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POVERTY AND ASPIRATIONS FAILURE*

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We develop a theoretical framework to study the psychology of poverty and 'aspirations failure', defined as the failure to aspire to one's own potential. In our framework, rich and the poor persons share the same preferences and same behavioural bias in setting aspirations. We show that poverty can exacerbate the effects of this behavioural bias leading to aspirations failure and hence, a behavioural poverty trap. Aspirations failure is a consequence of poverty, rather than a cause. We specify the conditions under which raising aspirations alone is sufficient to help escape from a poverty trap, even without relaxing material constraints.

The Chronic Poverty Report (2008–9) estimates that 320–443 million people live trapped in chronic poverty: that is, these people remain poor for much or all of their lives and their children are likely to inherit their poverty as well. An influential literature on poverty traps argues that such persistent poverty is driven by constraints that are external to the individual. Examples of such constraints are credit or insurance market imperfections (Loury, 1981; Banerjee and Newman, 1991, 1993; Galor and Zeira, 1993), coordination problems (Kremer, 1993), institutional or governmental failures (Bardhan, 1997), malnutrition (Dasgupta and Ray, 1986), neighbourhood effects (Hoff and Sen, 2005) or even the family system (Hoff and Sen, 2006).

An alternative view highlights the role of internal constraints in perpetuating poverty traps. Behavioural biases or internal constraints such as myopia, lack of willpower and lack of aspirations are often cited as traits that the poor likely suffer from.[1] In an influential contribution, anthropologist Arjun Appadurai argued that the poor may lack the capacity to aspire and that policies that strengthen this capacity could help them to 'contest and alter the conditions of their poverty' (Appadurai, 2004, p. 59). Unlike external constraints, it is not clear whether such internal constraints are the cause of poverty – or its consequence. Do the poor become and remain poor because they lack aspirations – or, in the words of Bertrand *et al.* (2004, p. 1), 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 behaviours [...] lead to worse outcomes'?

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[1] Data from the World Values Survey show that 60% of Americans think that the poor are lazy or lack willpower (Alesina *et al.*, 2001).

In this study, we examine this latter view of internal constraints and poverty traps rigorously. To understand the psychology of poverty and low aspirations, we study a behavioural bias (or 'internal constraint') that individuals, whether rich or poor, may suffer from in setting their aspirations: while they recognise that setting higher aspirations will spur greater effort, they fail to realise that the effort level they choose also influences their aspirations (via realised outcomes). As Aldous Huxley puts it: 'every ceiling, when reached, becomes a floor'. In other words, individuals take aspirations as given, when in fact, aspirations and effort are jointly determined.

We consider a world in which both the rich and the poor suffer from such a bias. However, poverty imposes additional external constraints on the poor that exacerbate the adverse effects of the behavioural bias in setting aspirations. Such constraints are not just about initial wealth, they include other correlates of poverty that make it harder for the poor to achieve a given outcome, be it less influential contacts or less access to relevant information. We capture the effect of such constraints by assuming that an individual's final wealth is proportional to his initial wealth. In other words, other things equal, the poor have to make a greater effort than the rich to achieve the same level of final wealth. We have chosen to work with this reduced-form representation of external constraints because our focus here is on aspirations. We show that external constraints make the poor more susceptible to an aspirations failure: they are more likely to choose a low level of aspiration and effort relative to the best outcome they could have achieved, where low aspirations lead to low effort which, in turn, reinforces low aspirations.

Our formulation of aspirations failure is based on three premises well-grounded in the behavioural economics literature, as well as in evidence from across the social sciences. First, a person's aspiration level is a reference point that affects his utility from any realised outcome. Higher aspiration could spur greater effort but it could also adversely affect his satisfaction from a particular outcome (i.e. loss relative to a higher reference point).

Our second key premise is that an individual's aspirations and effort are jointly determined in equilibrium. This is because there is a two-way feedback from effort to aspirations: higher aspirations induce greater effort which, in turn, reinforces high aspirations, through the outcome realised.[2]

Our third key premise concerns the decision-making process itself. Even though aspirations and effort are jointly determined at a solution of the decision-problem, we assume that individuals take aspirations as given when choosing effort. In other words, we study individuals who fail to internalise the feedback from effort to aspirations. This behavioural bias in the decision-making process is the source of an aspirations failure.

While both the poor and the rich are equally afflicted by such a bias, the more stringent external constraints that the poor face make them more susceptible to an aspirations failure. The intuition underlying this result is as follows. Think of two behavioural decision-makers who have the same initial aspirations level, one rich and the other poor. At this given aspirations level, the poor person would optimally choose a lower effort level than the rich one, because his lower wealth reduces his marginal

[2] Stutzer (2004) provides evidence from survey data that the higher the current achievement of an individual is, the higher is her aspirations.

benefit from effort. 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. In equilibrium, the poor person has two reasons to put in low effort: not only are his net benefits lower, his aspiration level, which determines the marginal benefit of effort in equilibrium, is lower as well. We note that the model does not describe a case where poverty lowers the probability that a person achieves the outcome that he aspires for. “Rather, poverty lowers the aspirations’ level of a poor person, relative to what he could optimally aim to achieve”. This is what we refer to as an aspirations failure. In this sense, poverty curtails a poor person’s capacity to aspire, in the spirit of Appadurai (2004).

At this point, it is important to clarify two aspects of the modelling approach we use in this study. Arguably, the motivation offered above suggests some adaptive dynamic mechanism in which aspirations at any given time adapt to the effort chosen in the past via the outcome realised. It turns out, however, from a modelling viewpoint, all that is needed is a (static) model in which individuals take aspirations as given when choosing effort, while aspirations and effort are required to be consistent (i.e. aspirations are equal to the final outcome given effort) at a solution to the individual’s decision-problem.

Second, we adopt an explicit normative benchmark to provide a welfare evaluation of the outcomes of an individual’s decision-problem. It is the solution to a decision-problem where the individual takes into account the two-way feedback between effort and aspirations when he chooses between consistent effort–aspirations pairs. In our model, ignoring the feedback from effort to aspirations creates the scope for multiple welfare ranked (behavioural) equilibria. Further, initial external constraints (lower wealth) determine the likelihood of ending up at a low effort–low aspirations (and hence low outcome) equilibrium. We call such a situation a behavioural poverty trap.

Two types of poverty traps emerge from our analysis: standard poverty traps that are driven solely by external constraints but also behavioural poverty traps characterised by low effort and low aspirations. While external constraints imposed by poverty make internal constraints more consequential, the latter becomes an independent source of disadvantage in behavioural poverty traps. Our model suggests that, for some range of initial wealth, it is possible to break a poverty trap by altering aspirations alone. Therefore, policy approaches that influence aspirations among the poor are essential to break this latter kind of trap.

This article contributes to an emerging literature that formally models how aspirations influence economic outcomes. Ray (2006) provides a discussion of how socially determined aspirations contribute to poverty persistence: this is the starting point of our article. A related paper is Genicot and Ray (2014) which models aspirations as socially determined reference points via exogenously specified aspiration windows. Other closely related papers on aspirations include Stark (2006) and Bogliacino and Ortoleva (2013). These papers have the feature that aspirations are purely socially determined; they also have a macroeconomic emphasis, examining how aspirations affect income distribution and growth. Our approach is complementary to these papers: we examine how an individual’s own internal (psychological), rather than social, constraints shape aspirations, and hence outcomes.

Our study relates to recent work that reflects a growing recognition of the role that such internal constraints in perpetuating poverty. For instance, in her Tanner lectures, Duflo (2012) talks about how a lack of hope among the poor can affect aspirations and hence, behaviour.[3] A second distinct channel that has been studied is the adverse impact of poverty on individual cognitive function, because being preoccupied with financial worries reduces mental resources available for other tasks (Mani *et al.*, 2013). This emerging body of work highlights an important lacuna in anti-poverty policy: a failure to appreciate the role of constraints internal to individuals in perpetuating poverty.[4]

The remainder of the article is organised as follows. Section 1 motivates our focus on poverty and aspirations failure, presents the formal model and examines the channel through which poverty increases the likelihood of an aspirations failure. Section 2 outlines the conditions under which poverty traps may emerge due to internal, rather than external constraints and discusses the welfare and policy implications of our analysis. Section 3 concludes. Appendix A provides the proofs of all results, Appendix B shows two examples of value functions consistent with our framework and Appendix C presents two possible extensions of our model.

1. Aspirations and Poverty

Our motivation to examine the link between poverty and aspirations failure via internal constraints arises from two observations. The first is the strong correlation between these two phenomena. The lack of aspirations as a trait of the poor has been documented across a wide range of countries and settings – among low-income urban residents in America (MacLeod, 1995) and UK (LYSPE, 2006, in Cabinet Office, 2008), Jamaican male youths (Walker, 1997) and rural Ethiopian households (Frankenberger *et al.*, 2007; Bernard *et al.*, 2011). Second, this lack of aspirations among the poor does not seem to be fully explained by external constraints such as a lack of opportunity or information about pathways out of poverty. For example, Banerjee *et al.* (2011) report on the take up of an asset assistance and training programme aimed at enhancing the living standards of the ultra-poor in West Bengal, India. They find that 35.6% of the households who are offered this programme did not take up the assistance – despite its obvious benefits, as confirmed by changes in the well-being of programme participants.[5] Similarly, Duflo *et al.* (2011) document very low rates of take up of highly profitable fertiliser by maize farmers in Busia, Kenya – despite convenient opportu-

[3] In her words, a lack of hope can cause a person 'to rationally decide to hold back his or her efforts, avoid investment, and thus achieve even less than he or she could otherwise have attained' ... Hope can fuel aspirations ... In turn, these aspirations can affect behaviour'. This is similar in spirit to the idea of aspirations failure, formally modelled in this article.

[4] As Albert Bandura puts it: 'failure to address the psychosocial determinants of human behaviour 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.' (Lecture to British Psychological Society (The Psychologist, 2009, p. 505.)

[5] Banerjee *et al.* (2011, p. 8) find no significant observable differences across participants and non-participants who were offered the programme other than the fact that participants were younger and more likely to be Hindu than Muslim. The religion difference in 'refusal was anecdotally attributed to rumours .... (and) a few households declined to participate on account of not having time or not wanting to care for livestock'.

nities to buy it at reasonable prices.[6] Farmers were also given ample opportunity both to learn how to use the fertiliser and to realise that the rates of return from its use were as high as 70% per annum – so the usual external constraints imposed by a lack of money, information or opportunity do not seem to be at work. In the model below, we therefore consider an alternative explanation for the persistence of poverty arising from internal (behavioural) constraints exacerbated by poverty.

1.1. *The Model*

In this subsection, we develop a simple model that allows us to focus on the two-way link between aspirations failure and poverty traps.

1.1.1. *Preferences: aspirations as reference points*

We consider an individual characterised by a given level of initial wealth $\theta_0 \in \Theta = [\underline{\theta}, \bar{\theta}]$ a bounded subset of $\mathfrak{R}_+$. He must choose costly effort $e \in [0, 1]$ that will determine his final wealth θ. The individual has an aspiration level (or goal) $g \in \mathfrak{R}_+$ with regard to his final wealth.

For any given initial wealth θ_0, the utility the individual derives from choosing an effort level e depends not only on the cost of effort and the benefit of achieving a particular level of final wealth θ but also on his aspirations, as described by the utility function below:

$$u(e, g, \theta) = b(\theta) + v\left(\frac{\theta - g}{\theta}\right) - c(e). \tag{1}$$

The utility function of the individual has three additive components. The first component is the benefit of reaching a specific level of final wealth. We make the following assumption on $b(\theta)$:

ASSUMPTION 1 (A1). *$b(\theta)$ is a continuously differentiable, strictly increasing, strictly concave function over final wealth where $b(0) = 0$ and the coefficient of relative risk aversion $r(\theta) = -\theta b''(\theta)/b'(\theta) < 1$.*

A1 is satisfied by a number of commonly used utility functions in the literature (e.g. $b(\theta) = \theta^\alpha, 0 < \alpha < 1$). The restriction on $r(\theta)$ is required to derive the complementarity between effort and initial wealth.

The second component, $v[(\theta - g)/\theta]$, is a reference-dependent value function that captures one of the key premises of the model: that is, an individual's aspiration level g is a reference point that affects the satisfaction experienced from achieving a level of final wealth θ. Specifically, we assume that it is the proportional gain or loss of final wealth, relative to the reference point, that matters to the individual.

We make the following assumption on the shape value function v:

[6] Duflo *et al.* (2011) interpret this evidence as being consistent with farmers who procrastinate on purchase decisions, and are not sophisticated enough to recognise this bias. However, there are other possible explanations for the same behaviour.

Assumption 2 (A2). $[v'(x) - v''(x)(1 - x)] \geq 0$ *for all feasible values of* x *and* v *is continuously differentiable with* $v'(0) > 0$.

The assumption that $[v'(x) - v''(x)(1 - x)] \geq 0$ for all feasible values of x is required to ensure that aspirations and effort are complements (Lemma 1). For example, when $x < 0$ and $v'(x) > 0$, heuristically, this assumption will be satisfied if v is not 'too' convex over losses. Evidence from both laboratory and field studies (cited below Proposition 2) suggests that there is considerable support for such complementarity between aspirations and effort. The assumption that $v'(0) > 0$ has the plausible implication that the decision-maker prefers to overachieve (rather than underachieve) relative to his aspired level of wealth.

One possible formulation of v satisfying A2 is an S-shaped Kahneman and Tversky (1979) value function with diminishing sensitivity, that is convex over losses and concave over gains. Formally, v can be an increasing, continuously differentiable function with $v(0) = 0$ being the inflexion point of the function so that $v'(0) > 0$ but $v''(0) = 0$.[7] Note that this formulation does not allow for loss aversion in a small neighbourhood of zero as it would necessarily imply that v has a 'kink' (i.e. is non-differentiable) at zero. Another possible formulation of v is a continuously differentiable and strictly concave function that attains a maximum at a reference point γ (γ, the bliss point of the value function, could be different from zero). In Appendix B, we show two specific examples of such value functions.

Finally, the third component is the cost of effort $c(e)$ about which we make the following assumption:

Assumption 3 (A3). $c(e)$ *is a continuously differentiable, strictly increasing and convex function of effort with* $c(0) = 0$.

1.2. *How Poverty Imposes External Constraints*

We assume that the poor face greater external (resource) constraints than the rich, which effectively reduce their productivity. This could happen in myriad ways – for instance, their lack of access to credit could render their efforts to acquire skills or run a successful business less effective. Likewise, lack of access to information or influential social networks could make it harder for them to find jobs than a rich person who puts in the same effort. We capture such productivity effects of external constraints with the following 'reduced form' assumption on the production function of final wealth:

Assumption 4 (A4). $\theta = f(e, \theta_0) = (1 + e)\theta_0$.

In other words, final wealth is proportional to initial wealth where the factor of proportionality is determined by effort. The specific functional form of $f(e,\theta_0)$ is made for ease of exposition. In Appendix C, we examine the robustness of our results to less restrictive assumptions on the functional form of f.

[7] Genicot and Ray (2014) use such an S-shaped value function for their analysis.

1.3. *Effort and Aspirations*

1.3.1. *Aspirations as consistent reference points*

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 do an individual's own traits. In this article, our focus is on the latter. We require an individual's aspirations and effort to be mutually consistent (self-fulfilling) at a solution to his decision-problem, even though he takes aspirations as given when choosing effort.

The idea of requiring consistency between reference points and actions goes back to Tversky and Kahneman's (1991) reference-dependent theory of riskless choice, in which preferences not only depend on consumption bundles but also on a reference consumption bundle which 'usually corresponds to the decision-maker's current position' (Tversky and Kahneman, 1991, p. 1046).[8] In light of this, we require that aspirations are equal to (or consistent with) the (expected) level of final wealth given effort, at the solution of the decision-problem.[9] To put it in MacLeod's (1995, p.15) words, the 'individual's view of his or her own chances of getting ahead' is consistent with the effort level chosen. Formally, in our deterministic framework, we define an effort–aspirations pair (e, g) as consistent whenever given individual effort $e \in [0, 1]$, aspiration g is equal to the realised final wealth:

$$g = f(e, \theta_0) = (1 + e)\theta_0 \tag{2}$$

Our framework considers a world in which everyone can reach their aspirations. We realise that such a framework is at odds with empirical evidence, because people often do not. However, our aim is to model aspirations failures, rather than aspirations gaps defined as the difference between achievement and aspirations.[10] Reaching aspirations does not necessarily imply aspiring optimally. This distinction is essential to understand the essence of our study. Our goal is to be able to explain why people may aspire lower than their potential, despite being able to reach it. In Appendix C, we discuss how our our model can be extended to allow not only for an aspirations failure but also for an aspirations gap.

1.4. *Choosing between Consistent Effort (and Aspirations) Pairs: A Normative Benchmark*

So far, we have laid out two key premises:

(*i*) aspirations are reference points that affect our utility from achieving a particular level of final wealth; but

[8] This idea is also in line with ethnographer MacLeod's (1995, p. 15) take on aspirations: 'aspirations reflect an individual's view of his or her own chances for getting ahead'.

[9] It is important to note that expectations and aspirations are two distinctive concepts. In our deterministic model, aspirations enter the pay-offs via a reference point. Expectations, however, enter typically via the weights (beliefs) attached to the pay-offs associated with (uncertain) future outcomes.

[10] In an interactive model where aspirations are at least in part socially determined, such a gap would be an endemic feature (Bogliacino and Ortoleva, 2013; Genicot and Ray, 2014).

(*ii*) at a solution to the individual's decision-problem, aspirations are required to be consistent with effort choice.

When an individual is choosing among consistent effort–aspirations pairs $(e, f(e,\theta_0))$, by construction, his view of his chances of getting ahead is consistent with the effort level he chooses. In this sense, he fully internalises the feedback between effort and aspirations. Hence, maximising pay-offs is formally equivalent to maximising the resulting induced preferences over effort. We label such a decision-maker as a rational decision-maker and the solution of such a rational decision-problem, a rational solution. We certainly do not claim that most individuals are rational decision-makers who fully internalise the feedback between effort and aspirations. Rather, this only provides a normative benchmark against which we contrast the behavioural model of decision-making studied below.[11]

Formally, a rational solution is defined below:

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

$$\hat{e} \in \arg\max_{e \in [0,1]} s(e, \theta_0) = u(e, f(e, \theta_0), f(e, \theta_0)) \tag{3}$$

and

$$\hat{g} = f(\hat{e}, \theta_0). \tag{4}$$

At a rational solution, by construction, $x = [f(e, \theta_0) - f(e, \theta_0)]/f(e, \theta_0) = 0$ so that

$$s(e, \theta_0) = b(f(e, \theta_0)) + v(0) - c(e).$$

Note that from a normative perspective, the value function v is irrelevant in ranking effort as it enters the (induced) preferences over effort of a rational decision-maker as an additive constant. Moreover, under Assumptions A1, A3 and A4, a rational solution is the unique outcome of a well-defined strictly concave maximisation problem.

The following proposition characterises the set $S(\theta_0)$ of rational solutions and states the conditions under which effort and initial status (or wealth) are complements.

PROPOSITION 1. *Under Assumptions* A1, A3 *and* A4, *for a fixed value of* θ_0, *there exists a unique rational solution level of effort and aspirations* $(\hat{e}, \hat{g})$ *which is non-decreasing in* θ_0 (*strictly increasing in* θ_0 *when the solution is interior*).

Proposition 1 tells us that a poor rational decision-maker will choose lower effort and aspire to a lower level of final wealth than a richer rational decision-maker. This result is driven by two opposite effects. On the one hand, as the benefit function $b(f(e, \theta_0))$ from final wealth is concave, the utility of an additional unit of effort is higher, the poorer a person is. On the other hand, the complementarity between effort and initial wealth implies that an additional unit of effort is less effective in producing wealth for a poor person than for a rich person. The assumption that $r(\theta) < 1$ (by A1) implies that

[11] The justification for such normative benchmark is provided in Dalton and Ghosal (2013).

the first effect does not dominate the second effect, thus ensuring that $(\hat{e}, \hat{g})$ is non-decreasing in θ_0. Of course, given the lower initial wealth θ_0, the modest aspiration and effort choice of a poorer person cannot be regarded as an aspiration failure.

1.5. *Effort and Aspirations Choice of a Behavioural Decision Maker*

Admittedly, most people do not fully internalise how their aspirations are shaped by their effort choices; henceforth, we refer to such decision-makers as behavioural decision-makers. Our third central premise then is that, while choosing effort *e*, a behavioural decision-maker takes an aspired level of wealth *g* as fixed.

There is considerable evidence of this kind of behaviour 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 do not foresee how their aspirations will adapt to their new situation and they end up less happy than non-migrants in both locations.[12]

Formally, a behavioural decision-maker chooses *e*, while taking *g* as given, to solve

$$\text{Max}_{e\in[0,1]}\,\tilde{u}(e,g,\theta_0)=u(e,g,f(e,\theta_0)) \tag{5}$$

let $e(g, \theta_0)$ denote the set of payoff maximising efforts. Then,

Definition 2. *A behavioural solution is a consistent effort-Aspiration pair* (e^*, g^*) *such that* (*i*) $e^* \in e(g^*, \theta_0)$ *and* (*ii*) $g^* = f(e^*, \theta_0)$.[13]

Even though a behavioural decision-maker takes his aspiration level *g* as fixed, we require that the effort–aspiration pair that solves his decision-problem is mutually consistent (as definition 2 suggests). The following Lemma shows that under the assumptions made on the curvature of the value function (A2) and the production function for final wealth (A4), effort and aspirations are complements.

Lemma 1. *For a fixed level of initial wealth* θ_0, *under Assumptions* A2 *and* A4, $\partial^2\tilde{u}(e, g, \theta_0)/\partial e\partial g \geq 0$ *that is effort and aspirations are complements.*

We are now in a position to state the following result characterising the set $B(\theta_0) \subset \Re^2_+$ of behavioural solutions for a given value of θ_0.

Proposition 2. *For a fixed level of initial wealth* θ_0, *under Assumptions* A2 *and* A4: (*i*) *there exists a minimal and a maximal effort level,* $\underline{e}(g, \theta_0)$ *and* $\bar{e}(g, \theta_0)$, *both of which are*

[12] Our framework can be extended to scenarios where the decision-maker partially internalises the feedback from effort to aspirations with some probability λ. In such a scenario, the decision-maker in a behavioural decision-problem chooses effort to maximise $\tilde{u}(e, g) = \lambda u(e, g) + (1 - \lambda)v(e)$. This is formally equivalent to Loewenstein *et al.*'s (2003) model of projection bias.

[13] The effort–aspiration pair at a behavioural solution is self-fulfilling. Köszegi (2010) defines a notion of a personal equilibrium which is conceptually equivalent to the notion of a behavioural solution. A behavioural solution is also equivalent to a psychological Nash equilibrium (Geanakoplos *et al.*, 1989) or a Nash equilibrium in Loss Aversion Games (Shalev, 2000) in a one-person deterministic decision-problem framework.

non-decreasing in g, and (ii) there exists a minimal and a maximal effort–aspiration pair in B (θ_0), $(\underline{e}^*, \underline{g}^*)$ *and* $(\bar{e}^*, \bar{g}^*)$.

Proposition 2 shows that, at a behavioural solution, effort and aspirations are complements, that is higher aspirations are motivators of greater effort.[14] This result is in line with evidence from psychology and economics. For instance, Heath *et al.* (1999) find that individuals exposed to high goals exert higher effort and persist more in different physical and cognitive tasks than individuals who are exposed to low goals. Abeler *et al.* (2011) find similar results in the laboratory: when participants have higher reference points for earnings, they persevere longer at the experimental task. There is also evidence that 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 behaviour.

In the next subsection, we use the two solution concepts proposed here (behavioural and rational) to define aspiration failures. We note that they are formally identical to the steady state(s) of adaptive preference mechanisms such as those studied by von Weizsacker (1971), Hammond (1976) and Pollak (1978).[15]

1.6. *Internal Constraints and Aspirations Failure*

To explore this link systematically, we begin by shedding more light on the nature of behavioural solutions. Although the effort–aspirations pair is required to be consistent at such a solution, a behavioural decision-maker takes his aspirations as given, when choosing effort. If the exogenously taken aspirations level does not happen to coincide with the level of aspirations at a rational solution, the individual will be imposing an externality on himself that he does not internalise. This creates the possibility that a behavioural solution is welfare dominated by another consistent effort–aspirations pair. At such a behavioural solution, we say that the (behavioural) decision-maker is internally constrained. Formally:

DEFINITION 3. *For a fixed level of initial wealth* θ_0, *an individual is internally constrained at a behavioural solution* (e^*, g^*) *if* $(e^*, g^*) \notin S(\theta_0)$.

[14] Note that Assumptions A2 and A4 which guarantee this result are assumptions on the fundamentals of the model (preferences and technology).

[15] To elaborate on the adaptive preference mechanism interpretation, suppose there is an initial exogenous and fixed aspirations level g_0. At any step t in the 'tatonnement-like' preference adjustment process, preferences over effort are represented by a utility function $\tilde{u}(e, g_{t-1}, \theta_0)$ which depends on the aspirations level at the preceding step. At each step, the decision-maker chooses effort $e_t \in e(g_{t-1}, \theta_0)$ while aspirations are determined by $g_t = f(e_t, \theta_0)$. The decision-maker continues adjusting the effort he is willing to undertake until a steady state outcome is reached, that is $e \in e(g, \theta_0)$ and $g = f(e, \theta_0)$, corresponding to the outcome of a behavioural solution. Under Assumptions A1–A4, standard results on the stability of Nash equilibria imply that the preference adjustment mechanism (and hence, the adjustment of effort) converges to a long-run outcome (Vives, 1990). In contrast, at a rational solution, the adjustment to a steady-state outcome takes at most one step. This is because, at the initial (and each subsequent) step, the decision-maker anticipates that the aspiration level at step $t+1$ is affected by the effort chosen at step t (i.e. $e_t \in \arg\max_{e \in [0,1]} s(e, \theta_0)$ and $g_t = f(e_t, \theta_0)$).

The question that arises now is under what conditions the behavioural individual is internally constrained. The following proposition shows that under the assumptions made so far, an interior rational solution can never be a behavioural solution.

PROPOSITION 3. *For a fixed level of initial wealth* θ_0, *under Assumptions* A1, A2, A3 *and* A4, *an interior rational solution* $(\hat{e}, \hat{g})$ *(where* $\hat{e} \in (0, 1)$*) is never a behavioural solution.*

In the proof of Proposition 3, we show that for an interior rational solution to be a behavioural solution it is necessary that $v'(0) = 0$. However, this possibility is ruled out by A2 $(v'(0) > 0)$.

This brings us to corner solutions – what happens if we allow for them? In what follows, we describe the conditions under which both the rational and the behavioural solution are corner solutions. Given these stronger restrictions on v and c (relative to those imposed by Assumptions A1–A4), we show that multiple behavioural solutions exist and that the minimal behavioural solution is welfare dominated.

PROPOSITION 4. *For a fixed level of initial wealth* θ_0, *there exist constants* $K_2 > K_1 > 0$ *such that whenever* $K_1 \leq c'(0)$, $c'(1) \leq K_2$, $v'(0) < K_2 - K_1$ *and* $2v'(x) - v''(x)(1-x) \geq 0$ *for all feasible values of x, both the unique rational solution and each behavioural solution is a corner solution and the minimal effort–aspirations pair is welfare dominated.*

The proof of the above proposition shows that the unique rational solution is a corner solution where $e = 1$; consequently aspirations are at the highest possible level $g = 2\theta_0$. There are two behavioural solutions: one (minimal solution) where $e = 0$ with the lowest possible aspirations $g = \theta_0$ and another (maximal solution) with $e = 1$ and $g = 2\theta_0$. At the minimal behavioural solution, the final wealth of the decision-maker is equal to his initial wealth and the individual is internally constrained. We refer to such a behavioural solution as an aspiration failure.

2. Behavioural Poverty Traps

In this Section, we examine how poverty can exacerbate aspiration failure, hence making it an additional cause of poverty persistence. Given the multiple behavioural solutions described above, we show that lower initial wealth raises the probability that he ends up at the welfare-dominated minimal effort–aspiration pair.

Consider a discrete effort version of our framework with two effort levels $e \in \{0,1\}$ and

$$c = \left\{ \begin{array}{ll} c(1) > 0 & \text{if } e = 1 \\ c(0) = 0 & \text{if } e = 0 \end{array} \right\}.$$

Recall that by A4, when $e = 1$, $\theta = 2\theta_0$ and when $e = 0$, $\theta = \theta_0$. Hence, the net benefit from exerting effort at a rational solution is $h(\theta_0) = b(2\theta_0) - b(\theta_0) - c$.

Let us spell out how $h(\theta_0)$ relates to θ_0 and also the implications for v in our model. We use these results throughout the rest of this Section.

LEMMA 2. (*i*) *Under A1, $h(\theta_0)$ the net benefit of exerting effort at a rational solution is strictly increasing in initial wealth θ_0.* (*ii*) *Under A2, $-v(1/2) \geq v(-1)$.*

Part (i) of Lemma 2 is self-explanatory. In Lemma 2(ii), note that, given the production function $f(e, \theta_0) = (1 + e)\theta_0$, $v(-1)$ denotes the aspirations-outcome gap when $e = 0$ and aspirations are set at their highest value $2\theta_0$; similarly, $v(1/2)$ denotes the value aspirations-outcome gap when $e = 1$ and aspirations are set at their lowest value θ_0. Thus, given two possible effort levels and outcomes, Lemma 2 (ii) says that the value of overachieving at the low target by exerting high effort (i.e. $v(1/2)$) is less than the value of underachieving at the high target by exerting low effort (i.e. $v(-1)$).

The following result characterises the rational solution and the behavioural solutions as a function of θ_0:

LEMMA 3. *Under* A1, A2 *and* A4:

(i) *There exists $\hat{\theta}$ s.t.* (a) *if $\theta_0 \leq \hat{\theta}$, at a rational solution, $\hat{e}(\theta_0) = 0$, $\hat{g}(\theta_0) = \theta_0$, and* ($b$) *if $\theta_0 \geq \hat{\theta}$, at a rational solution $\hat{e}(\theta_0) = 1$, $\hat{g}(\theta_0) = 2\theta_0$.*

(ii) *There exists $\theta_H \geq \theta_L$ s.t. for* (a) *$\theta_0 \leq \theta_L$: the unique behavioural outcome is $e^*(\theta_0) = 0$, $g^*(\theta_0) = \theta_0$;* (b) *$\theta_L \leq \theta_0 \leq \theta_H$: there are multiple behavioural outcomes $e^*(\theta_0) = 0$, $g^*(\theta_0) = \theta_0$ and $e^*(\theta_0) = 1$, $g^*(\theta_0) = 2\theta_0$ and* (c) *$\theta_0 \geq \theta_H$: the unique behavioural outcome is $e^*(\theta_0) = 1$, $g^*(\theta_0) = 2\theta_0$.*

(iii) *Further, $\theta_L \leq \hat{\theta}$ if and only if $v(-1) \leq 0$; and $\theta_H \geq \hat{\theta}$ if and only if $v(1/2) \leq 0$.*

First, note that Lemma 3 implies that Propositions 1 and 2 continue to apply in this discrete version of the model. That is, effort and aspirations are non-decreasing in initial wealth at a rational solution.

Second, recall that Proposition 4 already shows the possibility of multiple behavioural solutions in the continuous effort version of the model. This ensures that multiplicity does not necessarily arise only when effort is discrete.

Finally, Lemma 3 shows that two types of poverty traps can emerge from our model: a standard and a behavioural poverty trap. Whenever $\theta_0 < \hat{\theta}$, the individual is caught in a standard poverty trap driven solely by material deprivation: there are wealth levels so low that the incremental wealth benefit from greater effort is dominated by the cost of such high effort.

Let us now study in more detail, how a behavioural poverty trap may emerge. For this, we need to examine how a behavioural outcome pair of effort and aspiration level is selected. Consider an initial aspiration level g_0 of an individual, that is drawn from some underlying probability distribution common to the rich and the poor. g_0 is irrelevant for a rational decision-maker, because he internalises the feedback from efforts to aspirations. Therefore, he will always only pick the unique rational solution as his effort–aspirations choice, no matter what his g_0 is. In contrast, a behavioural decision-maker's effort choice will be affected by g_0, as he takes his aspiration level as given.

The selection mechanism involves two stages:

(i) first for a given randomly generated initial aspirations level g_0, the individual chooses an effort level e; and (*ii*) second for a given e, the aspirations level (i.e. anticipated outcome) adjusts via the function $g = f(e, \theta_0) = (1 + e)\theta_0$.[16]

Given the above selection mechanism, the following proposition addresses how poverty and initial disadvantage interact to generate a behavioural poverty trap characterised by low effort and aspirations failure.

PROPOSITION 5. *Under Assumptions* A1, A2 *and* A4, *the lower the initial wealth* θ_0 *of an individual, the more likely he is to experience a behavioural poverty trap, that is end up at the minimal effort–aspirations pair.*

Proposition 5 provides an explanation for the empirical observation of poor people holding low aspirations (as suggested by the evidence cited in Section 2) and not realising their full potential. To understand the intuition underlying Proposition 5, consider two behavioural decision-makers who have the same initial aspirations 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, because his lower wealth reduces his marginal benefit from effort. 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. In equilibrium, the poor person has two reasons to put in low effort: not only are his net benefits lower, his aspiration level, which determines the marginal benefit of effort in equilibrium, is lower as well. In this sense, poverty curtails a poor person's capacity to aspire, in the spirit of Appadurai (2004).

Thus, the gist of our analysis so far is that, far from being an innate trait of poor people, low aspirations emerge as an equilibrium outcome as a consequence of their initial disadvantage. It is not that a poor person fails to achieve the outcome he aspires to; rather, he simply does not aspire as high as the best outcome he could have realised.

2.1. *Welfare Implications*

It remains to examine the welfare implications of the two types of poverty traps we study here. We proceed as follows. We fix θ_0 and compare the pay-off of an agent caught in a behavioural poverty trap with the pay-off that the same agent would obtain at a rational solution:

PROPOSITION 6. *For a fixed level of initial wealth* θ_0, *under Assumptions* A1, A2 *and* A4, *whenever* $v(-1) \leq 0$ *and* $v(1/2) < 0$, *a behavioural poverty trap is welfare dominated. When* $v(1/2) > 0$, *there is no level of initial wealth* θ_0 *for which a behavioural poverty trap is welfare dominated.*

Recall from our discussion following Lemma 2 that $v(1/2)$ is the maximum extent to which a person can overachieve relative to the outcome he aspires to, given the

[16] Note that stage (*ii*) above is formally identical to the adaptive preference mechanism described in footnote 15 in the special case of two effort levels.

production function $f(e, \theta_0) = (1 + e)\theta_0$. Thus, the condition $v(1/2) < 0$, combined with the the Assumption A2 that $v'(0) > 0$ implies that an individual obtains positive utility from overachieving relative to his aspiration level, except at the maximum level of overachievement. This condition is consistent with A2 (that the value function is upward sloping at a behavioural equilibrium i.e. $v'(0) > 0$ and $[v'(x) - v''(x)(1 - x)] \geq 0$ for all feasible values of x).[17] When the $v(1/2) < 0$, the level of initial wealth at which the switch to a high effort–aspirations pair occurs at a rational solution ($\hat{\theta}$) is lower than the level of initial wealth at which such a pair is the unique behavioural decision outcome (θ_H). Therefore, for each level of initial wealth between two threshold values $\hat{\theta}$ and θ_H:

(*i*) the behavioural solution is welfare dominated by the corresponding rational solution; and
(*ii*) low aspirations become a source of disadvantage in their own right.

The two-way feedback between aspirations and effort implies that, in this wealth interval, any intervention that sufficiently raises aspirations alone will move the individual out of the behavioural poverty trap.[18]

However when $v(1/2) > 0$, an individual's utility from overachieving is positive even at the highest possible level of aspiration. In other words, higher effort is always welfare-enhancing. As a result, there is no level of initial wealth for which a behavioural poverty trap is welfare dominated by a rational solution. Further, raising aspirations for any level of initial wealth between θ_L and θ_H will increase effort at a behavioural decision outcome but such an outcome will be welfare dominated by the rational solution. In such scenarios, raising aspirations must also be accompanied by a transfer mechanism that raises the initial wealth of the individual.

Finally, when initial wealth is below $\hat{\theta}$, the only way to ensure that an individual breaks out of the poverty trap is to raise the initial wealth of such an individual.

2.2. *Policy Implications*

A key feature of our model is that it allows us to study, within a single framework, the justification for and the effectiveness of multiple kinds of policy interventions – those that aim to relax external constraints but also those that work on relaxing internal constraints. The kinds of poverty traps described in the previous subsection imply that anti-poverty initiatives aiming to tackle persistent poverty need to be mindful of two important issues. The first is that, under acute poverty, the effectiveness of policies targeted to relax external constraints will be maximised if they also reduce internal constraints (e.g. by changing aspirations). The second

[17] In Appendix B, we work a number of different examples of such value functions that satisfy these conditions.

[18] Bernard *et al.* (2014) report experimental evidence from rural Ethiopia consistent with our theoretical prediction. Individuals were randomly invited to watch documentaries about people from similar communities who had succeeded in agriculture or small business. Six months after the screening of the documentaries, they found that only those whose initial assets and/or initial aspirations were above the median in the baseline, increased their aspirations and assets.

is that there exist conditions where relaxing internal constraints alone (without altering external ones) can alter behaviour and reduce the persistence of poverty.

A good example of the latter type of policy intervention designed to raise aspirations of low-income children is the Fesnojiv classical music orchestra programme developed in Venezuela 30 years ago by Jose Antonio Abreu. The programme project provides free classical musical training and the opportunity to perform in orchestras, to these children. In the founder's words, 'Participating in the orchestral movement has made it possible for them [the children] to set up new goals, plans, projects and dreams, and at the same time, it is a way of creating meaning and helping them in their day-to-day struggle for better conditions of life'.[19] About 96% of the young musicians have good to excellent school records – even though education was not the focus of the programme. In terms of our framework in this study, the programme manages to raise g_0, the initial aspiration level of the children. The UK programme 'Supporting parents on kids education (SPOKE)' which works with groups of parents to set personal goals for their children is another example of this kind of intervention. In a different setting, Beaman *et al.* (2012) find that in India, that exposure to female leaders in local government (as part of a mandated reservation of posts for women) raises both the aspirations and educational attainment of girls significantly – despite no change in the resources available for their education. In terms of our framework, such exposure reduces the behavioural bias of those exposed to female leaders, by helping them see the link between their current effort and future aspirations.

3. Conclusion

Appadurai (2004) has argued that the lack of a capacity to aspire is an important reason for the persistence of poverty. We have developed a novel and simple framework to study the psychology of poverty and aspirations failure. We show that the failure to aspire may be a consequence of poverty, rather than its cause. In our model, this outcome 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*) the complementarity between initial wealth and effort further lowers their incentive to put in effort.

Their lower effort choices give rise to lower aspirations through the two-way feedback between effort and aspirations. The key policy implication of our study is that policies that address aspiration levels can, at the very minimum, enhance the effectiveness of policies that address material deprivation; moreover, there are situations in which such policies on their own, can enhance welfare, without any change in material circumstances.

[19] See http://www.rightlivelihood.org/recip/abreu.htm.

In this study, we have consciously chosen a deterministic static model of individual decision-making because it was the simplest model that could generate behavioural poverty traps. We view this as a first step of a bigger project, where future extensions would include models with explicit dynamics, learning and individual interactions. Also, while uncertainty in final wealth was not required in the present model, there are scenarios where it would be central to understanding poverty traps, especially to model pessimistic beliefs or an external locus of control. Incorporating these elements into the study of poverty and aspirations promises interesting avenues for future research.

Appendix A. Proofs

Proof of Proposition 1. A1 and A3 imply that $s(e, \theta_0)$ is continuous and strictly concave in e for each θ_0. As $e \in [0, 1]$ is a compact set, a unique solution to an rational decision-problem (RDP) exists.

We now characterise the conditions under which, at an RDP, effort and initial wealth are complements. Recall the utility at an RDP is:

$$s(e, \theta_0) = b(f(e, \theta_0)) + v(0) - c(e). \tag{A.1}$$

Given initial wealth θ_0, the marginal utility of effort at an RDP is:

$$\frac{\partial s}{\partial e} = b'(\theta)\frac{\partial f}{\partial e} - c'(e), \tag{A.2}$$

and the marginal utility of effort as initial wealth θ_0 increases is:

$$\frac{\partial^2 s}{\partial e \partial \theta_0} = b'(\theta)\frac{\partial^2 f}{\partial e \partial \theta_0} + b''(\theta)\frac{\partial f}{\partial e}\frac{\partial f}{\partial \theta_0}. \tag{A.3}$$

Given initial wealth θ_0, effort and initial wealth are complements as long as:

$$\frac{\partial^2 s}{\partial e \partial \theta_0} \geq 0 \Leftrightarrow b'(\theta)\frac{\partial^2 f}{\partial e \partial \theta_0} + b''(\theta)\frac{\partial f}{\partial e}\frac{\partial f}{\partial \theta_0} \geq 0. \tag{A.4}$$

By A4, $f(e, \theta_0) = (1 + e)\theta_0$. Then $\partial f/\partial e = \theta_0, \partial^2 f/\partial e \partial \theta_0 = 1$ and $\partial f/\partial \theta_0 = 1 + e$. By substitution:

$$\frac{\partial^2 s}{\partial e \partial \theta_0} = b'(\theta) + b''(\theta)\theta_0(1+e) \geq 0 \Leftrightarrow b'(\theta) \geq -b''(\theta)\theta_0(1+e) \Leftrightarrow \frac{1}{(1+e)} \geq -\frac{b''(\theta)\theta_0}{b'(\theta)}.$$

Note that A4 implies $\theta/(1 + e) = \theta_0$. Substituting this in the equation above:

$$\frac{\partial^2 s}{\partial e \partial \theta_0} \geq 0 \Leftrightarrow 1 \geq -\frac{b''(\theta)\theta}{b'(\theta)} = r(\theta),$$

with $\partial^2 s/\partial e \partial \theta_0 > 0$ provided we are at an interior solution to an RDP and $r(\theta) < 1$.

Proof of Lemma 1. Recall, the utility at a behavioural decision-problem (BDP) is:

$$\tilde{u}(e, g, \theta_0) = b(f(e, \theta_0)) + v\left(\frac{f(e, \theta_0) - g}{f(e, \theta_0)}\right) - c(e). \tag{A.5}$$

Given initial wealth θ_0 and an aspiration level g, the marginal net utility of effort is:

$$\frac{\partial \tilde{u}}{\partial e} = b'(f(e, \theta_0))\frac{\partial f}{\partial e} + v'(x)\frac{\partial f}{\partial e}\frac{g}{(f(e, \theta_0))^2} - c'(e), \tag{A.6}$$

where $x = [f(e, \theta_0) - g]/f(e, \theta_0)$. The marginal net utility of effort as the aspiration level g increases is:

$$\begin{aligned}\frac{\partial^2 \tilde{u}}{\partial e \partial g} &= \frac{\partial f}{\partial e}\left[v''(x)\frac{-1}{f(e,\theta_0)}\frac{g}{(f(e,\theta_0))^2} + v'(x)\frac{1}{(f(e,\theta_0))^2}\right] \\ &= \frac{\partial f}{\partial e}\frac{1}{(f(e,\theta_0))^2}\left[v'(x) - v''(x)\frac{g}{f(e,\theta_0)}\right].\end{aligned} \tag{A.7}$$

Note that as $x = [f(e, \theta_0) - g]/f(e,\theta_0) \leftrightarrow (1 - x) = g/f(e,\theta_0)$. Hence,

$$\frac{\partial^2 \tilde{u}}{\partial e \partial g} = \frac{\partial f}{\partial e}\frac{1}{(f(e,\theta_0))^2}[v'(x) - v''(x)(1-x)]. \tag{A.8}$$

By A4, $\partial f/\partial e > 0$. Hence, for a given value of initial wealth θ_0, whenever $[v'(x) - v''(x)(1 - x)] \geq 0$ (A2), effort and aspirations are complements.

Proof of Proposition 2. Define a map $\Psi : [0, 1] \times [\theta_0, 2\theta_0] \rightarrow [0, 1] \times [\theta_0, 2\theta_0]$, $\Psi(e,g; \theta_0) = (e(g,\theta_0), f(e,\theta_0))$. Since $f(e, \theta_0)$ is (strictly) increasing in e (A4) and $\partial^2 \tilde{u}/\partial e \partial g \geq 0$ (Lemma 1 which relies on A2 and A4), it follows that $e(g, \theta_0)$ is a compact (and hence complete) sublattice of [0, 1] and has a maximal and minimal element (in the usual component wise vector ordering) denoted by $\underline{e}(g, \theta_0)$ and $\bar{e}(g, \theta_0)$ respectively both of which are increasing in g. Therefore, the map $(\bar{e}(g,\theta_0), f(e,\theta_0))$ is a continuous, non-decreasing function from $[0, 1] \times [\theta_0, 2\theta_0]$ to itself and as $[0, 1] \times [\theta_0, 2\theta_0]$ is a compact (and hence, complete) lattice, by Tarski's fix-point theorem $(\bar{e}^*(\theta_0), \bar{g}^*(\theta_0)) = (\bar{e}(\bar{g}^*, \theta_0), f(\bar{e}^*, \theta_0))$ is a fix-point of Ψ. By a symmetric argument, $(\underline{e}(g,\theta_0), f(e,\theta_0))$ is a continuous, non-decreasing function from $[0,1] \times [\theta_0,2\theta_0]$ to itself and $(\underline{e}^*(\theta_0), \underline{g}^*(\theta_0)) = (\underline{e}(\underline{g}^*, \theta_0), f(\underline{e}^*, \theta_0))$ is also a fixed-point of Ψ; moreover, $(\bar{e}^*(\theta_0), \bar{g}^*(\theta_0))$ and $(\underline{e}^*(\theta_0), \underline{g}^*(\theta_0))$ are respectively the largest and smallest fix-points of Ψ.

Proof of Proposition 3. As already noted in the proof of Proposition 1, under A1 and A3, $s(e, \theta_0)$ is strictly concave in e. Therefore, at an interior rational solution $(\hat{e}, \hat{g})$, (A.2), the marginal utility of effort must be zero, that is

$$\frac{\partial s}{\partial e} = b'(f(\hat{e},\theta_0))\frac{\partial f}{\partial e}(\hat{e},\theta_0) - c'(\hat{e}) = 0. \tag{A.9}$$

Likewise, from (A.6), we know that the marginal utility of effort at behavioural equilibrium (e^*, g^*) is:

$$\frac{\partial \tilde{u}}{\partial e} = b'(f(e^*,\theta_0))\frac{\partial f}{\partial e}(e^*,\theta_0) + v'(0)\frac{\frac{\partial f}{\partial e}(e^*,\theta_0)}{f(e^*,\theta_0)} - c'(e^*). \tag{A.10}$$

Hence, an interior rational solution is a behavioural solution if and only if

$$v'(0)\frac{\frac{\partial f}{\partial e}(e^*,\theta_0)}{f(e^*,\theta_0)} = 0.$$

However, note that by A4, $\partial f/\partial e > 0$ and $f(e^*, \theta_0) \in (\theta_0, 2\theta_0)$ so for $\theta_0 > 0$, $f(e^*, \theta_0) > 0$. So an interior rational solution is a behavioural solution if and only if $v'(0) = 0$. However, since $v'(0) > 0$ (by A2), an interior rational solution cannot be a behavioural solution as well.

Proof of Proposition 4. The proof proceeds by construction of a robust example with stronger restrictions than those imposed by Assumptions A1–A4. In this example, the rational solution is in a corner. There are two behavioural solutions, one in the same corner as the rational solution, and the other behavioural solution has a lower level of effort (we take this low effort to be equal to zero).

By computation, note that

$$\frac{\partial^2 \tilde{u}}{\partial e^2} = b''((1+e)\theta_0)\theta_0 - \frac{g}{(1+e)^3}[2v'(x) - v''(x)(1-x)] - c'(e), \tag{A.11}$$

where $x = [(1+e)\theta_0 - g]/(1+e)\theta_0$ and if we assume that $2v'(x) - v''(x)(1-x) \geq 0$ for all feasible values of x in addition to A1 and A3, $\partial^2\tilde{u}/\partial e^2 < 0$ i.e. $\tilde{u}(e, g, \theta_0)$ is strictly concave in e. It follows that if $(0, \theta_0)$ is a behavioural solution, then

$$b'(\theta_0)\theta_0 + v'(0) \leq c'(0),$$

and if $(1, 2\theta_0)$ is a behavioural solution, then

$$b'(2\theta_0)\theta_0 + \frac{v'(0)}{2} \geq c'(1) \Leftrightarrow b'(2\theta_0)2\theta_0 + v'(0) \geq 2c'(1).$$

By A1, as $r(\theta) < 1$, $\theta b'(\theta)$ is an increasing function of θ; it follows that

$$2\theta_0 b'(2\theta_0) - \theta_0 b'(\theta_0) > 0 \Leftrightarrow 2\theta_0 b'(2\theta_0) + v(0) > \theta_0 b'(\theta_0) + v'(0).$$

Let $K_1 = \theta_0 b'(\theta_0) + v'(0)$ and $K_2 = 2\theta_0 b'(2\theta_0) + v'(0)$: it follows that $0 < K_1 < K_2$ (under A1) so that whenever

$$K_1 + v'(0) \leq c'(0) < c'(1) \leq K_2 + v'(0),$$

$(\underline{e}^*(\theta_0), \underline{g}^*(\theta_0)) = (0, \theta_0)$ and $(\bar{e}^*(\theta_0), \bar{g}^*(\theta_0)) = (1, 2\theta_0)$.

Note that $(\hat{e}(\theta_0), \hat{g}(\theta_0)) = (1, 2\theta_0)$ is the unique rational solution, if and only if

$$b'(2\theta_0)\theta_0 \geq c'(1) \Leftrightarrow K_2 \geq 2c'(1),$$

which implies that

$$0 < v'(0) < b'(2\theta_0)2\theta_0 - \theta_0 b'(\theta_0) = K_2 - K_1.$$

Moreover, as the unique rational solution is $(\hat{e}(\theta_0), \hat{g}(\theta_0)) = (1, 2\theta_0)$, it follows that $(\underline{e}^*(\theta_0), \underline{g}^*(\theta_0)) = (0, \theta_0)$ is welfare dominated.

Proof of Lemma 2.

(*i*) As $h(\theta_0) = b(2\theta_0) - b(\theta_0) - c$, by computation, $h'(\theta_0) = 2b'(2\theta_0) - b'(\theta_0)$. Thus, for $\theta_0 > 0$

$$h'(\theta_0) > 0 \Leftrightarrow \theta_0 h'(\theta_0) > 0.$$

By A1, as $r(\theta) < 1$, $\theta_0 b'(\theta_0)$ is an increasing function of θ_0. It follows that

$$\theta_0 h'(\theta_0) = 2\theta_0 b'(2\theta_0) - \theta_0 b'(\theta_0) > 0,$$

so that $h'(\theta_0) > 0$ as required.

(*ii*) From Lemma 1 (under A2) we know that effort and aspirations are complements: $\partial^2\tilde{u}/\partial e\partial g > 0$. This is equivalent to the property that $\tilde{u}(e, g, \theta_0)$ satisfies increasing differences in e,g: that is for $(e', g') \geq (e, g)$,

$$\tilde{u}(e', g', \theta_0) - \tilde{u}(e, g', \theta_0) \geq \tilde{u}(e', g, \theta_0) - \tilde{u}(e, g, \theta_0).$$

As $\tilde{u}(e, g, \theta_0)$ satisfies the property of increasing differences in e, g, by computation, it follows that for $(e', g') \geq (e, g)$,

$$v\left(\frac{f(e',\theta_0)-g'}{f(e',\theta_0)}\right) - v\left(\frac{f(e,\theta_0)-g'}{f(e,\theta_0)}\right) \geq v\left(\frac{f(e',\theta_0)-g}{f(e',\theta_0)}\right) - v\left(\frac{f(e,\theta_0)-g}{f(e,\theta_0)}\right). \tag{A.12}$$

Let $e' = 1$, $g' = f(1, \theta_0) = 2\theta_0$, $e = 0$ and $g = f(0, \theta_0) = \theta_0$ (by A4). Then, by substitution, (A.12) reduces to:

$$-v(-1) \geq v\left(\frac{1}{2}\right) \Leftrightarrow v(-1) \leq -v\left(\frac{1}{2}\right) \tag{A.13}$$

as required.

Proof of Lemma 3. (*i*) Consider, first, the effort and aspiration pair consistent with a rational solution as initial status changes. For a given value of θ, $e = 1$, $g = 2\theta_0$ (by A4) is a rational solution iff

$$b(2\theta_0) - c \geq b(\theta_0) \Leftrightarrow h(\theta_0) \geq 0.$$

Therefore, whenever $r(\theta) < 1$ for all $\theta > 0$ (by A1), $h'(\theta_0) \geq 0$. Further,

$$\lim_{\theta_0 \to 0} h(\theta_0) < 0,$$

so that there exists $\hat{\theta}$ (the implicit solution to $h(\theta_0) = 0$ or $\hat{\theta} = h'^{-1}(0)$) such that:

(*a*) if $\theta_0 < \hat{\theta}$, at a rational solution $\hat{e}(\theta_0) = 0$, $\hat{g}(\theta_0) = \theta_0$; and
(*b*) if $\theta_0 \geq \hat{\theta}$, at a rational solution $\hat{e}(\theta_0) = 1$, $\hat{g}(\theta_0) = 2\theta_0$.

(*ii*) Consider, next, the effort and aspiration pair consistent with a behavioural solution as initial wealth changes. For a given value of θ_0:

(*a*) $e = 1$, $g = 2\theta_0$ is a behavioural solution iff

$$b(2\theta_0) - c \geq b(\theta_0) + v\left(\frac{\theta_0 - 2\theta_0}{\theta_0}\right) \Leftrightarrow h(\theta_0) \geq v(-1); \text{ and}$$

(*b*) $e = 0$, $g = \theta_0$ is a behavioural solution iff

$$b(\theta_0) \geq b(2\theta_0) + v\left(\frac{2\theta_0 - \theta_0}{2\theta_0}\right) - c \Leftrightarrow h(n\theta_0) \leq -v\left(\frac{1}{2}\right).$$

By Lemma 2, (A.13) (which relies on A1, A2 and A4), $-v(1/2) \geq v(-1)$. Let θ_L be the implicit solution to $h(\theta_0) = v(-1)$ (i.e. $\theta_L = h'^{-1}(v(-1))$) and θ_H be the implicit solution to $h(\theta_0) = -v(1/2)$ (i.e. $\theta_H = h'^{-1}(-v(1/2))$). Then, clearly, $\theta_H \geq \theta_L$. It follows that there are three possible configurations compatible with a behavioural solution:

(*a*) when $\theta_0 \leq \theta_L$, the unique behavioural outcome is $e^*(\theta_0)=0$, $g^*(\theta_0) = \theta_0$;
(*b*) when $\theta_L \leq \theta_0 \leq \theta_H$, there are multiple behavioural outcomes $e^*(\theta_0) = 0$, $g^*(\theta_0) = \theta_0$ and $e^*(\theta_0) = 1$, $g^*(\theta_0) = 2\theta_0$; and
(*c*) when $\theta_0 \geq \theta_H$, the unique behavioural outcome is $e^*(\theta_0) = 1$, $g^*(\theta_0) = 2\theta_0$.

(*iii*) Note that $h(.)$ is an increasing function. As $\hat{\theta}$ is the implicit solution to $h(\theta_0) = 0$ and θ_L is the implicit solution to $h(\theta_0) = v(-1)$, it follows that $\theta_L \leq \hat{\theta}$ if and only if $v(-1) \leq 0$. Further, as θ_H is the implicit solution to $h(\theta_0) = -v(1/2)$, it follows that $\theta_H \geq \hat{\theta}$ if and only if $-v(1/2) \geq 0 \Leftrightarrow v(1/2) \leq 0$.

Proof of Proposition 5. As a first step, fix θ_0. Let $\tilde{g}(\theta_0)$ solve the equation

$$\begin{aligned}\tilde{u}(1,g,\theta_0) &= \tilde{u}(0,g,\theta_0)\\ b(2\theta_0)+v\left(\frac{2\theta_0-g}{2\theta_0}\right)-c &= b(\theta_0)+v\left(\frac{\theta_0-g}{\theta_0}\right)\\ b(2\theta_0)-b(\theta_0)-c &= v\left(\frac{\theta_0-g}{\theta_0}\right)-v\left(\frac{2\theta_0-g}{2\theta_0}\right)\\ h(\theta_0) &= v\left(\frac{\theta_0-g}{\theta_0}\right)-v\left(\frac{2\theta_0-g}{2\theta_0}\right).\end{aligned}$$

By Lemma 3 (which relies on A1, A2 and A4), (*i*) $h(\theta_0)$ is increasing in θ_0, while (*ii*) $v(\theta_0-g/\theta_0)-v(2\theta_0-g/2\theta_0)$ is decreasing in g. Let $\tilde{g}(\theta_0)$ denote the implicit solution to the preceding equation. Then, clearly $\tilde{g}(\theta_0)$ is decreasing in θ_0.

Further, for $\theta_L < \theta_0 < \theta_H$:

(*i*) $\tilde{g}(\theta_0) > \theta_0$: $\tilde{g}(\theta_0) \leq \theta_0$ implies that the optimal effort for the behavioural individual is $e = 0$; and

(*ii*) $\tilde{g}(\theta_0) < 2\theta_0$: $\tilde{g}(\theta_0) \geq 2\theta_0$ implies that the optimal effort for the behavioural individual is $e = 1$.

Moreover, $\theta_0 \leq \theta_L$ implies $\tilde{g}(\theta_0) = \theta_0$ and $\theta_0 \geq \theta_H$ implies $\tilde{g}(\theta_0) = 2\theta_0$. It follows that:

(*a*) if $g < \tilde{g}(\theta_0)$, the optimal effort for a behavioural individual is $e = 0$; and

(*b*) if $g \geq \tilde{g}(\theta_0)$, the optimal effort for a behavioural individual is $e = 1$.

Therefore, $[0, \tilde{g}(\theta_0))$ is the basin of attraction of the behavioural decision outcome:

$$(e^*(\theta_0)=0, g^*(\theta_0)=\theta_0),$$

while $[\tilde{g}(\theta_0), 2\theta_0]$ is the basin of attraction of the behavioural decision outcome:

$$(e^*(\theta_0)=1, g^*(\theta_0)=2\theta_0).$$

Let m denote the pdf (and M the corresponding cdf) for g_0. The probability with which the behavioural outcome is $(e^*(\theta_0) = 0,\ g^*(\theta_0) = \theta_0)$ is equal to the probability that $g_0 \in [\theta_0, \tilde{g}(\theta_0))$ which is $M(\tilde{g}(\theta_0))$. Likewise, the probability with which the behavioural outcome is $(e^*(\theta_0) = 1,\ g^*(\theta_0) = 2\theta_0)$ is equal to the probability that $g_0 \in [\tilde{g}(\theta_0), 2\theta_0]$ which is $1 - M(\tilde{g}(\theta_0))$. As $\tilde{g}(\theta_0)$ is decreasing in θ_0, the probability that the individual is caught in a behavioural poverty trap, $M(\tilde{g}(\theta_0))$, is decreasing in θ_0.

Proof of Proposition 6. We check that for a fixed level of initial wealth θ_0, an individual stuck in a behavioural poverty trap is welfare dominated by another individual stuck in standard poverty trap. Note that $\hat{\theta} = h'^{-1}(0) \leq h'^{-1}(-v(1/2)) = \theta_H$ by Lemma 3 (which relies on A1, A2 and A4) if and only if $-v(1/2) > 0 \Leftrightarrow v(1/2) < 0$. Further, $\hat{\theta} = h'^{-1}(0) > h'^{-1}(v(-1)) = \theta_L$ as $v(-1) < 0$ and h'^{-1} is an increasing function.

If $v(1/2) < 0$, $\theta_H > \hat{\theta}$ so that whenever θ_0 is such that $\hat{\theta} \leq \theta_0 < \theta_H$, if the behavioural decision outcome is the low effort and low aspirations pair, given that a rational decision outcome is the high effort, high aspirations pair, the individual is necessarily choosing an effort and aspiration pair that is strictly welfare dominated.

If $v(1/2) \geq 0$, $\theta_H \leq \hat{\theta}$ so that if the behavioural decision outcome is the low effort and low aspirations pair, given that a rational decision outcome is also the low effort, low aspirations pair, a behavioural outcome is not welfare dominated.

Appendix B. Two Examples of Value Functions

We show two specific formulations of the value function that satisfy A2 on v.

B.1. *An S-shaped Value Function*

An example of such a value function satisfying A2 is $v(x) = ax^3 + kx$ where $a < 0$ and $k > 0$. By computation, $v'(0) = k$, $v''(0) = 0$, $v'(x) - v''(x)(1 - x) = 3ax^2 + k - 6ax(1 - x)$ and $v(1/2) = a/8 + k/2$, so that when $0 < k < -a/4$, $v'(0) > 0$, $v'(x) - v''(x)(1 - x) \geq 0$ for all $0 \leq x \leq 1/2$ (the feasible values of x under A4 on the production function for final wealth) and $v(1/2) \leq 0$. Note that since $v'(x) = 3ax^2 + k$, under the preceding parameter restrictions, $2v'(x) - v''(x)(1 - x) \geq 0$ as well. Finally, note that $v'(0) = k$ so that whenever $k \neq 0$, $v'(0) \neq 0$; therefore, $v'(0) \neq 0$ on a null set of parameters.

B.2. *A Value Function with a Bliss Point*

An example of a value function satisfying A2 is $v(x) = -(x - \gamma)^2$ where γ is the reference point. When $\gamma = 0$, v is symmetric over gains and losses. In this case, the effect of the frustration from falling short of aspirations (underachieving) is equal to the effect of the pleasure from exceeding aspirations (overachieving). However, a value of γ different from zero measures the degree of asymmetry over gains and losses in the value function. By computation, $v'(x) = -2(x - \gamma)$, $v'(x) - v''(x)(1 - x) = 2(1 + \gamma - 2x)$ and $v(1/2) = -(1/2 - \gamma)^2$ so that when $\gamma > 0$, $\gamma \neq 1/2$, $v'(0) > 0$, $v'(x) - v''(x)(1 - x) \geq 0$, for all $0 \leq x \leq 1/2$ (the feasible values of x under A4 on the production function for final wealth) and $v(1/2) < 0$. In addition, when $\gamma > 1/2$, $v'(x) > 0$ for all feasible values of x so that if $v'(x) - v''(x)(1 - x) \geq 0$, it follows that $2v'(x) - v''(x)(1 - x) \geq 0$ as well. Finally, note that $v'(0) = 2\gamma$ so that whenever $\gamma \neq 0$, $v'(0) \neq 0$ as well; therefore, $v'(0) \neq 0$ on a null set of parameters.

Appendix C. Extensions

We now consider some extensions to our basic model with a view to shedding light on the generality of our model and addressing some additional issues.

C.1. *Extension* 1: *Alternative Specification of the Production Function for Final Wealth*

We examine how our formal analysis changes when the production function for final wealth has a more general form than the one specified in Assumption (4). Consider the following assumption:

Assumption 4′ (A4′). $f(e,\theta_0) = \theta$ satisfies the following conditions:

(*i*) $f(0, \theta_0) = \theta_0$, if the individual puts in zero effort, his final wealth equals to his initial wealth;
(*ii*) $f(e, \theta_0)$ is (strictly) increasing and concave in effort at any given level of initial wealth, that is $\partial f(e,\theta_0)/\partial e > 0$ and $\partial^2 f(e,\theta_0)/\partial e^2 \leq 0$;
(*iii*) $f(e,\theta_0)$ is (strictly) increasing in initial wealth at any given level of effort, that is $\partial f(e,\theta_0)/\partial\theta_0 > 0$; and
(*iv*) effort and initial wealth are complements in the production function for final wealth (*i.e.* $\partial^2 f(e,\theta_0)/\partial e\partial\theta_0 > 0$).

The production function specified in Assumption (4) also satisfies Assumption (4′) but not necessarily vice versa. How robust are our results to A4′?

Lemma 1 and Proposition 2. The proofs of these two results need $\partial f(e,\theta_0)/\partial e > 0$ (*A4′ (ii)*).

Proposition 3 and Proposition 4. The proofs of Propositions 3 and 4 need that $\partial f(e,\theta_0)/\partial e > 0$, $\partial^2 f(e,\theta_0)/\partial e^2 \leq 0$, $f(0,\theta_0) = \theta_0$ (A4′ (*i*) and A4′ (*ii*)).

Proposition 1. Proposition 1 shows that $\partial^2 s/\partial e\partial\theta_0 \geq 0$. For this to be true under Assumption A4′, we require $r(\theta) < 1$. Now, if we assume a more general functional form of $f(e, \theta_0)$ under A4′ it should be as before in proposition 3 and 4 the restriction on $r(\theta)$ that makes Proposition 1 hold will be more general too. An argument along the lines of the proof of Proposition 1 establishes that there exists a unique rational solution level of effort and aspirations $(\hat{e}(\theta_0), \hat{g}(\theta_0))$ which is increasing in θ_0 provided that $b'(\theta)(1 - r(\theta)/\varepsilon(\theta)) \geq 0$ where

$$\varepsilon(\theta) = \frac{f(e,\theta_0)\dfrac{\partial^2 f}{\partial e\partial\theta_0}}{\dfrac{\partial f}{\partial e}\dfrac{\partial f}{\partial\theta_0}}.$$

Now, $(\partial^2 f/\partial e\partial\theta_0)/(\partial f/\partial e)$ is the percentage change in the marginal product of effort in the production of final wealth due to an increase of the level of initial wealth and $(\partial f/\partial\theta_0)/f(e,\theta_0)$ is the percentage change in final wealth due an increase in the level of final wealth. Therefore, $\varepsilon(\theta)$ is the elasticity of the marginal product of effort in the production of final wealth with respect to an increase in the level of initial wealth. Note that under A4, by computation, $\varepsilon(\theta) = 1$ and this allowed us to simplify the exposition of our model.

Lemma 2, Lemma 3, Proposition 5 and Proposition 6. Define $f(1, \theta_0) = kf(0,\theta_0) = k\theta_0$ and (with a slight abuse of notation) *let* $h(\theta_0) = b(k\theta_0) - b(\theta_0) - c$. Then, as in Lemma 2, $h'(\theta_0) > 0$ if and only if $r(\theta) < 1$ for all $\theta > 0$. Note that neither the statement nor the proof of Lemma 3 and Proposition 5 change. However, now the statement of Proposition 6 has to be changed so that whenever $v(k - 1/k) < 0$ a behavioural poverty trap is welfare dominated.

To summarise, all our results, with two exceptions, continue to hold with this more general assumption on the production function. The precise statements of two of our results (specifically, Proposition 1 and Proposition 6) change and require different assumptions on preferences. However, under these assumptions, we obtain a characterisation of a standard and behavioural poverty trap along the lines of Proposition 5 and 6 above.

C.2. *Extension 2: Allowing for an Aspirations Gap*

A key feature in the specification of our model is that effort and aspirations are required to be mutually consistent at any solution to a BDP: this precludes the possibility of an aspirations gap at a behavioural (or rational) solution. Here, we point out how we can extend our model to allow for an aspirations gap and discuss how our formal analysis extends to this case.

Let G_0 denote an initial aspiration level that is fixed exogenously; this could reflect environmental and internal factors (already discussed above) that are exogenous to the individual. Instead of assuming that at a solution to the individual's decision-problem aspirations equal final wealth, we could assume that aspirations equal some convex combination of final wealth and the initial exogenously determined level of aspirations, that is

$$g = \lambda f(e,\theta_0) + (1-\lambda)G_0.$$

In this case, clearly, there is the possibility of an aspirations gap even at a consistent effort–action pair (e, g) we have

$$g - G_0 = \lambda(f(e, \theta_0) - G_0).$$

By appropriately modifying the definition of a consistent effort–aspiration pair, we can then extend the existing definitions of a rational and a behavioural solution in an obvious way.

The model (and its associated results) studied in the main body of the article corresponds to the case where $\lambda = 1$. At the other extreme, when $\lambda = 0$ aspirations are always equal to the initial exogenously determined aspiration G_0: in this case, a behavioural and a rational solution always coincide. Generically, there is an aspirations gap; but importantly, there is no possibility of an aspirations failure in the sense studied in this article. However, for an arbitrary value of λ between zero and one, our results do not go through without further strengthening the assumptions made in our model. In sum, our results are robust to small changes in the value of λ below one. They would not hold, however, for any arbitrary value of λ between zero and one without further strengthening the assumptions made in our model.

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