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Cesar Calvo

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Cesar Calvo[†]
Universidad de Piura, Peru

Abstract

Two competing strands exist within the theoretical literature on vulnerability to poverty, each with its own policy implications. Vulnerability may be seen as low expected utility and thus stress the danger of self-perpetuating poverty, as the poor shy away from risky, yet necessary decisions to escape their hardship. Alternatively, vulnerability is often construed as expected poverty and provides policy-makers with a forward-looking viewpoint that both sheds light and raises new questions on how best to formulate the targeting of social spending. This paper provides an overview of the theoretical work underpinning each of these competing views.

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[†]**Contact details:** C. Calvo, Universidad de Piura, Martir Olaya 162, Lima 18, Peru. Email: cesar.calvo@udep.pe.

1 Introduction

The future can inspire hope, but also fear. The economic literature on poverty has gradually come to realise that hardship today is often compounded with sombre expectations for tomorrow. Some of the non-poor may likewise feel the threat of a downturn looming. Since households are vulnerable to future shocks that may force them down into poverty, both theoretical and empirical work need to assess the *ex-ante* implications of this threat. Even before shocks materialise, this vulnerability affects households – it clouds their present, it reduces their subjective well-being and it shapes their behaviours.

The concept of 'vulnerability to poverty' captures these concerns. As in the case of the usual, *ex-post* poverty concept, it is founded on the conviction that failure to reach some critical 'poverty line' causes hardship of an entirely different nature from, say, the 'mild discomforts' which a household above that threshold might experience. Life below the poverty line is grim, and both the affected households and societies at large must work towards the reduction of poverty. In the case of vulnerability to poverty, the possibility of such hardship is assessed *ex-ante*, before it strikes the household.

This chapter discusses the existing theoretical proposals about how best to define vulnerability to poverty, which immediately bear implications as to how we should measure it, and indeed as to why we should care about it in the first place. The structure follows an underlying divide between proposals placing the threshold in the space of well-being and proposals placing it in the space of outcomes (say, consumption levels). The former are concerned with the risk of the household failing to reach some well-being standard, while the latter focus on the threat of a shortfall with respect to some minimal outcome level.

Section 2 lays down the notation and defines key concepts which jointly compose either of these two possible views of vulnerability. Section 3 addresses the first of them and considers vulnerability as a shortfall in expected utility. Following this lead, section 4 goes over the theoretical literature where vulnerability prompts households to mitigate their exposure to future poverty, paradoxically at the cost of sacrificing their chances to improve their overall expectations for the future. Whether this future will come shortly or lies rather far ahead is not without consequences for vulnerability assessments, and section 5 explores these implications. Section 6 addresses the second main view of vulnerability and defines it as the expectation of critically low outcomes, i.e. as the threat of a poverty episode. Section 7 dwells on issues regarding aggregation over several households. Section 8

concludes.

2 Basic properties

Let x_t stand for some relevant outcome level at time t, and let it determine utility at that point in time u_t, i.e. $u_t = U(x_t)$, where a capital letter is used, here and hereafter, to signal a function. Let z stand for a poverty line defined in the space of outcomes, so a household is poor if $x_t < z$. Even though other outcomes may be as important as consumption, we refer to x_t as consumption for the sake of concreteness.

At time t, the household is uncertain about $t+1$, due to random shocks that may hit at $t+1$ and impinge on x_{t+1}. Let E_t be the expected-value operator based on information at time t, so e.g. $\mathrm{E}_t[x_{t+1}]$ is the expectation at t for consumption in the next period. Assuming for simplicity a finite number m of possible states of the world at $t+1$, let vectors $\mathbf{x}_{t+1}$, $\mathbf{u}_{t+1}$ and $\mathbf{p}$ contain values for consumption, utility and probabilities for those m states. In this case, $\mathrm{E}_t[x_{t+1}] = \mathbf{p}'\mathbf{x}_{t+1}$, $\mathrm{E}_t[u_{t+1}] = \mathbf{p}'\mathbf{u}_{t+1}$ and we can define vulnerability at time t as follows:

$$v_t = V(z, x_t, \mathbf{p}, \mathbf{x}_{t+1}) \tag{1}$$

For ease of exposition, we assume function V is differentiable. State-specific utility values in $\mathbf{u}_{t+1}$ may determine vulnerability through $u_{t+1} = U(x_{t+1})$, but this is not imposed since some views of vulnerability will give no role to utility. All views will however agree in paying attention to states of the world where consumption is low. Intuitively, vulnerability cannot decrease if consumption $x_{t+1,s}$ decreases in any s-th state. Function V should thus be monotonic:

$$[\textit{Monotonicity}] \quad \frac{\partial V(z, x_t, \mathbf{p}, \mathbf{x}_{t+1})}{\partial x_{t+1,s}} \leq 0 \tag{2}$$

Beyond this monotonicity property, there is no strong consensus on other attributes of function V. Any further desideratum will be present in only part of the literature. For the purpose of this chapter, we focus on three decisive properties. First, consider *reference dependence*, which claims that current consumption x_t should matter, since low future consumption will be arguably harder to bear if the household has got used to a high living standard. Formally,

$$[\textit{Reference dependence}] \quad \frac{\partial V(z, x_t, \mathbf{p}, \mathbf{x}_{t+1})}{\partial x_t} > 0 \tag{3}$$

Second, function V could be required to exhibit *risk sensitivity*, since the very uncertainty over their future dents the well-being of the vulnerable.

$$[\textit{Risk sensitivity}] \quad V(z, x_t, \mathbf{p}, \mathbf{x}_{t+1}) > V(z, x_t, \mathbf{p}, \mathrm{E}_t[x_{t+1}]\mathbf{1}) \tag{4}$$

where $\mathbf{1}$ is a vector whose elements are all 1. Vulnerability would be lower if the expected consumption level were attained with certainty.

Third, the states looming as a threat are arguably those where poverty strikes. In this vein, a *focus* property should ensure that states with $x_{t+1,s} > z$ receive no attention besides the fact that poverty has been prevented:

$$[\textit{Focus}] \quad \frac{\partial V(z, x_t, \mathbf{p}, \mathbf{x}_{t+1})}{\partial x_{t+1,s}} = 0 \text{ if } x_{t+1,s} > z \tag{5}$$

The appeal of this property depends on the answer to the following question. Suppose a farmer faces two scenarios. A drought may occur and hence she may face poverty. Otherwise, if it rains, she will be rich. "Does she becomes less vulnerable if the harvest in the rainy scenario improves, with no change in the harvest if the drought occurs?" (Calvo and Dercon 2013). Opting for a negative answer, which is reasonable but not compelling, clearly invokes the *focus* property. The literature includes this stance and also the opposite, allowing the non-poor state to compensate for the poor state.

The convenience of other sensible properties might be raised, such as *scale invariance* in $\mathbf{x}_{t+1}$ and z. However, *reference dependence*, *risk sensitivity* and *focus* will suffice as a useful structure to discuss the main views of vulnerability in the literature. We now turn to this discussion.

3 Vulnerability as low expected utility

As early as in Chambers (1989), vulnerability "refers to exposure to contingencies and stress, (...) which is defencelessness, meaning lack of means to cope" (p. 1). Exposure to uninsured risks causes stress and undermines well-being. Economics has long been aware of this intuition, and has formalised it as risk aversion, which is secured by concavity in $U(x)$. A stream of the literature has drawn on this concept and relates vulnerability closely to the deleterious effect of risk exposure on the expected utility of a risk-averse household.

Consider the following two proposals:

$$V^L = U(z) - \mathrm{E}_t[U(x_{t+1})], \text{ with } U' > 0 \text{ and } U'' < 0 \quad (6)$$
[Ligon and Schechter (2003)]

$$V^G = \mathrm{Max}\{U(z|x_t) - \mathrm{E}_t[U(x_{t+1}|x_t)], 0\} \quad (7)$$
[Günther and Maier (2014)]

where the notation drops the arguments in $V(z, x_t, \mathbf{p}, \mathbf{x}_{t+1})$. Ligon and Schechter (2003) provided the seminal view of vulnerability to poverty as a shortfall in the *ex-ante* expected utility of a risk-averse individual, as compared to her utility when the poverty line x is secured with no risk. Since x_{t+1} only enters their definition through the concave utility function, *risk sensitivity* is secured by construction.

Since they place their critical threshold in the space of utility, Ligon and Schechter (2003) omit the *focus* property and thus allow the possibility of rich states ($x_{t+1,s} \geq z$) to compensate for states threatening with poverty. Likewise, they pay no attention to *reference dependence*, which is a major concern for Günther and Maier (2014). In (7), V^G brings into consideration that households take their current consumption x_t as reference and dread the possibility of falling down to a lower living standard (even if the fall is not deep enough to plunge them into poverty). This is indeed a recurring notion in the literature (e.g. Povel 2015). Formally, they draw on prospect theory results, and in particular on loss aversion, which also secures a weak form of *risk sensitivity*, even if $U'' = 0$ for most consumption values.[1]

Günther and Maier (2014) do consider a *focus* on the threat of falling below the poverty line, but only to a limited extent – vulnerability is said to be zero if expected utility is higher than utility at $x_{t+1} = z$ with certainty. However, as in V^L, this expected utility could be high due to some very rich states of the world, even if the threat of extreme poverty looms in others. The strong, outcome-based *focus* property in (5) will only come into full effect in section 3, under a different view of vulnerability.

4 Vulnerability and household choices

With or without *reference dependence*, if vulnerability mirrors expected utility, then a forward-looking utility-maximiser household will

[1] For instance, in Günther and Maier (2014), $U(x_{t+1}|x_t) = x_{t+1} + \beta(x_{t+1} - x_t)$, with $\beta = \begin{cases} 1 & \text{if } x_{t+1} \geq x_t \\ 2 & \text{if } x_{t+1} < x_t \end{cases}$.

also minimise vulnerability, and hence vulnerability can be thought of as driving household choices. This view is explicit in (6) and can be said to underlie a larger literature where vulnerability is invoked as an explanation for reduced, perhaps inefficiently low risk-taking among the poor. In (7), this is only partially true due to its *focus*, which disregards efforts to raise expected utility beyond $U(z)$.

If choices promising higher returns also imply higher risks (of greater poverty), then the poor may be led into a poverty trap by their own efforts to reduce their vulnerability. Morduch (1994) brought to light this link between vulnerability and poverty, which can however be traced back to the seminal model in Sandmo (1971), where greater wealth implies greater willingness to take entrepreneurial risks, provided risk aversion decreases in wealth. The same early intuition is present in Stiglitz (1974), where sharecropping is an optimal, stable contract between the landlord and his poor tenants, since it implicitly provides the latter with insurance.

A number of models later followed this vein, with Banerjee (2000) providing the most explicit formalisation of the fact that "the poor are vulnerable: they are afraid of any losses because losses cause them too much pain" (p. 135). The poor have 'too much to lose' if things go wrong, and paradoxically this will scare them away from opportunities to escape poverty whenever they entail some risk. These opportunities can take several forms, but two instances will suffice to illustrate.

In Fafchamps and Pender (1997), a profitable investment is also irreversible, and risk-averse preferences exhibit precautionary-savings motives. Households will hence need to pile up savings beyond the cost of the (indivisible) investment asset, since this asset cannot be turned into cash in the case of a negative shock and these cautious households will never sacrifice entirely their access to readily available resources. Vulnerability thus implies a higher savings threshold and a greater difficulty to escape poverty. Likewise, in Eswaran and Kotwal (1989), risk-averse poor households look for credit as a safety net in the case of a negative shock – if their poverty restricts their access to credit, they will again reduce their exposure and forfeit investments even if their expected returns are high.

All these arguments highlight that efforts to minimise vulnerability (i.e. to maximise expected utility) include choices aiming to smooth income (or assets) over states of the world, even at the cost of reducing expected earnings. However, this is only true if households fail to insure their consumption from the uncertainty surrounding their income sources. Even though they may resort to formal and, with greater likelihood among the poor, informal insurance contracts, households find no access to complete insurance. Both to ensure clarity and for later

use, we now formalise these ideas.

Let w_{t+1} denote income, and allow for a random shock ϵ_{t+1} on this income (with $\mathrm{E}_t[\epsilon_{t+1}] = 0$ and $\mathrm{Var}_t[\epsilon_{t+1}] = \sigma^2_{t+1}$):

$$w_{t+1,s} = \mu_{t+1} + \epsilon_{t+1,s} \tag{8}$$

where subscript s denotes the s-th state of the world and μ_{t+1} is a non-random value. Next, consider the household effort to insure their consumption from income shocks. To this end, let $b_{t+1,s}$ be an insurance payment due to the household if the s-th state occurs:

$$b_{t+1,s} = -\lambda\epsilon_{t+1,s}, \text{ with } 0 \leq \lambda \leq 1 \tag{9}$$

where λ measures the completeness of the insurance contract. Note (9) imposes fair insurance (i.e. $\mathrm{E}_t[b_{t+1}] = 0$). From (8) and (9), available income in the s-th state depends on the expected income μ_{t+1}, the realised income shock $\epsilon_{t+1,s}$, and the degree of insurance λ:

$$w_{t+1,s} + b_{t+1,s} = \mu_{t+1} + (1-\lambda)\epsilon_{t+1,s}, \text{ with } 0 \leq \lambda \leq 1 \tag{10}$$

If $\lambda = 1$, insurance is complete and the household secures $w_{t+1,s} = \mu_{t+1}$ regardless of the state actually occurring.

Given (10), the household consumption function may be written as follows:

$$x_{t+1,s} = X(\mu_{t+1} + (1-\lambda)\epsilon_{t+1,s}) \tag{11}$$

Vulnerability assessments feed on this state-specific consumption function. To highlight this link with greater clarity, ignore intertemporal transfers momentarily and assume all available income is consumed:

$$x_{t+1,s} = \mu_{t+1} + (1-\lambda)\epsilon_{t+1,s} \tag{12}$$

Lastly, taking V^L for concreteness and then feeding (12) into a second-order Taylor approximation of (6),

$$v^L_t = U(z) - U(\mu_{t+1}) - \frac{U''(\mu_{t+1})}{2}(1-\lambda)^2\sigma^2_{t+1} \tag{13}$$

In (13), as their vulnerability worries households at t, they will forgo opportunities to raise their expected income μ_{t+1} whenever they come at the cost of a significantly higher exposure to uninsured risk, as measured by $(1-\lambda)^2\sigma^2_{t+1}$. As discussed above, in this view vulnerable households fear any risk to lose the little they have, and this fear may lock them into persistent poverty.

Lastly, we use this setup to note that (12) clarifies the rationale for the outcome-based *focus* property in (5), which prevents high-consumption states from compensating for poverty-striken states. So

to speak, consumption in the rainy scenario already discounts the insurance payment to protect consumption if a drought occurs. Vulnerability is assessed on state-specific consumption $x_{t+1,s}$, *after* all such insurance efforts have been made.

5 The time frame of vulnerability

Echoing the bulk of the literature, the discussion has referred to the threat of a poverty episode in one particular period in the future. In the notation above, $t+1$ could lie one month, one year, or one whole decade ahead. The choice should make no dramatic difference if consumption levels in all future periods exhibited a strong positive correlation *ex-ante*. However, arguments to the contrary exist.

For instance, in the presence of poverty traps, households may be willing to suffer severe consumption shortfalls in the near future so as to avoid the risk of persistent poverty in the longer run (Carter and Lybbert 2012). They realise that long-run consumption will stabilise at a dismally low level if they dissave their assets for the sake of short-run consumption – say, if they sacrifice their ox, they will never be able to buy another one to plough their land and their productivity will be permanently low.

Formally, taking $t+2$ as the long-run,

$$x_{t+2,s} = \begin{cases} \underline{x} & \text{if } a_{t+1,s} < \hat{a} \\ \overline{x} & \text{if } a_{t+1,s} \geq \hat{a} \end{cases} \tag{14}$$

where $a_{t+1,s}$ denotes savings at the end of $t+1$ when the s-th state occurs and $\hat{a}$ is a critical threshold condemning those below to low future consumption $\underline{x} < \overline{x}$. Assuming households maximise $U(x_{t+1}, x_{t+2}) = \ln(x_{t+1}) + \beta \ln(x_{t+2})$ with $0 < \beta < 1$, the consumption function in (11) takes an explicit form:

$$x_{t+1,s} = \begin{cases} \mu_{t+1} + (1-\lambda)\epsilon_{t+1,s} & \text{if } \epsilon_{t+1,s} < \hat{\epsilon} \\ \mu_{t+1} + (1-\lambda)\epsilon_{t+1,s} - \hat{a} & \text{if } \epsilon_{t+1,s} \geq \hat{\epsilon} \end{cases} \tag{15}$$

and

$$x_{t+2,s} = \begin{cases} \underline{x} & \text{if } \epsilon_{t+1,s} < \hat{\epsilon} \\ \overline{x} & \text{if } \epsilon_{t+1,s} \geq \hat{\epsilon} \end{cases} \tag{16}$$

where $\hat{\epsilon} = \frac{1}{1-\lambda}\left(\frac{\hat{a}\overline{x}^{\beta}}{\overline{x}^{\beta} - \underline{x}^{\beta}} - \mu_{t+1}\right)$ is a threshold dividing long-run poverty from high long-run consumption. Provided $\epsilon_{t+1,s} \geq \hat{\epsilon}$, bad shocks are not bad enough to obscure the long-run future, and vulnerability to long-run poverty $V_t(x_{t+2})$ remains unaffected. Households sacrifice

the short run for the sake of the future, and thus they are vulnerable to immediate hardship in the face of such bad shocks. Worse shocks however, such that $\epsilon_{t+1,s} < \hat{\epsilon}$, force households to give up their future, since protecting it would require extreme short-run deprivations. Their vulnerability to poverty in the near future $V_t(x_{t+1})$ thus lessens, to the cost of a dramatic rise in vulnerability $V_t(x_{t+2})$ for the longer horizon. Clearly, the time frame of the vulnerability assessment matters. Note this is not due to the additional uncertainties of a longer time span, since ϵ_{t+1} has remained the only source of risk.

6 Vulnerability as expected poverty

An increasingly dominant view among policy-makers follows a different path. They find the concept of vulnerability to poverty relevant because it helps them predict who will be poor in the future, and thus provides them with a tool to craft a forward-looking policy. Vulnerability relates to how much poverty the policy-maker should expect.

On the flip side, concerns about expected utility are allowed to fade, not least due to pragmatic reasons – both utility functions and their parameters are unknown, as well as subjective probabilities. Hence, the expected-utility view is deemed to provide little guidance to fine-tune policy in practice, and furthermore this advice will be clouded by doubts about the true reasons behind the choice of parameters. From this standpoint, expected poverty offers a gain in both empirical guidance and transparency, as it builds explicitly on the set of parameters and probabilities shaping the stance of the policy-maker (Christiaensen and Subbarao 2005). The rationale for the switch from the utility space to that of outcomes is thus pragmatic.

Let $P(z, x_t)$ denote a household poverty function and define $e_t = z - x_t$ as the gap between the poverty line and consumption. In many instances, e.g. in the well-known FGT index (Foster, Greer and Thorbecke 1984), poverty is determined by this gap: $P(z, x_t) = \tilde{P}(e_t)$. With this notation, we may summarise the existing proposals

as follows:

$$V^R = \mathrm{E}\left[\tilde{P}(e_{t+1})\right] \quad (17)$$

[Ravallion (1988)]

$$V^D = \mathrm{E}\left[\tilde{P}(D(z, x_t) - x_{t+1})\right] \quad (18)$$

[Dutta et al. (2011)]

$$V^C = V^L \text{ in (6), with } U(x_t) = \frac{1}{\theta}\left(\frac{\mathrm{Min}\{x_t, z\}}{z}\right)^{\theta} \text{ and } \theta < 0 \quad (19)$$

[Calvo and Dercon (2013)]

By exploring the consequences of uncertainties in consumption on expected (aggregate) poverty, Ravallion (1988) paved the way for this whole stream of the literature, even though his piece did not use the term vulnerability. He allowed $\tilde{P}(e_{t+1})$ to take any specification within the Atkinson class of poverty measures, and showed that greater risk will raise expected poverty if the consumption function in (11) is concave. The concavity of consumption in available resources thus secures *risk sensitivity*.

In the case of the headcount, i.e. $\mathrm{FGT}_{t+1}(\alpha = 0)$, Ravallion (1988) finds a more demanding condition: the consumption function must be quasi-concave and the consumption mode must be above the poverty line. That *risk sensitivity* hinges on a rather strong condition is significant because most of the subsequent empirical literature estimates vulnerability as the probability of facing poverty in the future, i.e. $\mathrm{E}_t[\mathrm{FGT}_{t+1}(\alpha = 0)]$, which is the household-level equivalent to the aggregate headcount.

In particular, the specification in (17) also captures a more recent strand of proposals aiming to find a 'vulnerability line' z_v, such that a current outcome below this line ($x_t < z_v$) can be interpreted as a high probability of falling into poverty in the future. This approach arises from the practitioners' need to easily identify the vulnerable, and policy papers have provided it with insightful foundations. For instance, in Cafiero and Vakis (2006), z_v includes insurance as part of the basket of basic needs, while López-Calva and Ortiz-Juarez (2014) and Dang and Lanjouw (2014) resort to empirical household-specific estimates of the probability of future poverty and set z_v at the consumption level of those whose probability rises above a given threshold.

As for *focus*, it is clearly built into (17) by construction, since

$\tilde{P}(e_{t+1,s})$ is evaluated in each s-th state of the world.[2] On the other hand, *reference dependence* is entirely ignored.

The view of Dutta et al. (2011) differs both because *reference dependence* is acknowledged and because *focus* is compromised. As in e.g. López-Calva and Ortiz-Juarez (2014), they also modify the standard poverty line, but with a different aim. Dutta et al. (2011) propose a hybrid line combining the usual minimal consumption level z with the desire to preserve initial living standards x_t – for instance, $D(z, x_t) = z^{\alpha} x_t^{1-\alpha}$. They allow both for a higher line when current consumption rises ($0 < \alpha < 1$), in line with the loss aversion conjecture, and also for a lower line ($\alpha > 1$), because arguably a higher x_t implies that the household will have better means to cope in the future if misfortune strikes. While this second case ($\frac{\partial D(z,x_t)}{\partial x_t} < 0$) is appealing, a proper discussion goes beyond the scope of this chapter, since it touches on manifold issues related to the analysis of poverty over time, e.g. as in Calvo and Dercon (2009). In either case, their proposal drops the *focus* property, since $D(z, x_t) - x_{t+1} < 0$ does not discard $z - x_{t+1} > 0$ (nor $x_t - x_{t+1} > 0$).

Lastly, Calvo and Dercon (2013) propose $V^C = \mathrm{E}\left[\frac{1}{\theta}\left(1 - \frac{\mathrm{Min}\{x_{t+1}, z\}}{z}\right)^{\theta}\right]$, which is both the expected value of the poverty measure in Chakravarty (1983) and, as expressed in (19), the particular case of the expected-utility V^L definition for $U(x_t) = \frac{1}{\theta}\left(\frac{\mathrm{Min}\{x_t, z\}}{z}\right)^{\theta}$. This proposal may thus be seen a bridge between the expected-poverty and the expected-utility views, largely due to the poverty specification in Chakravarty (1983), which does not depend on the poverty gap and does not impose the form $\tilde{P}(e_{t+1})$. Seen as an expected-utility case, V^C relies on the usual CES utility function, which is however turned unusual by the censoring of x_t at the poverty line, as imposed by $\mathrm{Min}\{x_t, z\}$. While not appealing at first glance, this censoring is the cost to secure *focus*. The well-known CES function provides however the benefit of ensuring that *risk sensitivity* is both active and also well-behaved (unlike the cases under V^R and V^D), with risk aversion decreasing in income as typically found in empirical work since Binswanger (1981).[3] On the downside, *reference dependence* is entirely absent.

While each of these proposals will exhibit some drawback, they all can certainly contribute to policy-making. Poverty alleviation programmes should benefit from the foresight of future poverty episodes. Planning efforts should gain efficiency from anticipating where, when and whom poverty will strike next. Yet the toolkit provided by the

[2] For any function $\tilde{P}(e_t)$, $\tilde{P}(e_t) = \tilde{P}\left(\mathrm{Max}\left\{e_t, 0\right\}\right)$.

[3] As first pointed out by Ligon and Schechter (2002), common poverty measures such as FGT($\alpha = 2$) entail increasing risk aversion when fed into (17).

vulnerability literature remains far from widespread use in actual targeting decisions. To some extent, this is due to the challenges posed by the empirical estimation of vulnerability, which Lidia Ceriani discusses in this volume. However, arguably part of the reason is rooted elsewhere, in the lack of theoretical foundations for forward-looking targeting decisions. Suppose empirical estimation challenges are overcome and policy-makers know which households will be poor next year and how poor they will be – should available resources be relocated from the currently poor to help those households reduce their vulnerability? The answer is far from obvious and will probably build on several smaller, theory-loaded questions.

For instance, if a currently poor household is also among those in poverty next year, is this more worrisome than seeing two different households in poverty in either year? Can vulnerability-reducing insurance policies trigger moral hazard and other undesired side-effects? If current poverty and future expected poverty are correlated across households, what are the implications for targeting purposes? These questions remain open, and their answers will enable policy-makers to reap the fruits of the progress made to date on the theory of vulnerability as the threat of future poverty.

7 Aggregation

Lastly, since the view of vulnerability as expected poverty is largely inspired by the concern of policy-makers, it needs to pay attention to aggregation issues. Knowing that a number of households are individually exposed to the threat of poverty provides only partial information about the extent of poverty looming on society at large. Under any of the usual definitions of aggregate poverty, e.g. $\mathrm{FGT}_{t+1}(\alpha)$, the policy-maker is interested *inter alia* in how many households may suffer poverty simultaneously. Individual vulnerability is blind to outcomes for other households and hence to such simultaneity.

In the literature, aggregation has however typically taken the form of simple averages of individual vulnerability indices, which place no weight on the correlations among household consumption levels over all possible states of the world. Drawing on the properties of multidimensional poverty measures (which do care about such correlations, albeit over the set of relevant well-being dimensions), Calvo and Dercon (2013) provide the following proposal:

$$\bar{V}^C = \frac{1}{\theta}\left(1 - \mathrm{E}\left[\left\{\prod_{i=1}^{n}\left(\frac{\mathrm{Min}[z, x_{t+1,i}]}{x_{t+1,i}}\right)^{\frac{1}{n}}\right\}^{\theta}\right]\right), \text{ with } \theta < 1 \quad (20)$$

where the bar in $\bar{V}$ denotes this is an aggregate measure for a population with n households. Making loose use of the properties in section 2, which were defined for the individual case, visual inspection shows that *reference dependence* is absent, whereas *monotonicity* and *focus* are in place. The upper limit on θ can be equally proved to secure the aggregate equivalent to *risk sensitivity*, but the role of this parameter goes beyond this property.

Since Keeney (1979), the literature on multivariate risk is aware of the dilemma between *catastrophe avoidance* and *risk equity*. In (20), $\theta > 0$ would prioritise *risk equity*, i.e. if household consumption levels in each state of the world were reshuffled among household so that the *same* households suffer poverty in all states, then the policy-maker would say society has become more vulnerable to poverty. Such concern for *risk equity* comes at the cost of *catastrophe avoidance*, which requires $\theta < 0$ and implies that the policy-maker first and foremost dreads states of the world where poverty is widespread (regardless of how these poor households fare in other states).

Aggregation thus raises the question on how to judge any correlation among households in their consumption levels over all states of the world. A stronger positive correlation may lead to higher ($\theta < 0$) or lower ($\theta > 0$) aggregate vulnerability, depending on the view of the policy-maker. In turn, this view will shape policies aiming to reduce vulnerability. If the threat of widespread poverty (*catastrophe avoidance*) dominates other concerns, then the policy-maker will pay greater attention to the reduction of covariant risks (e.g. macroeconomic downturns or plagues). If she cares more strongly about *risk equity*, then policies to mitigate idiosyncratic risks (e.g. crime or job-related accidents) will be called upon.

8 Conclusion

This chapter reviews the theoretical literature on vulnerability and finds two competing views, with different policy implications. First, vulnerability as low expected utility stresses the danger of self-perpetuating poverty. The poor may shy away from decisions paving their way out of poverty whenever these decisions entail some degree of additional uncertainty. They feel vulnerable and thus they protect the little they have. From this point of view, insurance and safety nets may be instrumental to reduce their sense of defencelessness and unleash their energy to fight for their own success. This should also hold true for households narrowly above the poverty trap, which will be especially wary of shocks forcing them to dissave and thus condemning them to long-run poverty.

Second, vulnerability as expected poverty requires the policy-maker to think through and be explicit about her priorities. For instance, the ability to foretell (however imprecisely) who will be poor will only prompt stark policy implications when the policy-maker is ready to relocate available resources to protect these households, sometimes unavoidably to the detriment of programmes targeting the currently poor. Likewise, strategies to reduce aggregate vulnerability will determine the relative importance of idiosyncratic and covariant sources of risk depending on the relative strength of her concern for risk equity and for the threat of widespread poverty. These are no simple questions and go beyond the scope of economics. Their answers will necessarily draw on interdisciplinary work.

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