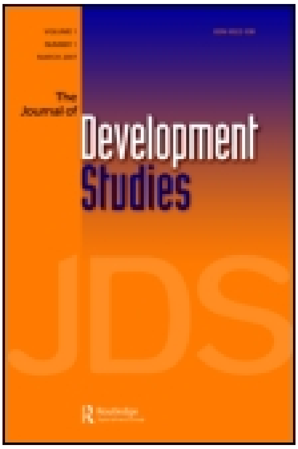

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The Economics of Poverty Traps and Persistent Poverty: Empirical and Policy Implications

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ABSTRACT *The moral and economic imperatives to intervene in poverty traps motivate the identification of poverty traps and their structural causes so as to inform the design of appropriate policy responses. However, empirical identification remains challenging because of poverty traps' complexity. After reviewing mechanisms that can generate poverty traps, we focus on one – multiple financial market failures – emphasising its heretofore underappreciated testable implications, including specific behaviours that are rational only in the presence of a poverty trap. We therefore recommend tests for these behaviours rather than more econometrically challenged efforts to directly test for poverty traps in estimated asset dynamics.*

I. Introduction

Numerous studies utilise longitudinal data on individuals, households and communities to document the extent of persistent, or chronic, poverty. The observation that a particular person or family is poor for multiple time periods does not, however, mean that they are caught in a poverty trap, nor does it by itself identify the appropriate policy intervention, which necessarily depends on the mechanisms that cause and sustain persistent poverty. In this article, we offer a critical review of ongoing theoretical and empirical research in a dynamic and fast changing area, including the articles in this special issue, to extend and refine central messages from Carter and Barrett (2006). We re-emphasise the centrality of asset dynamics and associated investment incentives, as well as that the appropriate strategies to empirically identify poverty traps depend on the mechanisms at play, as do the suitable policy responses.

After reviewing a range of candidate mechanisms that can generate observations of persistent poverty – some of which imply poverty traps, and others of which do not – we focus on what we hypothesise is the most commonplace mechanism, multiple financial market failures (MFMF). We discuss key behavioural and policy implications of this mechanism, which suggest novel empirical strategies to test for the existence of MFMF poverty traps indirectly, by looking for behaviours that would be rational only in the presence of a MFMF poverty trap, in lieu of more traditional approaches of directly testing for poverty traps by studying asset dynamics. This indirect approach to testing for the existence and source of poverty traps provides a way around the formidable identification challenges posed by conventional, direct tests of the poverty trap hypothesis. We then take stock of what we know about the empirical importance of poverty traps, reviewing the contributions to this

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special issue as well as other recent efforts that test the behavioural and policy implications of the MFMF theory of poverty traps.

II. Mechanisms that Underlie Persistent Poverty and Poverty Traps

The core idea underpinning the term chronic or persistent poverty is that an observed household's[1] income or expenditures consistently, or at least on average, fall below the poverty line. Persistent poverty is a powerful descriptor. But it intrinsically lacks the analytical foundation necessary to mount a thoughtful policy response, which requires knowing *why* households are persistently poor.

Indeed, the observation of persistent poverty over a modest time horizon is by itself insufficient to motivate intervention (Carter & Barrett, 2006; Carter & May, 2001; Naschold & Barrett, 2011), while identification of a poverty trap, defined as 'any self-reinforcing mechanism which causes poverty to persist' (Azariadis & Stachurski, 2004, p. 33), does suffice. A poverty trap is about staying poor, not just about being poor at a few moments in time. Poverty traps research therefore focuses on identifying and explaining the existence of low well-being 'basins of attraction' within an economy and naturally emphasises how stocks of assets (and resulting flows of income) evolve – or fail to evolve – over time.

The literature identifies a variety of structural mechanisms that can generate poverty traps. Some operate at the level of the individual or household, while others operate at community, regional or national scales. Some are single equilibrium mechanisms in the sense that a non-poor equilibrium outcome simply does not exist for a particular economic unit (given its immutable characteristics and the state of production and exchange technologies). Others are multiple equilibrium mechanisms, meaning that both poor and non-poor outcomes exist and are potentially attainable for a given economic unit. Adding to this complexity, single and multiple equilibria mechanisms can coexist within a single economy, with some households facing a single, impoverished equilibrium outcome; other households facing a single, non-poor equilibrium outcome; and, yet others subject to multiple equilibrium, with their fates dependent on their initial endowments and the shocks they receive over time. The remainder of this section develops these points in further detail, emphasising the challenges they pose to both empirical work and to the design of policy.

(a) Single Equilibrium Poverty Traps

Some poverty traps may be characterised by a single stable state (or dynamic equilibrium) at a low level of well-being toward which everyone converges. Macro-scale traps can originate because of institutional phenomena (Acemoglu, Johnson, & Robinson, 2001) or disadvantages of physical geography that afflict all residents in nations or regions (Jalan & Ravallion, 2005). This kind of poverty trap can be understood as the result of a technology (understood broadly to include institutional arrangements of production and exchange) that is insufficiently productive to generate non-poor standards of living, conditional on geography, climate or other fixed endowments.

There may likewise exist single stable states specific to individuals or groups of individuals, perhaps due to mental or physical disability, to systematic discrimination and social exclusion, or to some other mechanism that keeps particular individuals from attaining and maintaining a high level of well-being.[2] The key is that individuals possess an immutable characteristic(s) that sorts them into groups, with some groups naturally bound, in long-run expectation, for a high-level stable state and others toward a low-level one. In either the macro or micro cases of poverty traps with single stable states, persistent poverty appears as the natural consequence of an immutable condition specific to (perhaps many) households.

(b) Multiple Equilibrium Poverty Traps

Multiple equilibrium poverty traps are characterised by multiple stable states, with at least one equilibrium associated with a poor standard of living. Small perturbations or interventions designed to help those stuck in the poverty trap equilibrium may merely change the short-term path to the same long-term state. The existence of multiple such regions, corresponding to multiple stable states, implies the existence of 'threshold' or 'tipping points' at the boundaries between them. Minor initial inter-household differences that leave two households very close to each other, yet on opposite sides of a threshold, naturally lead to long-term divergence as each household follows the path inherent to its own basin of attraction.

Under multiple equilibrium poverty traps, and unlike single equilibrium traps, individuals suffer unnecessary, remediable deprivation. Multiple equilibrium poverty traps violate a moral principle of horizontal equity as the initially similar face strongly divergent futures. They also imply avoidable human deprivation, a feature that does not exist with single equilibrium poverty traps due to individuals' immutable characteristics (Barrett, Carter, & Ikegami, 2012 develop a measure of unnecessary deprivation). This adds a powerful efficiency argument for intervention to the equity arguments that motivate all interventions to reduce poverty.

Several potential mechanisms can give rise to multiple equilibrium poverty traps, each with distinct empirical and policy implications. At the macro scale, the 'big push' theory of Rosenstein-Rodan (1943) is a prime example of a multiple equilibrium poverty trap. As formalised by Murphy, Shleifer and Vishny (1989), a technology is available that allows the economy to industrialise and thereby reach a 'non-poor' living standard. However, coordination problems between firms may mire the economy at a low standard of living. If such a trap exists, then governments can ignite rapid growth through coordinated investment by way of industrial and trade policy to promote savings, exports and rapid factor productivity growth, as occurred in several East Asian countries in the 1960s–1980s.

At the intermediate scale (for example, that of the community), a still-different mechanism can arise when people derive non-material value from interpersonal relationships or network externalities. An associational propensity among similar individuals – the poor network mainly with other poor people, and the rich with the rich – can generate multiple equilibria naturally from either signalling or learning effects (Calvó-Armengol & Jackson, 2004; Montgomery, 1991). When individuals need social networks to overcome the fixed costs related to information or the adoption of improved technologies, such associational propensities can similarly generate multiple equilibria (Chantarat & Barrett, 2012; Mogues & Carter, 2005;). Indeed, social networks and norms can generate strong, if sometimes subtle, pressures to conform to local customs, thereby retarding technological change (Moser & Barrett, 2006).

These sorts of network effects are a special case of more general spillover effects – for instance due to disease transmission (Bonds, Keenan, Rohani, & Sachs, 2010) or water management (Ostrom, 1990) – that can easily lead to coordination failures and multiple equilibria. The resulting low-level equilibria can easily become institutionalised through formal or informal rules, such as property rights, social norms regarding informal taxation or contributions to public goods, or information sharing, that then guide individual and group behaviour (Acemoglu et al., 2001; Barrett, 2005a; Barrett & Swallow, 2006; Bowles, Durlauf, & Hoff, 2006; Platteau, 2000). As with 'big push' macro theories, these mesoscale coordination problems require concerted efforts to alter interhousehold interactions. Examples include changing water use rules (or other rules of collective action), and coordinating behavioural change among a critical mass of households so as to tip group behaviour into a new equilibrium (through, for example, farmer field schools, or other efforts to simultaneously promote the visible and widespread adoption of new technological practices).

At the scale of the individual, one of the best developed multiple equilibrium poverty trap theories is based on the idea that physical work capacity declines more rapidly than wages once wages (and the food they can buy) falls below a critical level (Dasgupta 1993, 1997; Dasgupta & Ray, 1986, 1987). In the simplest version of this theory, in equilibrium, a subset of workers obtain employment and enjoy a higher standard of living than the unlucky who are rationed out of the labour market. In its more complex version, job rationing is correlated with asset ownership, with the best endowed potential workers hired first, leading to a critical asset threshold that separates the non-poor from those mired in poverty and malnutrition.

The non-tradability of essential productive inputs can also cause initial conditions to shape incentives to invest or to adopt improved technologies. That mechanism yields natural resource degradation poverty traps wherein small farmers endowed with marginal or fragile soils have no incentive to apply fertilisers or to invest in soil conservation measures, creating a downward spiral of deteriorating soils, lower productivity and persistent poverty (Antle, Stoorvogel, & Valdivia, 2006; Marenya & Barrett, 2009a, b; Stephens et al., 2012). Modestly better endowed neighbours invest in fertilisers and soil conservation, thereby maintaining yields and soil quality, crowding in complementary investments (e.g., in livestock) and leading to a higher standard of living. Small differences in a farmer's initial biophysical conditions thereby lead to larger, permanent gaps in productivity and well-being.

A further mechanism may arise from behavioural anomalies that lead to persistently inefficient activities. Individuals may face psychosocial incentives or constraints on behaviour related to self-control problems, habits, addictions and other 'irrational' behaviours that cause them material harm. If those are immutable, they can lead to single equilibrium poverty traps of the sort discussed above, much like a permanent cognitive or physical disability might. But if such behaviours can be altered through 'nudges' (Thaler & Sunstein, 2008) to the choices and constraints agents face, most commonly through commitment devices of some sort, then multiple equilibria can emerge (Banerjee & Mullainathan, 2010).

A new, but related literature considers how the key material drivers of persistent poverty (shocks and low asset levels) may cause preferences to change endogenously in ways that can generate behavioural poverty traps. Laajaj (2012) models asset poor individuals reacting psychologically by shortening their time horizons to underweight their 'gloomy future prospects', then shows that randomised enhancements of individuals' future prospects in rural Mozambique indeed extended their time horizons. Moya (2012) shows that individuals exposed to violence in Colombia exhibit a marked increase in risk aversion, a shift that would imply a lower standard of living even in a standard, single equilibrium dynamic model. Conditional on preferences, these recent studies suggest a single equilibrium poverty trap but that, unconditionally, individuals are subject to multiple equilibria, gravitating between low and high steady states, depending on endowments and realised shocks. Note that in contrast to Banerjee and Mullainathan (2010), an endogenous preferences mechanism does not blame the poor for their own persistent poverty (due to their intrinsic lack of self-control), but instead identifies structural mechanisms that distort preferences in ways that drive individuals to behave in ways that sustain their lower standards of living.

Finally, multiple equilibria poverty traps stem from fixed costs that generate locally increasing returns to scale. For example, farmers might receive different farmgate prices for the products they sell based endogenously on the volume sold to a trader who incurs fixed costs in product collection. The resulting volume-based difference in prices creates different investment incentives and resulting production patterns, each corresponding to a distinct level of expected farmer well-being (Barrett, 2008). Similar patterns arise from choices among livelihoods and technologies that have sunk costs of adoption, inducing sorting into adoption propensity based on initial endowments (Carter & Barrett, 2006; Dercon, 1998). Similar to the nutrition wage and natural resource degradation mechanisms, borrowing constraints make it impossible for the trapped producer to borrow the funds needed to increase her scale of operation and reap feasible higher returns. The next section will explore this mechanism, and its rich set of testable implications in greater detail.

III. The Multiple Financial Markets Failures Poverty Trap

This section summarises recent theoretical extensions insights from the core multiple financial market failures poverty trap model. The emphasis here is not the theory per se, but instead its rich empirical and policy implications, including the possible coexistence of single and multiple equilibrium poverty traps.

(a) Core Implications

In a canonical representation of the MFMF model (Barrett et al., 2012; Janzen, Carter, & Ikegami, 2012), an individual i has an immutable skill level, α_i, and can accumulate a stock of productive assets, the amount of which at time t is given by A_{it}.[3] The individual deploys her assets and skill under either a 'high' ($F^h(\alpha_i, A_{it})$) or 'low' ($F^l(\alpha_i, A_{it})$) technology, each of which is monotonically increasing in both α_i and A_{it}. The high technology is subject to fixed costs such that output is greater under the low technology up to a minimum scale of production, after which the high technology is more productive, as reflected in superior marginal returns. Switching between technologies is assumed costless. The individual can build up her asset stock over time, but subject to depreciation at rate τ and a periodic asset shock, θ_t , representing the fraction of assets destroyed by weather, theft, accident or any other adverse property event.

Finally, the model makes MFMF assumptions. Specifically, the individual is assumed unable to borrow against future income earnings in order to either accumulate assets more rapidly, or to insulate consumption, c_{it}, against the effects of shocks. These borrowing constraints are the first financial market failure. In addition, we assume that no insurance (contingent claims) market exists, therefore the individual cannot indemnify herself against asset losses. These financial market failures routinely afflict poor people (Besley, 1995).

Under these assumptions, the individual faces the following inter-temporal choice problem:

$$\max_{\underline{c},\underline{A}} E_0 \left\{ \sum_{t=0}^{\infty} \delta^t u(c_{it}) \right\}$$

$$\textit{subject to:}$$

$$\begin{aligned} x_{it}(A_{it}, \theta_t) &= F(A_{it}, \alpha_i) + (1-\tau)\theta_t A_{it} \\ F(A_{it}, \alpha_i) &= \max\left[F^h(A_{it}, \alpha_i), F^l(A_{it}, \alpha_i)\right] \\ c_{it} &\le x_{it} \\ A_{it+1} &= x_{it} - c_{it} \end{aligned}$$

where $\delta \epsilon$ (0,1) is a time preference parameter, and x_{it} is consumable wealth, defined as the sum of current income and the stock of productive assets. The MFMF assumptions are embodied in the constraint that says that current consumption must always be less than or equal to x_{it} as there are no insurance payouts, nor is credit available to borrowing against future earnings. The asset accumulates only through autarchic savings, again reflecting credit market failure.

Dynamic programming analysis of this model (as reported in Barrett, Carter & Ikegami, 2012) reveals several key implications:

(1) *Endowments are expected fate.* Figure 1 illustrates the direct implications of the model for individuals of different ability levels (shown on the horizontal axis) and different initial asset endowments (the vertical axis). The solid line cutting across the figure divides the endowment space between those agents to the northeast of the line who (in probability) converge to a high-income equilibrium, and those to the southwest who in expectation collapse to a low-level, poverty trap equilibrium. For each ability level, this line defines the 'Micawber Threshold' (MT) (see Carter & Barrett, 2006; Zimmerman & Carter, 2003). If an individual begins, or due to an asset shock falls below, the MT, then she will fall into a poverty trap. If that same individual remains above her MT, then she will tend to the high equilibrium. The model thus captures a multiple equilibrium poverty trap mechanism.

(2) *Risk matters and shocks have permanent consequences.* Imagine an individual who finds herself just above the MT. An event that destroys a fraction of her assets will suddenly push her below the MT and into a poverty trap. As Lybbert, Just, and Barrett (2013) express it, risk matters more than it otherwise might because one-off perturbations can have persistent effects, that is, the

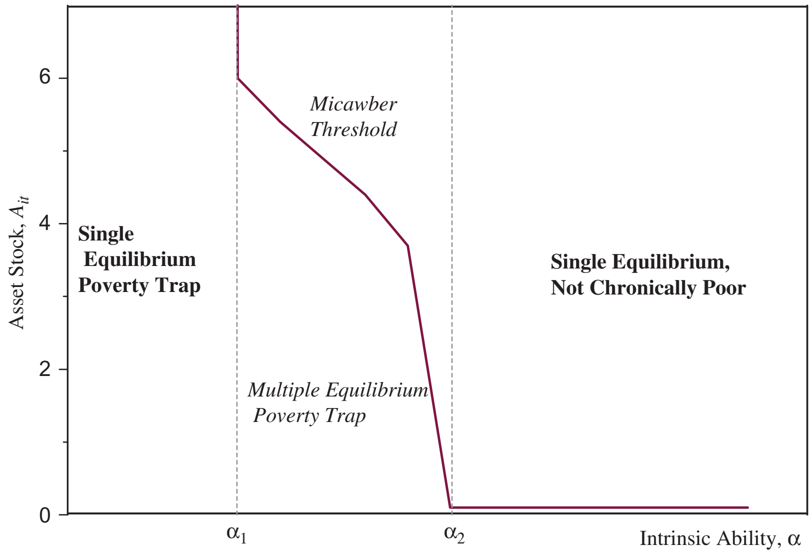

Figure 1. Multiple and single dynamic equilibria in ability-asset space.

system can be shocked from one stable equilibrium to another by a single event. Lack of insurance and credit routinely trap poor households in low return, lower risk technologies, thereby perpetuating poverty (Dercon & Christiaensen, 2011).

(3) *Coexistence of single and multiple equilibrium poverty traps.* As can be seen in the figure, the MT exists only for individuals whose skill levels lie between α_1 and α_2. Low ability individuals face a single, low-level equilibrium and ultimately collapse to a poverty trap standard of living, even if initially endowed with many assets, because their low intrinsic productivity limits their capacity to save or replace depreciated assets. Thus single and multiple equilibrium poverty trap mechanisms coexist in the MFMF model. Note also that high ability individuals ($\alpha_1 > \alpha_2$) face a single, high-level equilibrium. They might be persistently poor in a short panel as they accumulate wealth from a low initial asset stock; but their unique long-run equilibrium is non-poor. As we discuss below, the coexistence in a single population of these distinct poverty traps and asset dynamics creates problems for empirical analysis.

(4) *Systemic change matters.* Figure 1 is contingent on the productivity of the available technologies as well as the distribution of shocks. In the real world, both of these vary over time and space. Technology changes due to human agency and policy interventions. Nature evolves with changes in climate, disease epidemiology, and so forth. But changes in either technology or nature shift the location of the MT as well as the critical values α_1 and α_2. This implies yet further complexity for empirical testing and poses significant targeting challenges for policymakers.

As we discuss in greater detail in Section IV, most empirical work on poverty traps (including our own) focuses on implications 1 and 2 by studying asset dynamics. However, implications 3 and 4 substantially complicate the identification of multiple equilibrium poverty traps, as do the intrinsic difficulties of estimating asset dynamics in a multiple equilibrium system. The MFMF model also has important behavioural implications, however, some of which may enable empirical testing in addition to or in place of the direct examination of asset dynamics.

(b) Behavioural Responses to Shocks and Interventions

The MFMF poverty trap model has at least four important implications about behavioural responses to shocks and interventions.

(1) *Asset smoothing.* Zimmerman and Carter (2003) noted that individuals in the vicinity of a tipping point tend to preserve or smooth their asset stocks in the face of shocks rather than sell assets in order to stabilise or smooth consumption, as is predicted by standard models of inter-temporal choice (Deaton, 1991). Following up on this insight, Carter and Lybbert (forthcoming) note the incremental (shadow) value of assets in the vicinity of the MT is the additional income that the assets can generate *plus* the option value of a changing the future likelihood of a high standard of living. People might choose to destabilise consumption in order to protect assets and avoid falling below the MT.

(2) *Risk-taking by the risk averse.* A closely related implication is that when agents face a multiple equilibrium poverty trap, observed risk-taking behaviours reflect not just static risk preferences but also forward-looking risk management given the expected impact of shocks on future asset holdings (Lybbert & Barrett, 2011). As a result, even risk averse agents just below the MT may consciously choose to gamble in the hope that a favourable stochastic realisation will catapult them beyond the MT and onto a more favourable growth path. Conversely, better endowed individuals near the MT may go to great lengths to avoid risk exposure that might cast them beneath the MT and onto an undesirable path to a poor stable state. The resulting discontinuities open up, as yet, unexplored opportunities to study wealth-conditional risk-taking behaviours as a natural result of an MFMF structure to the economy.

(3) *Multiplier effects of small asset transfers.* A third implication of the MFMF model is that modest asset transfers that just suffice to lift an individual over the MT will crowd in additional saving and investment as the recipient suddenly finds it feasible to reach the high-level steady state capital stock. This additional investment would not occur absent the asset transfer. Barrett et al.'s (2012) simulations show that a relatively low-cost transfer programme can generate strong economic growth and poverty reduction by way of this mechanism. Furthermore, as Chantarat and Barrett (2012) show, if asset transfers affect social connections that matter to individual behaviour, well-targeted small transfers can crowd in investment and technology adoption among beneficiaries' network members who do not themselves receive transfers. Empirically, these theoretical analyses suggest that in the presence of MFMF poverty traps, well-designed asset transfers should yield large increases gains in recipients' well-being relative to a control group population and with very high rates of return on the (modest) public dollars invested in the asset transfer. This assumes, however, that careful targeting keeps the general equilibrium effects of such transfers modest enough so that the partial equilibrium effects dominate, a point to which we return below.

(4) *Crowding-in effects of risk reduction.* A fourth behavioural response implication is that a social protection scheme that functions as, or through, an asset insurance contract could also crowd in private investment. Barrett et al. (2012) develop this intuition by analysing the impact of a productive safety net scheme that indemnifies individuals for exogenous asset losses that push them below the MT. In their analysis, this sort of social protection shifts the location of the MT and sharply reduces poverty. Building on that insight, Janzen et al. (2012) show that an index insurance contract that pays off in the event of an asset shock, realistically priced above the actuarially fair level, shifts the MT leftward, making investment in now-safer assets more attractive and sparing those who begin with an endowment between the pre- and post-insurance MTs from unnecessary deprivation. The insurance opportunity also increases both the low and high steady state asset levels, as the certainty value of investment increases with the availability of insurance. In principle, these investment effects are empirically testable once asset index insurance contracts are adequately available for study.

In summary, MFMF poverty trap models offer multiple, testable behavioural implications that contrast with the predictions of standard economic models.

(c) Policy Targeting and Design

While poverty trap theory is often discussed from the perspective of how shocks and initial disadvantage can create unnecessary deprivation, the theory also has the happier implication that modest investment in what Carter and Barrett (2006) term 'safety nets' (policies to protect households against asset loss) and 'cargo nets' (interventions to increase household asset holdings) can have strong multiplier effects by inducing investments that some individuals would not otherwise undertake. These implications in turn motivate the question about how best to allocate available poverty reduction resources in the presence of MFMF poverty traps.

To date, little work explicitly tackles questions regarding the design and targeting of social protection and other anti-poverty programmes. An exception is the theoretical and simulation analysis reported in Barrett et al. (2012), which highlights an inter-temporal trade-off in the well-being of the poor. A purely progressive allocation of funds to the worst off (including the single equilibrium, persistently poor) will of course help those individuals in the short run. However, in the long run, the extent and depth of poverty may be higher under purely progressive targeting than if social assistance was targeted first at braking the downslide of the vulnerable into poverty and boosting the middle ability, multiple equilibrium poor above the MT. In the MFMF model, the poorest are better off in the short run under purely progressive targeting, but better off in the long run if some resources are targeted at the better-off poor near the MT to induce those near the asset poverty line to invest their way out of long-term poverty. This troubling, but important trade-off has heretofore gone unrecognised. Given these strong implications of MFMF systems, empirical testing for poverty traps can play an important role in guiding development policy.

IV. Empirical Tests for Poverty Traps

As the preceding two sections emphasise, the different mechanisms that can create poverty traps imply different empirical patterns. This diversity – along with the fact that poverty traps surely do not exist everywhere – helps account for the mixed micro-scale empirical evidence on the poverty traps hypothesis. The variety of poverty trap mechanisms challenges empirical tests for poverty traps, as does the inherent endogeneity of critical thresholds and equilibria as illustrated with the mixed equilibria model above. Because these challenges have received relatively little attention to date, this section highlights some of these issues before drawing out the important policy implications of different sorts of empirical tests for, and findings on poverty traps.

(a) Estimating Asset and Income Dynamics to Detect Poverty Traps

The vast majority of the empirical literature on poverty traps tries to identify low-level equilibria directly through the study of welfare dynamics, typically using asset measures. The most commonplace tests for poverty traps (for example, Adato , Carter & May, 2006; Antman & McKenzie, 2007; Barrett et al., 2006a; Carter, Little, Mogues, & Negatu, 2007; Jalan & Ravallion, 2005; Lokshin & Ravallion, 2004; Lybbert, Barrett, Desta, & Coppock, 2004; McKenzie & Woodruff, 2006; Van Campenhout & Dercon, 2009) are actually tests for a specific class of multiple equilibrium poverty trap. The articles in this special issue all follow in that tradition, although several push further, looking for single equilibrium poverty traps as well. There is much to be learned from these explorations. But having estimated many such asset dynamics models ourselves, we have come to appreciate the many significant shortcomings to the direct approach to testing for poverty traps.

First, empirical results are commonly misunderstood. Perhaps because the multiple equilibrium poverty trap is an especially interesting sort, analysts often misinterpret evidence against multiple equilibria as evidence against poverty traps per se. Rejection of multiple equilibria can of course be completely consistent with the existence of a single equilibrium poverty trap. Indeed, findings of a unique, poor dynamic equilibrium are fairly commonplace (Quisumbing & Baulch, 2013; Kwak &

Smith, 2013; Naschold, 2012, 2013). The failure to find multiple equilibria does not reject the poverty trap hypothesis, merely that of a specific, multiple equilibrium class of poverty trap.

Second, it is difficult to discriminate empirically between true state dependence (that is, the existence of multiple equilibria) and situations in which different single equilibria coexist (for example, individuals with a disability invariably tend to a single low equilibrium level of well-being, while those without the disability gravitate towards a single higher equilibrium). Permanent or near-permanent traits (cognitive or physical disability, gender, race, adult educational attainment, genetic predisposition to disease, inherited social connections, or physical environment) that matter to productivity and well-being can cause conditional convergence to a single equilibrium poverty trap for the disadvantaged strata. Yet because some of those traits (for example, educational attainment, health status) may themselves be endogenous to initial wealth in the presence of multiple financial market failures (Bonds et al., 2010; Loury, 1981), disentangling heterogeneity from state dependence is conceptually fuzzy and empirically depends on strong identifying assumptions (Heckman, 1981, 1991).

Third, even when multiple equilibria exist, they can be difficult to pin down empirically. The underlying dynamic theory implies that the parameters that describe observed well-being dynamics – including the stable and unstable dynamic equilibria empirical researchers seek to identify – are endogenous to the specific conditions under study. Changes in the underlying biophysical or economic environment can change the underlying behavioural parameters and thus the dynamic equilibria. Any sample-based estimate of wealth dynamics is thus inherently unstable and vulnerable to a host of unobserved heterogeneity problems as well as to general equilibrium effects related to changes in endogenous investment, market participation and technology adoption behaviours. Put differently, the MT moves over time in response to changing market and non-market conditions and varies across individuals based on unobserved attributes. But variation in both cross-section and time series makes identification of unstable equilibria extremely challenging. Any of a host of cross-sectional or time series representations can arise in the data, regardless of whether the underlying dynamics are truly characterised by poverty traps.

Fourth, direct test for poverty traps can fall short, for a host of econometric reasons. For example, if multiple equilibria exist, then thresholds should be dynamically unstable points around which one should find few observations in any sample. Bifurcated asset dynamics might therefore appear instead as heteroskedastic and positively autocorrelated errors (Barrett, 2005b). This problem is easily aggravated by the twin complications that (i) the individuals who identify the out-of-equilibrium dynamics are a non-random sub-sample with unknown selection, and (ii) non-random attrition is commonplace in panel data. In parametric regressions these problem are compounded by the necessary instability in estimating equilibria far from the sample means (Barrett et al., 2006), while in nonparametric regressions, one always worries about unobserved heterogeneity problems due to the absence of control variables. Naschold (2012, 2013) discusses the trade-offs among nonparametric and parametric estimators and the appeal of semi-parametric approaches to test for the existence of multiple asset dynamic equilibria in panel data. Empirical researchers employ multiple, increasingly sophisticated semi-parametric, nonparametric and parametric estimators to try to overcome these problems through robustness checks (Kwak & Smith, 2013; McKay & Perge, 2013; Quisumbing & Baulch, 2013).

Fifth, as the model developed in the previous section and the empirical work by Santos and Barrett (2006, 2011) illustrate, within a single population, some individuals may be subject to multiple equilibria, while others are not. The MT, and even whether it exists, may be conditional on individual skill, or even on whether the individual is subject to financial market constraints. While threshold estimation (Hansen, 2000) is one way to try to identify the MT (Carter et al., 2007), the econometrics of conditional threshold estimation have yet to be developed.

Sixth, sampling strategies commonly aggravate the econometric obstacles that exist. For example, panel studies of households and individuals commonly rely on cluster sampling with a relatively small number of clusters. Not only can the resulting within-cluster correlation bias the standard errors of parameter estimates, it naturally leads to regression-toward-the-mean effects that disfavour finding multiple equilibria even if they exist. Unique poverty trap equilibria can arise due to high levels of within-group correlation, due to political economy, institutional or geographic factors common to many households; but within-sample correlation due to sampling design can lead to spurious findings of such effects (Jalan & Ravallion, 2005; Naschold, 2013).

Seventh, most recent tests for poverty traps, including all of the articles in this special issue, rely on asset-based measures for well-known reasons (Carter & Barrett, 2006). Despite the compelling conceptual, practical and statistical advantages of asset-based approaches, they do come at a price. Asset stocks are often slow changing, which can make it difficult to discern change in short panels, especially with small samples.[4] Perhaps more importantly, the diversity of types of assets poses aggregation challenges. The use of money metric measures is commonly complicated by problems of accounting appropriately for depreciation, thin secondary markets and heterogeneous asset quality. For that reason, analysts commonly construct asset indices so as to reduce a large number of relevant assets denominated in radically different units – land, livestock, machinery, vehicles, and so forth – into a scalar measure. Furthermore, many critical financial, human capital and natural assets may be unobserved. But as Michelson, Muñiz and DeRosa (2013) demonstrate, empirical tests for poverty traps prove quite sensitive to inherently arbitrary choices among asset index construction methods.

Finally, even simple descriptive tests for multiple equilibrium poverty traps that check for multi-modal cross-sectional asset distributions, as demonstrated by Barrett (2005b) and Kwak and Smith (2013), only work for very specific sorts of stochastic processes. A stochastic system characterised by multiple equilibria can readily generate a unimodal cross-sectional distribution depending on the nature of the stochastic error term – additive or multiplicative, its variance, and so forth.[5] Finding multimodal cross-sectional distributions is neither necessary to the existence of even a equilibrium poverty trap, nor is it even sufficient, as two distinct modes observable in data could reflect distinct single equilibria for non-overlapping subgroups whose membership is defined by unobservables.

(b) Alternative Strategies to Test for Poverty Traps

While the obstacles to direct testing for poverty traps based on asset and income dynamics have become apparent, the policy importance of knowing whether or not poverty traps exist motivates the search for alternative empirical strategies. One approach is to elicit state-dependent wealth or well-being dynamics from survey respondents in a game or an experiment in order to get respondents to directly identify apparent non-linearities in well-being dynamics explicitly controlling for state-dependence. Santos and Barrett (2006, 2011) do this with Ethiopian pastoralists, eliciting their expectations of herd growth conditional on poor, normal or good rainfall states. By blending the resulting estimated state-conditional herd growth functions according to the observed probabilities of each rainfall state in the region, they almost exactly replicate the unconditional herd dynamics observed in the same region in other data (Lybbert et al., 2004) and can disentangle the role of exogenous climate variation from initial herd size and even herding ability in generating a poverty trap. But this approach likely depends on the simplicity of the system; livestock are effectively the only non-human form in which southern Ethiopian pastoralists hold wealth, making such an exercise feasible there although it might not be in an urban setting or in a mixed crop–livestock system with a vibrant rural non-farm economy.

A radically different approach abandons the quest of estimating asset dynamics in favour of an indirect approach using behavioural data. Behavioural patterns that could only result from the rational response of agents confronting a poverty trap serve as an allegory of the poverty trap, a representation of something more abstract and complex that often eludes direct observation. For example, do those with low asset stocks fail to invest in assets offering attractive returns, on average, while those with greater initial stocks of the same asset invest, thereby signalling locally increasing returns consistent with the existence of a threshold separating multiple dynamic equilibria? As an alternative approach to testing for poverty traps, empirical researchers might explore the testable behavioural implications of poverty traps models rather than trying to identify low-level dynamic asset equilibria explicitly, especially in panels with relatively few repeated observations.

As discussed previously, one of the most powerful behavioural implications of an MT is that while canonical consumption smoothing is an equilibrium behaviour over some wealth ranges, asset smoothing – that is, the wilful destabilisation of consumption – is an equilibrium behaviour in other wealth ranges (Carter & Lybbert, forthcoming; Zimmerman & Carter, 2003). This observation has led to several indirect tests for poverty traps on the basis of observed asset smoothing behaviours among an appropriate subpopulation.

Hoddinott (2006), for example, finds consumption smoothing by Zimbabwean households who possess sufficient draught animals to ensure that they can plough their fields the next year. But those who own just a single team of two oxen (or less), destabilise consumption in the face of rainfall shocks so as to safeguard their productive assets. In a still more indirect fashion, Lybbert and McPeak (2012) estimate the risk and time preference parameters of northern Kenyan pastoralists and find that poorer households are simultaneously more risk averse and more willing to destabilise consumption than are the relatively rich. Such patterns are consistent with a poverty trap model based on herd size thresholds – of the sort found in this area by Barrett et al. (2006) – but inexplicable in the absence of such thresholds. Carter and Lybbert (forthcoming) use threshold estimation techniques to show that rural households in Burkina Faso exhibit asset smoothing, rather than consumption smoothing, in the neighbourhood of critical herd sizes at which optimal accumulation behaviour bifurcates. Households above the estimated MT almost completely smooth consumption against weather shocks using livestock sales, while those below the MT asset smooth instead.

Along similar lines, Santos and Barrett (2011) recognise that an unstable herd size threshold between multiple dynamic asset equilibria should naturally create an inverted U-shaped pattern of informal lending in wealth space, contrary to conventional credit rationing models. Studying southern Ethiopian pastoralists who previous studies found face multiple herd size equilibria (Lybbert et al., 2004; Santos & Barrett, 2006), they indeed find a 'middle-class bias' in informal lending favouring those in the neighbourhood of a potential threshold at which wealth dynamics bifurcate. This leads to credit rationing patterns, as the poorest are excluded because of their proximity to the low wealth level attractor and the richest members are rationed out due to diminishing returns to wealth. This sort of pattern is entirely consistent with the existence of a poverty trap in this system and inconsistent with other models of informal lending.

In a similar spirit, Marenya and Barrett (2009a, b) observe that in the presence of multiple market failures, farmers' fertiliser purchases should depend on their ex ante soil quality because the marginal returns to fertiliser application depend on initial soil quality. They indeed find that even though the average returns to fertiliser use are considerable for western Kenyan maize farmers, fertiliser application does not pay for the poorest third of farmers, who cultivate lower quality soils. The poor rationally fail to invest in what unconditionally appears an attractive input. An endogenous switching regression model of fertiliser purchase behaviour (Marenya & Barrett, 2009b) indeed finds a pronounced discontinuity in fertiliser demand at the soil carbon threshold Marenya and Barrett (2009a) identify as the MT for profitable fertiliser use. Stephens et al. (2012) build on these findings to demonstrate in a dynamic bioeconomic model how feedback between farm household economic decision-making and long-term soil fertility dynamics can generate multidimensional asset thresholds that trap some households in persistent poverty and food insecurity.

The indirect approach to testing for poverty traps also lends itself to intervention-based tests wherein researchers exploit plausibly exogenous variation in the vicinity of a prospective MT (for example, through randomised assignment of cash transfers, credit, insurance or fertiliser), then look for bifurcations in subsequent behaviours. We are in the midst of such an experiment in northern Kenya, where index-based livestock insurance (IBLI)[6] began a commercial pilot in early 2010 linked to a randomised encouragement research design that should enable us to identify differential behavioural responses attributable to whether or not households were insured conditional on their herd sizes. That design is overlaid on a new unconditional cash transfer programme so that we can explicitly study the individual and joint effects of cash transfers and insurance against proper control communities and households. Very preliminary findings from data on households' anticipated coping strategies, gathered just as initial indemnity payments were announced in the midst of a major drought, indeed suggest that insurance leads to markedly different behaviours (Carter & Janzen, 2012). Reducing uninsured risk was statistically significantly associated with lower expectations of harmful behaviours such as reduced food consumption or livestock sales, while those anticipating larger insurance payouts anticipate buying livestock to accumulate herds for faster post-drought recovery.

Keswell and Carter (2012) exploit a South African land reform programme that operated as a natural experiment, with some approved beneficiaries receiving land transfers (worth about $4000) and others not, for exogenous reasons unrelated to their individual characteristics. MFMF poverty trap theory suggests that an asset transfer that lifts a family above their MT will generate very high observed rates of return on the transfer. Keswell and Carter indeed find that after a few years, the estimated impacts on family well-being imply a 50–75 per cent annual rate of return on the initial public investment in the programme. Returns of this magnitude only make sense if transfers induced beneficiaries to increase their own investments in productive assets. Because a control group showed no increases, these results appear to identify the kind of crowding-in effect that MFMF poverty trap theory predicts.

In summary, the empirical literature tapping the potential of indirect tests of the poverty traps hypothesis remains thin. But these initial forays show considerable promise in helping illuminate important policy questions concerning the existence and nature of poverty traps.

V. Conclusions and Policy Implications

The moral and economic efficiency imperatives to intervene in the case of a poverty trap makes this line of theoretical and empirical work highly policy relevant. Empirical findings of a poverty trap add evidence to arguments for direct action to help the poor escape the structural circumstances that cast a long shadow over their future, although we reinforce McKay and Perge's (2013) point that the absence of empirical evidence of a poverty trap does not argue against intervention. In practical terms, very slow accumulation by those far below the poverty line is scarcely different from no expected accumulation by those a bit below the poverty line. Either merits assistance.

The trick is what sort of assistance. This is where more discriminating empirical tests of the poverty traps hypothesis and its behavioural implications can have considerable value. Where we can identify – directly through the study of welfare dynamics or indirectly through the study of behaviours – poverty traps of the MFMF sort, then interventions that remedy those multiple financial market failures for even a limited time can generate large, lasting gains. Hence the promise of credit and insurance innovations and asset transfer programmes coupled with research on poverty traps.

By contrast, if chronic or persistent poverty and poverty traps arise mainly due to heterogeneity in immutable traits – for example, early childhood health and nutritional status, educational attainment, gender, or race – that lead to conditional convergence on a single, low-level, trait-specific dynamic equilibrium, then short-lived interventions to remedy MFMF are unlikely to have lasting impact. More appropriate policy responses would then address the longer-term sources of the underlying heterogeneity that gives rise to subpopulation-specific poverty traps. Hence the importance of testing for poverty traps of any sort, not just of the multiple equilibrium variety central to the MFMF model.

These questions matter fundamentally to development policy. Sachs's (2005) argument for large-scale development interventions rests firmly on a foundational theory of poverty traps. Incremental changes make little difference when the prevailing dynamic equilibrium is a poor one. The possibility of such poverty traps also undercuts arguments that favour experimentation with many small randomised controlled trial (RCT) interventions in order to learn and subsequently scale-up what works at the margin. In the absence of poverty traps, significant changes identified in small-scale RCTs may lead to big impacts once taken to scale. But where poverty traps exist, small-scale changes effected within RCTs do not alter the underlying structure of the economic system and thus should rarely be expected to make a big difference. Moreover, the absence of evidence of impact at the margin tells us little about likely effects at larger scale or scope. The exception is where small, randomised interventions are carefully targeted to bump intended beneficiaries just beyond a pre-identified (or hypothesised) MT or to shift that threshold. Of course, such outcomes require ex ante identification of critical asset thresholds through non-experimental methods.[7]

The burgeoning empirical development microeconomics literature on poverty traps, nicely exemplified by the articles in this special issue, exhibits enormous potential to inform poverty reduction policies. The next steps will likely need to combine more rigorous theorising with more creative, indirect empirical testing of the behavioural implications of poverty traps.

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Notes

1. The logic applies to any observational unit, from individual through multinational aggregates. In this article, we use the term 'household' merely as convenient shorthand, not to imply these phenomena only occur at household scale of analysis.
2. As but one example of a single equilibrium, the foetal origins hypothesis posits that adult cognitive and physical potential are largely determined in utero (Almond and Currie, 2011) or, more broadly, within the first 1,000 days since conception (World Bank, 2006). In the context of this article, this hypothesis suggests that the number of people caught in single equilibrium poverty traps can be reduced through prenatal and early childhood health and nutrition interventions that enable children to realise their full genetic potential as adults (Heckman, Stixrud, & Urzua, 2006).
3. Note that because α_i is immutable it would not include individual skills that can vary over time due to investments in education, health, nutrition, learning by doing, and so forth. We conceptualise those investments as adding to the time varying capital stock, A_{it}.
4. Although a recent study by Christiansen, Lanjouw, Luoto, and Stifel (2012) suggest that asset-based measures do change quickly enough to estimate changes in poverty over a relatively short time span.
5. We thank David Ruppert for pointing this out to us.
6. See Chantarat, Mude, Barrett, & Carter (2013) for details on the design of the IBLI product.
7. Barrett and Carter (2010, forthcoming) make the case for combining experimental and observational empirical research for precisely this reason (among others).

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