioral decision (and hence hence  $(e^*, g^*)$ ) but they do affect the preceding equation and via the first order condition characterizing the outcome of a standard decision problem affect  $(\hat{e}, \hat{g})$ . Therefore,  $(e^*, g^*) \neq (\hat{e}, \hat{g})$  generically.

Finally, note that the statement in Lemma 2 cannot be further strengthened to "always" instead of "typically". To see this, let

$$b(\theta, g) = K\theta - (\theta - g)^2, \text{ for large but finite } K,$$

$c(e) = ce$ ,  $c > 0$  and  $p(\theta, e, \theta_0)$  be such that  $p(\theta_0, e, \theta_0) = p(e)$ ,  $p(\theta_0 + K, e, \theta_0) = 1 - p(e)$  with  $p(\theta, e, \theta_0) = 0$  for all  $\theta \notin \{\theta_0, \theta_0 + K\}$ . Then, by computation, it is easily checked that  $\partial_g b(\theta, g) = 2(\theta - g)$  and  $p(\hat{e})(\theta_0 - \hat{g}) + (1 - p(e))(\theta_0 + K - \hat{g}) = 0$ . ■

<sup>34</sup>Our formulation allows for a value function a la Kahneman and Tversky and as 0 is a kink-point of the value function, the value function isn't differentiable in  $g$ . However, as we work with integrals, as long as the underlying gross payoffs are continuous, are continuously differentiable almost everywhere and bounded, we can characterize decision-outcomes with take derivatives.

*Proof of Lemma 3:*

By Proposition 1, under assumption 2,  $u(e, g, \theta_0)$  is a supermodular function in  $(e, \theta_0)$ . Therefore, given Proposition 3, the maximal and minimal elements in  $B(\theta_0)$  are increasing in  $\theta_0$ . Further, for  $\theta'_0 \geq \theta_0$ , under assumption 2, again by the monotone likelihood ratio property, (i)  $p(\theta, \bar{e}(\theta'_0), \theta'_0)$  first order stochastically dominates  $p(\theta, \bar{e}(\theta_0), \theta_0)$  as  $\bar{e}(\theta'_0) \geq \bar{e}(\theta_0)$  and  $p(\theta, \underline{e}(\theta'_0), \theta'_0)$  first order stochastically dominates  $p(\theta, \underline{e}(\theta_0), \theta_0)$  as  $\underline{e}(\theta'_0) \geq \underline{e}(\theta_0)$ . ■

*Proof of Proposition 3:*

As a first step, fix  $\theta_0$ . For each effort  $e_k$ , let

$$g_n(\theta_0) = \int_{\theta \in \Theta} p(\theta, e_n, \theta_0) \theta d\theta.$$

By assumption 2 (i) (first order stochastic dominance) note that  $g_n(\theta_0) < g_{n+1}(\theta_0)$ ,  $n = 1, \dots, N-1$ . Define a sequence  $\{\tilde{g}_n(\theta_0) : 1 \leq n < N\}$  where for each  $n > 1$ ,  $n < N$ ,  $\tilde{g}_n(\theta_0)$  solves the equation

$$u(e_{n+1}, g, \theta_0) = u(e_n, g, \theta_0)$$

with  $\tilde{g}_0(\theta_0) = \underline{\theta}$  and  $\tilde{g}_N(\theta_0) = \bar{\theta}$ . Observe that under assumptions 1 and 2, the expression  $u(e_{n+1}, g, \theta_0) - u(e_n, g, \theta_0)$  is increasing in both  $g$  and  $\theta_0$  and therefore,  $\tilde{g}_n(\theta_0)$  is (i) decreasing in  $\theta_0$  for each  $n \geq 1$ ,  $n < N$ , and (ii) increasing in  $n$  for each  $\theta_0$ .

Under assumption 1 and 2, note that for each  $n$  such that  $(e_n, g_n)$  is a behavioral solution, (i)  $g' \in (\tilde{g}_{n-1}(\theta_0), \tilde{g}_n(\theta_0))$ ,  $u(e_n, g', \theta_0) > u(e, g', \theta_0)$  for all  $e \in E$  so that  $e_k$  is the unique best response and (ii)  $g_n(\theta_0) \in (\tilde{g}_{n-1}(\theta_0), \tilde{g}_n(\theta_0))$ .

Therefore,  $(\tilde{g}_{n-1}(\theta_0), \tilde{g}_n(\theta_0))$  is the basin of attraction of the behavioral decision outcome  $(e_n, g_n)$ . Then if  $g_0 \in (\tilde{g}_{n-1}(\theta_0), \tilde{g}_n(\theta_0))$ , the individual will choose  $e_n$  and there will end up with an aspiration level  $g_n$  i.e. the behavioral decision  $(e_n, g_n)$ . Therefore, the probability with which the internal constraint binds is equal to the probability that  $g_0$  is not in the basin of effort of the behavioral (and standard) decision  $(e_S, g_S)$  which, in turn, is the probability that  $g_0 < \tilde{g}_{S-1}(\theta_0)$  which is  $F(\tilde{g}_{S-1}(\theta_0))$ . As  $\tilde{g}_{S-1}(\theta_0)$  is decreasing in  $\theta_0$ , the probability that internal constraint binds,  $F(\tilde{g}_{S-1}(\theta_0))$ , is decreasing in  $\theta_0$ . Therefore, the lower is the initial status of the individual the greater is the probability that the internal constraint binds and in a behavioral decision.

Note that by assumption 2,  $\tilde{g}_1(\theta_0) > \theta_0$  so  $(e_1, g_1(\theta_0) = \theta_0)$  is also a behavioral solution. Moreover, by a similar argument to the one made above,  $\tilde{g}_1(\theta_0)$  is decreasing in  $\theta_0$ , the probability that internal constraint binds,  $F(\tilde{g}_0(\theta_0))$ , is decreasing in  $\theta_0$ . Therefore, the lower is the initial status of the individual the lower is the probability that  $(e_1, g_1(\theta_0) = \theta_0)$  is selected.

Finally, for  $n' \geq n$ , if  $(e_n, g_n(\theta_0))$  and  $(e_{n'}, g_{n'}(\theta_0))$  are two behavioral solutions, by assumption 2,  $p(\theta, e_{n'}, \theta_0)$  first order stochastically dominates  $p(\theta, e_n, \theta_0)$ , so that in equilibrium, a behavioral

decision-maker located at  $p(\theta, e_n, \theta_0)$  perceives higher downside risk than a behavioral decision-maker located at  $p(\theta, e_{n'}, \theta_0)$ . ■

*Proof of Proposition 4*

Note that  $\frac{s(\theta_0^j, \theta_0^i) + p^i}{1 + s(\theta_0^j, \theta_0^i)} = p_1^i$  are individual  $i$ 's posterior beliefs of changing his initial status. Given his updated beliefs, individual  $i$  will choose  $\bar{e}$  iff

$$p_1^i b(K + \theta_0^i, \underline{g}(\theta_0^i)) - c(\bar{e}) \geq 0 \quad (10)$$

or equivalently

$$p_1^i \geq \hat{p}^i(\theta_0^i) = \frac{c(\bar{e}, \theta_0^i)}{b(K + \theta_0^i, \underline{g}(\theta_0^i))} \quad (11)$$

As  $p_1^i$  is increasing in  $s(\theta_0^j, \theta_0^i)$ ,  $p_1^i > p^i$  whenever  $s(\theta_0^j, \theta_0^i) > 0$  and as  $s(\theta_0^j, \theta_0^i) \rightarrow 0$ ,  $p_1^i \rightarrow p^i$ . Therefore, the updating of priors after observing the peer is an example of similarity based learning. Moreover, observe that if  $s(\theta_0^j, \theta_0^i) \cong 1$ ,  $p_1^i \cong \frac{1+p^i}{2}$ . Therefore, even when the two individuals have an identical initial status,  $s(\theta_0^j, \theta_0^i) = 1$ , individual  $j$  will be included in the aspirations neighborhood of individual  $i$  if and only if  $\frac{1+p^i}{2} \geq \hat{p}^i(\theta_0^i)$ . Thus, whenever  $\frac{1+p^i}{2} \geq \hat{p}^i(\theta_0^i)$ , a person located at  $\theta_0$  will never alter his behavior by observing a successful peer, even if the peer is identical in initial status.

How similar does the successful individual need to be in order to inspire a change in individual  $i$ ? As long as  $s(\theta_0^j, \theta_0^i)$  is (weakly) decreasing in the distance between  $\theta_0^j$  and  $\theta_0^i$ , there is an endogenous upper bound to the aspirations neighborhood of the individual  $i$  which can be computed from the inequality

$$s(\theta_0^j, \theta_0^i) \geq \frac{\hat{p}^i(\theta_0^i) - p^i}{1 - \hat{p}^i(\theta_0^i)}. \quad (12)$$

The fraction on the right hand side of inequality (12) is increasing in  $\hat{p}^i(\theta_0^i)$  and decreasing in  $p^i$ . As  $\hat{p}^i(\theta_0^i) = \frac{c(\bar{e})}{b(K + \theta_0^i, \underline{g}(\theta_0^i))}$ , it follows that the size of the aspirations neighborhood of the person located at  $\theta_0^i$  is smaller when (i) the cost of choosing  $\bar{e}$  is higher; (ii) the benefit of achieving a higher final status is lower and (iii) the prior beliefs of the individual are more pessimistic (lower  $p^i$ ). ■