The Economics of Asset Accumulation and Poverty Traps

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1. Introduction

The world has seen much progress in economic growth and poverty reduction over the last few decades. At the same time, extreme poverty continues to persist, and its increased concentration in specific places, in particular sub-Saharan Africa, has stimulated renewed interest in the microfoundations of economic growth. While it is clear that asset accumulation (broadly defined to include social, physical, natural, human and financial capitals) can improve household living standards—as can adoption of improved technologies or participation in more remunerative markets that increase the returns to existing asset holdings—it is also clear that incentives to accumulate assets or to adopt new technologies or to participate in new market opportunities vary significantly across households, locations, and time.

These observations draw our attention to understanding how households accumulate assets and increase their productivity and earning potential, as well as the conditions under which some individuals, groups, and economies struggle to escape poverty, and when and why adverse shocks have persistent welfare consequences. While much research has investigated these issues, our understanding of the complexities of asset and well-being dynamics and their intrinsic heterogeneity across households remains disturbingly incomplete. Further scholarly review and evaluation are needed of the factors affecting (multi-dimensional) capital formation and resulting productivity and income dynamics. The goal of this volume is to think through the mechanisms that can trap households (and, intergenerationally, families) in poverty, paying particular attention to the interactions between tangible, material assets and general human capabilities, including psychological assets.

The need to better understand the economics of asset accumulation and poverty traps is especially pressing given world leaders' commitment to eliminate 'extreme poverty' by 2030 as part of the Sustainable Development Goals. The World Bank defines the 'extreme' poor as those who live on US$1.90/day per person or less in 2011 purchasing power parity (PPP)-adjusted terms. The Bank's most recent (2013) estimates indicate that 766 million people worldwide live in extreme poverty, just

under 11% of the global population and 12.6% of the world's developing regions.[1] Extreme poverty has fallen quickly and dramatically. One generation earlier, in 1993, the comparable rates were 33% of world population and more than 40% within developing regions. Global progress over the past generation has been nothing short of remarkable, with pro-poor economic growth doing the "heavy lifting," as Ravallion (2017) remarks.

Progress against poverty remains, however, uneven. As Ravallion (2017) goes on to observe, there is ample scope for direct interventions intended to improve the well-being of those left behind. Ultra-poverty (a standard of living below US$0.95/day in 2011 PPP-adjusted terms), has likewise fallen sharply from 1993 to 2013, from 9.6% to just 2.6% of the population of developing world regions. But ultra-poverty has also become extremely spatially concentrated, with more than 83% of the world's ultra-poor residing in sub-Saharan Africa, up from just 33% in 1993. The absolute number of the ultra-poor in sub-Saharan Africa decreased just 13% from 1993-2013. It is possible that this spatial concentration merely represents average growth from lower initial conditions, thus necessarily taking longer to cross a fixed, global extreme (or ultra) poverty line. But that seems an overly simplistic explanation given that Sub-Saharan Africa was at least as wealthy as Asia a half century ago and given the region's slow progress relative to even the ultra-poverty line.

The destitution reflected by ultra-poverty commonly correlates strongly with a range of other indicators of ill-being: poor physical and mental health, limited education, weak political representation, high rates of exposure to crime, violence, disease and uninsured risks, etc. The problem of poverty transcends limited monetary income. Deprivation manifests itself along multiple dimensions, including financial, human, manufactured, natural and social capital that people can accumulate or decumulate. This multi-dimensionality also reflects the correspondence among flow indicators– e.g., of income, expenditures, nutrient intake, cognitive performance – and stock measures – e.g., anthropometric scores, wealth, educational attainment – that is intrinsic to any dynamic system.

Furthermore, the poorest populations typically live their entire lives in abject deprivation, suffering chronic or persistent poverty. This is not true across the income spectrum, as reflected by patterns

[1] These and other figures are available through the World Bank's Povcalnet data portal: http://iresearch.worldbank.org/PovcalNet/home.aspx. The World Bank defines the developing regions as: East Asia and Pacific, Europe and Central Asia, Latin America and the Caribbean, Middle East and North Africa, South Asia, and Sub-Saharan Africa.

of economic growth observed in many countries over the last few decades or centuries. For example, during the early 1990s recession, poverty in the United States was remarkably transitory, with a median spell length in poverty – the duration of time between falling into and exiting poverty – of just 4.5 months (Naifeh 1998).[2] By contrast, spell lengths in extreme poverty remain poorly understood in the low income world. In most longitudinal data sets, we have not yet seen half the population exit extreme poverty (Barrett and Swallow 2006).

The depth and persistence of extreme poverty raises the prospect of poverty traps, which arise if poverty becomes self-reinforcing when the poor's equilibrium behaviors perpetuate low standards of living. This can happen when income dynamics are nonlinear and generate multiple equilibria, with a low-level equilibrium corresponding to poverty. But the analysis grows in complexity in the presence of unanticipated shocks. The welfare effects of shocks can vary with the nature and magnitude of the shocks and the ability of decision makers to adjust. Firms and households that can recover quickly from adverse shocks are termed "resilient". But the ability to escape low income scenarios can vary across households. This stresses the need to distinguish between transitory poverty and persistent poverty, to examine scenarios where households may find it difficult to escape poverty, and to evaluate economic and policy strategies that may stimulate economic growth among the poor.

The poverty traps hypothesis has major policy implications. As Ghatak (this volume) emphasizes, if no traps exist and poverty is transitory, then costly and imperfectly targeted interventions may impede rather than accelerate escapes from poverty.[3] However, the strength of the argument for intervention rises with the strength of the evidence of poverty traps. If a poverty trap exists and makes it difficult for some households to escape poverty, then a strong economic and moral argument exists to experiment with interventions and to implement and scale interventions demonstrated to generate sustained improvements in standards of living. Of course, complex political economy considerations are associated with policies targeted effectively to marginalized populations, and in sun-setting policies that are needed for only a fixed period of time. But where poverty arises due to the existence of multiple equilibria, making some poverty unnecessary and

[2] The Great Recession of the past decade may well represent a shift in the balance between persistent and transitory poverty in high-income economies. But we know of no compelling evidence on this point to date.
[3] Poverty may be transitory if it is due to temporary, adverse income shocks (Baulch and Hoddinott,2000) resulting in what Carter and May (2001) term 'stochastic poverty', or if poverty can be easily escaped through migration (Kraay and McKenzie 2014). Alternatively, transitory poverty may simply reflect a slow ascent form poor initial conditions,

avoidable, policy response will often prove both ethically compulsory and economically attractive (Barrett and Carter 2013).

The papers in this volume, which were first presented at a National Bureau for Economic Research (NBER) conference in Washington, DC, in June 2016, extend the range of the mechanisms hypothesized to generate poverty traps, and offer empirical evidence that highlights both the insights and limits of a poverty traps lens on the contemporary policy commitment to achieve zero extreme poverty by 2030. In this introductory essay we aim to frame these contributions in a simple, integrative model meant to capture the key features of the chapters that follow. Mechanisms include poor nutrition and (mental and physical) health, endogenous behavioral patterns (e.g., risk and time preferences), poorly functioning capital markets, large uninsured risk exposure, and weak natural resource governance institutions. The papers in this book examine these factors in detail. The empirical analyses many of the papers offer inform us about the factors affecting the prospects for household productivity and income growth, with a special focus on how and why these effects can be heterogeneous across household types and economic/policy environments. They also offer important findings on the effectiveness of programs and policies designed to address persistent extreme poverty, such as cash transfers and microfinance.

2. Towards an Integrative Theory of Poverty Traps

As Ghatak (this volume) and several other contributors emphasize, it is essential to have a clear theoretical framework to help identify the relationships between specific anti-poverty programs and particular mechanisms that cause poverty to persist. Economists' interest in the topic of poverty traps has waxed and waned over the decades. Economists have long known that coordination failures and market failures can each lead to situations of multiple equilibria characterized by both locally increasing returns that are conducive to capital accumulation and rapid income growth, as well as regions of rapidly diminishing returns where people face weak incentives to invest. A range of largely-unintegrated theories exist to explain patterns of differential investment that lead to persistent poverty in equilibrium (Nelson 1956, Mazumdar 1959, Stiglitz 1976, Loury 1981, Dasgupta and Ray 1986, 1987, Banerjee and Newman 1993, Dasgupta 1993, Barham et al. 1995, Zimmerman and Carter, 2003).[4] Whatever the theorized mechanism, the essence of a poverty trap

[4] For reasonably complete reviews of the poverty traps literature through the early 2000s, see Azariadis and Stachurski (2005). Barrett, Garg and McBride (2016) provide an updated summary of the literature.

is that equilibrium behavior leads predictably to expected poverty indefinitely, given preferences and the constraints and incentives an agent faces, including the set of markets and technologies (un)available to her. Azariadis and Stachurski (2005) therefore define a poverty trap as a "self-reinforcing mechanism, which causes poverty to persist." The contributions to this volume reflect on four candidate poverty trap mechanisms:

- Multiple financial market failures that impede both investment in and savings for asset accumulation as well as insurance against asset loss.
- Psychological feedback loops in which poverty undercuts human cognitive and pro-social capabilities and performance, in turn entrenching one's poverty;
- Deteriorations in or premature cessation of investments in health and human capital brought on by uninsured shocks and poverty; and,
- Bio-physical feedback loops in which environmental shocks and poverty undercut the productive capacity of natural resource systems.

The chapters in this volume offer an array of theoretical reflection and empirical evidence on these various mechanisms, and in several cases evaluate the impacts of policies and programs intended to reduce persistent poverty through various lenses.

One theme that emerged clearly from the NBER conference was the importance of analytically integrating and empirically disentangling the multiplicity of mechanisms potentially at work simultaneously in situations of persistent extreme or ultra-poverty. The empirical challenge is particularly daunting because the coexistence of multiple mechanisms implies that any empirical reality contains a mixture of different causes of chronic poverty, implying further that the impacts of a shock or an intervention may by intrinsically heterogeneous across the population. Yet despite these challenges, as reflected in this collection of papers, there is considerable new activity on this topic, by some of the profession's most promising young scholars, and significant new insights are advancing our ability to inform policy through more nuanced, rigorous, theory-guided research.

2.1 A Poverty Trap Model with Endogenous Capabilities

The four mechanisms above, the interactions among them, and the potential impacts of policy that targets chronic poverty, can be most easily explained using a general theoretical framework that

encompasses the models used in several contributions to this volume. First, consider the following model of income generation for a household[5] (or dynasty[6]) i in time period t:

$$y_{it} = f_l(\alpha_{it}, k_{it}), \tag{1}$$

where y_{it} is output, k_{it} is a productive asset—buildings, land, livestock, machinery, money in the bank, or other forms of capital—and α_{it} is human capability, a term we use to be general enough to encompass such concepts as skill, human capital and perceived self-efficacy.[7] Absent financial markets and informal transfers between households, household consumption in every time period *t* is restricted to be no more than cash on hand (the value of current income and productive assets):

$$c_{it} \leq k_{it} + y_{it}. \tag{2}$$

Finally, we introduce stochasticity into the model by assuming that productive assets are subject to a random shock, θ_{it}, which occurs at the beginning of every time period such that:

$$k_{it+1} = [k_{it} + y_{it} - c_{it}][1 + \delta_0 + \delta_1(\theta_{it+1})]. \tag{3}$$

Note that the first square bracket measures the amount of productive capital that the household carried forward from the prior time period. The second square bracket measures the net capital growth or loss the household experiences, where δ_0 is the natural rate of growth, or depreciation, of productive assets, and $\delta_1(\theta_{it+1}) \leq 0$ is the stochastic asset depreciation or destruction driven by the random variable, θ_{it+1}, that captures the exogenous shocks that may affect the household in any time period.[8]

[5] We use the household as the unit of analysis, fully recognizing that we abstract here from important issues of intra-household bargaining. The unit of analysis could equally be an individual or a more aggregate unit of analysis. Since most micro data on poverty exist at household level, we use this terminology to maximize correspondence with the empirical evidence offered in this volume and elsewhere.

[6] Because we will want to consider changes in human capabilities that occur intergenerationally, we will also use the term dynasty to refer to a multi-generational sequence of biologically related households.

[7] It is of course the decision maker's perception of their capabilities that matter, a factor stressed by de Quidt and Haushofer (this volume).

[8] Stochasticity could also be introduced by applying the shock directly to the production process. What matters for the decision making problem is that cash on hand is stochastic. Assigning the shock to assets rather than incomes simplifies the graphical discussion. Following McPeak (2004), separate, imperfectly correlated, shocks could be assigned to both income flows and asset stocks. We here abstract away from that additional complexity.

Assembling these pieces, we assume that the i^{th} household makes decisions according to the optimization problem:

$$Max_{c_{it},k_{it}} E_\theta \sum_{t=0}^{\infty} \beta^t u(c_{it}) \tag{4}$$

$$subject\ to:$$

$$c_{it} \leq k_{it} + y_{it}$$

$$y_{it} = f_l(\alpha_{it}, k_{it}, \theta_{it})$$

$$k_{it+1} = [k_{it} + y_{it} - c_{it}][1 + \delta_0 + \delta_1(\theta_{it+1})]$$

$$\alpha_{it+1} = \alpha_{it} = \alpha_i$$

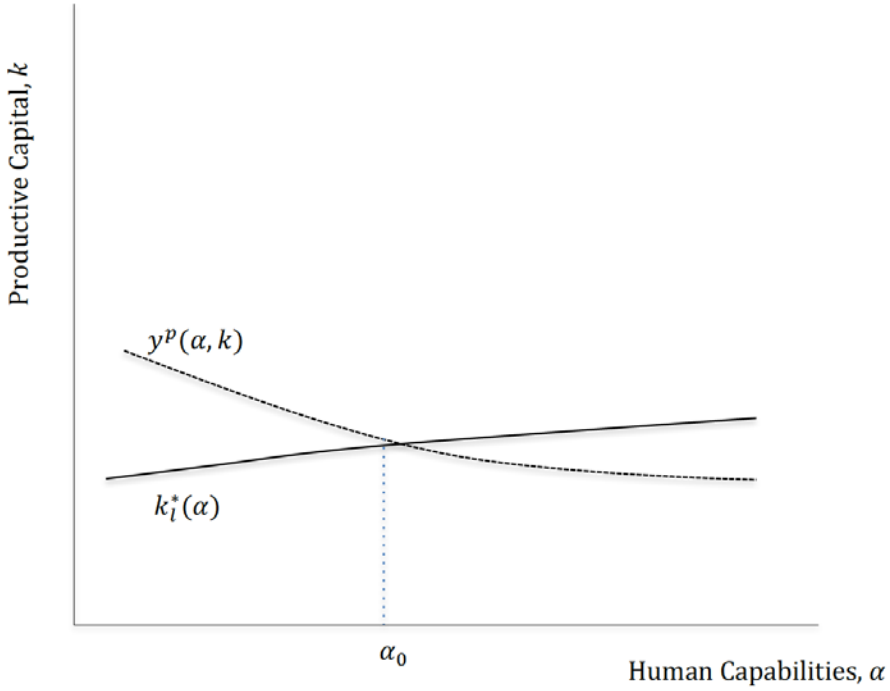
$$k_{it} \geq 0$$

where E is the expectation operator, c_{it} represents consumption of a numeraire composite good, $u(c_{it})$ is the utility function representing the household preferences, β is the discount factor, We assume for the moment that capabilities, α_{it}, do not evolve and are fixed at the initial endowment level for each dynasty, α_i. As explored in detail by Deaton (1991) and Zimmerman and Carter (2003), the multiple financial markets failures this assumption implies generate discontinuities in intertemporal tradeoffs—kinks in the standard Euler equations—and thus thresholds where optimal behaviors bifurcate conditional on wealth.

Figure 1 allows us to capture the implications of this model and begin to frame the contributions of the different chapters in this volume. Given heterogeneity in non-tradable human endowments, α_{it}, optimal steady state capital holding, $k_\ell^*(\alpha)$, is increasing in human capabilities, as shown in the figure. Treating capabilities as fixed, this model implies a type of conditional convergence, with the more capable enjoying a higher optimal steady state level of capital and income than the less capable. Foreshadowing later discussion, note that a deterioration in capabilities (*e.g.*, through a deterioration in psychological assets) will reduce optimal capital, forming what might be termed an internal barrier to capital accumulation, as distinct from the external barrier associated with financial market failures.

To relate this discussion to poverty, define the locus $y^p(\alpha, k)$ as combinations of α and k that yield an income equal to an (arbitrary) money-metric income poverty line, y^p. Note that $y^p(\alpha, k)$ will be downward sloping in α, k space, as shown. To the southwest of the locus, a household will be poor,

while to the northeast they will not be. For a relatively poor and unproductive economy, we might expect y^p to cut the steady capital curve, k_i^*, from above as shown in Figure 1.[9] Under this configuration, those with $\alpha_{it} < \alpha_0$ will be chronically poor, trapped by their own low level of capabilities in this conditional convergence model. Cash or other forms of non-human capital alone cannot free the household from poverty over time, as the Buera, Kaboski and Shin and the Ikegami, Carter, Barrett and Janzen chapters highlight. The barriers can arise as well due to sociocultural limits imposed on human capabilities, for example, race (Fang and Loury 2005) or caste (Naschold 2012). This poverty trap mechanism exemplifies what Barrett and Carter (2013) call a single equilibrium poverty trap.*Figure 1. Conditional Convergence and Single Equilibrium Chronic Poverty*



The model so far considered restricts movement to the north-south direction in the α, k space in Figure 1. However, as studied by a number of contributions to this volume, households and dynasties can also move in the east-west direction through a variety of voluntary and involuntary mechanisms. Opening this model up to changes in capabilities, α_{it}, expands the array of potential poverty trap mechanisms. Akin to equation (3) for the evolution of tangible capital assets, we can replace the fourth constraint in the maximization problem above with a law of motion for human capabilities:

$$\alpha_{it+1} = [\alpha_{it}][1 + \xi_0(c_{it}) + \xi_1(\theta_{it})], \tag{5}$$

[9] Ikegami, Carter, Barrett and Janzen (this volume) describe in greater detail the model and computational methods used to generate figures such as those used illustratively in this chapter.

where $\xi_0(c_{it})$ is the growth (or deterioration) of capabilities based on consumption choices (*e.g.*, of food and educational services), while $\xi_1(\theta_{it}) \leq 0$ is the destruction of capabilities directly caused by shocks (*e.g.,* temperature spikes that destroy human capabilities *in utero*).

While the notion that capabilities can be affected by consumption choices is well-developed in the literature, the notion that shocks may directly affect psychological capabilities is less well developed.[10] Both the de Quidt and Haushofer and Dean, Schilbach and Schofield chapters raise the possibility that income or asset shocks may induce depression or deterioration in cognitive functioning that would depress effective capabilities, shifting the individual household to the west in Figure 1. [11] In this poverty trap model, a shock could push a household into chronic poverty if its capabilities dropped below the critical value α_0.

In addition to its direct psychological effects, shocks (and low living standards more generally) can also influence capabilities via household consumption choices. Frankenberg and Thomas (this volume) explore the impact of two mega shocks that hit Indonesia (the 1998 Asian financial crisis and the 2004 Tsunami). In contrast to some studies that suggest that shocks of this magnitude result in irreversible losses in human capabilities, they find that despite some short-term deterioration in child health and education, households (and multi-generation dynasties) proved remarkably able to shield themselves from medium-term deterioration in human capital, as measured by schooling and anthropometric measures. Recent work by Adhvaryu *et al.* (2017) indicates that social safety net schemes, such as Mexico's Progresa, can augment household's coping capacity and shield child human capital from the deleterious consequences of environmental shocks.

While the Indonesia study signals the remarkable range of coping mechanisms that families can employ, Frankenberg and Thomas note that their finding does not imply that shocks do not have more deleterious consequences in other instances, and that even the recovery of linear growth in shock-exposed children may mask longer term consequences in terms of lost cognitive capacity. This latter point is stressed by Hoddinott (this volume), who reviews a range of medical studies that

[10] There is a well-developed literature showing how climatic and other shocks can undercut the development of cognitive capabilities—see, for example, the recent paper by Garg *et al.* (2017) and the references therein.

[11] Other recent contributions examine the impact of shocks on other deep preference parameters (risk aversion and time horizons) that can depress investment in ways similar to a decrease in α in the model here. Examples include Rockmore, Barrett and Annan (2016), who show that post-traumatic stress in post-conflict Uganda increases risk aversion and Moya (2017) who finds a similar phenomenon for victims of violence in Colombia. Laajaj (2017) provides a theoretical model and empirical evidence that shifts around the poverty line influence time horizons.

caution that shocks can result in long-term damage to capabilities even amongst individuals who suffered no long-term loss of physical stature.

2.2 A Multiple Equilibrium Poverty Trap Model with Endogenous Capabilities

The basic model above becomes richer if we add a second, higher productivity technology, f_h, which is characterized by fixed costs or a minimum project size such that $f_h > f_l \; \forall \; k > \widehat{k}$. The non-convex production set for the household thus becomes:

$$y_{it} = max[f_l(\alpha_{it}, k_{it}), f_h(\alpha_{it}, k_{it})] \tag{4}$$

and we denote as $k_h^*(\alpha)$ the steady state capital values implied by the inter-temporal optimization problem above for those households that choose to accumulate capital beyond $\hat{k}$. As noted by Skiba (1978), this kind of non-convex production set can lead to multiple equilibria with an individual choosing to accumulate to $k_l^*(\alpha)$ or $k_h^*(\alpha)$ depending on her initial endowment of capital. Subsequently, other authors have generalized this class of model to include skill heterogeneity (Buera, 2009) and skill heterogeneity and risk (Carter and Ikegami, 2009, Ikegami, Carter, Barrett and Janzen, this volume, Santos and Barrett, this volume).

Figure 2 Non-convex Technology and Coexisting Single and Multiple Equilibrium Poverty Traps

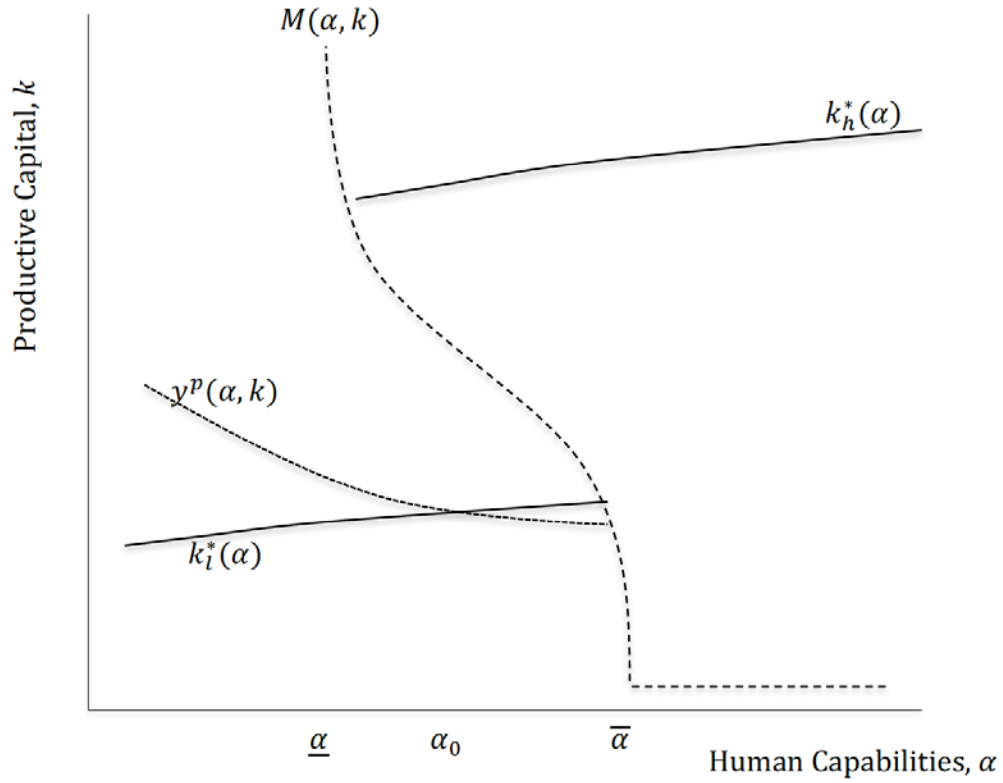


Figure 2 illustrates the richer set of equilibrium possibilities that emerge when the basic model is augmented with a non-convex production set. This model, with embedded financial market failures, generates two critical skill values, denoted $\underline{\alpha}$ and $\overline{\alpha}$ in the figure. Individuals below $\underline{\alpha}$ will find it optimal to tend to the low technology steady state irrespective of their initial capital endowment. Above $\overline{\alpha}$, high capability individuals will always strive for the high technology steady state, k_h^*, again irrespective of their endowment of productive capital. In between ($\underline{\alpha} < \alpha < \overline{\alpha}$), "middle ability" individuals will split depending on whether they find themselves below or above the downward sloping "Micawber Frontier," denoted $M(\alpha, k)$ in Figure 2[12] As discussed in greater detail in Carter and Ikegami (2009), an increase in risk will shift $\underline{\alpha}$ and $\overline{\alpha}$ to the east and the Micawber frontier, $M(\alpha, k)$ to the northeast. Those in the middle ability group thus face what Barrett and Carter (2013) call a multiple equilibrium poverty trap. Treating capabilities as fixed, those born either

[12] This usage, inspired by Ravallion and Lipton (1994) and adopted to the context of poverty trap models by Zimmerman and Carter (2002), harkens to asset levels below which it is not optimal to strive to save and become non-poor, belying the folk wisdom of Charles Dickens' fictional character Wilkins Micawber who urged David Copperfield and others to supersede their poor circumstances through careful capital accumulation.

above α_h or to the northeast of $M(\alpha, k)$ will place themselves on an optimal trajectory to reach k_h^*. However, a sufficiently large negative shock to the current wealth of those in the middle ability group may push them below $M(\alpha, k)$ and into a permanently poor standard of living at $k_l^*(\alpha)$. Indeed, as Ikegami, Carter, Barrett and Janzen (this volume) illustrate, those above $M(\alpha, k)$ will only probabilistically approach the high equilibrium, with that probability increasing in their distance above the Micawber Frontier. Santos and Barrett (this volume) provide empirical evidence of this mixed structure in the risk-prone semi-arid rangelands of southern Ethiopia.

With the exception of Carter and Janzen (forthcoming), there has been little exploration of the endogenous skills or capabilities (as represented by equation 3 above) in the context of a multiple equilibrium poverty trap model. Their theoretical model shows that the fraction of the initial endowment space that absorbs households into long-term poverty expands when capabilities deteriorate in the face of shocks.[13] A similar impact would be expected from the psychological feedback loops discussed in the chapters by de Quidt and Haushofer, by Dean, Schilbach and Schofield, and by Lybbert and Wydick. As discussed by these authors, stress, depression and poverty itself may affect cognitive function and thus earnings, resulting in low income that in turn reinforces stress and depression, leading to a stable, low-level equilibrium standard of living.

In the presence of such reinforcing feedback, exogenous shocks and endogenous consumption behaviors can jointly influence individuals' psychological state—feelings of depression or hope—and cognitive and physical functioning, which in turn affect future productivity and optimal investment behaviors. For example, negative shocks may lead to overly pessimistic assessments of the return to effort, leading to lower effort and investment, which leaves one worse off and more vulnerable to further shocks (de Quidt and Haushofer this volume). In terms of Figure 2, these feedback loops suggest that a material shock that initially moves the household to the south in the figure may result in induced changes in capabilities that then move the household to the west, with attendant declines in productivity and incomes. Consistent with the theoretical model of Carter and Janzen (forthcoming), one can easily imagine scenarios in which a modest shock to the tangible

[13] In contrast to equation (3), Carter and Janzen (forthcoming) only explore the indirect effects of shocks through their impacts on low consumption. Formally, these authors assume that households choose consumption levels ignoring their long-term consequences for the human skills or capabilities of the dynasty. The findings of Frakenberg and Thomas (this volume) suggest that households or multi-generation dynasties have intra-household degrees of freedom to protect the education and capabilities of the next generation at the cost of the well-being of the older generation.

assets of a middle ability household induces a deterioration in the household's capabilities which places it to the southwest of the Micawber Frontier, sentencing it to a state of chronic poverty.

The central problem, from an economic perspective, is the non-tradability of human capabilities. One cannot simply buy hope or (mental or physical) health or cognitive capacity. The possibility of absorbing states – e.g., blindness, permanent amnesia or paralysis, death – implies nonstationary stochastic processes that naturally lead to multiple steady states if human capabilities are essential complements to non-human capital in income generation. The same multiplicity of equilibria arise with tradable forms of capital in the presence of multiple financial markets failures. The crucial difference is that the cognitive, psychological, sociocultural (e.g., gender, race) and even some physical elements of human capabilities are intrinsically internal constraints on human agency, in contrast to the external constraints posed by market failures that may impede accumulation of other financial or physical assets.

This dynamic stochastic system, with multiple time-varying assets, quickly becomes complex and nonlinear. As the chapter by Chavas explains, stochastic dynamical systems lend themselves to distinct zones defined by the current state of asset holdings, (α_{it}, k_{it}), with some zones undesirable and difficult to escape – a poverty trap – others undesirable but relatively easy to escape – poor but resilient – and others desirable – non-poor. Identifying those zones in data, however, is a terribly complex task (Barrett and Carter 2013).

One reason empirical analysis is challenging is that if people recognize the dynamic consequences of shocks, then households may alter behaviors so as to protect productive human and non-human assets and thereby defend future productivity and consumption, even if it entails some short-run sacrifice. Such 'asset smoothing' behaviors arise endogenously in the presence of systems with feedback and multiple equilibria (Hoddinott 2006, Carter and Lybbert 2012, Barrett and Carter 2013). Such behaviors stand in striking juxtaposition to the familiar consumption smoothing that prevails when income follows a stationary stochastic process, leading to a single dynamic equilibrium.

Shocks can degrade non-human capital as well as human capabilities. Since most of the world's extreme poor live in rural areas and work in agriculture, exogenous shocks to agricultural productivity – due to extreme weather and other phenomena – can be especially important.

Rosenzweig and Binswanger (1993) and Carter (1997) showed how risk preferences can induce poor agricultural households that lack access to credit and insurance markets to choose low-risk, low-return livelihoods as a way of self-insuring against weather risk. Unfortunately, those choices can also trap them in chronic poverty.

The experience of shocks to natural capital, such as soils and rangeland vegetation, can also strongly influence accumulation of capital, k_{it}, as described in both the Santos and Barrett chapter on east African pastoralists and the Chavas contribution on the resilience of farmers in the US Midwest following the Dust Bowl experience of the 1930s. A Micawber threshold may exist in natural capital space, for example in soils that become excessively degraded, making investment in fertilizer application or conservation structures unprofitable (Marenya and Barrett 2009, Barrett and Bevis 2015). As Barbier's commentary (this volume) emphasizes, the environmental and geographic conditions faced by poor households fundamentally shape investment incentives, especially in fragile agro-ecosystems subject to extreme external environmental shocks.

The model sketched out in this introductory chapter has abstracted away from social interconnections among individuals. If multiple financial market failures are a central obstacle to asset accumulation, then social connections can mitigate the effects of those market failures. As the chapter by Frankenberg and Thomas demonstrates, extended family and other social support networks can cushion the blow of shocks that might otherwise drive vulnerable people into poverty traps. Social networks might also matter to individuals' self-efficacy, as both the Lybbert and Wydick and Macours and Vakis chapters suggest. Given that material poverty may affect pro-social behavior and social connectivity (Adato et al. 2006, Andreoni et al. 2017), there may be significant social spillover effects of interventions (Mogues and Carter 2005, Chantarat and Barrett 2011, Macours and Vakis, this volume).[14] As Macours and Vakis (this volume) demonstrate in their evaluation of the medium-term impacts of a short-term transfer program in Nicaragua, the possibility of non-trivial social multiplier effects may matter to the effectiveness of interventions, especially if it is difficult to target individuals appropriately due to incomplete information.

This integrative framework also helps us to recognize the many settings where poverty traps are less likely to occur. Where financial markets are largely accessible at reasonable cost to most people,

[14] Social connections can likewise generate the opposite sort of reinforcing feedback through the ecology of infectious diseases (Bonds et al. 2010, Ngonghala et al. 2014).

where social protection programs effectively safeguard the mental and physical health of poor populations and ensure the development of children's human capital through their formative years, and where geographic and intersectoral migration is feasible at reasonably low cost, the likelihood of a poverty trap is far smaller. Moreover, history is not necessarily destiny. Forward-looking behaviors can obviate the adverse effects of even massive shocks. Many poor populations prove amazingly resilient, as the chapters by Frankenberg and Thomas and by Chavas so nicely demonstrate. The aim of poverty traps research is to help render the concept increasingly irrelevant.

3. Implications for policy and project design

The stylized integrative model we offer not only reflects several crucial features outlined in the mechanism-specific papers that comprise most of this volume, it also captures several key policy implications of the emergent poverty traps literature.

First, it underscores the challenge of targeting poverty reduction programs in systems where multiple mechanisms might exist simultaneously. It is not enough to know that someone is poor. We need to know *why* they are poor in order to target effective interventions. For some whose human capabilities are permanently compromised, such that $\alpha_{it} < \alpha_0 \; \forall \; t$, persistent poverty may be the only possibility going forward in the absence of an ongoing social safety net that provides regular transfers to supplement their meagre earnings. By contrast, other poor people may be able to pull themselves out of poverty through asset accumulation and thereafter maintain a non-poor standard of living if given a brief boost and some protection against catastrophic shocks. With fixed budgets, policymakers face tradeoffs between these two poor sub-populations, which leads to the 'social protection paradox' explained in the chapter by Ikegami *et al.* Spending on short-term poverty reduction may aggravate longer-term poverty, even for near-term beneficiaries, if inadequate attention is paid to preventing the collapse of the vulnerable non-poor beneath the Micawber frontier and into chronic poverty.

Second, the multiplicity of mechanisms potentially in play can also lead to striking heterogeneity in the impact of programs and interventions that target financial markets, physical assets, human capabilities and even aspirations or preferences. For households with mid-range capabilities, microfinance interventions that relax financial market constraints may open a pathway from poverty. But for others, who suffer internal or capabilities constraints, such program may be ineffective,

signaling the kind of impact heterogeneity found by Buera, Kaboski and Shin (this volume). Moreover, as Lajaaj's (this volume) thoughtful commentary underscores, the risk-reward profile of different interventions may not be similar. Interventions can easily have adverse unintended consequences, perhaps especially those that aim to relieve internal psycho-social constraints on asset accumulation.

A third key policy implication is that, to the extent that market failures are the root cause of poverty traps, systemic interventions that address the underlying structural causes of poverty traps are likely to generate indirect, general equilibrium benefits – e.g., in wage labor markets – that almost surely dominate the direct effects of small-scale interventions that benefit just a few direct program participants. Bandiera et al. (forthcoming) find that an asset building program for poor women in Bangladesh increased the low skill wages received by non-program participants. Whether the dominant poverty trap mechanism revolves around fundamentally non-tradable human attributes like hope or depression—for which market failures appear insurmountable—or originates from credit and insurance market failures that impede accumulation of physical assets like livestock or machinery, the core challenge to escaping persistent poverty boils down to overcoming the market failures that impede the accumulation of assets. It is easy to lose sight of the structural underpinnings of persistent poverty in the rush to generate cleanly identified reduced form impacts of interventions.

Fourth, this integrative framework also helps underscore why multi-faceted intervention—so called poverty graduation programs—exhibit consistently large impacts (e.g., Banerjee *et al.* 2015, Bandiera *et al.* forthcoming, Gobin *et al.* 2016). The interdependence of co-evolving human capabilities and capital stocks, each potentially impeded by financial (and other) market failures, means that graduation programs that couple asset transfers with skills training, the strengthening of social networks, and psychological "coaching" become especially promising. Conceptually, these programs move individuals to the northeast in Figure 2 as they bolster both tangible and psychological assets. Indeed, in practice, most graduation programs follow the original BRAC model (see Hulme and Moore, 2008) and build capabilities and psychological assets first, and then transfer tangible productive assets. While research has yet to unpack exactly what these coaching interventions change in the psychological realm (aspirations, self-efficacy or mental health?) the longevity and magnitude of their impacts stand out. In contrast, pure cash interventions, even when conditioned on behaviors such as keeping children in school, may have only small and short-term results, as

Araujo, Bosch and Schady (this volume) find in their study of the multi-year effects of Ecuador's conditional cash transfer program.[15]

Fifth, the emphasis so many of the papers place on shocks, whether these are economic, environmental, or psychological, underscores the critical role safety nets play in poverty reduction. As Smith (this volume) eloquently puts it, "as we move toward fully addressing the zero-poverty goal of the Sustainable Development Goals (SDGs), as also embraced by the World Bank, USAID and other key development agencies, it is very helpful to have an enhanced focus on preventing people from falling into poverty. At least from a poverty headcount or income shortfall perspective, ultimately we may view this as equally important to pulling people out of poverty."

Finally, the interdependent laws of motion of different forms of (financial, human, natural, physical and social) capital necessitate multi-dimensional thinking in policy deliberations. Familiar models with a single state variable (unidimensional capital) lend themselves to overly simplistic diagnoses and prescriptions that fail to capture many of the ways in which deprivation manifests in the lives of the poor. Just as the conference where the papers in this volume originated forced all of us in attendance to grapple simultaneously with these complexities, so too we hope the slightly more nuanced framework we advance here helps readers of this volume think in more integrative ways about the challenges facing the world's poorest populations today and about how best to design, target and evaluate interventions targeted at the poor.

[15] As stressed in earlier, it is important not to overlook the role that safety nets can play in insulating households from shocks that might otherwise compromise child health and education (Adhvaryu *et al.* 2017).

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