DISSERTATION


THREE ESSAYS ON HETEROGENEOUS CAPABILITIES, POVERTY TRAP

THRESHOLDS, AND THE PERSISTENCE OF INEQUALITY


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ABSTRACT

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The current trends in poverty measurement moving toward a focus on asset and wealth stocks, and hence away from traditional flow measures of consumption and income, warrant the scaling up of efforts to understand how individuals convert asset stocks into economic well-being. At the same time, modern advancements in computing power have led to an increase in the level of rigor associated with ex ante simulations of how macroeconomic changes potentially impact microeconomic well-being. In the presentation of three essays, this study investigates how individuals and households that are endowed with heterogeneous capabilities convert productive assets into economic well-being through the lenses of ex-post empirical analysis and an ex-ante macro-micro simulation.

This analysis advances thinking on poverty an inequality by presenting a re-constructive critique of both the asset-based and human development/capabilities perspectives on poverty measurement, arguing that there are significant complementarities and reconcilable differences in which researchers can take significant advantage of. The theoretical and empirical insights regarding the role of capability disparities in conditioning household poverty trap thresholds are then applied in a preliminary fashion to a computable general equilibrium (CGE) model that is linked to a

microsimulation model (MSM). The top-down behavioral CGE-MSM is capable of addressing the question of how macro changes impact poverty and income distribution when individuals are endowed with heterogeneous capabilities in an ex-ante fashion.

In an attempt to isolate the impacts of macro changes on micro poverty and well-being, the questions of what poverty and well-being really are must be addressed first. The opening essay thus traces out the common origins, divergent evolution, and reconcilable differences across asset-based and Human Development/Capabilities perspectives of poverty. It is argued that asset-based studies have embedded in them a strong temptation to focus solely on asset accumulation policies without giving the conversion process of assets into livelihood its due study. Although the asset-based literature has made advances on the theoretical front in explaining how poverty trap thresholds are unique and dependent on intrinsic ability, the empirical analysis of what intrinsic ability may encompass remains understudied.

The essay proposes that empirical asset-based studies of poverty trap thresholds stand to benefit from insights of the Human Development/Capabilities literature by viewing intrinsic ability as capability constraints which leads to differing opportunity costs. To illustrate the bridging role of opportunity costs, a simple, two-household model with heterogeneous opportunity costs is presented and applied to South Africa's most populated province. The results of the simple model underscore the need for a capabilities consistent asset-based framework.

The second essay extends the first by asking how particular asset holdings are associated with capabilities to take on new economic opportunities. Knowledge of the patterns and linkages between capabilities and particular asset holdings has been relatively under- realized, particularly in the empirical poverty traps literature.

Using the same household survey data of essay one, this essay seeks to empirically decompose how early period asset endowments impact future levels of well-being into direct and indirect mechanisms. A direct impact of asset endowments on future well-being would include consumption of the asset or the direct use of it to produce incomes (i.e. grain stock consumption or the sale of livestock offspring, respectively). The indirect impacts of endowments are of greater interest to this study and are of two forms: asset-to-asset complementarities and how household capabilities (or deprivations thereof) interact with particular asset holdings. To achieve this decomposition, this paper employs a method of path analysis akin to early heritability of traits studies which were aimed at distinguishing between the effects of nature versus nurture.

This second essay contributes to the prior literature in three primary ways. First, it adds empirical robustness to prior theoretical work linking intrinsic ability with household-specific poverty trap thresholds. Second, it bridges the quantitative work on poverty traps with qualitative insights from the human development/capabilities literature by identifying which particular asset holdings are associated with different household capability constraints. Lastly, it serves as a reminder to policy that measuring poverty as

asset stocks requires additional knowledge about the process of converting those assets into well-being.

After the first two essays tackle the issue of poverty measurement and its conversion into economic well-being, the final essay reviews a host of macro, micro, and macro-micro modeling strategies in order to draw out central features of a framework that can address the micro impacts of macro changes in the presence of heterogeneous behavioral responses. Additionally, this essay presents a preliminary framework of that model and explores how capabilities, that heterogeneously impact the occupational choice of individuals, might be incorporated.

When there are heterogeneous responses to changes in the macroeconomic employment situation, the identification of winners and losers of potential macro-policy changes in an ex-ante fashion is more complex. Standard computable general equilibrium (CGE) models are only able to identify between group changes in income distributions and not within group changes. Additionally, there is a lack of capacity to include unique behavioral responses. One alternative is to link a behavioral microsimulation model (MSM) to a CGE. The benefit of this approach is that the outcomes of behavior are aggregated rather than behavior itself being homogenized and aggregated as is implicitly done in models with representative agents or household groups.

Though the original aim of the entire study - to put forth a macro-micro model flexible enough to incorporate heterogeneous behavior - was accomplished, the true benefits of the study come from considering the linkages between capabilities, poverty trap thresholds, and the distribution of well-being in greater detail.

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INTRODUCTION TO THE THREE ESSAYS

When economic well-being is measured by income flows, it seems trivial to ask how income is converted into well-being. The mere fact that money exists as a common medium of exchange suggests that individuals can reasonably do whatever they choose with income that translates into economic well-being. However, flow measures of well-being such as income and consumption are less indicative of future poverty prospects. Assets, on the other hand, are much more predictive in that they provide cushions against future income shocks, can be consumed directly, or can be used to generate income and consumption flows. As household and individual data on asset holdings and well-being have become more common around the globe, viewing poverty in terms of stock measures has also become more fashionable. Because assets are a broader class of wealth when compared to money and do not perform the role of a commonly accepted medium of exchange, the conversion process of assets into economic well-being is less straight forward than income.

The overall objective of this dissertation is to advance the study of poverty and inequality by addressing the socially embedded nature of poverty and poverty measurement. The setting of the analysis is South Africa's most populated province of KwaZulu-Natal; the scope is to first focus on the microeconomic aspects of poverty measurement and to then construct a preliminary framework for assessment of the macro-

micro linkages between export sector evolution and individual winners and losers as informed by the preceding microeconomic aspects of poverty.

The first of three essays begins the dialogue of what is poverty and how should it be measured. The primary aim is to address the social aspects of economic well-being. Two approaches are first considered and then theoretically merged via a common element – heterogeneous opportunity costs. The two approaches under consideration are the asset-based and human development/capabilities (HD/C) perspectives. In the case of the former, asset stocks are the focus of well-being for reasons mentioned above. This essay outlines a central tenet of this approach describing time as an ally of the poor so long as asset stocks are sufficiently high. This tenet leads explicitly to a discussion of how high is high enough? This is implicitly asking the question of what determines critical thresholds in which if asset stocks are above, time is an ally of the individual. This is not unrelated to the introductory remarks above that suggest the process of converting asset stocks into well-being is understudied. The corollary is that poverty trap thresholds are relatively understudied. This may be due in part by the fact that they are a theoretical construct, unobservable on the individual level.

Essay one outlines attempts to theoretically observe thresholds at a larger community or sample-wide level, but this ignores individual differences that households likely face in reality. Although there has been some theoretical role on intrinsic ability's role in condition critical thresholds, it has been done without any discussion of what intrinsic ability may encompass. Thus the essay moves on to the second perspective of poverty measurement – that of the human development and capabilities literature.

There is a natural overlap with the former perspectives on poverty trap thresholds in which intrinsic ability can be defined as capabilities (or deprivations thereof). The essay goes on to outline the common origins, recent divergence, and reconcilable differences among the two seemingly competing traditions. The case is made that both perspectives on poverty measurement, implicitly or explicitly, have a significant place for opportunity costs within their respective theoretical frameworks. Essay one goes on to present a simple, two-household model of poverty traps with heterogeneous opportunity costs. This framework takes the quantitative elements of the asset-based approach and fuses them with the qualitative elements of the HD/C perspective in an empirically tractable manner. A simple test is then applied to KwaZulu-Natal revealing that the degree of time deprivation stemming from subsistence activities may condition poverty trap thresholds (i.e. impact the conversion process of assets into livelihood) in a significant way. This incorporates the essence of the HD/C approach in that time deprivations act as increased opportunity costs leading to household disparities in their ability to take on new economic opportunities.

The second essay follows up from the first in that it explores the simultaneous roles of asset holdings and household agency in determining poverty trap thresholds. Said another way, this essay cracks open the black box of asset holdings in an attempt to identify linkages between particular capability deprivations and asset holdings. The empirical method employed in this essay is borrowed from the genetic heritability of traits literature. The correlation of initial asset endowments and future economic well-being is decomposed into direct and indirect effects (nature versus nurture in the heritability of traits language). Direct effects are asset endowments ability to generate

livelihood by employment of labor, consumption of grain stock, or productive uses of equipment. Indirect effects are how particular assets influence future livelihood through household agency or capability characteristics such as child dependency ratios, time deprivations, and alternative measures of social capital. The results suggest that time deprivations are heavily associated with higher powered assets such as educated labor, productive capital, and access to agricultural land. This is likely reflective of the wider-economy underperformance in South Africa in which well-resourced households are the only ones with the wherewithal to face binding micro-constraints. That is to say, households that primarily rely on uneducated labor are not converting assets into livelihood due to the macro-structure and underemployment.

The take away lessons of the first two micro-oriented essays is that differences in individual capabilities to take on new economic opportunities play an important role in converting productive assets into economic well-being. Essay one lays out the argument that asset-based studies of poverty are at risk of focusing on asset accumulations alone; this short-sighted target assumes seamless conversion of assets. Essays one and two together provide both theoretical and empirical evidence that this is a heroic assumption.

Essay three broadens the scope of the study by asking what tools are capable of addressing the micro impacts of macro shocks in a world in which agents are heterogeneously endowed with differing capabilities. The aim is to identify an appropriate ex ante modeling strategy flexible enough to accommodate the differences in micro-behaviors. This essay starts with a general review of macro, micro, and macro-micro simulation strategies with particular focus on linking computable general equilibrium models (CGE) with behavioral microsimulations (MSM). After a review of

this emergent literature, the essay presents a benchmark framework of a microsimulation model in which capability constraints are embedded in an occupational choice model with heterogeneous behavior. The model outlined sequentially links a behavioral MSM with a macro CGE model. The top CGE model evolves in a manner consistent with the self-discovery ideas found in the international economics literature. No data or calibration of the model is presented in essay three as the focus is on the nature of a CGE-MSM and the range of research questions it could accommodate.

Overall this study contributes to the poverty literature in the following ways. First, it provides a clear and concise history of the asset-based and HD/C perspectives of poverty outlining their common origins and reconcilable differences. The study proposes a theoretically simple and empirically tractable way in which elements of the two perspectives can be linked via heterogeneous opportunity costs. Next, the study is one of the firsts to open up the black box of asset holdings that households use to generate livelihood and identifies linkages between particular assets and household agency characteristics. Lastly, the study proposes a macro-micro framework capable of analyzing how macro changes impact the distribution of well-being in the presence of capability disparities influencing labor market choices.

**#1 Opportunity Costs as a Theoretical Link between Asset-Based and Human Development Studies of Chronic Poverty**

## 1. Introduction

Beyond the basic income and consumption measures, two dominant views of poverty measurement have emerged over the last two decades since the gradual demise of macro-inspired models based on the premise of convergence. The asset-based (AB) and human development/capabilities (HD/C) approaches have many stark contrasts in their current forms, but also claim similar origins and have the potential to complement one another's limitations. For example, within asset-based poverty measurements, critical minimum stocks of assets needed to get ahead in the future have been described as being a function of intrinsic ability (Carter and Ikegami, 2007). However, what intrinsic ability may encompass in any empirical manner has been given inadequate consideration. This often has the result of asset-based poverty studies narrowly focusing attention on asset accumulation and falling short on understanding the conversion process of turning assets into livelihood. This is indeed an area of further exploration for asset-based studies, but familiar ground of studies evolving out of Amartya Sen's work on capabilities and livelihoods (1999; Sen, 1981).

To further highlight the idea that asset accumulation is not by itself an end goal of poverty reduction, consider the case of South Africa's most populated province of KwaZulu-Natal. Households in KwaZulu-Natal have improved or begun to recover their asset base over the eleven year period from 1993 to 2004. However, over that same time period there have been significant disparities among households in terms of their successes of converting those assets into livelihood (where livelihood is measured as material well-being or consumption). Figure one traces the asset stocks of the same 744 households over the eleven year period. Every endowment quartile ended the period with greater stocks of assets. Yet figure two tells a richer story by mapping the successes of those asset stocks in terms of livelihood per unit of asset holdings. By 2004 the bottom two quartiles have not recovered from their 1993 levels. This is in stark contrast to the upper quartiles. What explains the observed disparities in figure two? What intrinsic abilities do these households lack in order to generate a sufficient livelihood? It is argued within this paper that viewing intrinsic ability from the lens of capabilities may provide crucial clues into who the vulnerable households are and where policy can enhance the conversion process.

The question then becomes: How to incorporate the qualitative aspects of the HD/C perspective into a quantitative asset-based model of poverty traps with the aim of empirically describing intrinsic ability. I argue that the opportunity costs associated with taking on new economic opportunities provides the theoretical - and empirically observable - link between HD/C and asset-based studies of chronic poverty.

In order to draw out the relationship between intrinsic ability and critical asset levels, this paper bridges the asset and HD/C perspectives on poverty by integrating

household agency characteristics into an estimable micro-model of the process of converting asset stocks into economic livelihood which can explain how critical thresholds depend on household capabilities. If borne out by empirical evidence, poverty reduction strategies could be made more effective by incorporating knowledge of asset levels and household characteristics.

Using household data from South Africa's most populated province of KwaZulu-Natal, I find that the degree of time spent on subsistence activities (a form of capability deprivation) may condition critical thresholds in which the ability to convert assets into livelihood bifurcates. This simple model and quick empirical test represent a first pass at incorporating capability constraints within the particular framework.

This study contributes to the prior literature in two primary ways. First, it provides a concise history and synthesis of commonalities across alternative approaches to poverty measurement. Second, it brings awareness to the current state of asset-based studies by encouraging movement away from an abbreviated focus on asset accumulation and to incorporate awareness of structural influences on the process of converting asset stocks into economic livelihood.

The rest of the paper is organized as follows. Section two outlines the central tenets of, common origins of, and reconcilable differences between the two prominent approaches to poverty measurement with particular emphasis on poverty trap thresholds, opportunity costs, and capability constraints. Section three then describes a simple, two-household model with heterogeneous opportunity costs that embodies elements from both approaches. Sections four and five discuss the econometric model and data respectively,

used to test the framework presented in the prior section. Section six then discusses the results, implications, limitations, and extensions.

## 2. Theoretical Foundations: Bridging the Human Development/Capabilities and Asset-Based Approaches

In the past decade there has been a divergent evolution of asset-based and HD/C perspectives in which potential mutual gains have not been realized. Namely, the asset-based frameworks tend to borrow insights from the macro-development literature that resemble the big push-type models. It will be argued that analyses that focus on poverty trap thresholds are at risk of falling into the same trap as past convergence models with respect to a narrow focus on accumulation of asset stocks as the ends rather than simply one of many means to poverty reduction. The capabilities literature serves as a good reminder that empowerment and livelihood are powerful means and ends to consider in addition to asset stocks alone. This section outlines the central tenets of the two approaches, traces their common origin and their divergent evolution, and then proposes a simple capabilities consistent, asset-based framework of chronic poverty.

*Asset-Based Approach*

When considering chronic poverty the issue of time must be addressed. Current income or consumption flows may reflect past dynamics, but reveal relatively little about a household's future welfare prospects. Assets, on the other hand, implicitly contain information on future livelihood by their very nature. Asset endowments provide a

cushion against income shocks, are a source of future income and consumption streams, and are generally indicative of future economic well-being. The multi-dimensional nature of assets thus offers a more predictive measurement of poverty than current income or consumption flows. In the now seminal, "The Economics of Poverty Traps and Persistent Poverty: An Asset-Based Approach", Carter and Barrett (2006) outline an asset-based framework of multiple equilibria capable of explaining how households or individuals can persist over time at higher or lower welfare states[1]. Inherent in a discussion of multiple equilibria, however, is a discussion of critical thresholds that define the boundaries between equilibria. With few exceptions, the challenge to date has been not just to confirm the existence of critical thresholds, but to identify how individual or group abilities condition them. This is complicated by the fact that thresholds, if they exist, are generally unobservable at the individual level.

Figure three is adapted from Carter and Barrett (2006) and illustrates a basic situation in which there are two production activities available to a particular household, $\mathcal{L}_1$ and $\mathcal{L}_2$. Activity $\mathcal{L}_2$ requires a higher level of fixed costs, but can ultimately generate a higher level of livelihood or welfare – measured on the vertical axis. The horizontal axis measures the inputs of assets used to produce the output of livelihood or welfare. For now, assume assets can be easily aggregated into one bundle. One could interpret $\mathcal{L}_1$ as subsistence, in home production process of generating livelihood; whereas, $\mathcal{L}_2$ might be formal labor in which the higher fixed costs stem from the opportunity cost of being outside the home or accumulation of skills. The asset level $A^s$ identifies the level of assets

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[1] See also Barrett Barrett, Christopher B. (2008) Poverty Traps and Resource Dynamics in Smallholder Agrarian Systems. In Rob B. Dellink and Arjan Ruijs (eds.), *Economics of Poverty, Environment and Natural-Resource use*: Springer Science+Business Media B.V. for a concise treatment of the economics of poverty traps.

in which it would be optimal to switch from process $\mathscr{L}_1$ to $\mathscr{L}_2$. Two equilibria emerge: a lower $(L_L, A_L)$ and higher welfare state $(L_H, A_H)$. The two equilibria correspond to where the marginal return on assets is equal across the two production processes. That is, the forward looking household in this simple model is just indifferent between the two processes. If the household were endowed with assets below $A^s$, but above $A_L$, the out of equilibrium dynamics would suggest a decumulation of assets and the household could be described as moving toward a poverty trap at the lower equilibrium (provided it is below the poverty line).

With regard to credit access, a forward looking household would simply crossover the $A^s$ threshold provided there are well-functioning credit markets and no impediments to autonomous saving strategies. However, in the development context this would commonly be considered the exception rather than the rule. Impediments to process switching thus lead Carter and Barrett to conclude that as long as a household is "not too far away" from $A^s$ then switching toward a strategy that moves them toward the upper equilibrium might be expected (see also (Loury, 1981; Banerejee and Newman, 1993; Galor and Zeira, 1993; Mookherjee and Ray, 2002)). The level of what is "not too far away" is what Carter and Barrett term the *Micawber threshold*, $A^*$ in figure three, and what has generally been referred to, up to this point, as the household's poverty trap threshold.

Figure four provides a different point of view of the Micawber Threshold. For illustrative simplicity it is assumed that the threshold is constant over time. This perspective highlights the role of vulnerability to shocks by different household types. Path $P^1$ represents a less vulnerable household than $P^2$. At some point in time $P^2$ crosses

under the Micawber Threshold and moves toward a new, lower steady state. As was mentioned above, the challenge to date has been to identify how individual or group abilities influence the location of these critical thresholds.   It is worth noting that a study of household-specific poverty trap thresholds is subtly different from traditional studies of poverty traps and observed persistent poverty. Studies of the determinants of poverty traps (rather than poverty trap thresholds) focus on defining chronic poverty and then characterizations can be made regarding the existence or determinants of the observed, past chronic poverty. Often this includes using lagged values of the dependent income or welfare measures as regressors which requires an assumption of past dynamics continuing into the future. A study of poverty trap thresholds, however, is fundamentally different in that household-specific thresholds are generally unobserved – no matter how they are defined. If the multiple equilibria model accurately describes a household's behavior, at any given time researchers are likely to observe households around a stable equilibrium rather than near a dynamically unstable threshold point. Therefore, relatively few households in a sample would be near the threshold (Carter and Barrett, 2006). Additionally, an individual or collective household is not likely to know where their threshold level lies. It is difficult for one to know that if their stock of assets fell below a certain level, recovery would be difficult or impossible in to the medium to long run. Thus, direct observation of critical thresholds is unlikely and requires an indirect, and somewhat novel, approach. The benefit of a threshold study is that it is more forward looking than studies of observed, past persistent poverty. In essence, a threshold study is structured to identify those that are more vulnerable to future uncertainties.

Turning now to empirical analysis of the existence of poverty trap thresholds, pioneering studies include: Lybbert et al. (2004), Adato et al. (2006), Barrett et al. (2006), and Santos and Barrett (2006). All four studies do find evidence of poverty trap thresholds in this framework, but typically rely on one sample-wide threshold, rather than a household-specific threshold. This is often justified in samples where there is one predominant asset or occupational choice. In the case of Lybbert et al (2004), the sample is limited to an impoverished pastoralist population in Southern Ethiopia in which there is one primary asset (cattle), thus effectively controlling for asset heterogeneity. When assets and occupational choices increase in number the identification of a sample-wide threshold is more difficult. Additionally, the role of individual or group ability in determining critical asset stocks remains understudied. Of the above authors, Santos and Barrett provide the most significant exception by addressing the role of herder ability when there is primarily one asset and livelihood strategy. They extend the work of Lybbert et al (2004) and empirically suggest that the minimum herd size where future accumulation behavior bifurcates is in part a function of herder ability as captured by past responses to shocks to herd size.

The complexities involved with observing heterogeneous thresholds that may be dependent on household capabilities suggest two types of responses: expansion of theoretical treatments via simulations and searches for empirical clues rather than direct observation. This paper is concerned with the latter, but a discussion of the former theoretical simulations will help to se the context of this paper.

Carter and Ikegami (2007) take a first step in bringing the capabilities discussion to the forefront of the theoretical literature through dynamic programming simulations.

The agents in their simulation are heterogeneously endowed with a given amount of ability with certain probability. Their results suggest that critical thresholds are a negative function of intrinsic ability at the individual level. Figure five is adapted from that study and illustrates a situation where individuals face a unique threshold which is a function of their level of intrinsic ability. This study is instrumental in initiating the idea of a household specific critical threshold, but lacks any empirical discussion of what intrinsic ability might encompass. What household characteristics make up the ability to convert productive assets into livelihood? Recall the Santos and Barrett study mentioned above defined herder ability as past successes to herd size shocks; but what is intrinsic ability when assets are multidimensional? Among others, social networks, intra-household structure, and time constraints are all capabilities (or constraints thereof) that can facilitate the attainment of higher welfare. Returning to the South Africa example illustrated at the outset, a number of households had relatively high levels of assets, but were not observed to be successful in converting them into livelihood. Carter and Ikegami's theoretical study on intrinsic ability is pioneering in that it provides a natural entry point for a human development/capabilities approach to further explore the role of intrinsic ability through the lens of capabilities. An overview of this perspective and its commonalities with asset based models is provided in the next two sections with a particular focus on how the two could benefit from a unified framework.

*Human Development/Capabilities Approach*

This section begins with the classic work *Development as Freedom*, in which Sen describes the roles that "constitutive" and "instrumental" freedoms play in development

(Sen, 1999). The former refers to freedoms as the primary end of development, while the latter refers to the principle means of development. Instrumental freedoms contribute directly or indirectly to the overall freedom people have to live the way they would like to live. Sen further decomposes instrumental freedoms into the following five types: (i) political freedoms, (ii) economic facilities, (iii) social opportunities, (iv) transparency guarantees, and (v) protective securities. In Sen's words, "these instrumental freedoms tend to contribute to the general capability of a person to live more freely, but they also serve to complement one another" (ibid:38). What is generally referred to as household agency or capabilities in this study, references these instrumental freedoms that define the capabilities to take on new economic opportunities.

Two studies evolving out of the human development approach provide a brief sampling of the HD/C perspective of poverty and development. First is Klasen's deprivation index as a measure of poverty (2000). The aim of Klasen's index is to examine capability outcomes directly, rather than using a traditional money-metric measure. This is done by identifying 14 components of well-being.[2] Seven components make up the core deprivations and they are: education, housing, water, employment, nutrition, health care, and safety. Many of the seven core components are obvious extensions of Sen's instrumental freedoms, but also offer a link to the assets approach. Human, physical, and social capitals are all present within the components. One limitation reported in Hulme and McKay (2007), however, is that this measure is somewhat paternalistic in nature. That is, what was listed as a deprivation was not chosen

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[2] Hulme and McKay (2007) present an in depth discussion of the limitations and advantages of Klasen's method (as well as Clark and Qizilbash's presented below). This section draws heavily from their work. A detailed analysis of the particular advantages and limitation exceeds the scope of this paper; rather, the aim is to get a feel for the general nature of human development approaches in comparison to asset-based approaches.

in a participatory manner. Households or individuals have the outcomes of development chosen for them by the researcher. Clark and Qizilbash (2005) survey a random sample of "ordinary people" in South Africa about "...which needs and capabilities...are basic, and where they draw the line between the poor and non-poor" (Hulme and McKay 2007:19). They refer to the participatory outcomes as identifying the "essentials of life". As Hulme and McKay note, all seven of Klasen's core components are included in the reported 12 core dimensions of Clark and Qizilbash's study (ibid: 21).

The brief sampling above set the stage for a comparison with the asset-based approaches. Four primary criticisms of the assets framework levied by the HD/C literature emerge (ibid: 23). First, is that a narrow range of assets is typically the focal point. This is often justified on the grounds that assets typically are highly correlated and standard regressions have inflated standard errors when all assets are included. This leads to aggregation methods such as using factor or principle component analysis to achieve a reduction in the dimensionality. However, knowledge of heterogeneities across assets has important policy implications and the criticism is that dimensionality reduction is throwing the baby out with the bath water. Second, there is very little discussion of factors that affect the returns to these assets, however assets are defined. Assets in a unique household setting may exhibit locally increasing returns to scale as compared to other environments. If policy is to center on asset transfers, then knowledge of an environment of successful absorption is important. In other words, how households convert assets into livelihood is understudied. Third, income and monetary metrics still have a central role in asset-based poverty measures and they may not be reflective of the true state of development as outlined by Sen's description above. Finally, asset-based

studies tend to be non-participatory in nature as is Clark and Qizilbash's "essentials of life" for South Africa.

In a broad sense, the HD/C literature has a more explicit focus on disparities in agency and empowerment of individuals than does the asset-based approach. The latter arguably has an implicit focus on empowerment given the inherent qualities asset stocks to generate future livelihood, but this can lead to a slippery slope of policy recommendations. In particular, a focus on asset accumulation alone ignores the process of converting those assets into livelihood and the external factors that affect their returns. As is described in the next section, research on the process of converting assets into livelihoods could benefit by inclusion of capability insights from the HD/C literature.

**2.1 Common Origins, Qualitative Differences, and Reconcilable Differences**

A simplified chronology of development thinking relevant to the current discussion of how capabilities influence poverty trap thresholds would describe a common lineage of the two approaches under study dating back to the 1990s – an era of intellectual structural change responding to the relative failures of development models based on convergence that dominated the latter half of the twentieth century. It can be argued that the big push models of capital accumulation and the resultant convergence of incomes faced greater intellectual criticism which was most vocal in the 1990s; it was in this setting in which asset-based and human development approaches gained traction even though the phenomenon of livelihood diversification was at odds with the increasing specialization and division of labor that is conventionally seen as the hallmark of

development[3]. This historical account is not novel to this paper, however. What will be put forth is the argument that there exists a strong tendency for current applied asset-based studies to regress back toward the big push models with an undue focus on asset accumulation alone, and that the capability of households to convert assets into livelihoods is of great policy relevance.

Borrowing heavily from the historical account of Toye (2003), the 1940s saw development economics emerge as a sub-discipline of academic economics. The key assumption behind the new economics of development was that governments needed guidance from economists on how to make economic development happen differently – and, especially, faster – in the future (ibid: 21). The inequality of world income tended to be seen as a reflection of the division between rich industrial and poor agricultural countries, brushing aside the anomalies of the like of Australia, New Zealand, Argentina, and Denmark. If world income inequality were to be reduced, this agrarian excess population either had to migrate to find capital to work with (an option not favored), or capital had to be brought in to create more productive and better paid occupations – through industrialization (ibid: 22). These types of development models lead Ray to refer to them as big push models because the policy prescription tended to focus on capital accumulation and a reliance on assumed convergent dynamics (Ray, 2000). A complete history of the successes and failures of the convergence style models is out of the scope of this paper; what are more relevant are the responses that have emerged in the past two decades and how the asset-based and HD/C approaches have evolved since this common beginning.

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[3] One could consider the vast literature on livelihoods and vulnerability to be a subset of the HD/C literature for purposes of this paper and brevity.

Shaffer (2008) summarizes the recent trends in thinking on poverty since this structural transition of the 1990s. He describes the occurrence of three main changes: a broadening of the concept of poverty, a broadening of the causal framework, and a deepening of the causal structure. The concept of poverty has moved from income/consumption measures toward models that include social deprivation, vulnerability, inequality, and human rights. The causal framework for understanding poverty has also expanded to include discussion of different forms of capital – from economic, human, and natural capital to social, political, cultural, and coercive. The deepening of the causal structure is primarily in reference to a greater understanding of the spells of poverty for individuals that have emerged out of studies taking advantage of increased availability of panel data.

Given the discussion of the previous section it is clear that both asset-based and HD/C approaches to poverty measurement are associated with all three major changes identified by Shaffer. In fact, at times it is difficult to distinguish clear boundaries between the two approaches. Evidence of significant overlap and common origins is exemplified in an often cited 1999 paper describing a framework that includes elements of "capitals and capabilities" (Bebbington, 1999). Additionally, seminal authors of modern asset-based studies self-describe analyses as having roots in the work of Sen.

In the past decade, however, there has been significant evolution of the two perspectives in which potential gains have not been realized. Namely, the asset-based frameworks (such as that presented above) tend to borrow insights from the macro-development literature that resemble the big push-type models. Analyses that focus on poverty trap thresholds are at risk of falling into the same trap as the convergence models

with respect to a narrow focus on accumulation of asset stocks as the ends rather than simply one of many means to poverty reduction. The capabilities literature serves as a good reminder that empowerment and livelihood are appropriate means and ends to consider in addition to asset stocks alone.  To reiterate the lessons presented above, poverty trap threshold studies still have some ground to cover before applied analysis can be taken to large-scale policy recommendations.

To illustrate the idea that empirical asset-based studies have some catching up to do with their theoretical counterpart concerning the roles of ability in conditioning poverty trap thresholds, consider the following quote from Carter and Ikegami (2007),

> "The predictive failure of the asset-based measure may reflect an underlying change in asset dynamics. It may also reflect the simplifying assumption…that the Micawber threshold is the same for all households."

The quote serves as a good reminder that asset-based studies (as described by seminal authors) do not ignore the conversion process altogether, rather it illustrates that the task of identifying the uniqueness across households and asset holdings is of highest importance, but understudied. It is in this mutually beneficial setting that an HD/C influenced perspective on the role of opportunity costs can bridge the two gaps by setting the stage for a capabilities consistent framework of chronic poverty that exploits the quantitative aspects of the asset-based framework.

*Elements of a Capabilities Consistent, Asset-Based Framework of Chronic Poverty*

The prior section argued that asset-based models of poverty traps and poverty trap thresholds have in their origins commonalities with the HD/C perspectives on livelihood. The implicit argument within the comparison of the two perspectives is that the asset-based framework of the household production process contains great potential in moving chronic poverty studies forward in an empirically tractable way; however, the downside is that there is great temptation to focus on the low lying fruit of accumulation of asset stocks alone and ignore the complex processes of converting those assets into livelihood which inevitably varies at the household level. Although work by Carter and Ikegami (2007) have explored the theoretical role of intrinsic ability in conditioning poverty trap thresholds (and thus implicitly touching upon the process of converting assets into livelihood), there has been little discussion of what intrinsic ability may encompass. The question then is how might insights from the capabilities perspective provide empirically tractable clues into the determinants of poverty trap thresholds?

The clearest link between the two perspectives is the role played by opportunity costs. Opportunity costs are explicitly incorporated into the simple asset model of figure three by determining the horizontal intercept of the second livelihood production process. With respect to the HD/C literature, it is possible to think of opportunity as capability deprivations. For example, if two households both encounter a new economic opportunity (perhaps a new employer arrives in the next village over), we are likely to observe differences in their ability to take on the new opportunity. Perhaps one family has a greater ratio of child dependents relative to working adults or spends more time on subsistence activities such as gathering wood and fetching water. These are easily

captured in household survey data and naturally convey a deprivation of time resulting in an inability to take on the new economic opportunity. It is in this view of opportunity costs in which an asset-based model of poverty traps can incorporate insights from the capabilities literature. A simple capabilities consistent asset-based model is presented next to illustrate the bridging role of opportunity costs.

## 3. A Simple, Capabilities Consistent Model with Heterogeneous Opportunity Costs

As new economic opportunities present themselves, households differ in their ability to absorb them. Not only will the opportunities available differ by geography, market access, and other factors, but will also differ across the ability of the individuals in the household to take them on. Education levels, degree of household care commitments, and attitudes (to name just a few) differ and potentially impact how effectively asset holdings (including human capital) are employed. Capability constraints can be thought of as increased opportunity costs at the household or individual level and can be easily incorporated into a simple asset-based framework of poverty traps.

Recall that figure three described a multiple equilibria situation for a household in which the two livelihood strategies differed by their initial start up costs. In order to incorporate heterogeneous opportunity costs across households that stem from capability deprivations, figure six departs from the standard model and introduces a second household type into the model. The assumption is that the $\mathcal{L}_1$ process is available to both households with the same fixed costs associated with it. What is different is that the $\mathcal{L}_2$ process for the second household has higher fixed costs associated with it. Assume the

two households are identical in all respects except that household two has a reduced capability of switching. The reduced capability of switching (i.e. higher fixed costs) may come in the form of greater care responsibilities in the home, more time needed for gathering wood and water, lack of social networks, or a general inability to accommodate the time spent attaining the greater human capital requirements. A lower capability to switch livelihood strategies suggests less household agency, or potential, in the form of empowerment. If we are to further assume that the distance between $A^*$ and $A^s$ is equal across the households, then the marginal return to assets for household two will be lower than that of household one. This implies the poverty trap threshold is also higher for household two. This simple framework lends itself to an empirical study of household characteristics that impact the marginal returns to assets. It is the marginal returns to assets that reveal insights into the general nature of household-specific poverty trap thresholds that are otherwise unobservable.

The benefit of a simple framework such as this is that the focus shifts from determinants of household-specific thresholds (which are unobservable) to a focus on the determinants of marginal returns to assets (which are much more observable). With a rich set of control variables the theoretical extension of how capability deprivations impact poverty trap thresholds can plausibly be made. However, some assumptions must be made in order to translate characteristics that impact marginal returns into characteristics that condition poverty trap thresholds. Of primary concern are the availability of similar economic opportunities, the distance between $A^*$ and $A^s$, and the aggregation of assets into a single index. As the extent of each assumption depends on the nature of the data available, section five discusses each as appropriate. Before describing the South African

household data and how capability constraints are captured, section four presents the simple econometric model used to test how capability deprivations interact with asset holdings to impact the marginal return of assets.

## 4. Econometric Model

To begin decomposing what intrinsic ability might encompass, this section performs a simple test of what might influence the marginal returns to assets at the household level. As section four argues, by viewing differences in the marginal returns it is possible to identify some likely suspects – in terms of constraints to capabilities - that play a role in the location of a household specific threshold. This indirect examination of thresholds ultimately sheds light on how household capabilities influence the process of converting assets into economic livelihood.

One of the advantages of the simple theoretical model with heterogeneous opportunity costs presented above is that an empirical test of the differing marginal returns hypothesis takes advantage of the fact that observations are likely in the neighborhood of the stable equilibrium points. Much of the empirical work discussed in section two attempted to identify a single, sample-wide Micawber threshold in which observations are likely to be few because of the unstable nature of critical thresholds. By looking for differing marginal rates of return conditional on household structure and capabilities, the simple test can rely on the assumption that more of the observations will be in the neighborhood of the stable equilibrium than not.

The simple test focuses on marginal changes in asset returns. As the simple model in section three hypothesizes, the marginal returns to assets should be different across household types that, all else equal, have differing opportunity costs of the same productive alternatives. This provides a testable hypothesis of whether or not the marginal returns of assets are impacted by alternative indicators of capability: dependency ratios, local network trust, associational activity, or the degree of time deprivation.

The following household process of converting assets into economic livelihood decomposes the marginal returns into direct and indirect effects of assets on economic livelihood. Start with the following household production function

$$lnL_{it} = \beta_0 + \beta_1 A_{it-1} + \beta_2 X_{it-1} + \beta_3 A_{it-1}*X_{it-1} + \beta_4 Z_{it-1} + u_{it} \quad (1)$$

where i subscripts the household, t subscripts the time period, X is a vector of household and community characteristics that includes proxies for capabilities, A is the stock of assets held by the household, lnL is the log of economic livelihood (defined as total monthly expenditure per a household specific subsistence line[4]), and Z a set of controls. The vector X includes measures of the household's capabilities as captured by associational activity (ASC), local network trust (TRST), elderly dependency ratio (eDR), child dependency ratio (cDR), and degree of time deprivation (TM). Each of the variables that are included is described in greater detail in section five.

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[4] For continuity with previous asset poverty research with KIDS, the concept and measurement of livelihood follows Adato, Michelle, Michael R. Carter and Julian May (2006) Exploring Poverty Traps and Social Exclusion in South Africa Using qualititative and Quantititative Data. *Journal of Development Studies* 42, pp.226-247.

Equation (1) could easily be augmented to include fixed or random effects that capture the household idiosyncrasies. Indeed this would be preferred if sufficient panel data is available. As is addressed in the next section, the South African data used in this simple test do not permit the inclusion of fixed effects. Thus equation (1) will be estimated with ordinary least squares and a set of quantile regressions as put forth by Koenker and Bassett (1978). Having a set of estimated linear quantiles allows one to see how various explanatory variables differentially affect different parts of the conditional distribution of $\ln L_{it}$ (Wooldridge, 2010).

The inclusion of the interaction terms distinguishes the marginal effects that are common across the sample from the type-specific effects. The model above suggests that the marginal change in this period's natural log of livelihood with respect to the prior period's assets endowments will be:

$$\partial \ln L_t / \partial A_{t-1} = \beta_1 + \beta_2 * X_{it-1} \tag{2}$$

Equation (2) is the marginal return of assets to livelihood or the marginal effectiveness of assets. Note that $\beta_1$ represents the marginal effectiveness of assets that is common across the sample. The "total" marginal return includes structural effects through assets as captured by the interaction/second term of equation (2). Thus the variables of interest are the interaction terms. A significant coefficient on the interaction term would suggest that the marginal effectiveness of assets is impacted by X. With the information from the interaction term combined with the theoretical priors of the asset framework discussed in section three, one can generalize the nature of the type-specific

Micawber threshold. In other words, this suggests that (all else equal) the location of the Micawber threshold is not constant with respect to the structure variable. For example, a negative coefficient on the AxcDR would suggest that marginal asset effectiveness is also a function of the level of the dependency ratio, and that one would expect that if the Micawber threshold is household specific, it would be higher for households with higher dependency ratios, all else equal.

Given that the original aim of the paper is to suggest a clear overlap between asset-based and HD/C perspectives on chronic poverty and to thus provide a more empirical decomposition of what intrinsic ability might be, the interaction terms taken together suggest a first pass, quick-and-dirty notion of capability within this framework. All else equal, significant differences in the marginal returns to asset bundles suggest that time deprivation, local network trust, association activity, and dependency ratios indirectly determine the location of a critical threshold and provides insight into how capable a household is in converting their asset bundle into livelihood.

Some assumptions of the empirical estimation should be noted. First, it is assumed that poverty traps may (though need not) exist that are characterized by a pattern of asset dynamics that may bifurcate when in the neighborhood of a minimum asset threshold. In other words, there may exist a minimum asset level households need in order to expect future accumulation and generation of economic welfare. Obviously, this may not be the case in any and/or all household situations. A second assumption is that the minimum threshold may differ for every individual household, but should display similar characteristics and location for similar type households. As previous discussions have shown the direct observation of a household specific threshold is difficult due to

extreme data requirements; while estimates of a single, sample-wide threshold requires strong assumptions of homogeneous households. The aim is for this framework to be somewhere in between the two extremes. To even capture a modest amount of household heterogeneities requires a rich set of cross sectional controls or lengthy panel data. The data limitations for this study rule out the latter. Perhaps the most heroic assumption (given this particular data set) is that the As-A* distance is viewed primarily as a function of credit market imperfections and autonomous savings impediments. The differences across households with respect to credit, savings, and local opportunities are imperfectly controlled for by inclusion of a variable capturing variation in outcomes of different savings strategies and a heavy reliance on the narrowness of the data set. For example, the fact that the data set only consists of black South Africans and a few Indian minority households, the effects of racism in credit and labor markets is ignored.

## 5. Data

The case of KwaZulu-Natal, South Africa is used from 1998 – 2004 for continuity with past studies, as well as for its central focus on asset redistribution policies in a post-Apartheid era. Asset and land redistribution discussions have formally been on the policy table in South Africa at least since the African National Congress' (ANC) *Freedom Charter* of 1955 (Johns and Davis Jr., 1991; Hirsch, 2005). In a post-Apartheid era, the knowledge about facilitations and constraints to household agency via the asset bundle is a necessity for social policy and asset effectiveness. This section outlines the KwaZulu-Natal Income Dynamics Study (KIDS), describes the logic behind construction of

household agency variables, and presents descriptive statistics. Section five will then present the results of the model.

## 5.1 KwaZulu-Natal Income Dynamics Survey (KIDS)

In 1993 the South African Labor and Development Research Unit spearheaded the first South African national household survey, the Project for Statistics on Living Standards and Development (PSLSD). In 1998 and 2004 KwaZulu-Natal province was resurveyed as a sub-sample of the national survey by a research consortium including the University of Natal, the University of Wisconsin, and the International Food Policy Research Institute; this sub sample is named the KwaZulu-Natal Income Dynamics Study (KIDS) (Carter and May, 2001; May et al., 1999; May et al., 2007).

Similar in its construction to the familiar Living Standards and Measurement Surveys (LSMS) found in over 100 hundred developing countries, the KIDS survey consists of a household survey in 1993, 1998, and 2004. In both 1993 and 1998 a community questionnaire accompanies the household survey providing information on public perceptions of trust, violence, community wide shocks, as well as infrastructure and services. The survey contains 760 household dynasties that were identified and surveyed in all three waves. Of the 760 households, all are from the African or Indian population of the province. The original survey contained information on white households, but due to measurement issues and small numbers represented these were dropped. The originally nationally representative PSLSD study from 1993 became less than regionally representative in the form of KIDS. This limits the analysis by not

allowing for generalizations of the results. However, the narrow nature of the sample does afford more control over wider-economy influences.

What are important to this analysis are the components of the household survey on asset ownership, social capital, and time use. Unfortunately, while the 1998 and 2004 rounds of sampling contain the relatively comprehensive sections regarding assets, networks, social, and other household specific variables, the original 1993 round contains relatively little. This imbalance in the 1993 data limits my focus solely on 1998 and 2004. For consistency with the established asset poverty literature the focus is on asset endowments' impact on current livelihood. That is to say, with data only available for two time periods (1998 and 2004), many of the benefits of the panel nature of the data fall out due to only one observation per household as the dependent variable is in period t and regressors are in period t-1.

Though the short nature of the data prohibits the inclusion of fixed effects, the relatively narrow scope may benefit this study in a number of ways. First, consider the simple, two-household model presented in section three. The different equilibriums faced could differ because of the shape or positions of the relative $\measuredangle_2$ curves. By narrowing the study to one province within South Africa that includes only non-white households, differences in the available opportunity set outside of the household can more reasonably be assumed similar. Racial discrimination, for example, is predominately controlled for. All households in the study live in an environment with similar employment opportunities as shaped by the macroeconomic environment, save their geographic distance to urban centers. This issue is addressed by the inclusion of a population density control. Additionally, the model explicitly assumes that the distance between $A^s$ and $A^*$

is the same for all households (though the $A^s$ and $A^*$ levels are unique). This is arguably the strongest assumption of the model, but the narrowness of the data combined with the dummy variable designed to capture household differences in saving strategies make it more plausible.

The primary benefit of the KwaZulu-Natal survey is that it provides for continuity and comparability with many of the empirical and theoretical studies in the asset and poverty trap literature. Seminal authors in this literature such as those reviewed in prior sections have done extensive work (in some cases designed and implemented the survey) with the KIDS data. This allows for benchmark comparisons that would otherwise not be possible.


## 5.2 Variables and Descriptive Statistics


Table one lists the household level variables and descriptive statistics. Economic livelihood, L, is the metric to capture welfare or utility. Following a similar method used for South Africa in Adato et. al (2006), it is defined as the total monthly expenditures per a household specific subsistence line, hsli. The subsistence line is simply the household size (in adult equivalent units) multiplied by the 1998 Rand equivalent of $2 per day for 30 days. The livelihood mean of 2.26 poverty line units (PLUs) suggests the average household in the sample has an economic livelihood of 2.26 times the poverty line. The monthly equivalent of $2 per day was arbitrarily chosen.

*Asset Holdings*

In figures three and six it was assumed that assets could easily be aggregated into a one dimensional bundle in which the household uses to produce material livelihood. However, assets are multidimensional and rarely aggregate easily. At a stretch, exceptions may be found in pastoralist societies where the occupational choices and assets are limited to, say, livestock. Because the focus of this study is on the evolution and complementarities of the asset-based and HD/C literatures, it is out of the scope of this simple empirical application to fully address the heterogeneities of assets directly. The strategy will be to aggregate assets into a livelihood weighted asset index following a technique employed by Adato et al (2006). In short, the weights given to each asset in the bundle are derived from the marginal contribution of a particular asset to livelihood, L. Here livelihood is defined as the total monthly expenditures divided by a household specific subsistence line, hsli. The subsistence line is the number of household members (adult equivalent) times the monthly monetary subsistence line equivalent to two U.S. dollars per day (expressed in 1998 Rand). Following the aforementioned authors, the analysis starts by estimating the following regression equation

$$L_{it} = \sum_{j} \beta \, (a_{it}) \, (a_{ijt}) + \varepsilon_{it} \qquad (3)$$

Note that the weight of the $j^{th}$ asset depends on levels of other assets in the bundle for household i, and that the coefficient $\beta(A_{it})$ gives the marginal contribution to livelihood of the j different assets (ibid:233). The structure of the above equation allows

for non-linearities and interaction of among different asset holdings. After estimating the above equation, the fitted values for each household give the asset index, $A_{it}$

$$A_{it} = \sum_{j} \beta(\hat{A}_{it})(A_{ijt}) \tag{4}$$

Continuing with the index put forward by Adato et al, the returns to assets are estimated using a polynomial expansion of the assets. In the authors' language, this specification permits marginal returns to assets be both diminish (or increase) with the level of the assets, as well as to be influenced by holdings of other assets (for example, marginal returns to capital assets may be boosted by the presence of educated labor or exogenous income) (ibid:234).

This analysis uses four similar assets as Adato et al, but likely constructs each asset in a unique fashion as different subsistence lines and forms of capital are included or excluded. Thus, the livelihood weighted asset indexes across the two studies are likely to be different and not directly comparable. The four assets used to create the livelihood weighted asset index are: educated labor, uneducated labor, productive/financial capital, and unearned/exogenous incomes.

Human capital is modeled as education embodied in labor, and is thus divided into educated versus uneducated labor. The number of educated or uneducated laborers in the home is used as these measures reflect of the overall situation in the household and aggregate more easily than do average years of educational attainment or education of the

household head. As well, just focusing on education levels of parents ignores the potentially large impact that younger, more educated members may have on the household. The average household in KwaZulu-Natal has approximately twice as many uneducated workers as educated workers.

Productive capital is reduced from seven dimensions down to one index, K. It is the first principal component (PCA) of: financial assets, household durables, electricity in the home (yes/no), number of rooms in the home, home ownership (yes/no), self employment equipment, and agricultural equipment[5]. The PCA scores for K are conditional on each population density category (1=rural, 2=village/town, 3=urban) to capture the differences in relative values of particular assets across rural and urban areas. For example, farming equipment might be of greater significance in rural areas than in downtown Durban, a metropolitan area of more than two million people. Agricultural land access, La, is used over land ownership due to the fact that very few respondents report owning any land, but many report having access. This reflects the tribal dynamics within the province.

Unearned transfers reflect the average monthly value of transfer payments and remittances the household has had access to over the prior twelve months. The source of this income may come from members that have migrated out of the house and sent earnings back into the home or government programs such as the Old Age Pension Grant.

Of the four asset endowments, capital and the two labor divisions are more highly correlated with future economic livelihood than the unearned transfers category. This low correlation between $T_{t-1}$ and $L_t$ is to be expected. The correlation would tend to be

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[5] For additional discussion and examples of principal component analysis, see also: Filmer and Pritchett (2000), Moser and Felton (2007), and Jolliffe (2002).

negative as lower income households are targeted for higher public transfers. However, if the programs are successful, those receiving transfers in 1998 would be expected to achieve higher livelihood in 2004 and lend to a positive correlation. The regression results for the asset weights are reported in table two.

*Household Agency Variables*

Perhaps of greater interest are variables intended to capture the essence of household capabilities in the form of heterogeneous opportunity costs across households. When individuals face different time constraints within the family or community, it creates a varied set of cost-benefit decisions across households with respect to adoption of new livelihood generating strategies. This study uses five variables describing the structure of the household: elderly dependency ratio, child dependency ratio, subsistence time deprivation, associational activity, and trust in the local network/community.

Using these five variables as proxies for capabilities originated in response to Carter and Ikegami's (2007) theoretical treatment of the determinants of poverty trap thresholds. In that simulation, the authors suggest that a latent concept of intrinsic ability conditions how high the minimum assets need to be in order to gravitate toward higher welfare equilibria. The lack of discussion of what intrinsic ability might encompass combined with the human development literature's criticisms that asset based measures contain little discussion of factors that affect asset returns, prompted greater empirical dimensionality of intrinsic ability. Thinking in terms of capabilities, measures such as the dependency ratio and subsistence time deprivation capture the inability of households to embrace new productive opportunities. Bridging social capital has the potential to create

additional productive alternatives that may not have otherwise existed. Bonding social capital can alleviate time deprivations, provide psychological and emotional support, and facilitate opportunities through the reduction of fear of harm. All five household agency measures represent an aspect of capability, are empirically observable, and play an indirect role in the persistence or transition out of poverty.

The dependency ratio is disaggregated to draw out the fundamentally different roles that non-working age household members play. An individual is of working age if they are between the ages of sixteen and sixty. Any member younger is considered to be a child dependent. Similarly, any member older than age sixty is considered to be an elderly dependent. The dependency ratio is calculated as the proportion of dependents to working age adults. Thus, a higher dependency ratio suggests more household members per worker. The natural distinction the study draws out implicitly centers on the role of in home care. It is expected that a high child dependency ratio will reflect a different set of opportunity costs of switching to out of the home employment than would a high elderly dependency ratio. The key question is if there are identifiable asset holdings in which the constraints become more binding.

The degree of time deprivation describes the amount of time the household spends in subsistence activities such as fetching water and gathering fuel wood. This is the per capita number of hours per week that the household spends in these activities. It is expressed in per capita terms to distinguish the effects of subsistence activities from any overlap with household size or dependency ratios. In 1998, of the 744 KIDS observations, 451 households report spending some amount of time either gathering wood or fetching water. The median household spent approximately ten minutes per

person over the week, whereas the 90th percentile household spent two hours per person per week. In 2004, the median household reports an increase of only a few minutes, and the 90th percentile reports a drop of twelve minutes per person. Though the mean time spent drops from 1998 to 2004 by about five minutes per person per week, the number of households reporting some time spent rises by 5.5%, or 25 households. For KwaZulu-Natal, the degree of time deprivation arising from subsistence activities has only marginally improved for poorest households, and appears to persist for the majority into 2004.

To further capture freedoms generated by household agency, social capital is treated as having an indirect influence on assets, rather than an asset itself. Two measurable forms of social capital are used: bridging and bonding social capital. The former is measured as the number of different associations the household belongs to. Although this measure is blind to informal social identities, it is reasonably comprehensive in the KIDS survey and includes financial, religious, and other associations. Bonding social capital is measured by an index of trust in the local community. This is a self reported rating (scale of 1 to 5 with higher equaling more trust) of how much one trusts their immediate family, extended family, neighbors, strangers, and local government. As with the construction of the capital asset, K, this was reduced in dimensionality via principle component analysis. It is not clear that there is an income distinction between the two types of assets. An inspection of the KIDS sample suggests that neither form of social capital has a correlation with monthly income higher than .05 in absolute value. Again, the question of interest is whether an identifiable pattern exists

in which social capital works through a particular asset holding to condition critical poverty trap thresholds.

*Additional Controls*

Additional control variables, Z, used include the number of positive and negative financial surprises per capita that the household reports experiencing within the past two years and the variable labeled saver. This is a dummy equal to one if the change in K (primarily driven by financial capital and household durables) from one time period to the next is positive. Since the unbalanced nature of the data do not allow for fixed effects, this control is a modest proxy to capture the differing autonomous saving strategies across households (at least the outcome of those strategies). In addition, community negative shocks are reported from the community survey and are a count of the number of negative shocks the community has experienced over the past two years. Examples of negative community shocks are the death of a local leader, a health outbreak, or flood. In 1998, 80% of KIDS respondents lived in a community in which negative shocks were reported on the community survey.

One particular dynamic characteristic of households is that they tend to expand and contract in response to life events over time. This change in size potentially creates measurement error due to, say, accumulation of a new spouse between 1998 and 2004. To account for possible measurement error of household dynasties, the change in household size is also included.

## 6. Results and Discussion

Households in KwaZulu-Natal have improved or begun to recover their asset base over the eleven year period from 1993 to 2004. However, over that same time period there have been significant disparities among households in terms of their successes of converting those assets into livelihood. Although the asset-based literature has made advances on the theoretical front in explaining how poverty traps are unique and dependent on intrinsic ability, the empirical analysis of what intrinsic ability may encompass remains understudied. The argument put forth in this paper is that empirical asset-based studies of poverty trap thresholds stand to benefit from insights of the Human Development/Capabilities literature. In particular, viewing intrinsic ability as capabilities (or deprivations thereof) within a quantitative, asset framework provides an estimable account of which capability determinants impact critical thresholds. Further, the policy implication is moved beyond asset accumulation alone toward attention on the conversion of assets into livelihood.

A simple household production model of assets and other inputs to produce an output of material well-being is estimated separately via ordinary least squares and quantile regressions to get a clearer picture of how the marginal returns are impacted across the conditional distribution of livelihood. The interaction terms allow for the levels of capability variables to impact the marginal contribution of asset endowments to future livelihood. Table three presents the full results and figures seven and eight illustrate some of the interesting findings.

The OLS results (column one of table three) suggest that the only statistically significant capability variable is that of per capita time spent gathering wood and fetching water. All else equal, a household that spends no time on these subsistence activities has a marginal return on assets nearly one-half of a percent higher than a household that spends one hour per person per week. Interpreting capability deprivations as the flip side of intrinsic ability, it is plausible that access to fuel and water, in part, determine a household's specific critical threshold as evidenced by the impact on converting other productive assets into well-being. Figure seven illustrates the degree to which marginal returns decrease as the amount of time devoted to subsistence activities rises from zero, to the sample mean, and then one and two standard deviations above the mean.

It is worth careful attention to recall how the time deprivation variable is constructed. It is measured as the total household hours spent gathering wood and water then divided by the household size. The magnitude of the estimates of column one reflect only the average result upon the household. If the burden of gathering and fetching falls disproportionately on certain members of the household, one would wish to investigate whether the negative effects also fall disproportionately on household members.

To gain further insight into the role of the capability variables, a set of quantile regressions centered on the twentieth to the eightieth percentile are presented in columns two through five. The first thing to note is that for the upper quantiles of the conditional livelihood distribution, the marginal returns to assets rise. This is taken as evidence against uniform diminishing returns to assets. This may reflect the fact that households with higher levels of livelihood are better endowed with assets that carry greater weight in the asset index such as educated labor (Le) and productive/financial capital, K. Also,

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this may likely be due in large part to asset to asset complementarities that are suppressed by the use of an aggregated asset index. Knowledge of the intra-index asset dynamics is taken to be important, but out of the scope of this paper where the focus is on bridging the assets and HD/C frameworks.

Figure eight compares the OLS and quantile estimates for the AxTMpc variable. The coefficient estimates on AxTMpc are noticeably more negative at lower levels of the conditional distribution. Together with the observation of the coefficient on assets described above, this implies that the marginal returns to assets are lower - both from direct effects and indirect effects through time deprivation- for those households near or below the poverty line. Thus for these households, critical thresholds are likely to be more sensitive to time deprivation than those households that are further from the poverty line.

Also of interest is the direct impact of child dependency ratios and social capital (as measured by associational activity and trust in local networks). These are estimated to impact future welfare, but not through any interaction in assets. In other words, social capital and child dependency ratios appear to help or hind material well-being, but not through facilitation or hindrance of asset returns.

*Limitations and Extensions*

Given the structural characteristics of equation one requiring that the dependent variable, livelihood, be in period t and the asset endowments be observed in period t-1, the inclusion of household fixed effects is not possible given this particular data set. Although many variables are observed over three time periods, the primary capability

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variables are observed for only 1998 and 2004, thus not allowing the estimation to take full advantage of the original panel nature of the data. In this particular study, the narrowness of the sample being limited to only non-white households in KwaZulu-Natal province provides only a moderate amount of comfort in trying to capture the ceteris paribus nature put forth in the theoretical framework of section three. Replications and extension would benefit by the full use of available panel data.

In addition to the lack of fixed effects insight into two significant black boxes is of utmost importance. That is, insight into the asset bundle and the intra-household dynamics. Considering that asset bundle the household has access to, knowledge of how different capabilities interact with particular asset holdings may prove to be effective in targeting vulnerable households. The estimates above reveal that time deprivations impact marginal asset returns, but says little about which type of asset holdings the deprivation is working through. Again, the purpose of the paper is to draw out the commonalities and mutually beneficial relationship across the assets and HD/C literatures, but this is done with the tradeoff of not fully understanding the heterogeneities among assets. The intra-household structure of occupation and time use also have the potential to shed light on other forms of capital not included in this study such as cultural and coercive capital. How do gendered differences in wood gathering and water fetching impact returns to assets and critical thresholds?

Additional interpretations and proxies for capabilities are desirable, but not available in the KIDS data. A clear example of this is the role of health, HIV, and AIDS. In South Africa, with nearly a 20% infection rate, this is surely to impact one household's ability to effectively use assets in generating material well-being. Further, how well-

being is defined is dependent on health status. Medical expenditures are an economic good, but up to a certain point convey greater information on a lack of welfare rather than the opposite.

*Summary and Concluding Remarks*

The primary goal of this paper is to trace out the common origins, divergent evolution, and reconcilable differences across asset-based and Human Development/Capabilities studies of poverty. It is argued that asset-based studies have embedded in them a strong temptation to focus on asset accumulation policies without giving the conversion process of assets into livelihood its due study. This potential gap can conveniently be filled by the capabilities literature in which opportunity costs play a particular bridging role. By taking the qualitative aspects of the HD/C perspectives and infusing them into a qualitative model of poverty traps, a first step is made to allow empirical studies of how intrinsic ability impacts critical thresholds to catch up to their theoretical counterparts.

A simple, two-household model with heterogeneous opportunity costs was presented to illustrate the potential for a capabilities consistent asset-based model. The simple model suggests that the marginal returns to assets contain information on the determinants of household-specific poverty trap thresholds. Applied to the case of South Africa's KwaZulu-Natal province, there is evidence that the degree of time spent on subsistence activities may condition these critical thresholds. This represents a first pass at incorporating capability constraints in to this framework. Undoubtedly, the empirical

research remaining is vast. If nothing else, however, this analysis shows the potential for gains in poverty identification and reduction.

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**Figure 1**



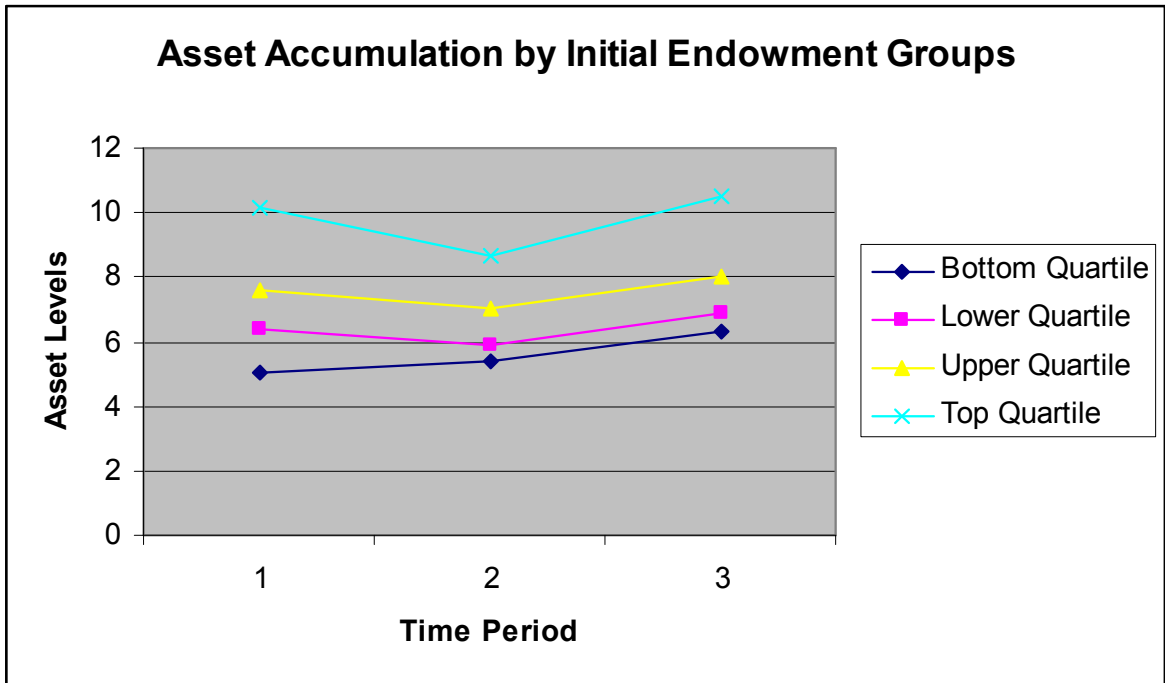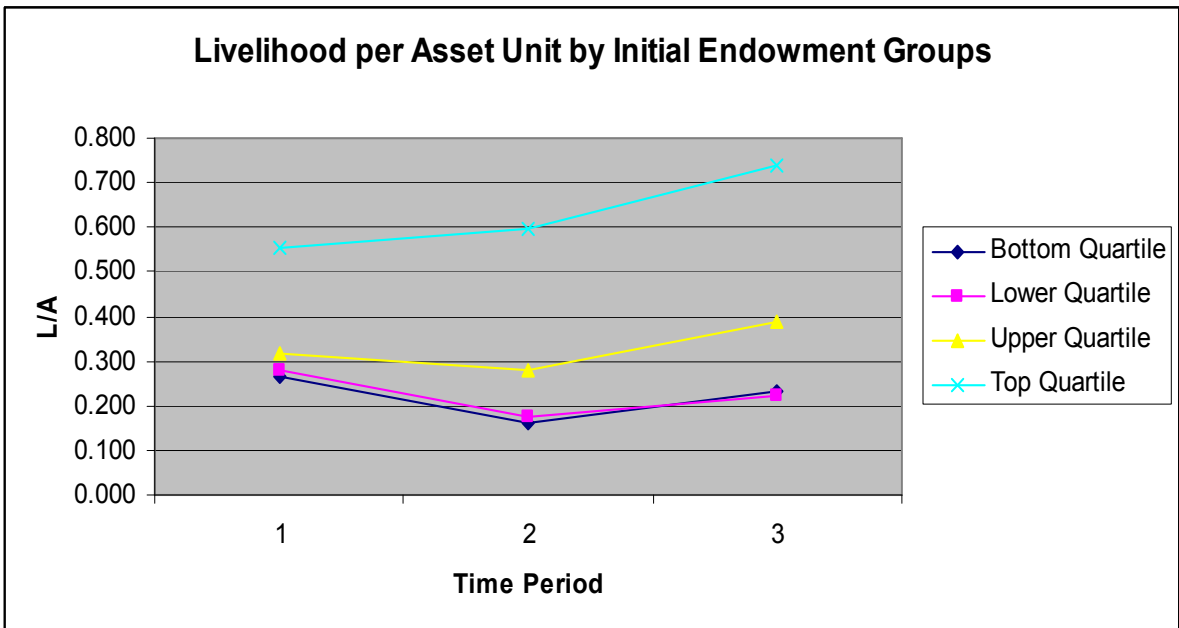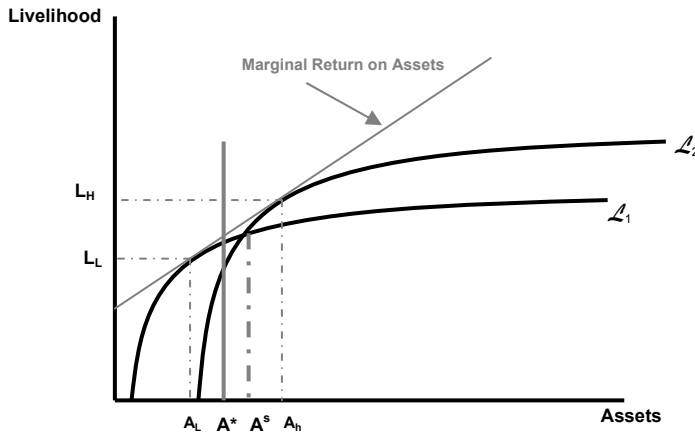Asset Accumulation by Initial Endowment Groups

**Figure 2**



Livelihood per Asset Unit by Initial Endowment Groups
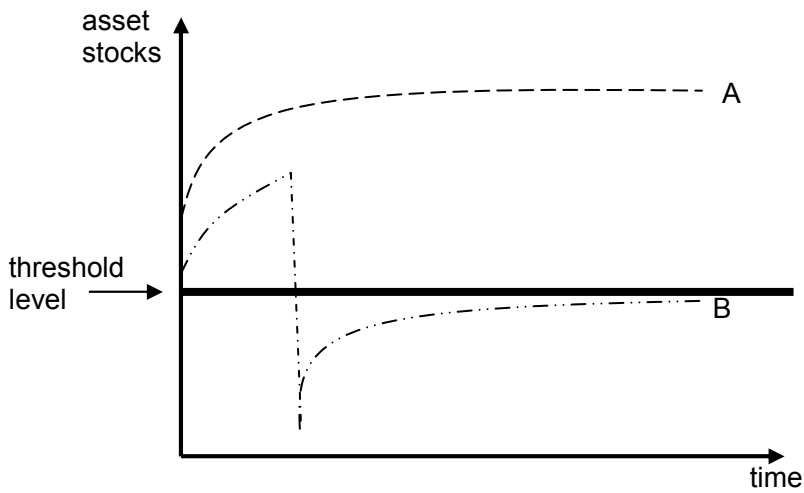
**Figure 3**



**Figure 4**
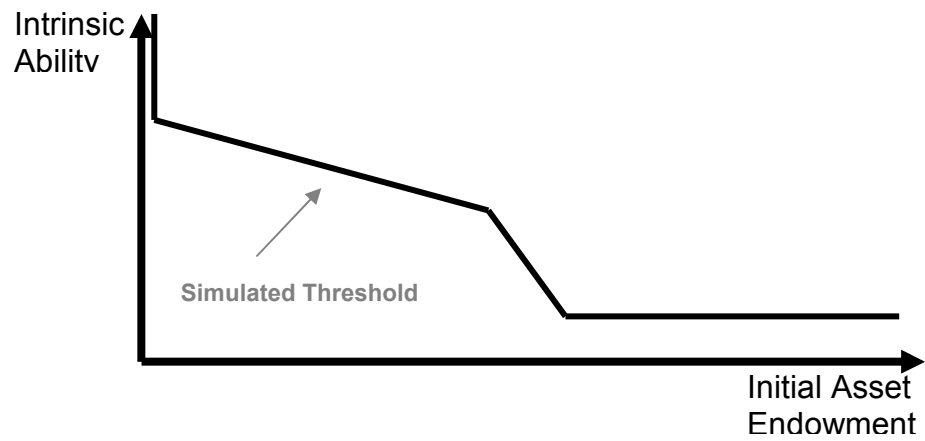


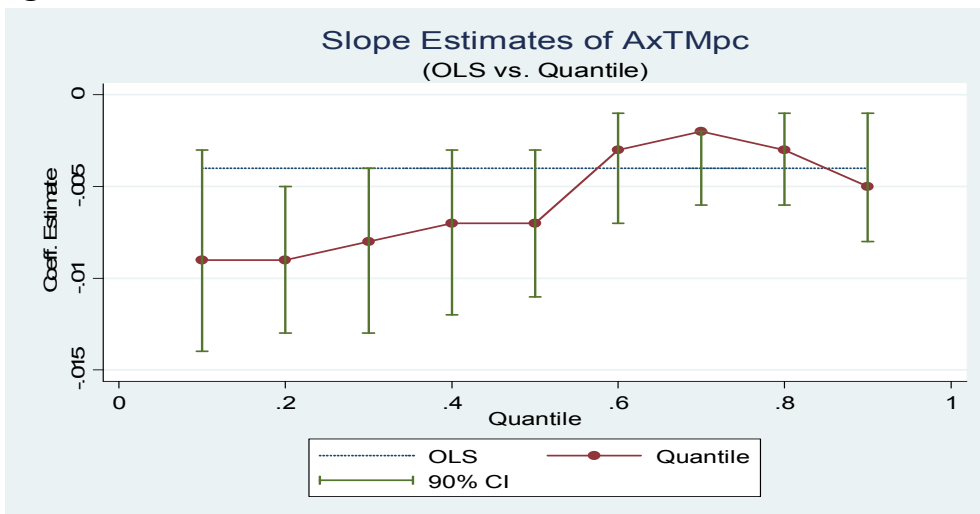**Figure 5** *(adapted from Carter & Ikegami 2007)*

**Figure 6**
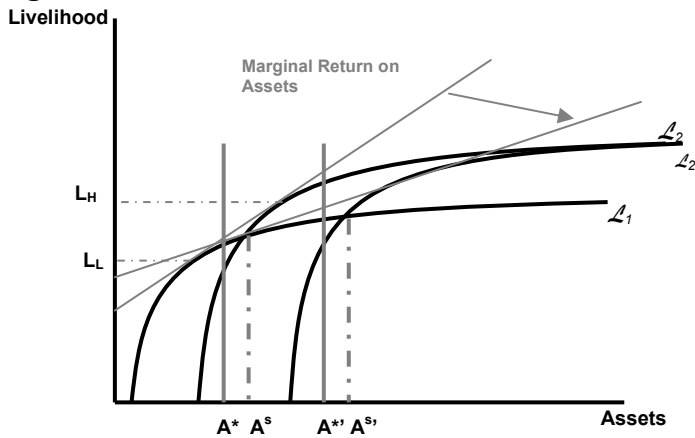


**Figure 7**



**Figure 8**

**Table 1: Variable Names and Descriptive Statistics**

| Variable* | Description** | 1998 mean | 1998 (s.d.) | 2004 mean | 2004 (s.d.) |
|---|---|---|---|---|---|
| $L_{it}$ | livelihood: total monthly expenditures per a household specific subsistance line | 2.26 | (3.36) | 3.47 | (5.04) |
| Inc | Total Monthly Household Income in 1998 Rand. | 539.0 | (1040.1) | 815.5 | (1710.5) |
| $A_{it}$ | Asset index. $1^{st}$ Princ. Component of K, Le, Lu, T | 6.74 | (2.53) | 7.94 | (3.44) |
| $K_{it}$ | Productive capital. Index derived from durables, fin. assets, # of rooms, agric. equip, electricity in home, own vs rent, home size, livestock, access to land. (normalized to zero mean / unit var.) | 0 | (1.37) | 0 | (1.50) |
| $Le_{it}$ | # of core members in HH with more than standard 9 education | 1.01 | (1.28) | 1.77 | (2.14) |
| $Lu_{it}$ | # of core members in HH with less than standard 10 education | 3.9 | (2.57) | 4.17 | (3.37) |
| $T_{it}$ | Unearned income such as remittances and transfers (adult equivalent) | 569.3 | (2806.19) | 876.72 | (2673.35) |
| $TMpc_{it}$ | Time poverty: # of hours per week spent gathering wood and water per household member | 0.72 | (1.67) | 0.64 | (1.05) |
| $cDR_{it}$ | Dependency ratio: # of children per working age adults (>60 years). | .66 | (.52) | 1.32 | (1.32) |
| $eDR_{it}$ | Dependency ratio: # of elderly per working age adults (<16 years). | .12 | (.20) | .14 | (.25) |
| $ASC_{it}$ | # of different associations HH belongs to | 1.40 | (1.26) | 1.12 | (1.30) |
| $TRST_{it}$ | Local Level Trust: 1st Principle component of self-assessed level of trust in family, extended family, strangers, neighbors, and locol gov't. | 4.30 | (1.48) | 4.37 | (1.46) |
| $CN_{it}$ | Community Level Negative Shocks: # in past two years, community level, reported by community survey e.g. floods, outbreaks, etc. | 1.66 | (1.47) | NA | NA |
| $saver_{it}$ | dummy to capture household differences in consumption propensities. 1 if change in K from 98-04 >0 | 0.36 | (0.48) | 0.73 | (0.45) |
| $popden_{it}$ | population density. 1=rural, 2=village/town, 3=urban | 2.00 | (0.91) | 2.03 | (0.91) |
| $pSrp_{it}$ | # of positive financial surprises reported by the HH in the past two years per household member | 0.17 | (0.41) | 0.73 | (0.86) |
| $nSrp_{it}$ | # of negative financial surprises reported by the HH in the past two years per household member | 0.53 | (0.80) | 0.61 | (0.87) |
| hhsize | # of members residing in the house | 6.28 | (3.17) | 10.14 | (6.36) |
| $hsli_{it}$ | household subsistence line: monthly equivelant of $2 per day per HH member (adult equivelant in Rand) | 1421.4 | (860.6) | 1686.3 | (1058.5) |

* where i indexes the houshold, t indexes the year, and j indexes the individual asset
** all monetary measures expressed in 1998 Rand

## Table 2: Livelihood Weighted Asset Index

*Following Adato et al. (2006)*

| Dep. Var., L | OLS Results | | | |
|---|---|---|---|---|
| | t = 1998 | | t = 2004 | |
| **Economic Assets** | Coeff. | S.E.* | Coeff. | S.E.* |
| $L^e$ | 0.440*** | (0.107) | 1.972*** | (0.338) |
| $L^u$ | -0.388** | (0.183) | -0.572** | (0.264) |
| K | 1.358*** | (0.187) | 3.169*** | (0.518) |
| T | 0.628 | (0.411) | 1.284*** | (0.402) |
| La | -0.373*** | (0.098) | -0.152 | (0.118) |
| | | | | |
| **Asset Interactions** | | | | |
| Le*Le | -0.099*** | (0.036) | -0.147*** | (0.051) |
| Lu*Lu | 0.186*** | (0.059) | 0.289*** | (0.072) |
| K*K | -0.04 | (0.04) | -0.110*** | (0.036) |
| T*T | -0.111*** | (0.041) | -0.024 | (0.074) |
| La*La | 0.175*** | (0.055) | -0.108 | (0.067) |
| Le*Lu | -0.098 | (0.076) | -0.169 | (0.115) |
| Le*K | -0.053 | (0.211) | 1.515** | (0.706) |
| Le*T | 0.05 | (0.216) | 0.223 | (0.448) |
| Le*LA | -0.134** | (0.055) | -0.21 | (0.164) |
| Lu*K | -0.173 | (0.205) | -1.865*** | (0.667) |
| Lu*T | -0.476** | (0.241) | -0.192 | (0.381) |
| Lu*La | -0.009 | (0.08) | 0.453*** | (0.136) |
| K*T | 0.662* | (0.392) | 2.078 | (1.414) |
| K*La | -0.744*** | (0.21) | 0.631*** | (0.149) |
| T*La | 0.675* | (0.352) | 0.082 | (0.453) |
| La*Le*Lu*K*T | 0.138 | (0.294) | 3.882*** | (1.086) |
| | | | | |
| **Other Factors** | | | | |
| hsli | -0.000*** | (0.000) | -0.001*** | (0.000) |
| popden | 0.822*** | (0.099) | 1.036*** | (0.122) |
| Constant | 0.993*** | (0.294) | 3.690*** | (0.595) |
| | | | | |
| **N** | 1075 | | 788 | |
| **$R^2$** | 0.66 | | 0.47 | |

*robust st. errors reported

**Table 3: OLS and Quantile Estimates**

| VARIABLES | (1) OLS | Quantile Regressions (2)q=0.2 | (3)q=0.4 | (4)q=0.6 | (5)q=0.8 |
|---|---|---|---|---|---|
| | | Dep. Var. = lnL | | | |
| lagassets | 0.113*** | 0.081*** | 0.102*** | 0.127*** | 0.158*** |
| | (0.025) | (0.028) | (0.021) | (0.012) | (0.015) |
| lagAxTPC | -0.004** | -0.009*** | -0.007*** | -0.003 | -0.003** |
| | (0.002) | (0.002) | (0.002) | (0.002) | (0.001) |
| lagAxeDR | 0.005 | 0.035 | 0.034 | 0.016 | 0.010 |
| | (0.018) | (0.029) | (0.024) | (0.015) | (0.020) |
| lagAxcDR | -0.007 | -0.011 | -0.005 | -0.007 | -0.017** |
| | (0.006) | (0.010) | (0.009) | (0.006) | (0.008) |
| lagAxAS | -0.002 | 0.003 | -0.000 | -0.002 | -0.002 |
| | (0.002) | (0.004) | (0.003) | (0.002) | (0.003) |
| lagAxTRST | -0.001 | 0.003 | -0.002 | -0.003 | -0.001 |
| | (0.002) | (0.003) | (0.003) | (0.002) | (0.003) |
| dK | 0.016 | 0.018 | 0.006 | 0.018 | 0.084*** |
| | (0.026) | (0.021) | (0.017) | (0.012) | (0.011) |
| popden | 0.081*** | 0.058 | 0.086** | 0.054** | 0.076** |
| | (0.028) | (0.045) | (0.039) | (0.024) | (0.032) |
| pSrpPC | -0.379* | -0.222 | -0.158 | -0.371* | -0.660** |
| | (0.209) | (0.317) | (0.296) | (0.196) | (0.285) |
| nSrpPC | 0.136 | 0.065 | 0.127 | 0.114 | 0.317 |
| | (0.203) | (0.293) | (0.267) | (0.169) | (0.261) |
| dhhsize | -0.002 | -0.002 | -0.004 | -0.004 | 0.003 |
| | (0.004) | (0.007) | (0.007) | (0.004) | (0.007) |
| timePC | -0.028 | -0.019 | -0.044 | -0.007 | 0.008 |
| | (0.023) | (0.032) | (0.030) | (0.020) | (0.028) |
| edepR | -0.018 | -0.206 | -0.103 | -0.051 | -0.022 |
| | (0.100) | (0.166) | (0.143) | (0.090) | (0.133) |
| cdepR | -0.041** | -0.027 | -0.031 | -0.015 | -0.029 |
| | (0.017) | (0.027) | (0.026) | (0.016) | (0.022) |
| assoc | 0.042** | 0.051* | 0.030 | 0.046*** | 0.019 |
| | (0.016) | (0.027) | (0.025) | (0.016) | (0.023) |
| trust | -0.116*** | -0.114*** | -0.116*** | -0.119*** | -0.096*** |
| | (0.016) | (0.025) | (0.023) | (0.015) | (0.021) |
| lagCN | -0.015 | 0.001 | -0.007 | -0.034*** | -0.013 |
| | (0.013) | (0.023) | (0.021) | (0.013) | (0.018) |
| lnINC | 0.439*** | 0.490*** | 0.493*** | 0.466*** | 0.423*** |
| | (0.029) | (0.039) | (0.031) | (0.020) | (0.030) |
| Constant | -2.134*** | -2.786*** | -2.503*** | -2.167*** | -2.012*** |
| | (0.180) | (0.259) | (0.224) | (0.142) | (0.203) |
| | | | | | |
| Observations | 730 | 730 | 730 | 730 | 730 |
| R-squared | 0.709 | | | | |

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

**#2 Converting Assets into Livelihood: An Empirical Study of the Interaction between Asset Holdings and Capabilities in South Africa**

## 1. Introduction

To understand the transmission of poverty, flow variables like income or consumption have only limited use. Asset stocks are more informative since they implicitly contain additional information on the future livelihood prospects of the economically disadvantaged. Asset endowments provide a cushion against income shocks, are a source of future income and consumption streams, and are generally indicative of future economic well-being. The inherent qualities of asset stocks thus offer a more predictive measurement of poverty than current income or consumption flows (Carter and Barrett, 2006). It follows that a central tenet of an asset-based view of poverty is that time is an ally of the poor so long as asset levels are sufficiently high; but what constitutes sufficiently high is not readily known. For example, in South Africa's most populated province of KwaZulu-Natal, time has not been an ally to many of the poor even when asset stocks are relatively high. During the eleven year period of 1993 to 2004, approximately half (51%) of the 750 households sampled had, on average, been living on less than two U.S. dollars per day. Of that half, 21% were in the upper half of

the distribution of initial asset endowments.[6] For some households, the critical minimum level appears to be higher than for others.

As with any measure of poverty, tradeoffs exist. Assets typically do not aggregate easily and are thus often reduced to an index or one choice asset to draw out the dynamics over time. In that regard, there is a stark disconnect between asset-based approaches and the more multi-dimensional human development/capabilities (HD/C) perspectives of poverty measurement that focus on household agency, or empowerment, as the principle means and end goal of development. The capabilities view in combination with the South African experience suggests that asset levels alone are not enough to clearly identify vulnerable households.

Although there has been some theoretical work on the role of intrinsic ability as a determinant of poverty trap thresholds, what intrinsic ability may encompass has been understudied within the assets framework (Carter and Ikegami, 2007). The question then is how to identify the fundamental relationships between household capabilities and individual asset holdings that may influence critical thresholds. If borne out by empirical evidence, poverty reduction strategies could be made more effective by incorporating knowledge of how different capabilities interact with particular asset holdings that either facilitate or constrain the process of converting productive assets into economic livelihood.

Following a technique used in the heritability of traits literature and employed by Bowles and Gintis (2002), this paper decomposes the impact of initial asset endowment on future livelihood into direct and indirect components. I find that although direct effects and asset-to-asset complementarities are important to the conversion process at the

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[6] Author's calculations using the KwaZulu-Income Dynamics Study described in section four.

household level in South Africa's KwaZulu-Natal province, the degree of time deprivation from subsistence activities may condition poverty trap thresholds to a greater extent for households with higher levels of educated laborers, capital, and access to agricultural land. The results likely reflect the larger realities of macroeconomic conditions and underemployment in South Africa in which relatively well-resourced groups have the wherewithal to face binding micro-constraints, whereas households with few resources cannot overcome the constraints imposed by poor macroeconomic conditions. In terms of poverty policy, opportunities at the macroeconomic level and household agency at the microeconomic level both play an important role.

This study contributes to the prior literature in three primary ways. First, it adds empirical robustness to prior theoretical work linking a latent concept of intrinsic ability with household-specific poverty trap thresholds. Second, it bridges the quantitative work on poverty traps with qualitative insights from the HD/C literature by identifying which particular asset holdings are associated with different household capability constraints. Lastly, it brings awareness to policy makers that though asset levels alone may be a necessary condition for poverty alleviation, knowledge of the sufficient condition of possessing the capability to convert assets into livelihood is equally important.

The rest of the paper is organized as follows. Section two outlines the merged asset based-HD/C framework with particular focus on the relationship between capability deprivations and poverty trap thresholds. Section three describes the empirical decomposition of asset endowments' impact on future livelihood into direct and indirect effects in an attempt to identify which asset holdings are associated with particular

household capabilities. Section four describes the household data from KwaZulu-Natal, and section five discusses the results and possible extensions.

## 2. Theoretical Foundations: Asset Holdings, Household Agency, and Economic Livelihood

One way of making poverty measurements more forward looking and predictive than observed income or consumption flows is to follow the now prominent framework of asset-based poverty measures. This section begins by outlining some of the basic features of the assets view with particular emphasis on the empirical and theoretical treatments of poverty trap thresholds[7]. Although the asset-based approach has well-grounded micro-foundations, it often lacks the qualitative dimensionalities of HD/C perspectives of poverty. Consequently, after laying out the quantitative aspects of poverty trap thresholds, the discussion turns toward inclusion of qualitative aspects from the HD/C literature in order to diagnose how structural characteristics that lead to household agency and empowerment play an instrumental role in converting particular asset holdings into economic livelihood.

### 2.1 Asset-Based Studies and Empirical Observations of Critical Thresholds

In a now seminal paper titled, "The Economics of Poverty Traps and Persistent Poverty: An Asset-Based Approach", Carter and Barrett (2006) outline a microeconomic framework capable of explaining how households or individuals can persist over time at

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[7] The terms *critical thresholds* and *poverty trap thresholds* are used interchangeably.

higher or lower welfare states[8]. Inherent in their discussion of multiple equilibria is a discussion of critical thresholds that define the boundaries between equilibria. A poverty trap threshold is defined as a critical minimum stock of assets that are needed for an individual or household to ensure increases in economic livelihood into the future. With few exceptions, the challenge within this literature to date has been not just to confirm the existence, but to identify how individual or group abilities condition these critical thresholds. This is complicated by the fact that thresholds, if they exist, are unobservable at the individual level.

Figure one is adapted from Carter and Barrett (2006) and illustrates a basic situation in which there are two production activities available to a particular household, $\mathcal{A}_1$ and $\mathcal{A}_2$. Activity $\mathcal{A}_2$ requires a higher level of fixed costs, but can ultimately generate a higher level of livelihood or welfare – measured on the vertical axis. One could interpret $\mathcal{A}_1$ as subsistence, in home production process of generating livelihood; whereas, $\mathcal{A}_2$ might be formal labor in which the higher fixed costs stem from the opportunity cost of being outside the home. For now, assume assets can be easily aggregated into one bundle. The asset level $A^s$ identifies the level of assets in which it would be optimal to switch from process $\mathcal{A}_1$ to $\mathcal{A}_2$. Two equilibria emerge: a lower $(L_L, A_L)$ and higher welfare state $(L_H, A_H)$. The two equilibria correspond to where the marginal return on assets is equal across the two production processes. That is, the forward looking household in this simple model is just indifferent between the two processes. If the household were endowed with assets below $A^s$, but above $A_L$, the out of equilibrium dynamics would

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[8] See also Barrett (2008) for a concise treatment of the economics of poverty traps.

suggest a decumulation of assets and the household could be described as moving toward a poverty trap at the lower equilibrium (provided it is below the poverty line).

With regard to credit access, a forward looking household would simply crossover the $A^s$ threshold provided there are well-functioning credit markets and no impediments to autonomous saving strategies. However, in the development context this would commonly be considered the exception rather than the rule. Impediments to process switching thus lead Carter and Barrett to conclude that as long as a household is "not too far away" from $A^s$ then switching toward a strategy that moves them toward the upper equilibrium might be expected (see also (Loury, 1981; Banerejee and Newman, 1993; Galor and Zeira, 1993; Mookherjee and Ray, 2002)). The level of what is "not too far away" is what Carter and Barrett term the *Micawber threshold*, $A^*$ in figure one, and what has generally been referred to, up to this point, as the household's poverty trap threshold.

Figure two provides a different point of view of the Micawber Threshold. For illustrative simplicity it is assumed that the threshold is constant over time. This perspective highlights the role of vulnerability to shocks by different household types. Path $P^1$ represents a less vulnerable household than $P^2$. At some point in time $P^2$ crosses under the Micawber Threshold and moves toward a new, lower steady state. As was mentioned above, the challenge to date has been to identify how individual or group abilities influence the location of these critical thresholds. With the imagery of figure two in mind, the current study is simultaneously concerned with how households A and B differ in terms of their capabilities and opening up the black box of assets that do not aggregate easily.

It is worth noting that a study of household-specific poverty trap thresholds is subtly different from traditional studies of poverty traps and observed persistent poverty. Studies of the determinants of poverty traps (rather than poverty trap thresholds) focus on defining chronic poverty. Once an acceptable concept of chronic poverty is found, then characterizations can be made regarding the existence or determinants of poverty traps. Often this includes using lagged values of the dependent income or welfare measures as regressors which requires an assumption of past dynamics continuing into the future. A study of poverty trap thresholds, however, is fundamentally different in that household-specific thresholds are generally unobserved – no matter how they are defined. If the multiple equilibria model accurately describes a household's behavior, at any given time researchers are likely to observe households around a stable equilibrium rather than near a dynamically unstable threshold point. Therefore, relatively few households in a sample would be near the threshold (Carter and Barrett, 2006). Additionally, an individual or collective household is not likely to know where their threshold level lies. It is difficult for one to know that if their stock of assets fell below a certain level, recovery would be difficult or impossible in to the medium to long run.  Thus, direct observation of critical thresholds is unlikely and requires an indirect, and somewhat novel, approach. The benefit of this type of study is that it is more forward looking than studies of observed, past persistent poverty. In essence, a threshold study is structured to identify those that are more vulnerable to future uncertainties.

Turning now to empirical analysis of the existence of poverty trap thresholds, pioneering studies include: Lybbert et al. (2004), Adato et al. (2006),  Barrett et al. (2006), and Santos and Barrett (2006). All four studies do find evidence of poverty traps

in this framework, but typically rely on one sample-wide threshold, rather than a household-specific threshold. This is often justified in samples where there is one predominant asset or employment choice. When assets and occupational choices increase in number the identification of a sample-wide threshold is more difficult. More importantly, the role of individual or group ability in determining critical asset stocks remains understudied.[9]

Concerning authors in the more traditional poverty trap literature, McKenzie and Woodruff (2003), Jalan and Ravallion (2000), Loshkin and Ravallion (2004), and Antman and McKenzie (2005) all present mixed evidence of the existence of poverty traps; but as described above, these studies investigate fundamentally different patterns than studies of thresholds. To date, there have been no studies of how individual capabilities determine thresholds in a world of complex asset holdings. Progress has been made however in theoretical treatments of how intrinsic ability might condition critical thresholds, in which the next section addresses.

**2.2 Theoretical Determinants of Critical Thresholds**

The complexities involved with observing heterogeneous thresholds suggest two types of responses: expansion of theoretical treatments via simulations or searches for empirical clues rather than direct observation. This paper is concerned with the latter, but first discusses lessons emerging from theoretical simulations.

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[9] Of the above authors, Santos and Barrett provide the most significant exception by addressing the role of herder ability when there is primarily one asset and livelihood strategy. They extend the work of Lybbert et al (2004) and empirically suggest that the minimum herd size where future accumulation behavior bifurcates is in part a function of herder ability as captured by past responses to shocks to herd size.

Carter and Ikegami (2007) take a first step in bringing the capabilities discussion to the forefront of the theoretical literature through dynamic programming simulations. The agents in their simulation are endowed with a given amount of ability with certain probability. Their results suggest that critical thresholds are a negative function of intrinsic ability at the individual level. Figure three is adapted from that study and illustrates a situation where individuals face a unique threshold which is a function of their level of intrinsic ability. This study is instrumental in initiating the idea of a household specific critical threshold, but lacks any empirical discussion of what intrinsic ability might encompass. What household characteristics make up the ability convert productive assets into livelihood? Recall the Santos and Barrett study mentioned above defined herder ability as past successes to herd size shocks; but what is intrinsic ability in when assets are multidimensional? Among others, social networks, intra-household structure, and time constraints are all capabilities (or constraints thereof) that can facilitate the attainment of higher welfare. Returning to the South Africa example illustrated at the outset, a number of households had relatively high levels of assets, but were not observed to be successful in converting them into livelihood. Carter and Ikegami's theoretical study on intrinsic ability is pioneering in that it provides a natural entry point for a human development/capabilities approach to further explore the role of intrinsic ability through the lens of capabilities.

## 2.3 Observing Intrinsic Ability as Capabilities

Conceding that direct observation of household-specific poverty trap thresholds is not feasible leads to a search for more tangible clues rather than direct observation. This requires first taking on the question of what might intrinsic ability encompass in any observable manner. Given that both strands of the development literature – asset-based and HD/C – claim similar roots in the classic work *Development as Freedom* (Sen, 1999), it provides a natural bridge between the two perspectives built on the familiar concept of opportunity costs.

In that work, Sen describes the roles that constitutive and instrumental freedoms play in development. The former refers to freedoms as the primary end of development, while the latter refers to the principle means of development. Instrumental freedoms contribute directly or indirectly to the overall freedom people have to live the way they would like to live. Sen further decomposes instrumental freedoms into the following five types: (i) political freedoms, (ii) economic facilities, (iii) social opportunities, (iv) transparency guarantees, and (v) protective securities. In Sen's words, "these instrumental freedoms tend to contribute to the general capability of a person to live more freely, but they also serve to complement one another" (Sen 1999:38). What is generally referred to as household agency or capabilities in this study, references these instrumental freedoms.

Two studies evolving out of the human development approach provide an example of the overlap and discontinuities with the asset-based approached outlined above. First is Klasen's deprivation index as a measure of poverty (2000). The aim of

Klasen's index is to examine capability outcomes directly, rather than using a traditional money-metric measure. This is done by identifying 14 components of well-being.[10] Seven components make up the core deprivations and they are: education, housing, water, employment, nutrition, health care, and safety. Many of the seven core components are obvious extensions of Sen's instrumental freedoms, but also offer a link to the assets approach. Human, physical, and social capital are all present within the components. One limitation reported in Hulme and McKay (2007) is that this measure is somewhat paternalistic in nature. That is, what was listed as a deprivation was not chosen in a participatory manner. Households or individuals have the outcomes of development chosen for them. Clark and Qizilbash (2005), however, survey a random sample of 'ordinary people' in South Africa about '...which needs and capabilities...are basic, and where they draw the line between the poor and non-poor' (Hulme and McKay 2007:19). They refer to the participatory outcomes as identifying the 'essentials of life'. As Hulme and McKay note, all seven of Klasen's core components are included in the reported 12 core dimensions of Clark and Qizilbash's study (ibid: 21).

The sampling above set the stage for a comparison between the asset-based and HD/C approaches. Four primary criticisms of the assets framework levied by the human development literature emerge (ibid: 23). First, is that a narrow range of assets is typically the focal point. A narrow range of assets is typically used on the grounds that assets are correlated and standard regressions have inflated standard errors when all assets are included. This leads to aggregation methods such as using factor or principle

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[10] Hulme and McKay (2007) present an in depth discussion of the limitations and advantages of Klasen's method (as well as Clark and Qizilbash's presented below). This section draws heavily from their work. A detailed analysis of the particular advantages and limitation exceeds the scope of this paper; rather, the aim is to get a feel for the general nature of human development approaches in comparison to asset-based approaches.

component analysis to achieve a reduction in the dimensionality. However, knowledge of heterogeneities across assets has important policy implications, so dimensionality reduction is throwing the baby out with the bath water. Second, there is very little discussion of factors that affect the returns to these assets, however assets are defined. Assets in a unique household setting may exhibit locally increasing returns to scale as compared to other environments. If policy is to center on asset transfers, then knowledge of an environment of successful absorption is important. Third, income and monetary metrics still have a central role in asset-based poverty measures and they may not be reflective of the true state of development as outlined by Sen's description above. Finally, asset-based studies tend to be non-participatory in nature as is Clark and Qizilbash's "essentials of life" for South Africa.

At the risk of the discussion getting to far ahead, it is worth noting how the current paper addresses the four criticisms of conventional asset-based studies. I first begin with a broad brush stroke of assets to address the first criticism. Five dimensions of assets are used. The empirical model presented in section three can include many assets without the limitations typically imposed by high collinearities among assets. This framework also implicitly addresses the second criticism by discussing what factors might affect returns to assets, namely how capabilities interact with assets. This study is culpable with respect to the latter criticisms of monetary measures and non-participatory measures of development ends. However, a back of the envelope calculation of a Klasen-type index for South Africa that includes four of the seven deprivation components for which data were readily available has a correlation of .78 with this paper's welfare measure, livelihood. One could make the argument that, as a practical matter, the welfare

measure is at least highly correlated with identified and participation-defined development dimensions. Greater emphasis is placed on infusing an HD/C perspective into a practical assets framework rather than on revamping the framework entirely.

## 3. Econometric Model

To address the question of which particular assets facilitate or constrain household agency, the correlation between the jth asset endowment and future livelihood can be decomposed into direct and indirect effects. That is to say, the correlation between a household's possession of a particular asset, say its endowment of productive capital, with an observed future welfare level can be broken down in to the proportion of the correlation explained by a direct effect of capital on future livelihood and a set of indirect effects of capital endowment on future livelihood through other assets or household agency variables, such as child dependency ratios. Thus, it is possible to inspect the linkages between particular asset holdings and structural variables associated with instrumental freedoms.

To achieve the decomposition, I follow a technique employed by Bowles and Gintis (2002), (see also Rao, et al. (1976), Cloninger, Rice and Reich (1979), and Otto, Feldman and Christiansen (1994)). In the language of Bowles and Gintis, the continuous measure of livelihood allows for a simple metric of persistence, based on the correlation between livelihood and all factors that go into its production. Moreover, these correlations may be decomposed into additive components reflecting the various causal mechanisms accounting for the persistence of poverty (Bowles and Gintis 2002:5). As

stated in Bowles and Gintis, "as long as the multiple regression coefficients are unbiased, the decomposition is valid whatever the relationship among the variables. Specifically, it does not require that the regressors be uncorrelated" (ibid: 9). This is a benefit to asset-based studies of poverty as it allows for an inspection into the household's asset bundle that is otherwise muddied by high estimated standard errors. The relatively high correlations between assets (such as land and livestock) will lead to less efficient estimates in an ordinary regression equation, but OLS is still the best linear unbiased estimator. Concurrently, one criticism levied on asset based approaches mentioned in section two is the use of a narrow range of assets. Often studies will use the value of household durables or an index score as the only proxy for all assets. The method that follows has only the requirement of being unbiased, but is less sensitive to efficiency. Therefore, inclusion of multiple asset holdings is not only possible, but desirable.

Before the econometric model is outlined, figures four and five illustrate the statistical task of decomposing the correlation between endowments and future well-being. Modeled after the heritability of traits literature, information on the marginal impact of assets and capabilities, along with their correlations, show how the path of endowments impact on future livelihood can be traced out. This process is much like how a geneticist might trace out the transfer of athletic ability from parent to offspring. In this analogy, direct effects are akin to genetic transfers (nature) and the indirect capability interactions are much like the interaction of the offspring's talent set free via its environment (nuture). The analysis will return to the specifics of figures four and five after the particulars of the econometric model are laid out.

To draw out the additive components of the correlation decomposition, begin by estimating

$$\ln L_{it} = \beta_0 + \beta_1 A_{ijt-1} + \beta_2 X_{imt-1} + \beta_3 Z_{int} + u_{it} \tag{1}$$

where i subscripts the household, t subscripts the time period, X is a vector of m household capabilities and structural characteristics, A is a vector of j assets held by the household, lnL is the log of economic livelihood, and Z a set of n controls. All variables are normalized to have a zero mean and unit variance. Equation (1) has its roots in the theoretical framework outlined in Carter and Barrett (2006). $\beta_1$ represents the direct marginal effect of the endowment of asset j on the log of period t livelihood. Similarly, $\beta_2$ represents the direct marginal effect of period t-1 household agency variables on period t livelihood. To draw out the indirect effect of the endowment of asset j on period t livelihood through the household agency requires additional exploitation of equation (1).

As with Bowles and Gintis substituting the above expression for $\ln L_{it}$ into the expectation $E[A_{ijt-1}, \ln L_{it}]$, and noting that if two variables have zero mean and unit variance, the correlation between these variables is the expected value of their product, giving

$$r(A_{ijt-1}, \ln L_{it}) = E[A_{ijt-1}, \ln L_{it}] = E[A_{ijt-1}, A_{ikt-1}]*\beta_1 + E[A_{ijt-1}, X_{imt-1}]* \beta_2 \tag{2}$$

where $r(A_{ijt-1}, \ln L_{it})$ is the correlation between asset endowments and current economic livelihood. Given the normalization, $E[A_{ijt-1}, A_{ijt-1}] = 1$ and $E[A_{ijt-1}, X_{imt-1}] = r(A_{ijt-1}, X_{imt-1})$

and assuming that the equation (1) estimates of $\beta_1$ and $\beta_2$ are unbiased, equation (2) then reduces to

$$r(A_{ijt-1}, \ln L_{it}) = r(A_{ijt-1}, A_{ikt-1})* \beta_1 + r(A_{ijt-1}, X_{imt-1}) * \beta_2 \qquad (3)$$

Equation (3) allows for inspection of each individual asset's interaction with the household agency variables as well as asset-to-asset interactions. The first term of equation (3), $r(A_{ijt-1}, A_{ikt-1})* \beta_1$, is the indirect association of endowments on current livelihood through other assets when asset j is not equal to asset k. In other words, it is the proportion of the total correlation of asset j and livelihood that indirectly works through some other asset not equal to j. If asset j is equal to asset k (implying a correlation of exactly one) then the term simply reduces down to $\beta_1$, which is the direct impact of asset j on livelihood. The second term, $r(A_{ijt-1}, X_{imt-1}) * \beta_2$, is the proportion of the total correlation of asset j and livelihood that indirectly works through the household agency vector. Equation (3) describes the decomposition process of the total correlation between asset endowments and future livelihood into direct and indirect components as illustrated in figures four and five.

The correlation decomposition not only allows for a convenient breakdown of the association of asset endowments with livelihood, but also provides a suitable benchmark to compare the economic significance of the household agency effects with the asset combination effects. An introductory economics course stresses the mutually dependent – and economically significant – relationship between capital and labor, as well as other productive inputs into the production process. Thus, side by side, the size of the

household agency effects can then be compared in a meaningful way to the benchmark asset combination effects from this correlation decomposition. Because the household agency and asset variables of equation (1) are expressed in common standard deviation units, this comparison can be made.

## 4. Data

The case of KwaZulu-Natal, South Africa is used from 1998 – 2004 for continuity with past studies, as well as for its central focus on asset redistribution policies in a post-Apartheid era. Asset and land redistribution discussions have formally been on the policy table in South Africa at least since the African National Congress' (ANC) *Freedom Charter* of 1955 (Johns and Davis Jr., 1991; Hirsch, 2005). In a post-Apartheid era, the knowledge about facilitations and constraints to household agency via the asset bundle is a necessity for social policy and asset effectiveness. This section outlines the KwaZulu-Natal Income Dynamics Study (KIDS), describes the logic behind construction of household agency variables, and presents descriptive statistics and their trends. Section five then presents the results of the model.

### 4.1 Data: KwaZulu-Natal Income Dynamics Survey (KIDS)

In 1993 the South African Labor and Development Research Unit spearheaded the first South African national household survey, the Project for Statistics on Living Standards and Development (PSLSD). In 1998 and 2004 KwaZulu-Natal province was

resurveyed as a sub-sample of the national survey by a research consortium including the University of Natal, the University of Wisconsin, and the International Food Policy Research Institute; this sub sample is named the KwaZulu-Natal Income Dynamics Study (KIDS) (Carter and May, 2001; May et al., 1999; May et al., 2007).

Similar in its construction to the familiar Living Standards and Measurement Surveys (LSMS) found in over 100 hundred developing countries, the KIDS survey consists of a household survey in 1993, 1998, and 2004. In both 1993 and 1998 a community questionnaire accompanies the household survey providing information on public perceptions of trust, violence, community wide shocks, as well as infrastructure and services. The survey contains 760 household dynasties that were identified and surveyed in all three waves. Of the 760 households, all are from the African or Indian population of the province. The original survey contained information on white households, but due to measurement issues and small numbers represented these were dropped. The originally nationally representative PSLSD study from 1993 became less than regionally representative in the form of KIDS. This limits the analysis by not allowing for generalizations of the results. However, the narrow nature of the sample does afford modest control over wider-economy influences.

What are important to this analysis are the components of the household survey on asset ownership, social capital, and time use. Unfortunately, while the 1998 and 2004 rounds of sampling contain the relatively comprehensive sections regarding assets, social networks, and other household specific variables, the original 1993 round contains relatively little. This imbalance in the 1993 data limits the focus solely on 1998 and 2004. For consistency with the established asset poverty literature the focus is on asset

endowments' impact on current livelihood. That is to say, with data only available for two time periods (1998 and 2004), many of the benefits of the panel nature of the data fall out due to only one observation per household as the dependent variable is in period t and regressors are in period t-1.

Though the short nature of the data prohibits the inclusion of fixed effects, the relatively narrow scope may benefit this study in a number of ways. By narrowing the study to one province within South Africa that includes only non-white households, differences in the available opportunity set outside of the household can more reasonably be assumed similar. Racial discrimination, for example, is predominately controlled for. All households in the study live in an environment with similar employment opportunities as shaped by the macroeconomic environment, save their geographic distance to urban centers. This issue is addressed by the inclusion of a population density control.

## 4.2 Variables and Descriptive Statistics

Tables one and two describe the data and correlations used in the decomposition. Economic livelihood, L, is the metric to capture welfare or utility. Following a similar method used for South Africa in Adato et. al (2006), it is defined as the total monthly expenditures per a household specific subsistence line, hsli. The subsistence line is simply the household size (in adult equivalent units) multiplied by the 1998 Rand equivalent of $2 per day for 30 days. The livelihood mean of 2.26 poverty line units

(PLUs) suggests the average household in the sample has an economic livelihood of 2.26 times the arbitrarily chosen poverty line.

*Asset Holdings*

Assets themselves are multidimensional. As mentioned above the use of an aggregated asset index limits the study's ability to address how particular assets act as a mechanism for agency variables to condition critical asset thresholds. To that end, five primary categories of assets are used: capital, educated labor, uneducated labor, agricultural land, and unearned transfers. Productive capital is reduced from seven dimensions down to one index, K. It is the first principle component (PCA) of: financial assets, household durables, electricity in the home (yes/no), number of rooms in the home, home ownership (yes/no), self employment equipment, and agricultural equipment. The PCA scores for K are conditional on each population density category (1=rural, 2=village/town, 3=urban) to capture the differences in relative values of particular assets across rural and urban areas. For example, farming equipment might be of greater significance in rural areas than in downtown Durban, a metropolitan area of more than two million people.

Agricultural land access, La, is used over land ownership due to the fact that very few respondents report owning any land, but many report having access. This reflects the tribal dynamics within the province. La is a categorical variable in which an individual has no access to either grazing or crop land (La=0), access to either grazing or crop land (La=1), or access to both (La=2). Between 1998 and 2004 urban and metropolitan

households experienced a slight rise in access to agricultural land, whereas rural households experience a slight decline in land access.

Human capital is modeled as education embodied in labor, and is thus divided into educated versus uneducated labor. The number of educated or uneducated laborers in the home is used as these measures reflect of the overall situation in the household and aggregate more easily than do average years of educational attainment or education of the household head. As well, just focusing on education levels of parents ignores the potentially large impact that younger, more educated members may have on the household. The average household in KwaZulu-Natal has approximately twice as many uneducated workers as educated workers in the home. At the same time, all three population density groups experienced significant rises in the number of educated workers within the home between 1998 and 2004.

Unearned transfers reflect the average monthly value of transfer payments and remittances the household has had access to over the prior twelve months. The source of this income may come from members that have migrated out of the house and sent earnings back into the home or government programs such as the Old Age Pension Grant.

Of the five asset endowments, capital, land, and the two labor divisions are more highly correlated with future economic livelihood than the unearned transfers category. This low correlation between $T_{t-1}$ and $L_t$ is to be expected. The correlation would tend to be negative as lower income households are targeted for higher public transfers. However, if the programs are successful, those receiving transfers in 1998 would be expected to achieve higher livelihood in 2004 and lead to a positive correlation.

*Household Agency Variables*

Perhaps of greater interest are variables that capture the essence of household agency or freedoms in the form of heterogeneous opportunity costs across households. When individuals face different time constraints within the family or community, it creates a varied set of cost-benefit decisions across households with respect to adoption of new livelihood generating strategies. This study uses five variables describing the structure of the household: elderly dependency ratio, child dependency ratio, subsistence time deprivation, associational activity, and trust in one's local network/community.

Using these five variables as proxies for capabilities follows Carter and Ikegami's (2007) theoretical treatment of the determinants of poverty trap thresholds. In that simulation, the authors suggest that a latent concept of intrinsic ability conditions how high the minimum assets need to be in order to gravitate toward a higher welfare equilibrium. The lack of discussion of what intrinsic ability might encompass combined with the human development literature's criticisms that asset based measures contain little discussion of factors that affect asset returns, elicits greater empirical study of intrinsic ability. Thinking in terms of capabilities, measures such as the dependency ratio and subsistence time deprivation capture the inability of households to embrace new productive opportunities. Bridging social capital has the potential to create additional productive alternatives that may not have otherwise existed. Bonding social capital can alleviate time deprivations, provide psychological and emotional support, and facilitate opportunities through the reduction of fear of harm. All five household agency measures represent an aspect of capability, are empirically observable, and play an indirect role in the persistence or transition out of poverty.

The dependency ratio is disaggregated to draw out the fundamentally different roles that non-working age household members play. An individual is of working age if they are between the ages of sixteen and sixty. Any member younger is considered to be a child dependent. Similarly, any member older than age sixty is considered to be an elderly dependent. The dependency ratio is calculated as the proportion of dependents to working age adults. The natural distinction between child and adult dependents implicitly centers on the role of in home care. It is assumed that a high child dependency ratio will reflect a different set of opportunity costs of switching to out of the home employment than would a high elderly dependency ratio. The key question is if there are identifiable asset holdings in which the constraints become more binding.

The degree of time deprivation describes the amount of time the household spends in subsistence activities such as fetching water and gathering fuel wood. This is the per capita number of hours per week that the household spends in these activities. It is expressed in per capita terms to distinguish the effects of subsistence activities from any overlap with household size or dependency ratios.

In 1998, 64% of the 744 households report spending some amount of time either gathering wood or fetching water. The median household spent approximately ten minutes per person over the week, whereas the 90th percentile household spent two hours per person per week. In 2004, the median household reports an increase of only a few minutes, and the 90th percentile reports a drop of twelve minutes per person. Immediate inspection of the median trends suggest that for KwaZulu-Natal, the degree of time deprivation arising from subsistence activities has only marginally improved for poorest households and appears to persist for the majority into 2004. However, a closer

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inspection of these trends with respect to population densities highlights the potential role of time deprivation as a capability constraint.

Between 1993 and 1998 the degree of time spent on subsistence activities has significantly declined for almost all rural households but leveled off from 1998 to 2004. During the latter time period the proportion of the 744 households living in rural areas falls from 42% to 40% presumably relocating to more populated areas in which the proportion rises by a similar magnitude. What is interesting to note is that the proportion of rural households reporting any time spent on subsistence activities rises from 88% to 94% while in urban areas the proportion falls over the same time period. This suggests that household with less subsistence constraints are more likely to move away from the rural areas. The resultant question then is: Do subsistence time commitments constrain rural households' ability to take on the opportunities presented in more populated areas or are there other dynamics governing these trends?

To further capture freedoms generated by household agency, social capital is treated as having an indirect influence on assets, rather than as an asset itself. Two measurable forms of social capital are used: bridging and bonding social capital. The former is measured as the number of different associations the household belongs to. Although this measure is blind to informal social identities, it is reasonably comprehensive in the KIDS survey and includes financial, religious, and other associations. Bonding social capital is measured by an index of trust in the local community. This is a self reported rating (scale of 1 to 5 with higher equaling more trust) of how much one trusts their immediate family, extended family, neighbors, strangers, and local government. As with the construction of the capital asset, K, this was reduced

in dimensionality via principle component analysis. It is not clear that there is an income distinction between the two types of assets. An inspection of the KIDS sample suggests that neither form of social capital has a correlation with monthly income higher than .05 in absolute value. Again, the question of interest is whether an identifiable pattern exists in which social capital works through a particular asset holding to condition critical poverty trap thresholds.

*Additional Controls*

Additional control variables used in estimating equation one and three include the number of positive and negative financial surprises per capita that the household reports experiencing within the past two years and the variable labeled saver. This is a dummy equal to one if the change in K (primarily driven by financial capital and household durables) from one time period to the next is positive. Since the unbalanced nature of the data do not allow for fixed effects, this control is a modest proxy to capture the differing autonomous saving strategies across households (at least the outcome of those strategies). In addition, community negative shocks are reported from the community survey and are a count of the number of negative shocks the community has experienced over the past two years. Examples of negative community shocks are the death of a local leader, a health outbreak, or flood. In 1998, 80% of KIDS respondents lived in a community in which negative shocks were reported on the community survey.

One particular dynamic characteristic of households is that they tend to expand and contract in response to life events over time. This change in size potentially creates measurement error due to, say, accumulation of a new spouse between 1998 and 2004.

To account for possible measurement error of household dynasties, the change in household size is included.

## 5. Results and Discussion

Decomposing the total correlation of asset endowments and current livelihood provides a novel way of looking into the household's black box of asset holdings to identify patterns and relationships between structural characteristics and particular asset holdings. Knowledge of how structural characteristics that lead to agency are linked to particular asset holdings results in a greater understanding of how households with differing capabilities convert asset stocks into economic well-being. Are households that are dependent on uneducated labor more bound by a lack of social network or time spent on subsistence activities when attempting to generate economic livelihood?

Tables two and three present the correlation coefficients and estimation results of equation (1), respectively. Together they create the decomposition of equation (3). Table four then presents the entire correlation decomposition, and figures six and seven illustrate the decomposition components.

Recall the dependent variable is the log of economic livelihood calculated as total monthly expenditures per a household specific subsistence line. The latter subsistence line is primarily a function of household size and not observed budget shares of subsistence needs. Thus, the asset endowment coefficient is to be interpreted as the incremental percentage change in livelihood that a one unit increase in the asset endowment generates. If the coefficient is negative, such as the case of uneducated labor,

it suggests that an additional uneducated laborer in the household may increase the future consumption, but not by enough to offset the increased subsistence needs of having the additional household member. Capital and educated labor have the expected signs. Agricultural land has a negative impact on economic livelihood. This is not an uncommon finding as bad prior labor market experiences may draw individuals toward agricultural land as a livelihood strategy. Although the negative sign on agricultural land illustrates interesting dynamics in the South African labor market it presents an additional challenge. The challenge is that the correlation decomposition requires the estimates from equation (1) to be unbiased. The negative sign on land may be indicative of endogeneity, and thus require interpretations to be made with a degree of caution. This challenge aside, the discussion now turns to identifying patterns among particular asset holdings and capabilities.

*Are Particular Asset Holdings Associated with Particular Capabilities?*

The identification and comparison of the indirect components identify three primary results. First, the indirect components of asset-to-asset complementarities and the household agency account for the lion's share of the total correlation. Second, the household agency components are on par with the magnitude of the asset-to-asset components. Lastly, as the black box of asset holdings is opened up, interesting associations between higher powered assets (capital, educated labor, and to some extent land) and time deprivations emerge. Further, land and uneducated labor exhibit strong associations. As will be discussed in greater detail below, these last patterns may be

suggestive of the overriding role of macro-constraints to livelihood generation relative to micro-constraints.

As mentioned above, the indirect components of asset-to-asset complementarities and the household agency account for the lion's share of the total correlation. The decomposition results of table four show that the direct effects of asset endowments on future livelihood make up approximately forty percent of the total correlation for each of the different assets.[11] The estimated correlation between educated labor endowment and future livelihood is .25 (compared to an actual correlation of .31). Of that total correlation, .10 is estimated as the direct impact of putting 1998 educated labor to use directly leading to higher livelihood levels in 2004. An additional .1 of the total .25 correlation is estimated to be due to 1998 educated labor's impact on 2004 livelihood via it's associations with various agency or capability variables. The final additive correlation component of .05 is the estimated proportion of 1998 educated labor's impact on 2004 livelihood via other asset holdings. Concerning an asset-based model of poverty trap thresholds outlined in section two, the fact that indirect effects of asset endowments make up the lion's share of the correlation with future livelihood underscores the likelihood that critical asset thresholds are unique across households.

As figure six clearly shows, the impacts endowments have on future livelihood through household agency variables are at least as important as asset combination effects. Child and elderly dependency ratios, local community trust and networks, as well as, subsistence time deprivation all play a role in impacting welfare via asset holdings. This observation is integral to any argument of the relative economic importance of the

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[11] The one exception is that unearned transfer assets' direct component accounts for sixty seven percent of its total, though the entire actual correlation is only .03. The indirect effects are exclusively through other assets rather than household agency characteristics.

household agency component. All variables are expressed in common standard deviation units due to the standardization process before estimating equation (1). This allows for direct comparison of the relative sizes to be made.

The last two columns of table four look more in depth to particular asset holdings and their associations with different agency variables. However, figure seven provides a clearer picture of the relative size of the indirect components. On the vertical axis is the absolute value of the indirect correlation as a percent of the direct effect of a particular asset endowment[12]. The horizontal axis is categorized by the indirect component and the shaded bar is the asset of interest. For example, the leftmost bar in the land group (fourth bar from the left) implies the indirect effect of 1998 capital endowments on 2004 livelihood through land is 27% of the size of the direct correlation component.[13] Note that transfer assets are left out of figure seven due to the relatively small interactions.

It is immediately evident from figure seven that the impact that educated labor, land, and capital have on livelihood through subsistence time deprivation is larger than any of the other indirect components including any asset-to-asset complementarities. Though the asset-to-asset complementarities are not unimportant, one could interpret this as evidence of the economic significance of the indirect time poverty component. The fact that the subsistence time interaction is relatively larger attests to the importance of a deeper focus of poverty policy than simple asset redistributions. The answer to the question of how many assets is enough to ensure time is an ally of the poor is a complex one. The results here suggest that a household's ability to take on new economic opportunities may in part be a function of its subsistence commitments in the home.

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[12] Proportions are reported in absolute value for clarity.
[13] With respect to the data in table four, it is calculated as .03 divided by .11.

Recall the observation of section four in which the proportion of the KIDS sample remaining in rural areas decreased at the same time that the proportion of households reporting some amount of time spent on subsistence activities was rising. The hypothesis was that perhaps only households with less subsistence demands were able to take on new opportunities in urban areas. The results of this section are indirect support that this hypothesis is at least plausible.

Returning to labor viewed as two fundamentally different assets, educated and uneducated, an interesting pattern emerges. Educated labor tends to be more heavily associated with subsistence time deprivation, but uneducated labor interacts with local community trust, capital, and land to a relatively larger degree. This reflects a pattern in which households dependent on uneducated labor are attached to agricultural production perhaps due to familial heritage, past labor market experiences, or simply a skills mismatch at the macroeconomic level.

The two patterns of educated labor being associated with time deprivation and the association of uneducated labor and agricultural land may be reflective of the macroeconomic structure in South Africa. One interpretation of the patterns emerging from figure seven is that the macroeconomic constraints of underemployment may be pressing down harder on lower-resourced households more so than the well-resourced households. Told another way, this could reflect the fact that the employment situation for most of South Africa is relatively bleak, but there exists enough employment opportunities for the more highly educated households. Further, this analysis is statistically identifying a subset of the well-resourced households that are more constrained by micro-level, household conditions. This interpretation would suggest that

time deprivation may still be a future constraint for the less educated, but that larger, macroeconomic constraints are more likely the binding issue.

*The Macro and Micro Policy Implications*

The patterns that emerge from the correlation decomposition provide the first empirical description of the interaction between asset holdings and capabilities. The results, however, are difficult to generalize beyond a sub-group in the KwaZulu-Natal province. The obvious limitation is from the sample not being nationally representative. Yet there is a bigger issue at play. As the above interpretation of labor and time deprivations illustrated, the wider economic situation shapes the interpretations of the decomposition. For the KIDS sample in South Africa, it appears that the degree of time deprivation conditions poverty trap thresholds more for those households with more education, capital and land. This may not be the case in an economic environment of full employment and robust growth where the opportunities for process switching are available to all asset holders. One could easily make the argument that the economy-wide phenomena play a significant role in the presence of under development.

In a response to prior asset-based studies of chronic poverty in KwaZulu-Natal, Aliber states, "that the emphasis...place(d) upon household assets as a determinant of structural poverty or non-poverty – even though 'assets' are understood broadly to include human capital, money, social claims, and other forms of wealth – appears to obscure the overriding importance of employment as a cause of poverty" (Aliber, 2003). The conclusions from this study confirm Aliber's claim that the macroeconomic employment crisis in South Africa may in part separate households into transient and

chronic poverty. However, the lack of statistical evidence of micro-capability constraints for low-resource households in this study does not necessarily suggest that they are less affected than high-resource households. Rather, the statistical evidence may be hidden by broad underemployment among low-resource groups. In the context of the chronic versus transitory poverty debate, the current analysis suggests that low-resource households are more likely to be chronically poor due to their low asset base, and that a subset of high-resource households that face capability deprivations are also more likely to be chronically poor.

Thus, the results of this study suggest two dimensions of poverty policy that highlight that asset transfers alone simply one of many means and not an end to poverty reduction. The first policy implication is that without a macroeconomic environment of more robust growth and employment opportunities that South Africa's KwaZulu-Natal's province is currently experiencing, capital and land transfers may be ineffective due to a lack of viable outlets for those assets. Educated labor may be more insulated to the underemployment crisis simply due to the relative scarce supply of educated laborers.

The second lesson for poverty policy and asset-based studies concerns the role of binding micro-constraints to capabilities. It was found that even for well-resourced households there exist a subset in which time constraints impede the conversion process of educated labor, capital, and land into economic livelihoods. Thus, targeted policies should account not just for levels of asset stocks, but the environment in which those assets are being employed within.

*Study Extensions and Limitations*

The choice of analysis at the household level has its costs and benefits. Data on asset holdings, consumption, and general time use are typically more available at this level of aggregation. However, some very important dynamics are hidden when the household is viewed from the outside. In this analysis, the degree of time deprivation stemming from subsistence activities emerged as an important influence on how households are able to convert asset holdings into well-being. If, as is the case in many regions, the delegation of subsistence activities falls disproportionately on household members, then gender or individual deprivations are central issues to be explored. How intra-household decision regimes and the allocation of time spent on activities commonly referred to as women's work impact the livelihood generation process are important questions to be taken on next. Further, the nature and uses of agricultural land and crop production have important gender implications as well. This study does not address the uses of agricultural land, but differences in subsistence versus cash crop production may result in starkly different outcomes for men and women.

*Concluding Remarks*

On one level, this study is an attempt to bridge the asset-based and human development perspectives of poverty measurement and development. The principal means to illustrate the potential of this hybrid perspective was to empirically draw out the fundamental relationship between a household's level of instrumental freedoms and its particular asset holdings. The results suggest that although asset-to-asset interactions are important, the degree of time deprivation from subsistence activities may condition

poverty trap thresholds for households with higher levels of educated laborers, capital, and access to agricultural land. This statistical result may reflect the larger realities of macroeconomic underemployment in South Africa in which the relatively well-resourced groups have the wherewithal to face binding micro-constraints, whereas the low-resourced groups are primarily constrained by poor macroeconomic conditions. Poverty reduction strategies should not pull up short with a focus on asset accumulation levels alone. It was shown rather that the institutional setting at the macroeconomic and microeconomic level impact a households ability to convert a variety of asset holdings into economic well-being. Future research on asset holdings in conjunction with household capabilities should aim for explicit inclusion of the intra- and extra-household dynamics over time and regions.

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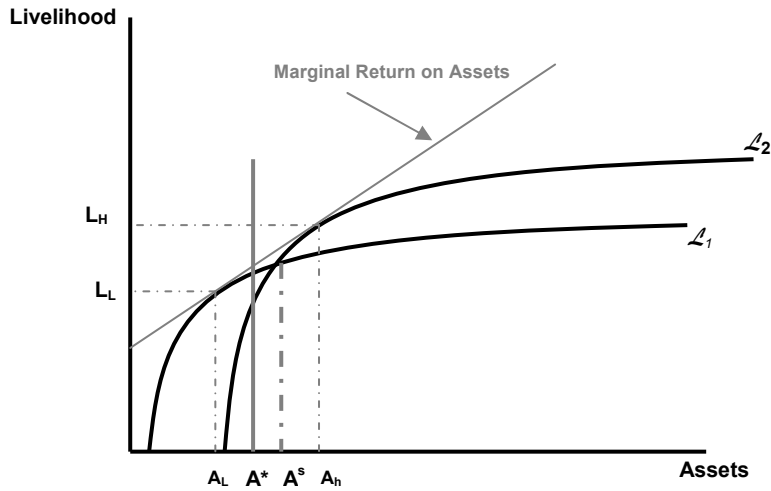**Figure 1: Multiple Equilibria**



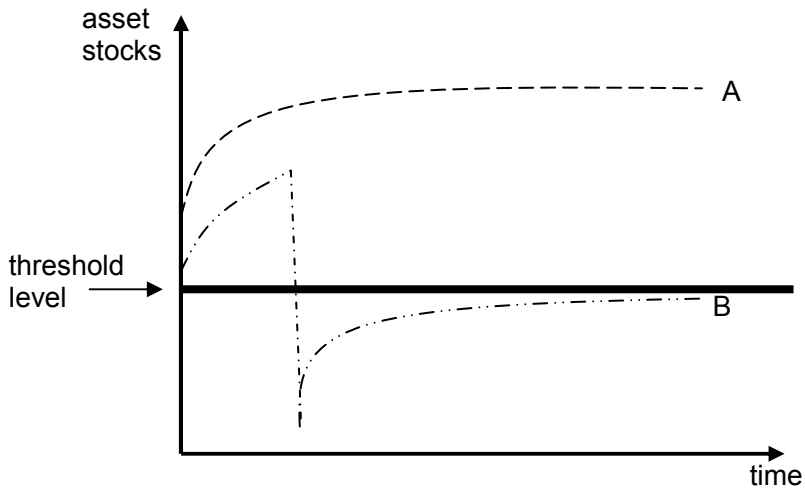**Figure 2: Simple Poverty Trap Threshold**



**Figure 3: Intrinsic Ability and Critical Asset Thresholds (Carter & Ikegami 2007)**
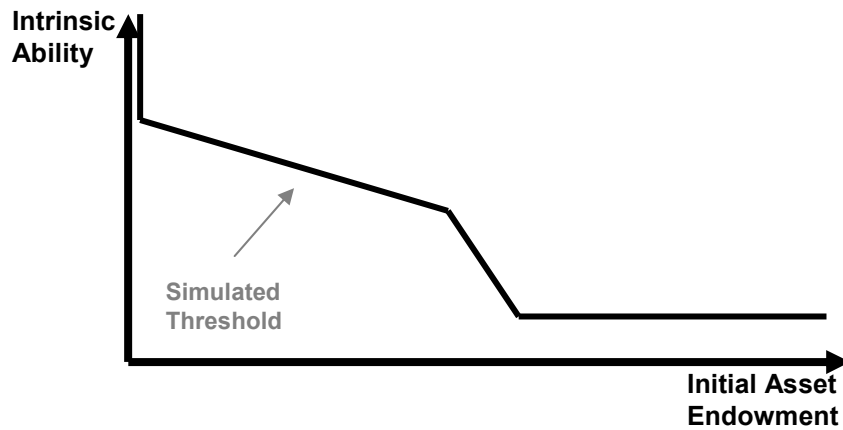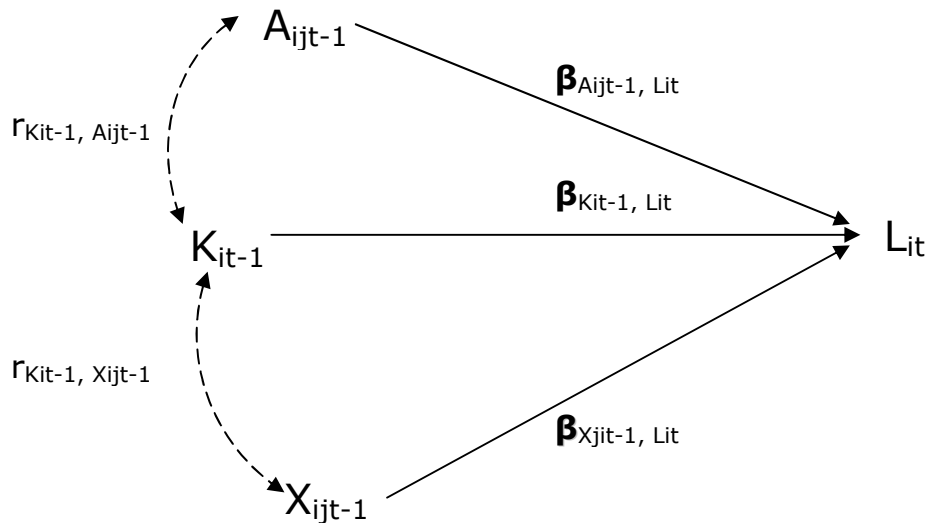
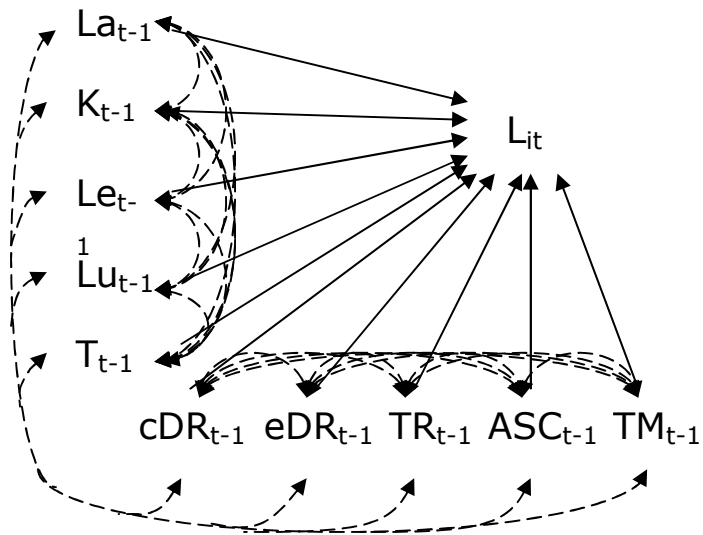**Figure 4: Path Analysis – Short Form**



**Figure 5: Path Analysis – Long Form**

# Table 1: Variable Names and Descriptive Statistics

| Variable* | Description** | n=744 1998 mean | (s.d.) | 2004 mean | (s.d.) |
|-----------|---------------|------|--------|------|--------|
| $L_{it}$ | livelihood: total monthly expenditures per a household specific subsistence line | 2.26 | (3.36) | 3.47 | (5.04) |
| Inc | Total Monthly Household Income in 1998 Rand. | 539.0 | (1040.1) | 815.5 | (1710.5) |
| $K_{it}$ | Productive capital. Index derived from durables, fin. assets, # of rooms, agric. equip, electricity in home, own vs rent, home size, livestock. (normalized to zero mean / unit var.) | 0 | (1.37) | 0 | (1.50) |
| $La_{it}$ | Access to Agricultural Land. 0=no access, 1=access to either grazing or crop, 2=access to both grazing and crop land | 0.69 | (0.76) | 0.91 | (0.51) |
| $Le_{it}$ | # of core members in HH with more than standard 9 education | 1.01 | (1.28) | 1.77 | (2.14) |
| $Lu_{it}$ | # of core members in HH with less than standard 10 education | 3.9 | (2.57) | 4.17 | (3.37) |
| $T_{it}$ | Unearned income such as remittances and transfers (adult equivalent) | 569.3 | (2806.19) | 876.72 | (2673.35) |
| $TMpc_{it}$ | Time poverty: # of hours per week spent gathering wood and water per household member | 0.72 | (1.67) | 0.64 | (1.05) |
| $cDR_{it}$ | Dependency ratio: # of children per working age adults (>60 years). | .66 | (.52) | 1.32 | (1.32) |
| $eDR_{it}$ | Dependency ratio: # of elderly per working age adults (<16 years). | .12 | (.20) | .14 | (.25) |
| $ASC_{it}$ | # of different associations HH belongs to | 1.40 | (1.26) | 1.12 | (1.30) |
| $TRST_{it}$ | Local Level Trust: 1st Principle component of self-assessed level of trust in family, extended family, strangers, neighbors, and locol gov't. | 4.30 | (1.48) | 4.37 | (1.46) |
| $CN_{it}$ | Community Level Negative Shocks: # in past two years, community level, reported by community survey e.g. floods, outbreaks, etc. | 1.66 | (1.47) | NA | NA |
| $saver_{it}$ | dummy to capture household differences in consumption propensities. 1 if change in K from 98-04 >0 | 0.36 | (0.48) | 0.73 | (0.45) |
| $popden_{it}$ | population density. 1=rural, 2=village/town, 3=urban | 2.00 | (0.91) | 2.03 | (0.91) |
| $pSrp_{it}$ | # of positive financial surprises reported by the HH in the past two years per household member | 0.17 | (0.41) | 0.73 | (0.86) |
| $nSrp_{it}$ | # of negative financial surprises reported by the HH in the past two years per household member | 0.53 | (0.80) | 0.61 | (0.87) |
| $hsli_{it}$ | household subsistence line: monthly equivelant of $2 per day per HH member (adult equivelant in Rand) | 1421.4 | (860.6) | 1686.3 | (1058.5) |

\* where i indexes the houshold, t indexes the year, and j indexes the individual asset
\** all monetary measures expressed in 1998 Rand

**Table 2: Correlation Matrix**

| | $I_{it}$ | $INC_{i,t-1}$ | $K_{it-1}$ | $La_{it-1}$ | $Le_{it-1}$ | $Lu_{it-1}$ | $T_{it-1}$ | $TMpc_{it-1}$ | $cDR_{i,t-1}$ | $eDR_{i,t-1}$ | $ASC_{it-1}$ | $TRST_{it-1}$ | $CN_{it}$ | saver | $popden_{it}$ | $pSrp_{it}$ | $nSrp_{it}$ | $hsli_{i,t}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $I_{it}$ | 1 | | | | | | | | | | | | | | | | | |
| $INC_{i,t-1}$ | 0.66 | 1 | | | | | | | | | | | | | | | | |
| $K_{it-1}$ | 0.5 | 0.44 | 1 | | | | | | | | | | | | | | | |
| $La_{it-1}$ | -0.34 | -0.2 | -0.16 | 1 | | | | | | | | | | | | | | |
| $Le_{it-1}$ | 0.25 | 0.21 | 0.12 | -0.11 | 1 | | | | | | | | | | | | | |
| $Lu_{it-1}$ | -0.39 | -0.31 | -0.4 | 0.33 | -0.15 | 1 | | | | | | | | | | | | |
| $T_{it-1}$ | 0 | 0.03 | 0.09 | 0.03 | 0.07 | 0 | 1 | | | | | | | | | | | |
| $TMpc_{it-1}$ | -0.17 | -0.12 | -0.09 | 0.24 | -0.16 | 0.02 | -0.02 | 1 | | | | | | | | | | |
| $cDR_{i,t-1}$ | -0.24 | -0.17 | -0.11 | 0.17 | -0.21 | 0.02 | -0.05 | 0.08 | 1 | | | | | | | | | |
| $eDR_{i,t-1}$ | -0.06 | -0.01 | -0.08 | 0.05 | -0.07 | 0 | 0.05 | 0.1 | 0.23 | 1 | | | | | | | | |
| $ASC_{it-1}$ | -0.12 | -0.06 | -0.04 | 0.17 | 0.23 | 0.14 | 0.09 | -0.04 | 0.04 | 0.06 | 1 | | | | | | | |
| $TRST_{it-1}$ | -0.15 | -0.07 | -0.07 | 0.15 | -0.04 | 0.15 | 0.02 | 0.11 | 0.03 | 0.07 | 0.02 | 1 | | | | | | |
| $CN_{it}$ | -0.24 | -0.16 | -0.08 | 0.09 | -0.06 | 0.16 | -0.04 | 0.19 | 0.07 | 0.07 | 0.15 | 0.13 | 1 | | | | | |
| saver | -0.26 | -0.17 | -0.52 | 0.08 | -0.07 | 0.34 | -0.08 | 0.04 | 0.12 | 0.1 | 0.07 | 0.03 | 0.09 | 1 | | | | |
| $popden_{it}$ | 0.32 | 0.22 | 0.06 | -0.51 | 0.09 | -0.29 | -0.08 | -0.21 | -0.15 | -0.04 | -0.12 | -0.19 | -0.19 | 0 | 1 | | | |
| $pSrp_{it}$ | -0.12 | -0.05 | -0.11 | 0.13 | 0.13 | 0.22 | 0.04 | 0.03 | 0.01 | 0.03 | 0.13 | 0.08 | 0.1 | 0.09 | -0.08 | 1 | | |
| $nSrp_{it}$ | -0.12 | -0.06 | -0.07 | 0.11 | -0.02 | 0.15 | 0.04 | 0.02 | 0.01 | -0.02 | 0.09 | 0.03 | 0.08 | 0.01 | -0.12 | 0.21 | 1 | |
| $hsli_{i,t}$ | -0.26 | -0.19 | -0.25 | 0.23 | 0.15 | 0.58 | 0 | -0.02 | 0.15 | -0.04 | 0.14 | 0.09 | 0.09 | 0.2 | -0.19 | 0.39 | 0.25 | 1 |

## Table 3: Structure and Asset Endowment on Livelihood

Dependent Var. = $\ln L_{04}$

| (i) Asset Endowments | | (ii) Household Structure and Agency | |
|---|---|---|---|
| $K_{98}$ | 0.11*** | $TMpc_{98}$ | -0.41** |
| | (0.04) | | (0.19) |
| $La_{98}$ | -0.17*** | $cDR_{98}$ | -0.11** |
| | (0.04) | | (0.05) |
| $Le_{98}$ | 0.10*** | $eDR_{98}$ | 0.02 |
| | (0.03) | | (0.03) |
| $Lu_{98}$ | -0.12*** | $ASC_{98}$ | 0.04 |
| | (0.04) | | (0.03) |
| $T_{98}$ | -0.02 | $TRST_{98}$ | -0.19*** |
| | (0.02) | | (0.03) |
| **(iii) Endowment Changes** | | **(iv) Structural Change** | |
| $\Delta K_{98}$ | 0.03 | $\Delta TMpc_{98}$ | -0.02 |
| | (0.02) | | (0.02) |
| $\Delta La_{98}$ | -0.12*** | $\Delta cDR_{98}$ | -0.04* |
| | (0.04) | | (0.02) |
| $\Delta Le_{98}$ | 0.05** | $\Delta eDR_{98}$ | 0.04 |
| | (0.02) | | (0.09) |
| $\Delta Lu_{98}$ | -0.01 | $\Delta ASC_{98}$ | 0.03* |
| | (0.02) | | (0.02) |
| $\Delta T_{98}$ | -0.00 | $\Delta TRST_{98}$ | -0.12*** |
| | (0.00) | | (0.02) |
| **(v) Other Explanatory Variables** | | | |
| $CN_{98}$ | -0.04* | | |
| | (0.02) | | |
| $\ln INC_{04}$ | 0.46*** | | |
| | (0.03) | | |
| $popden_{04}$ | 0.11*** | N | 730 |
| | (0.03) | R-squared | 0.72 |
| $pSrp_{98-04}$ | -0.45** | | |
| | (0.21) | | |
| $nSrp_{98-04}$ | 0.11 | | |
| | (0.22) | | |
| $dhhsize_{98-04}$ | -0.01 | | |
| | (0.01) | | |
| Constant | -2.78*** | | |
| | (0.19) | | |

Robust standard errors in parentheses

Note: Variables normalized to have zero mean and unit variance.

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

**Table 4: Decomposition of the Correlation Between 1998 Asset Endowments and 2004 Livelihood**

N = 730

*Total Est. vs Actual Correlation*

|  | Est. | Act. |
|---|---|---|
| K | 0.29 | 0.42 |
| Le | 0.25 | 0.31 |
| Lu | -0.3 | -0.47 |
| La | -0.41 | -0.42 |
| T | 0.00 | 0.03 |

*Direct Association of $A_{j, t-1}$ and $lnL_t$*

|  | Direct Impact |
|---|---|
| K | 0.11 |
| Le | 0.1 |
| Lu | -0.12 |
| La | -0.17 |
| T | -0.02 |

*Ind. Assoc. of $A_{j, t-1}$ and $lnL_t$ through Agency Variables*

|  | eDR | cDR | TMpc | ASC | TRST |
|---|---|---|---|---|---|
| K | 0.00 | 0.02 | 0.05 | 0 | 0.02 |
| Le | 0.00 | 0.01 | 0.08 | 0.01 | 0.00 |
| Lu | 0.00 | -0.01 | -0.04 | 0.01 | -0.02 |
| La | 0.00 | -0.02 | -0.13 | 0.01 | -0.02 |
| T | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

*Ind. Assoc. of $A_{j\,t-1}$ and $lnL_t$ through Other Assets*

|  | K | Le | Lu | La | T |
|---|---|---|---|---|---|
| K | -NA- | 0.01 | 0.05 | 0.03 | 0.00 |
| Le | 0.01 | -NA- | 0.02 | 0.02 | 0.00 |
| Lu | -0.05 | -0.01 | -NA- | -0.06 | 0.00 |
| La | -0.02 | -0.01 | -0.04 | -NA- | 0.00 |
| T | 0.01 | 0.01 | 0.00 | -0.01 | -NA- |

**Figure 6: Correlation Decomposition of Asset Endowments and Current Livelihood into Direct and Indirect Effects**
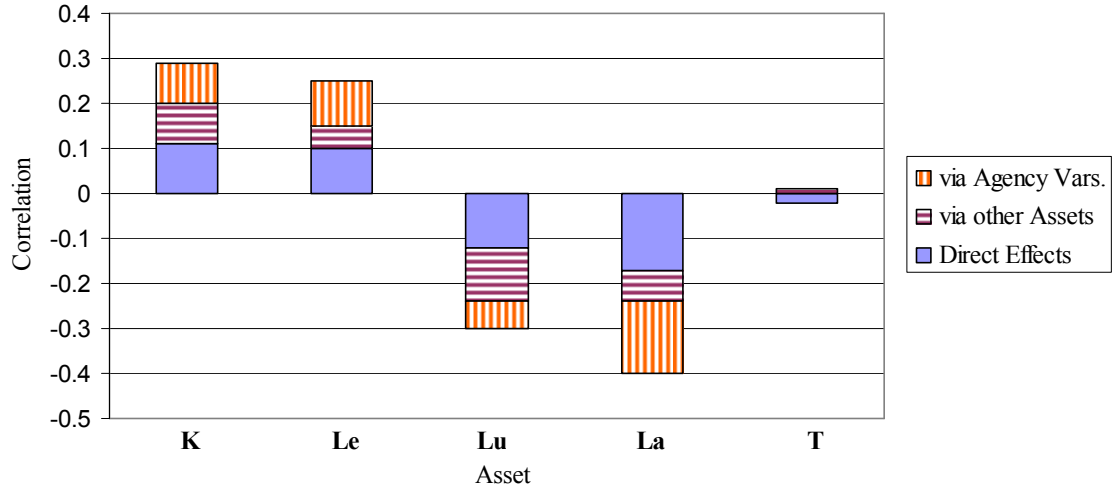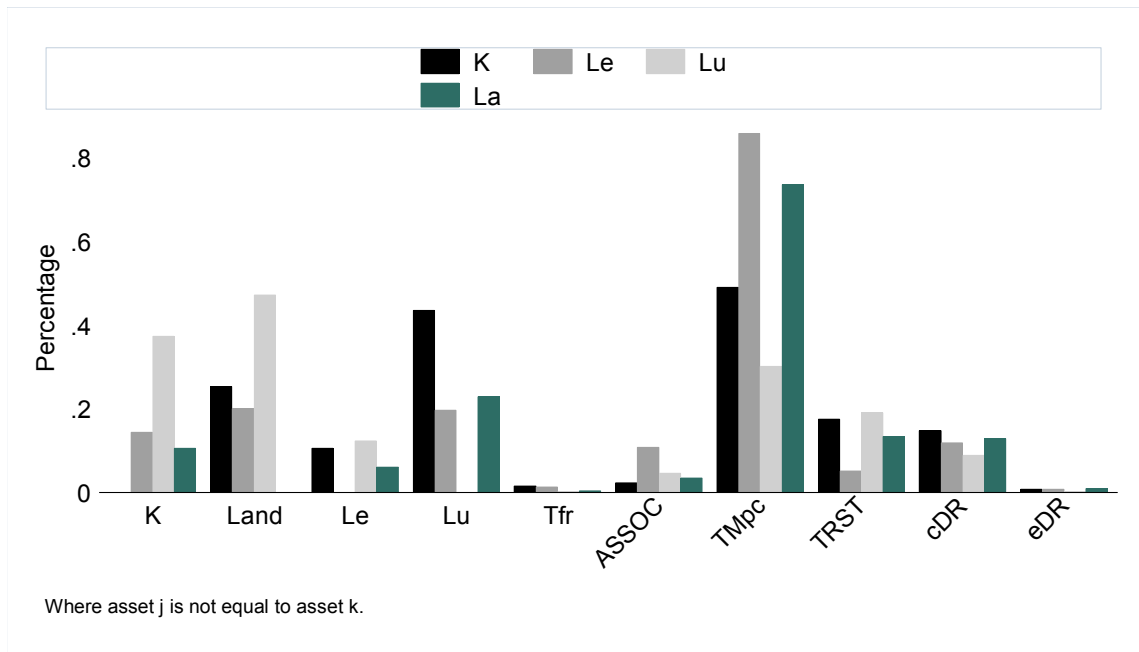


**Figure 7: Simultaneous Interaction of Agency and Assets**
Indirect Correlation Component as a Percent of Direct Correlation Component (Abs.Value)



Where asset j is not equal to asset k.

**#3 How Does the Distribution of Micro-Welfare Respond to Macro Self-Discovery in Exports: A Preliminary Macro-Micro Framework with Capability Disparities**

## 1. Introduction

The World Bank's focus on a post-stabilization phase of development policy puts equality of access to opportunities at the heart of a pro-poor criterion. [14] Increases in opportunities for the poor are only one side of this coin; recognition and removal of binding constraints that prevent some individuals from taking full advantage of the existing opportunities is the other. Disparities across individuals in their ability to take on new opportunities may take many forms. One's health, socio-demographic identity, lack of asset endowments, or exposure to risk could impact their choice of participation in different segments of the labor market (i.e. formal versus informal). In an economy with such variety in behavioral responses to potential opportunities, the question becomes how to identify the winners and losers of potential macro-policy changes in an ex-ante fashion.

Standard computable general equilibrium (CGE) models have been in wide use since 1982 (Dervis et al., 1982) and have become popular tools for identifying winners

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[14] See Bourguignon et al. 2008a for a description of the post-stabilization phase of development.

and losers at many international institutions such as The World Bank and International Food Policy Research Institute (IFPRI). However, a severe limitation to a stand alone CGE that relies on representative household groups is that it is only able to identify between group changes in income distributions and not within group changes. At the same time, rises in modern computing power have increased the prevalence of microsimulation models that focus on behavioral responses of individuals. Given their complementary nature, it is not surprising that formally linking the two models has become a popular endeavor over the past decade. One benefit that a linked CGE-MSM model provides over a stand alone CGE is that the outcomes of behavior are aggregated rather than attempting to aggregate behavior itself, as is done with representative agents.

This purpose of this paper is two-fold. The first aim is to review a host of macro, micro, and macro-micro modeling strategies in order to draw out central features of a framework that can address the micro impacts of macro changes in the presence of heterogeneous behavioral responses. The second aim is to present a preliminary framework of that model and explore how capabilities that heterogeneously impact the occupational choice of individuals might be incorporated.

Section two provides a wide-ranging review of the literature on macro-micro simulation efforts over the past several decades with particular focus on linking computable general equilibrium and microsimulation models. Section three follows with the presentation of a benchmark model of a top-down behavioral CGE-MSM with the aim of assessing the impact of macroeconomic changes on poverty and the distribution of well-being. Section four then summarizes and concludes with a discussion of the remaining steps and challenges.

## 2. Literature Review

Given the increases in computing power and data availability over the past several decades, a variety of simulation models have arguably enhanced their ability (along with their credibility) to measure the impact of macroeconomic phenomena and policies on poverty and the distribution of welfare. Along with this greater credibility comes responsibility for simulations to increase in rigor and tractability. In this section, a number of macro, micro, and linked macro-micro simulation methods will be reviewed, with the bulk of attention on the method of linking CGE models with microsimulations. Other macro structures will be considered along the way, but one can think of an orthodox CGE as a benchmark which can be augmented to address alternative structures as desired (such as models led by Kaleckian, Johansen or Keynesian closures). I begin by providing a brief overview of several macro and micro simulation strategies in order to draw out the central characteristics of each. This review then explores the origins and applications of linked CGE-MSM models with particular focus on linking strategies. This section concludes with a discussion of the advantages and remaining challenges of CGE-MSM modeling.

### 2.1 A Host of Simulation Strategies

The goal of this section is to set the stage for addressing a broad range of research questions relating of how macro shocks impact poverty and inequality when details of micro- behavior are explicitly incorporated. A sufficient description of the entire gamut

of simulation strategies would be out of the scope of this paper. Undoubtedly many will not receive their due attention or will be left out entirely. Thus in order to get at an appropriate modeling strategy for a wide range of research applications, the attention given to different simulation strategies is in part a function of the following subjective criteria: the perceived degree of analytical tractability of a sectoral shock, its perceived appeal across a wide audience within international and development economics, and the extent to which there is prior literature and momentum within the discipline. This section separately reviews the macro simulations, micro simulations, and the formally linked macro-micro simulations.

*Macro Simulations*

The term CGE commonly refers to the fundamental macroeconomic general equilibrium links among incomes of various groups, the pattern of demand, the balance of payments, and a multi-sector production structure. Often orthodox CGE models are thought of as Walrasian-type macroeconomic models relying on market clearance, zero profit, and income balance conditions. In empirical applications, however, it is clear that orthodox CGEs are only one subset of a more general class of models[15]. Thissen classifies different empirical CGEs by several different criteria, the largest being Walrasian vs macro CGEs (where the latter could simply be interpreted as non-Walrasian) (Thissen, 1998). In regard to the contentious nature between the two categories of CGEs, Robinson describes the lack of a clear, emergent consensus as hardly

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[15] More heterodox approaches to modeling institutional phenomena might reject the seemingly clear distinctions of macro and micro equilibria as a point of emphasis or model closure. Examples of more broad models of institutional dynamics can be found in the literatures regarding a Social Fabric Matrix and System dynamics. See for example Hayden (1982 and 2007), Forrester (1956, 1970, and 2007), and Radzicki (2003), respectively.

surprising since the debate really concerns the theoretical divide between Walras and Keynes, and the micro foundations of macro models – or lack thereof (Robinson, 2006).

According to Thissen, macro CGEs (as opposed to orthodox / Walrasian) can be further disaggregated by their particular choice of closure methods such as neo-Keynesian, Keynesian, Johansen, Kaleckian, loanable funds, or real balances type closures (Thissen, 1998: 7). For example, Ferreira et al. (2008) present a macro-micro model in which the top macro model follows an IS-LM framework calibrated to time series data as opposed to an orthodox CGE calibrated with ad hoc parameters. The complexities of each macro closure are without question out of great importance, but none-the-less out of the scope of this review. To avoid the discussion of modeling strategies turning into a discussion of historical macroeconomic divides, I'll follow Robinson (2006) in which he describes three schools of thought regarding the reconciliation of Walrasian and macro CGEs. First is the *orthodox school* in which he summarizes as a view that the Walrasian CGE "is elegant and complete, and that any attempt to add macro features and financial variables simply corrupts the model" (ibid: 215). The *eclectic school* suggest that one should build integrated models that incorporate the best elements from Walrasian CGE models and a variety of macro and financial models (ibid: 215). The last perspective of reconciliation is that of the *ecumenical school*. The philosophy of this school is to use separate CGE and macro-financial models and keep them separate, but specify ways through which the models can talk to one another and cooperate.

Given the range of research questions posed for this analysis, elements of the structuralist macro models are not to go unnoticed; the emphasis of structuralist models is

to regard structural characteristics of the economy as fundamental to its behavior. Among the structural factors are the distribution of income and wealth, tenancy relationships on the land, and the type and degree of specialization in foreign trade, among others (Taylor, 1990). These structural factors add empirical robustness to a macroeconomic model of a developing country. However, the focal point from here on out will be on the elements of linking an orthodox CGE to a microsimulation for two primary reasons. First, Robinson describes structuralist CGEs as belonging to the ecumenical reconciliation perspective in which structuralist macro models are linked to a CGE, but kept separate. Thus, a framework for linking a microsimulation to a structuralist CGE would traverse through the primary steps of linking a microsimulation to an orthodox CGE. The second reason for focusing on orthodox CGEs is due to the relatively mature nature of prior literature on orthodox CGE-MSMs with respect to their linking strategies, which is ultimately the aim of this paper. Thus, as the review and preliminary framework move forward, the emphasis will be on the structure of orthodox CGE-MSMs with the expectation that macro, or other structuralist, features can be augmented in an ex-post fashion. I now turn to an overview of the basic elements found in most CGEs.

Following Sue Wing, the conceptual starting point of most CGE models is the circular flow model in which individuals and firms interact in various markets with attention being paid to the flows of monetary and real flows. Equilibrium in the economic flows results in the conservation of both product and value. The implication is that neither value nor product can appear out of nowhere: each activity's production or endowment must be matched by others' uses, and each activity's income must be balanced by others' expenditures (Sue Wing, 2004). The conditions of market clearance,

zero profit, and income balance are the foundational accounting rules of a Walrasian CGE. Continuing with Sue Wing's description,

> "the three conditions... are employed by CGE models to solve simultaneously for the set of prices and the allocation of goods and factors that support general equilibrium. The three conditions define Walrasian general equilibrium not by the *process* of exchange by which this allocation comes about, but in terms of the allocation itself, which is made up of the components of the circular flow... General equilibrium can therefore be modeled in terms of barter trade in commodities and factors, without the need to explicitly keep track of—or even represent—the compensating financial transfers. Consequently, CGE models typically do not explicitly represent money as a commodity. However, in order to account for such trades the quantities of different commodities still need to be made comparable by denominating their values in some common unit of account. The flows are thus expressed in terms of the value of one commodity— the so-called numeraire good—whose price is taken as fixed. For this reason, CGE models only solve for relative prices."
>
> (ibid: 5)

It is natural then to organize these accounting rules into a social accounting matrix (SAM). The SAM can be seen as a data base, as a logical framework for economy-wide economic models, and as an extension of Leontif's input-output accounts, filling in the

links in the circular flow from factor payments to household income and back to demand for products (Robinson, 2006; Robinson et al., 1989). In a simple CGE model, three equations form the building blocks of the model: an equation capturing the representative agent's demand for some amount of commodities, an equation of producer's demand for intermediate inputs, and a final equation of producer's demand for factor inputs. The three equations are substituted into the accounting identities that govern clearance of the Walrasian model and, hence, guide the organization of the SAM.

As Sue Wing notes, even in a simple CGE the system of equations is still highly non-linear with the result that there is no closed form solution. Thus, the model must be calibrated to the aggregate level data contained in the SAM (giving rise to the "C" in CGE) (Sue Wing, 2004). Calibration to the SAM generates a numerical optimization problem that can be solved using optimization techniques. Examples of CGE applied to international trade and developing countries can be traced back several decades. For examples see Cockburn et al (2007), Birur et al (2008), Lofgren et al (2002), Martin and Winters (1996), Shields and Francois (1994), and Shoven and Whalley (1992).

Benefits of CGEs come from its simplicity, aggregative properties, and tractability. Although orthodox CGE models can easily amass several hundred lines of code, their relatively simple algebraic foundations lead to a certain degree of analytical tractability and micro-macro consistency. As was described above, most CGEs have at their core only a few equations originating from the national income account identities. Thus, the modeling strategy has the advantage of being able to capture the general equilibrium impacts of different economic events while tracking the partial equilibrium changes at the market, or sectoral, level; this hints at why orthodox CGE models are often

referred to as micro-macro models. Indeed, no macro-counterfactual exists when a shock truly impacts every agent in the system. This eliminates the possibility for standard regression analysis to capture this non-existent variation. Simulations within this general equilibrium framework also enjoy a certain degree of analytical tractability that is less present in a model that is more sensitive to path dependence or initial conditions. Primary applications are of standard CGE models are aimed at identifying the sectoral or household group winners and losers of macroeconomic changes such as changes in trade or tax policy.

There is one great limitation of standard CGE models concerning the identification of winners and losers of any given policy, however. CGEs based on representative firm and household groups only have the ability to simulate changes that occur *between groups* and not *within groups*. This provides a severe handicap for stand alone CGEs to properly simulate changes in inequality and poverty distributions. Alternatively stated, CGE simulations are not able to identify individual winners and losers, only the relative changes in group status. Savard (2004) points out that "it is quite likely, that the use of a representative agent model, which is not able to generate intra-group variance, would lead to biased conclusions" (Herault, 2006). The impact of within group inequality upon the entire distribution of well-being is an important component of inequality. Mookherjee and Shorrok (1982) provide an early discussion of its relevance; Cowell (2011) and Robilliard et al. (2008) provide recent treatments of measurement discontinuities across and within group inequality measurement.

The response to CGEs inability to capture the within group dynamics and their resultant distributional impacts has lead to the linking of CGE models with

microsimulation models. The latter MSMs have at their core structural features to capture heterogeneities in endowments, behavior, and responses to stimuli. Before reviewing the linked CGE-MSM literature, an overview of microsimulations themselves is first presented.

*Micro Simulations*

In this paper, the term micro simulation (with a space between) refers to general computer simulations which models at the individual-level. This is to be distinguished from a particular type of individual-level model of MSM, or microsimulation (without the space). Micro  simulations come in a variety of forms such as cellular automata (CA), agent-based models (ABM), and microsimulations models (MSM). Brief descriptions of, and references to, CA and ABM will be introduced as warranted, however the analysis will primarily center on MSMs.

The original concept of MSM was first put forth by Guy Orcutt in 1957. Motivated by capitalizing on a growing knowledge about decision-making units, he described the most distinctive feature of this type of model as the key role played by actual decision-making units of the real world such as the individual, household, or firm (Orcutt, 1957). The key roles played by the individual agents are governed by a set of rules (transition probabilities) leading to simulated changes in state and behavior (Williamson, 2007). In describing the transition probabilities of MSM, Williamson in the first issue of *The International Journal of Microsimulation* states,

...these rules may be deterministic (probability =1), such as changes in tax liability resulting from changes in tax regulations, or stochastic (probability <=1), such as chance of dying, marrying, giving birth or moving within a given time period. In either case the result is an estimate of the outcomes of applying these rules, possibly over many time steps, including both total overall aggregate change and, crucially, the distributional nature of any change. Given the emphasis on changes in distribution, microsimulation models are often used to investigate the impacts on social equity of fiscal and demographic changes (and the interactions)."

(ibid: 1)

It is the transition probabilities that distinguish MSM from the above CA and ABM models. Williams goes on to describe all three simulation methods, in their originally conceived forms, as representing three corners of a continuum of individual level modeling approaches (illustrating three corners of a triangle) (ibid: 1). The focus in CA and ABM is on spatial and behavioral interaction, respectively; the focus of MSM is on transition probabilities defining behavior[16]. As MSM takes on more behavioral and spatial interaction of agents, as CAs add a growing range of individual attributes and start to incorporate spatial behaviors, and as ABMs add both space and fiscal/demographic characteristics to their agents, the three approaches move towards a common ground.

MSMs can be either static or dynamic. Herault states that static models are designed mainly for short-term analysis and dynamic models more for medium-to long-

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[16] For seminal work on ABM see Axtell (2000) and Tesfatsion (2000).

term analysis (Herault, 2006). Static MSMs produce a set of cross-sectional counterfactuals whereas a dynamic MSM would produce a counterfactual panel across agents and through time. O'Donoghue provides a comprehensive review of the methodological issues associated with dynamic MSMs which includes questions such as: single versus multi-cohort modeling, continuous versus discrete time, open versus closed model, and whether to incorporate behavioral responses (O'Donoghue, 2001).

As mentioned above, static MSMs are often credited as being conceived by Orcutt in his 1957 paper titled, "A New Type of Socio-Economic System". Also recall that a CGE model's explicit assumption of fixed and exogenously determined within group behavior leads directly to an implicit aggregation of individual behaviors. That is to say, the representative agent embodies the typical behavior of all individuals (Orcutt, 1957). In Orcutt's 1957 model, he proposes the following alternative to with respect to aggregation of behaviors,

"Predictions about aggregates will still be needed but will be obtained by aggregating behavior of elemental units rather than by attempting to aggregate behavioral relationships of these elemental units."

(ibid: 117)

Orcutt's words predate a fundamental challenge of CGE models and provide a now feasible alternative. Instead of homogenizing and aggregating behavior, the idea is to aggregate outcomes of heterogeneous behavior. MSMs are currently used as stand alone models, indeed as Orcutt envisioned, to increase the range of predictions that are feasible,

to facilitate and improve hypothesis testing, and to furnish guidance in selection of research efforts (ibid: 121). However, the defining characteristic of aggregating outcomes of behavior rather than behavior itself is what makes MSM an ideal tool to bring light into CGEs black box of within-group dynamics.

How do MSMs work? In the language of Bourguignon and Spadaro, the MSM approach in economics imitates the experimental approach in biology or psychology – with one major difference. Experimentation in biology and psychology compares the observed state and behavior of agents before and after a change to their environment. In economics, the simulation bears only on the change in the environment and on "imputed" changes in behavior or welfare. The comparison is thus made ex-ante rather than ex-post (Bourguignon and Spadaro, 2006). Continuing to borrow from Bourguignon and Spadaro, the common structure of MSMs for redistribution analysis comprises three elements: a micro data set, the rules of the policies to be simulated, and a theoretical model of the behavioral response of agents. That latter being the greatest source of divergence across analyses. An MSM without any behavioral component is known as an arithmetical model. Consumption and labor supply responses dominate the focus of most behavioral MSMs (ibid: 79).

Behavioral responses of individuals are captured by the estimation of a structural econometric model for the cross-section of households in the survey being used or through the calibration of a behavioral model with some predetermined structure. There are three steps to the behavioral MSM. First, the logical economic structure of the model

being used must be specified. Next, the model must be estimated or calibrated. Lastly, counterfactuals are simulated for a given policy change (ibid: 85)[17].

Given the short-comings of CGE analysis and the complementary nature of MSMs, it is hardly surprising that the two have merged over the past decade as a tool to analyze the distributional impacts of macroeconomic events. Up to this point, the level of detail describing the nature and mechanics of both CGE and MSM strategies has been broad, the next section dives in to greater detail with respect to the structure and applications of a linked CGE-MSM framework.

## 2.2 CGE-MSM

Linked CGE-MSMs enable different questions to be asked about the poverty and distributional consequences related to policy changes. It allows for assessment of the micro effects (i.e. changes in the earnings structure, labor force participation behavior, and socio-demographic structure of the population) of macroeconomic policy changes and investigation of the second round effects (Bourguignon et al., 2008b; Bourguignon et al., 2001). As mentioned above, no micro-level counterfactual exists to economy-wide changes rendering traditional micro techniques less useful. Examples of this might be changes to trade policy, exchange rate devaluations, or changes in monetary/fiscal policy in which every individual is exposed to. Additionally, micro techniques lack the ability to capture the macro feedback effects of micro interventions, such as a conditional cash transfer (ibid: 3). This section first describes the general CGE-MSM model in detail and

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[17] Creedy and Duncan (2002) provide an in depth survey of technical issues and applications of behavioral MSMs.

then elaborates on the different strategies available for linking the two. It is followed by a discussion of the current state of CGE-MSM modeling within the discipline.

*Origins and General Framework*

Columbo (2008) identifies the first attempts to link microsimulation models to CGEs in order to account simultaneously for structural changes, general equilibrium effects, and the impacts on households' well-being as having been taken on by Decaluwe et al (1999b) and (1999a), Cogneau and Robilliard (2001) and (2004), Cockburn (2001), Bourguignon, Robilliard, and Robinson (2003), and Savard (2003). All of these initial models, as well as more recent applications, differ across four methodological dimensions: the type of macro-micro model, the extent of integration, the degree of behavioral response, and the time frame of analysis. The two greatest sources of variation in this literature stem primarily from the extent of integration and degree of behavioral responses.

The type of macro-micro model chosen depends on the nature of the research question at hand. Most macro-micro applications fall into the CGE-MSM category in which the CGE is that of the Walrasian type described above. Modest deviations come in the form of Keynesian frictions among wages, prices, and unemployment. An example of a CGE-MSM applied to South Africa is that of Herault (2006). In that paper, Herault follows the CGE structure of Thurlow and van Seventer (2002) describing it as a neoclassical-structuralist model (see also Dervis et. al. (1982) for the original CGE model).

Models differ substantially on the extent of integration of the micro model within the macro framework. The details of integration techniques (or linkages) are the subject of the next section, but an overview is provided here for continuity. Macro CGEs that are calibrated to aggregate data have to be linked to the MSM which relies on household (or other micro-level) data. The degree of integration is of great importance. For example, the simplest linkage would be to keep the CGE and MSM completely separate, but linked by only a few linking aggregate variables (LAVs) such as wages, employment, and prices. In this top-down approach, the CGE is calibrated to a baseline and the MSM is calibrated to replicate that baseline. Once a policy change has been simulated and the CGE produces a counterfactual, the MSM is used to reproduce the new set of counterfactual linking variables. The secondary MSM simulation without feedback to the CGE gives rise to the term top-down. This is contrasted with the top-down/bottom-up approach in which feedbacks are allowed to re-enter the CGE forcing multiple rounds of simulations until the two models converge. A third level of integration is termed fully integrated in which the MSM is embedded in the CGE as opposed to being linked by LAVs and simulated separately.

Applications of linked CGE-MSMs vary greatly by their level of behavioral response of agents. The nature and variety of behavioral responses built into MSMs is perhaps the defining feature across models. Indeed, in the preliminary framework to be outlined in section three, the disparities in capabilities within labor market opportunities will in part govern the behavior of agents in the MSM. An a-behavioral model is described as an arithmetic MSM. Beyond arithmetic and behavioral MSM, Vos and Sanchez (2010) provide an example of a non-parametric MSM which relies on a

randomized transition process to proxy a behavioral response. The benefit of this approach is its analytical simplicity.

The final dimension in which models differ on is the time frame of the analysis. CGE models, as well as MSMs, can be estimated or calibrated using cross-sectional or panel data. Annabi et. al. argue that dynamic CGE-MSMs have a greater capacity to analyze growth effects on poverty and inequality (Annabi et al., 2005). Harding had this to say in regard to the challenges of dynamic microsimulation modeling,

> "This review has made it clear that the construction of a reliable dynamic population microsimulation model for use in social policy formulation is a very demanding multi-year project. Indeed, the degree of effort involved seems more akin to the large scale multi-million dollar projects that occur in the natural sciences. In the social sciences, such large projects are relatively unusual — and many social scientists would not have extensive experience in managing projects of this scale and time span.
>
> - Harding (2007)

Given the variation across CGE-MSMs, there are also a number of common threads that allow for a general discussion of how they work. Most consider the vital links between the macro CGE and individual welfare to be strongest via factor markets. When considering the distributional impacts of a macro policy change, only the between group effects are simulated in a CGE. Thus, the primary contribution of the MSM is to view the entire distribution of well-being, usually in terms of income and hence the role of factor markets. Occupational choice models are often the defining feature of the

behavioral MSMs. That is to say, when a CGE simulates relative changes in sectoral employment, the MSM is employed to address the question of which households are able to move into (out of) the expanding (contracting) sectors. Given the choice of occupations across households (with potential frictions and constraints built in), the earnings of each agent (i.e. household or household member) can then be estimated to match the new CGE counterfactual and, thus, giving a description of how the entire distribution of well-being has changed from the benchmark to the simulation.

Herault's (2006) CGE-MSM model of South Africa mentioned above provides a description of one choice of MSM structure,

"...the model simulates the new labour market choices after changes in individual characteristics, such as earnings (due to macroeconomic changes as estimated in a CGE model), or in the coefficients of the model. The simulation is carried out for all individuals aged between 15 and 65 years. Incomes are simulated for each of the 26,000 households, representing 104,000 individuals, surveyed in the 2000 IES and LFS. The underlying selection model, which drives the behavioral responses, assigns each individual from the working-age population to one of the five labour market categories distinguished in the model: inactive, unemployed, subsistence agricultural worker, informal worker and formal worker. This model takes the potential earnings in these categories into account. A regression model is estimated to predict earnings in each category. Finally,

the results of both the selection and the regression model are used to compute household real net incomes."

The macro CGE model used by Herault is a standard model put forth by Thurlow and van Seventer (2002) and Dervis et. al. (1982). The model includes 43 sectors and four factors of production. The informal sector is not represented in the model due to the lack of data regarding its size and composition. The model is simulated using three different closure scenarios: two Keynesian and one Neoclassical (See Herault (2006), table six, page 47 for detail). The CGE and MSM are linked in a top-down, sequential fashion. First the CGE model is run, followed by a second step in which the changes in some selected variables are passed on to the MSM model (ibid: 28). Three sets of variables provide the linkages (i.e. are the LAVs): prices, returns on capital and labour, and employment levels. I now turn to a more detailed discussion of linkages and degrees of integration between CGE-MSMs.

*Linking Strategies*

Colombo (2008) provides a comprehensive survey of the three primary categories of liking strategies in which this section draws heavily from. All three are independent of the nature of behavioral responses of agents. That is to say, a top-down (TD), top-down/bottom-up (TD/BU), or an integrated approach could or could not contain behavioral elements in the MSM. The fundamental issue is that after the CGE simulation sets targets for a MSM (in the cases of TD and TD/BU models) the researcher must

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decide how to find a new set of parameters from the MSM that can communicate with the CGE.

The linking strategy of the integrated approach is somewhat different in its capacity to capture the complexities of household and individual behavior. Following Colombo's description, this strategy within this approach is basically to substitute in micro-data from real household's in place of representative household groups in a CGE framework. The advantage is that the modeling hypotheses of the macroeconomic model remain unchanged. Starting with a SAM containing aggregate level data, the household data is scaled up to the macroeconomic level to get an estimate of the population values. Next, it is necessary to reconcile the household data with the accounts contained in the SAM. How this adjustment is made is open to debate, but any method contains the drawback of the loss of the original data structure. A re-balancing of the SAM so the rows are equal to the columns is needed as well, and is not without tradeoffs in terms of choice of methods. The drawback of this strategy is that it is often difficult to include the behavioral equations in a CGE framework alone. That is to say, without a formal microsimulation model embedded within the CGE occupational choices, household dynamics, and heterogeneous behaviors are often left out of the model structure. Thus, this type of CGE which essentially includes as many representative households as there are in reality cannot predict which particular individuals will benefit or lose out given a change in macro employment (ibid: 5-7). The earliest example of the integrated approach is of Decaluwe et al (1999a). Cockburn (2001) provides a slightly more recent example applied to Nepal. Inclusion of explicit selection models via microsimulations is what differentiates the integrated approach from the TD or TD/BU approaches.

The most common way to link a CGE with a MSM is the top-down (TD) or sequential method. The MSM to be linked can contain behavioral elements or not (the latter being referred to as arithmetic or non-parametric). Again following Colombo's 2008 comparison, the basic TD idea is to develop separately a MSM, and then to run the simulation on the basis of changes in consumer/producer prices, wages, and sectoral employment levels as predicted by the CGE model using the two frameworks in a sequential way (Colombo 2008: 7)[18]. Figure one depicts the sequential structure and linking aggregate variables (LAVs) used in a generalized top-down CGE-MSM.

The primary difficulty in the TD approach is ensuring consistency between the two models estimated at different levels of aggregation. Colombo suggests that one may introduce a system of equations to ensure the achievement of consistency between the two models. In practice, this consists in imposing the macro results obtained in the CGE model onto the microeconomic level of analysis (ibid: 18). Colombo goes on to describe the following constraints imposed to ensure consistency,

1. changes in the commodity prices...must be equal to those resulting from the CGE model;

2. changes in average earnings with respect to the benchmark in the micro-simulation must be equal to changes in the wage rate obtained with the CGE model;

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[18] Colombo's review relies heavily on Bourguignon (2003), citing it as the seminal TD framework in which others have followed.

3. changes in the return to capital of the micro-simulation module must be equal to the same changes observed after the simulation run in the CGE model;

4. changes in the number of wage workers in the micro-simulation model must match those observed in the CGE model.

(ibid: 18)

After the above constraints are expressed in equations relating to variables coming from both the CGE and the MSM, it is common to impose the equalities by restricting changes in the parameters of the selection and regression models. In the language of Colombo and Bourguignon (2003), the justification for this choice is that it implies neutrality of the changes, that is, changing the intercepts...just shifts proportionally the estimated wages of all individuals, without causing any change in the ranking between one individual and the other (Colombo 2008: 19).

The top-down/bottom-up (TD/BU) approach was first developed by Savard (2003). It allows overcoming the problem of the lack of consistency between the micro and macro levels of the TD approach by introducing a bi-directional link between the two models (Colombo 2008: 20). This approach has the advantage of taking into account feedback loops between the two simulations. The basic idea is that a CGE simulates a particular change that is fed into a MSM, much like the TD approach. The difference is that instead of simply scaling up the MSM results to be consistent with the CGE simulation, the actual results are feed back into the CGE. Bourguignon et al (Bourguignon et al., 2008b) describe the difference as,

"the one-step sequential process from the top macro model to the bottom micro model is repeated iteratively and in a bidirectional way; that is, after the first shock, a subset of the LAVs is recalculated by aggregation from the micro data and transmitted to the macro model. The process continues iteratively until convergence is reached."

Savard (2010) provides a recent example of the TD/BU approach applied the Philippines asking how infrastructure investments funded through foreign aid can contribute to Dutch disease.

*2.2.3 Macro-Micro Simulations: Remaining Challenges*

Bourguignon et. al. (2010) describe the remaining challenges of macro-micro modeling as falling in to three categories. The first issue is that of data quality. Although more and more household surveys in developing countries are available, there remain questions on surveying techniques and data quality. As Deaton (2005) has described, and the consistency issues outlined above underscore, the quality of micro and macro data are integral to establishing a consensus on how the macro and micro models are able to communicate. Second, there remains a need to better model an economic system's evolution and the phenomena of growth, government, and behavior at the macro (or more broadly the systems and institutions) level.

The final challenge that they outline is the issue of model complexity. As more realistic behavior and interaction is incorporated into the models, there is risk of reduced tractability and a rise in sensitivity to initial conditions. The question remains of how best

to create models that have stronger forecast value (rather than simulation value) while retaining a sufficient degree of tractability.

## 3. Preliminary Framework: A Top-Down Behavioral CGE-MSM

The World Bank's focus on a post-stabilization phase of development policy puts equality of access to opportunities at the heart of a pro-poor criterion. [19] Increases in opportunities for the poor are only one side of this coin; recognition and removal of binding constraints that prevent some individuals from taking full advantage of the existing opportunities is the other. The aim of this section is to set up a model of a stable, and theoretically predictable, macroeconomic evolution in the export sector and to ask if this natural course is likely to be pro-poor in an economy where heterogeneous constraints to existing opportunities are binding for many.

It was put forth in the prior section that CGE models that rely on representative household groups cannot account for the within group responses that may significantly impact the distribution of well-being. Thus, the total distribution of well-being cannot be modeled within a CGE framework alone. In this section I outline a preliminary framework for a behavioral, top-down CGE-MSM in which labor market frictions are unique and thought to be partly a function of individual differences in capabilities of taking on new economic opportunities. The macroeconomic shock is a change in the export bundle that evolves in a manner consistent with production constraints and self-

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[19] In Bourguignon et al. 2008a, the authors state that the benefits of a stable macroeconomic environment are undisputed and, for many developing countries, the main challenges for macro policies have shifted from a stabilization phase...to a post-stabilization phase where governments are engaged in efforts to improve efficiency and quality of public spending, taxation, and economic management.

discoveries in the export sectors. The benefit of this type of shock is that the simulation models a theoretically plausible evolution of factor demands via the export industries. The principal aim is to identify which individuals stand to benefit from this evolution when disparities in capabilities are explicitly modeled.

Given that the nature of the research question centers on the role of capability deprivations in shaping the distribution of poverty, the defining features of the model are embedded in the behavioral dimensions of the microsimulation model. Therefore, greater attention to detail is given to this level of the model relative to the somewhat standard CGE model. In the next section, the behavioral microsimulation model is discussed in detail followed by a brief sketch of the macro CGE model and the linking strategy. The paper concludes with a discussion of the range of research questions the model can potentially address.

## 3.1 The Behavioral MSM

As outlined generally in sections 2.1 and 2.2 above, the behavioral dimensions of most MSMs are embedded in a selection or, synonymously, an occupational choice model. The MSM put forth here is no different in that the addition of constraints to taking on new economic opportunities can be incorporated into the model in the form of frictions in an individual's labor market participation choice. The model closely follows a now seminal structure originally put forth by Alatas and Bourguignon (2000) and (2005). For additional detail and applications regarding the original model see also (Ferreira et

al., 2008; Bourguignon et al., 2003; Herault, 2006; Colombo, 2008; Robilliard et al., 2008).

Following the above authors, the system of equations that make up the MSM can be divided into two primary categories: a set of behavioral equations to be estimated and a set of arithmetical computations. At the core of the behavioral model is the first category consisting of a regression model of individual earnings and a model that determines the occupational choices made by individuals given their observed characteristics. The latter category of arithmetical computations defines household-specific price indices, incomes, and consumption levels.

Following more the notation and specification of Bourguignon et al. (2003: 6-11), individuals, i, residing in household, m, with k working age members, can be divided into a number of labor market segments subscripted by the functional notation, g(mi). Labor markets may be segmented by gender, skill, and population density/region. Individuals within a household are further categorized into demographic groups, h(mi), such as household head, spouse, male children, and female children. Households as a whole are segmented into those that are involved in agricultural production and those who are not. As will be seen more clearly below, the labor market, demographic, and agricultural segmenting allows for the parameters of the household income generation and occupational choice models to vary across segments.

With the above notation, the microsimulation model is summarized in the following set of six equations,

$$Y_m = 1/P_m \left[ \sum_{i=1}^{k_m} w_{mi} * IW_{mi} + y_m * \text{Ind} (N_m > 0) + y_{0m} \right] \qquad (1)$$

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$$\text{Log } w_{mi} = \alpha_{g(mi)} + x_{mi} * \beta_{g(mi)} + v_{mi} \tag{2}$$

$$\text{Log } y_m = \gamma_{f(m)} + Z_m * \delta_{f(m)} + \lambda_{f(m)} * N_m + \eta_m \tag{3}$$

$$P_m = \sum_{i=1}^{K} s_{mk} * p_k \tag{4}$$

$$IW_{mi} = \text{Ind} \left[ a^w_{h(mi)} + z_{mi} * b^w_{h(mi)} + u^w_{mi} > \text{Sup} \left( 0, a^s_{h(mi)} + z_{mi} * b^s_{h(mi)} + u^s_{mi} \right) \right] \tag{5}$$

$$N_m = \sum_{i=1}^{k_m} \text{Ind} \left[ a^s_{h(mi)} + z_{mi} * b^s_{h(mi)} + u^s_{mi} > \text{Sup} \left( 0, a^w_{h(mi)} + z_{mi} * b^w_{h(mi)} + u^w_{mi} \right) \right] \tag{6}$$

Equation (1) is an accounting identity that defines real total household income, *Ym*, as the sum of the wage income of its members, profit from self-employment, and exogenous non-labor income, $y_{0m}$. $IW_{mi}$ stands for a dummy variable that is equal to one if the household member is a wage worker and zero otherwise. As with Bourguignon et al.'s initial specification, it is implicitly assumed that all wage workers are employed full-time (ibid: 7). This is an issue that can be addressed in future specifications. Ind is a dummy equal to one if there is at least one member of the household engaged in self-employment. Total income is then deflated by a household specific consumer price index, $P_m$, which is derived from the observed budget shares, $s_{mk}$, of household m and the price, $p_k$, of the various consumption goods, *k*, in the model (equation 4) (ibid: 7).

Equation (2) and (3) define the log of individual wage income, *w* and *y*, respectively. The vector x contains personal characteristics of the individual and the vector Z contains household characteristics. The residual terms, as with Bourguignon et al. (2003), capture unobserved earnings determinants. As mentioned above, the subscripts

of g(mi) and f(m) segment the labor market and household agricultural activities, respectively. This allows for the coefficients associated with x and Z to vary across the segments, but remain common to all individuals and households within the same segments. The vector x may contain age, education, and other individual characteristics. The vector Z may contain indicators of household structure, age of the household lifecycle, or other household level characteristics. $N_m$ is the number of household members involved in the entrepreneurial activity.

Equations (5) and (6) capture the behavioral essence of the MSM and are the occupation choice equations. Continuing with Bourguignon et al.'s specification, each individual has to choose from three alternatives: being inactive, being a wage worker, or being self-employed.[20] Equation (5) states that IW, the wage worker dummy, is equal to one so long as the utility of wage employment is greater than the utility of inactivity and self-employment. The utility of inactivity is arbitrarily set to zero in order to identify the model. Estimation of equation (5) gives a probability of individuals transitioning to a new occupation after a macroeconomic shock that will come from the CGE model simulation.

Equations (1) and (2) can be estimated with standard regression techniques, and equations (5) and (6) via multi-nomial logit estimation.

The set of individual and household determinants of occupational choice, z, is a natural place to include capability constraints. Notice that the coefficient vector on z differs across individuals of different household demographic types. That is to say, if z were to contain proxies for capability disparities of time deprivation and child dependency ratios, the specification of equation (5) allows for different impacts of those characteristics across household heads, spouses, male children and female children. Said

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[20] In their model, the possibility of being both self-employed and a wage earner is easily accommodated.

another way, the extent to which time deprivations and dependency ratios are binding is allowed to differ across the household demographic types. These heterogeneous coefficients impact individual probabilities of occupational transition in response to a macro shock, thus altering the household distribution of income of equation (1). It is equation (1) that will ultimately be used to trace out the changes in the entire distribution of well-being, both within and between representative groups at the macro level.

In order to summarize the basic elements of the benchmark microsimulation model, it may be clearest to repeat Bourguignon et al.'s (2003) description,

"Overall, it defines the total real income of a household as a non-linear function of the observed characteristics of household members ($x_{mi}$ and $z_{mi}$), some characteristics of the household ($Z_m$), its budget shares ($s_m$), and unobserved characteristics of the household ($\eta_m$) or household members ($v_{mi}$, $u^w_{mi}$, and $u^s_{mi}$). This function depends on five sets of parameters: the parameters in the earning functions ($\alpha_g$ and $\beta_g$), for each labor market segment, $g$; the parameters of the self-employment income functions ($\gamma_f$, $\delta_f$ and $\lambda_f$) for the farm or non-farm sector, $f$; the parameters of the occupational choice model ($a^w_h$, $b^w_h$, $a^s_h$ and $b^s_h$), for the various demographic groups $h$, and the vector of prices ($p$). It will be seen below that it is through a subset of these parameters that the results of the CGE part of the model may be transmitted to the micro-simulation module."

(ibid: 7)

The simple model describing occupational choice, individual earnings, and household income is only a starting point for a realistic MSM that includes capability constraints. The issues of multiple occupational strategies, under-employment, household structure, and other labor market frictions are yet to be addressed in any degree of detail. However, the fact remains that the MSM assigns occupational choices based on actual individual level data, and that the simple model outlined above has the capacity to easily assess the impact of macro shocks on changes in the distribution of income through $z_{mi}$, $b^s_{h(mi)}$, and $b^w_{h(mi)}$ when opportunity and capability disparities are present.

The MSM outlined above can be linked in a sequential fashion with a variety of macro models. The linking aggregate variables need only to be reduced down to a price, employment, and wage vector, and thus any number of macro structures can generate changes in them. This fact, combined with the observation that the questions of interest concern the micro-behavioral heterogeneities already outline above, suggests that a brief overview of the macro CGE may be sufficient for the current preliminary framework. After describing the nature of the macro model and its shock in the next section, the paper then provides more detail on the linkages between the CGE and MSM.

## 3.2 The Macro CGE Model

One distinct advantage of a sequential, or top-down, linking strategy is the relative independence of the top and bottom models. In practical terms, a host of macro models could be simulated and linked to a variety of microsimulations. As will be shown in the next section, the linking aggregate variables (LAVs) in this benchmark model

come from a vector of prices, employment, and earnings. A focus on these three LAVs leaves the macro model's closure open-ended, to be guided by the particular application and research question. For this preliminary framework, the CGE will be that of a Walrasian, orthodox closure based on a multi-sectoral SAM. Choice of the number of sectors is independent of the microsimulation model and is primarily limited in scope by available data.[21] Section 2.1.1 above describes a standard CGE framework and it will not be repeated here. What is more relevant is the nature of the shock to the CGE that will be applied for this particular research question.

Following the pioneering work of Hausmann and Rodrik (2003), in the presence of uncertainty about what a country can be good at producing, there can be great social value in discovering the costs associated with expanding domestic activities. This has lead to Hausmann et al (2007) and Hidalgo et al. (2007) to demonstrate that different export bundles provide different impacts on growth, but it is difficult for a nation to simply leap to new export bundle that has higher value in terms of future growth. There is, in other words, an evolutionary path toward exporting higher value goods and services that may follow a predictable (or perhaps plausible) path. Thus, one could ask: given this evolution of the export sector, which households are in a position to benefit or lose out on the potential gains? In particular, this analysis is interested in finding out how significant the role of capability disparities is in influencing the distribution of winners and losers.

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[21] For example, data on the informal sector is rarely available.

## 3.3 Linking the CGE to the MSM

In order to link the two models in a sequential fashion, the parameters of the microsimulation must be reconsidered. The model described in section 3.1 had the following set of coefficients, $(\alpha_g, \beta_g, \gamma_f, \delta_f, \lambda_f, a^w_h, b^w_h, a^s_h, b^s_h)$, and a set of observed and unobserved individual and household characteristics, $(x_{mi}, z_{mi}, Z_m, s_m, v_{mi}, \eta_m, u^w_{mi}, u^s_{mi})$. The linking strategy is to associate changes coming from the CGE model with changes in all of the coefficients above. This new set of simulated coefficients, in combination with the originally observed household characteristics, now permit computation of the new occupational choices, earnings, and resultant household incomes. However, consistency between the two models needs to be ensured. This requires an additional set of constraints to guarantee the MSM output is of the exact same magnitude as the CGE output. For brevity, the additional constraints will only be described here[22]. Similar to section 2.2.2, the consistency requirement can be ensured by the following constraints. First, changes in average earnings with respect to the benchmark in the microsimulation must be equal to changes in wage rates obtained in the CGE model for each segment of the wage labor market. Second, changes in self-employment income in the microsimulation must be equal to changes in informal sector income per worker in the CGE model. Third, changes in the number of wage workers and self-employed by labor market segment in the microsimulation model must match those same changes in the CGE model. Lastly, changes in the consumption price vector, $p$, must be consistent with the CGE model (Bourguignon et al. 2003: 9).

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[22] See Bourguignon et al. (2003: 9) for the consistency equations using similar notation.

This consistency must be met both in the benchmark case and after the simulated shock to the CGE. According to Bourguignon et al, the calibration of the CGE model, or the SAM behind it, is done in such a way that the preceding four sets of consistency requirements are satisfied in the benchmark simulation (ibid: 9). For consistency after the simulation, the observed and unobserved individual and household characteristics remain unchanged by their construction. That is, the set, $(x_{mi}, z_{mi}, Z_m, s_m, v_{mi}, \eta_m, u^w_{mi}, u^s_{mi})$, is unchanged from the benchmark to the simulation. The consistent solution then is to identify a new set of parameters, $C = (\alpha_g, \beta_g, \gamma_f, \delta_f, \lambda_f, a^w_h, b^w_h, a^s_h, b^s_h, p)$, of the MSM such that the preceding set of constraints will continue to hold for the new set of macro variables generated from the CGE simulation (ibid: 9). Notice that the pricing vector, $p$, is included in this set. The selection of a new parameter is trivial for $p$, as it is simply passed directly from the CGE with no need to make any methodological choice of scaling. The other parameters do require a methodological choice to ensure consistency, however; this is necessary due to the fact that a number of possible sets of parameters may exist that result in consistency. Continuing to follow Bourguignon et al (2003) and others, a common choice is to restrict changes in C to the intercepts of all earning, self-employment income, and occupational criterion functions – that is changes in $(\alpha_g, \gamma_f, a^w_h, b^w_h, a^s_h)$ (ibid: 9).

> "The justification for that choice is that it implies a *"neutrality"* of the
> changes being made with respect to individual or household
> characteristics. For example, changing the intercepts of the log earning
> equations generates a proportional change of all earnings in a labor-market

segment, irrespectively of individual characteristics—outside those that define the labor-market segments, that is skill, gender, and area. The same is true of the change in the intercept of the log self-employment income functions. It turns out that a similar argument applies to the criteria associated with the various occupational choices. Indeed, it is easily shown that changing the intercepts of the multi-logit model implies the following neutrality property. The relative change in the *ex-ante* probability that an individual has some occupation depends only on the initial ex-ante probabilities of the various occupational choices, rather than on individual characteristics.

...The micro-macro linkage described by the preceding system of equations may be seen as a generalization of familiar grossing up operations aimed at correcting a household survey to make it consistent with other data sources – e.g. another survey or a census or national accounts."

(ibid: 10-11)

## 3.4 Benefits and Limitations of the Simulation Strategy

Regarding the question of who stands to benefit from natural evolutions in the export sector, the model put forth can estimate how large of a role capability constraints might play across demographic segments. Are household heads, spouses, male children, or female children more constrained by the amount of time spent gathering wood or

water? How do differences in intra-household constraints translate in to household well-being and economy-wide distributions of income? Benefits of a top-down, behavioral CGE-MSM center on its flexibility to accommodate a range of scenarios that might impact the distribution of well-being. However, it is not without significant methodological challenges to achieve consistency, to deal with missing data, or to address evolutionary dynamics of any economy-wide system (such as growth, institutional change, and governance).

Since in a top-down CGE-MSM the two models are kept theoretically separate, there is little limitation on the degree of complexity or range of theoretical structures on either level. This has great appeal for a researcher interested in addressing empirical development questions that take place in structurally different macro- and micro-environments. For example, it is possible to augment the benchmark framework above to step away from Walrasian closures of the CGE and to include Keynesian or other closures of the macro system. As long as the linking aggregate variables are available to feed into the MSM, the structural features of the macro model are independent of the behavioral features of the MSM.

Though micro-data sets are ever more common, there are limits to the amount of complexity one can empirically observe concerning behavioral responses. Behavior that is institutionalized may evolve over time or space in which static rules of occupational choice are far from constant. Similarly, any marriage of micro- and macro-data that have been collected in inconsistent ways will continue to present consistency challenges. However, linking CGE models with MSMs appear to have significant policy and academic traction as evidenced by strong associations among referenced authors and The

World Bank's Development Research Group (among other international policy institutes).

A final challenge for macro-micro modeling is addressing how large the macro structure can be perceived. As overviewed in section 2.1.1, an institutional perspective of a socially embedded economy might argue that the macro-micro distinctions are misperceived in so much as there are larger institutional forces that are implicitly ignored (or held constant at best) in this narrow framework. It remains a question as to what the scope of the top model should be and if it can be linked in any relevant manner to a bottom model when the concepts of layers and sequencing are themselves debatable.

## 4. Summary and Concluding Remarks

This paper put forth a preliminary framework of a computable general equilibrium (CGE) linked in sequential fashion with a behavioral microsimulation (MSM). The aim was to present a benchmark model that can accommodate a range of research questions regarding the impact of macroeconomic changes on micro-level welfare and its distribution. An example is the question of who stands to benefit from the natural evolution of the export sector in a developing country when occupational choices of individuals are, in part, a function of capability disparities.

A host of macro and micro simulations were reviewed with particular emphasis on standard CGEs and behavioral MSMs. It was argued that the primary benefit of a top-down (i.e. sequential) CGE-MSM is that the range of model structures can be quite large due to the fact that the bottom MSM is not fully integrated within the top CGE.

Additionally, the two modeling strategies complement one another in their ability to asses the complete distributional impacts of macro changes. A CGE model alone is only capable of describing changes in between group well-being, where as the microsimulation uses data from real individuals and households to fill this gap. At the current stage of research, a linked CGE-MSM lacks the ability to encompass evolutionary processes of institutional change, requires a relatively large amount of data at different levels of aggregations, and faces trade-offs between model complexity and tractability; however, it provides an important advancement of CGE modeling by aggregating outcomes of behavior rather than homogenizing and aggregating behavior itself.

A simple behavioral MSM was put forth in section three that can easily asses how capability deprivations, such as high child dependency ratios and time deprivation stemming from subsistence activities, heterogeneously impact formal labor market participation choices across individuals. Thus, macroeconomic changes can be simulated in the top CGE model which impacts potential returns to individuals and households conditional on their behavioral responses. Both the between and within group changes in the distribution of well-being can now be assessed in this linked framework.

Now that the preliminary framework has been outlined, the next steps include addressing the specific structure of the macroeconomic CGE, the extent of capabilities and behavioral responses to be modeled, and the availability of data.

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**Figure 1: Top-Down CGE-MSM** *from Colombo (2008)*
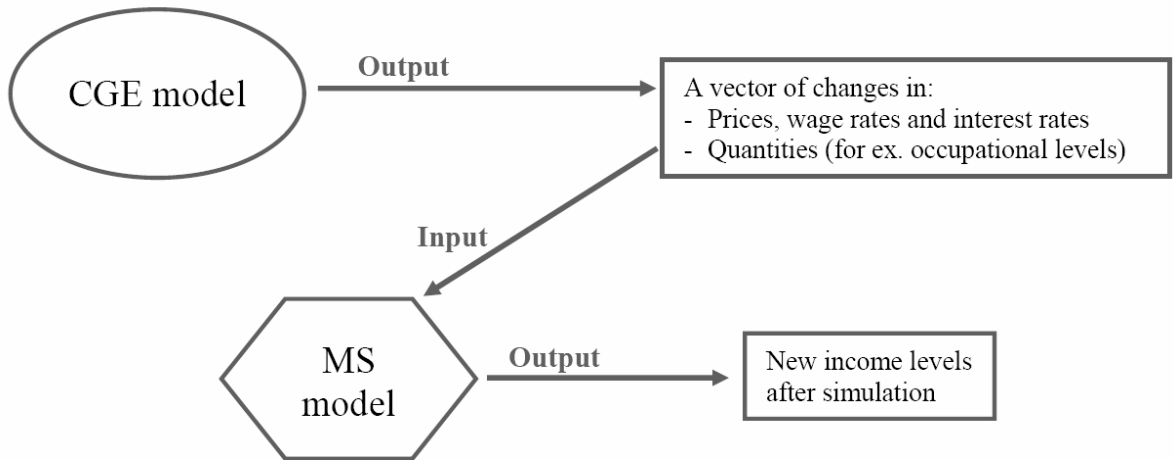
CONCLUSION TO THE THREE ESSAYS


In this three essay study, it was put forth that poverty measurement that relies on stock variables such as asset holdings often ignores the process of converting those assets into livelihood. This process is trivial in the money income measurement of poverty because money enjoys wide use as a medium of exchange. From an asset-based view of poverty, an implicit study of the conversion process is that of understanding the determinants and dynamics of critical threshold levels, or poverty trap thresholds. The first of three essays argued that the asset-based and human development/capabilities perspectives share a common origin, but are competing in their modern forms. It is put forth that by focusing on heterogeneous opportunity costs across individuals and households, the qualitative aspects of the HD/C perspective can be merged into the quantitative frameworks commonly used in the asset-based studies. The simple model presented in the first essay is applied to South Africa's most populated province of KwaZulu-Natal. It was found that the capability deprivation of time spent on subsistence activities is potentially a critical determinant of the conversion of assets into economic well-being.

The second essay extends the first by asking which particular asset holdings are associated with household capability and agency characteristics. The empirical approach used in this essay follows the heritability of genetic traits literature by decomposing the correlation of asset endowments and future well-being into direct and indirect

components. It is again found that time deprivations play an important role in KwaZulu-Natal. The extension of the first essay, however, is that time deprivation is found to be more heavily associated with the higher powered assets of educated labor, productive capital, and agricultural land. The results suggest that although asset to asset interactions are important, the degree of time deprivation from subsistence activities may condition poverty trap thresholds for households with higher levels of educated laborers, capital, and access to agricultural land. This statistical result may reflect the larger realities of macroeconomic underemployment in South Africa in which the relatively well-resourced groups have the wherewithal to face binding micro constraints, whereas the low-resourced groups are primarily constrained by poor macroeconomic conditions.

The last essay broadened the scope of the study by reviewing and constructing a macro-micro simulation model capable of addressing, in an ex ante fashion, how a range of macroeconomic changes might impact the distribution of well-being when agents have heterogeneous behavioral responses due to differences in endowed capabilities to take on new economic opportunities. This essay put forth a behavioral microsimulation model of occupational choice linked with a macroeconomic computable general equilibrium model.

Overall this study has contributed to the poverty literature in the following ways. First, it provided a clear and concise history of the asset-based and HD/C perspectives of poverty outlining their common origins and reconcilable differences. The study then proposed a theoretically simple and empirically tractable way in which elements of the two perspectives can be linked via heterogeneous opportunity costs. Next, the study was one of the first to open up the black box of asset holdings that households use to generate

livelihood and identifies linkages between particular assets and household agency characteristics. Lastly, the study proposed a macro-micro framework capable of analyzing how macro changes impact the distribution of well-being in the presence of capability disparities influencing labor market choices.