Measuring Individual Uncertainty and Fertility Preferences among Vulnerable Populations in Rural Malawi

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Abstract

In the area of population studies and health, scholars are currently debating the role of uncertainty in determining reproductive intentions and behaviors. Some scholars argue that contexts of uncertainty lead to postponement of childbirth and actions to limit fertility (Johnson Hanks 2005, 2006; Timaus and Moultrie 2008; Agadjanian 2005). Other scholars argue that high fertility exists because children are a means of security (Cain 1981; Nugent 1985). Furthermore, scholars lack a reliable protocol for measuring individual uncertainty in structured inquiry (e.g. surveys). This study draws on conceptualizations in the management literature as well as prior qualitative fieldwork with the study population to develop a survey measure of individual uncertainty in rural Malawi. Data collection was part of a representative longitudinal cohort study with women of reproductive age (15-40) and their partners. The study offers an interdisciplinary measure of uncertainty, and addresses empirical gaps in the study of fertility preferences.

Introduction

Unresolved debate about how uncertainty affects reproductive decision making has important implications for our understanding of fertility in Sub-Saharan Africa and prospects for fertility decline. One issue preventing resolution is the methodological challenge associated with measuring uncertainty in large-scale survey research. To date, the research about uncertainty in sub-Saharan Africa has been largely qualitative. Indeed, our motivation for further study of uncertainty arose out of qualitative data collection in rural Malawi in which uncertainty emerged as a central theme linking the formulation of fertility goals and the management of scarce resources. In light of a growing intellectual debate, we embarked on a second round of data collection, this time using both qualitative and quantitative methods, to define the relevant domains of contextual uncertainty, to construct questions to measure key dimensions of uncertainty, and finally, to pilot and test a survey measure with a subset of women and men (N=767) participating in a cohort study of reproductive aged women and their partners undertaken by the Umoyo wa Thanzi (UTHA; Health for Life) research project in Malawi.

When referring to **contextual uncertainty** we mean *the inability to assess current risks and predict future outcomes related to social, physical, and economic environments.* Research to date has examined both stated uncertainty in fertility goals (e.g. nonnumeric responses to survey questions about fertility) and contextual uncertainty (uncertainty present in the surrounding environment). Our research intends to examine contextual uncertainty that may influence the formation of childbearing goals and subsequent behaviors. In service of that larger goal, the present paper is an explanation of the conceptual and methodological development of our measure of uncertainty, and the descriptive results of data collected in the UTHA cohort survey.

While we speculate as to the links between uncertainty and fertility outcomes, we reserve that analysis for future papers after refining and validating the current measure.

Background

The ways that uncertainty bears on reproductive decision making has long been subject to debate, even more so during the past decade as scholars have struggled to explain fertility responses to the Great Recession and the slow fertility decline in SSA. An early influential contribution was Morgan (1981, 1982), who argues that fertility intentions cannot be viewed as simple dichotomies (yes/no) but instead are prone to uncertainty since they are defined in relation to an unknown future. Subsequent research by Schoen et al. (1999) demonstrates that respondents with more certain intentions are more likely to realize these intentions. These studies examine stated uncertainty in response to survey questions but do not situate this uncertainty in household or larger contexts. Stepping back, we can ask: to what extent is uncertainty about fertility goals a function of the unpredictability and known risks in one's context? Do persons confronting such uncertain contextual circumstances exhibit more uncertainty about their childbearing goals? Or, in contrast, do such circumstances solidify present goals/actions in a particular direction (e.g. "I do not want a child now")? These questions remain unanswered, particularly for low-resource settings such as SSA.

To this point, the role of uncertainty in reproductive decision making has been examined most thoroughly in Europe where fertility is low. Contemporary research has examined the impact of the Great Recession, asking the larger question of the effect of economic uncertainty during periods of economic downturn. The overall conclusion from this research is that economic uncertainty depresses fertility (see review by Sobotka, Skirbekk, and Philipov 2011) but effects vary by parity (Perelli-Harris 2006), level of education (Kreyenfeld 2010), and social

status (Testa and Basten 2014). The latter study confirms the importance of taking uncertainty into account: Testa and Basten (2014) find that fertility intentions do not change during periods of recession, but the certainty of meeting those intentions affects fertility, in particular having the first child.

In contrast to Europe's low fertility, African fertility in recent decades has remained high, with fertility decline occurring later and more slowly than demographers had expected based on the experiences of Asia and Latin America (Bongaarts and Casterline 2013). This is a scientific and policy concern due to the significant social and economic challenges imposed by large birth cohorts at both the societal and the household level (Birdsall, Kelley, and Sinding 2001). For women, early, closely-spaced, and high-parity births are associated with increased health risks to themselves and their young children (Bongaarts and Sinding 2009). The patterns in African fertility are occurring in an environment of pervasive uncertainty (Berner and Trulsson 2000). Given the large differences between Europe and SSA in resources (e.g. wealth, education, health care), family systems, the fact of persistent high fertility, and the type of uncertainty that households experience, it is unclear whether the processes observed in Europe apply in SSA. Research is needed to understand how contextual uncertainty contributes to patterns in African fertility.

The concerns about persistent high fertility in Africa and the debate about the impact of uncertainty on fertility have come together in a burst of research during the past decade on fertility in Africa. Four sets of scholars have produced highly influential work on uncertainty and fertility. Johnson-Hanks (2004, 2006), drawing on fieldwork in Cameroon, argues that uncertainty delays the formation of childbearing intentions and reduces fertility. Agadjanian (2005) concludes that uncertainty about economic prospects leads to downward revision of

childbearing goals and lower realized fertility. Moultrie and Timaeus (2008) propose that continued postponement of the next child because of various uncertainties constitutes a large component of the fertility decline to date in South Africa. All of this recent work on SSA suggests that uncertainty is anti-natalist in its effect. This is ironic, because earlier scholarship on low-resource settings came to the opposite conclusion, namely that uncertainty about future prospects encourages high fertility because children are a realizable form of security (Cain 1981, 1983; Nugent 1985; Jensen 1990; Pörtner 2001) and in fact represents one of the few certainties in life (Friedman, Hechter and Kanazawa 1994). Our own exploratory investigation in rural Malawi supports the latter argument: childbearing is viewed as a source of stability and security among those who are poor. In the course of our interviews and focus group discussions, individuals made statements such as, "The rich can afford to plan but the poor must have many children; you don't know which one is going to be the doctor" (married woman, focus group participant). This evidence suggests that unknown futures amidst poverty encourage childbearing rather than postponement or avoidance of births, in contradiction to the conclusions in the research cited above. The fourth body of work is that by Trinitapoli and Yeatman (2011) who measure uncertainty in HIV status and find that uncertainty contributes to an acceleration of the desired *timing* of fertility among young adults, suggesting that when expected futures are deemed incompatible with childbearing the importance of fertility is magnified. Does the contradictory evidence represent a theoretical conflict, or an analysis of different dimensions of future uncertainty? Might the same factor (uncertainty) operate differently in different settings? Or does this apparent contradiction reflect a lack of methodological rigor?

Our ability to advance this debate is constrained by two challenges. First, it lacks conceptual clarity about the forms of uncertainty being investigated and to whom uncertainty

matters. Regarding the latter, Johnson-Hanks' study population is young, urban, relatively educated women in Cameroon, Cain's research is on the rural poor in Bangladesh, and Agadjanian's interviews are with high-parity, disadvantaged women in Mozambique. All three bodies of work examine one or more dimensions of contextual uncertainty but the focus of each is distinct. Johnson-Hanks (2006) examines the uncertainty in young adults' pursuit of employment and marriage opportunities; one might posit that uncertainty is an intrinsic feature of young adult experience which can often result in hesitation to commit to adult transitions, including childbearing. Cain (1981, 1982), in contrast, focuses on married adults further in the life course who are struggling with economic adversity and worried about safety nets for their old age. Finally, Agadjanian's (2005) focus is on the uncertainty arising from a current period of severe economic hardship, which is distinct from the uncertainty arising from a life stage (e.g. transition to adulthood) or the consideration of the more distant future (e.g. old age).

Second, the debate is unresolved due to the inadequacy of available tools for measuring uncertainty in structured inquiry. The bulk of the European literature relies on, either macro-level or micro-level economic indicators, as a proxy for economic uncertainty. While this approach has led to a general consensus that economic uncertainty depresses fertility, Sobotka, Skirbekk, and Philipov (2011) argue that actual individual uncertainty is the fundamental construct of interest but has hardly been investigated empirically. In SSA, the inquiry to date remains primarily qualitative (Johnson-Hanks 2004, 2006; Agadjanian 2005; Watkins 2000). An exception is Trinitapoli and Yeatman (2011), who in a demographic survey incorporate a bean-counting technique to assess uncertainty about HIV status. Techniques of this kind have not yet been adapted for assessment of uncertainty about other domains (economics, partnerships, etc.).

Health research, and specifically research on reproductive health, has not yet effectively made use of developments in decision-science and behavioral economics, and this is especially the case on the matter of uncertainty. In these two fields, individual assessments of risk and probability, and decision making under ambiguity (i.e. uncertainty) have been studied extensively as determinants of managerial behavior and corporate decision making (Downey and Slocum 1975; Haase, Renkewitz, and Betsch 2013; Erdem and Keane 1996). Adapting the measures and tools used in decision science and behavioral economics to reproductive decision-making requires shifting from a focus on economic markets to the life domains prone to uncertainty and also relevant to reproductive decision-making, such as health or household scarcity.

Recognizing the conceptual and methodological challenges of assessing the impact of uncertainty on reproductive decision-making, we conducted qualitative and quantitative fieldwork in rural Malawi to develop and test a measure of contextual uncertainty. This research intends to examine the influence of contextual uncertainty on the formation of childbearing goals and behaviors. However, the present paper is an explanation of the conceptual and methodological development of the measure of uncertainty, and the descriptive results of data collected from a subset of women and men (N=767) who took part in a cohort survey of reproductive aged women and their partners (N=1475). Overall, the measure shows promise for further testing in the field, and some interesting patterns and paradoxes have emerged with the preliminary data.

Methods

Study Location and Population

We developed the measure in rural Malawi as part of the interdisciplinary research program known as UTHA. The project is a partnership between Ohio State (OSU), Child Legacy International (CLI), an international non-profit, the University of Malawi College of Medicine, and Baylor College of Medicine. UTHA operates from CLI's growing maternal and child health center, which recently achieved status as a community hospital. They provide care to a catchment area 21km in diameter containing more than 5,500 households.

UTHA is a multi-faceted research initiative consisting of both quantitative and qualitative data collection. To this point, UTHA's primary endeavor has been a cohort survey of reproductive age women (aged 15-39) and their partners (N=1475). We began the research program by collecting qualitative data (focus groups, in-depth interviews), regarding attitudes towards pregnancy prevention, and the management of scarcity during the Summer of 2013. During the summer of 2014 we developed the present measure of uncertainty. In addition to the cohort survey, additional clinic- and community-based research projects are on-going and proposed.

Preliminary Research

Table 1 Descriptive Statistics

Married (M), Formerly Married (FM), and Never-Married (NM)

Qualitative Data Round 1: Pregnancy Prevention, Managing Scarcity

	Pregnancy Prevention		Scarcity	
	IDIs	FGDs	IDIs	FGDs
Women	24	9	21	4
Men	6	4	**7**	4
Total	**30**	**13**	**29**	**8**

Qualitative Data Round 2: Measuring Uncertainty

	IDIs				Cohort Survey Subset			
		M	*FM*	*NM*		*M*	*FM*	*NM*
Women	**13**	7	4	2	**530**	414	25	91
Men	**9**	7	0	2	**237**	236	0	1
Total	**22**	14	4	4	**767**	650	25	92

Cohort Survey Subset (N=767)

Mean Age (years)	26.9
Mean Education (years)	5.0

Pregnancy Prevention and its Social Meanings Across the Life Course; The Management of Scarcity

The first round of qualitative data (summer 2013) examined attitudes towards pregnancy prevention among men and women using focus group discussions (N=13) and in-depth interviews (N=30). Supervising two Malawian research assistants, we used a vignette embedded in a semi-structured interview guide to explore perceptions of pregnancy prevention and its social meanings across the life course. Also during summer 2013, a parallel qualitative investigation examined the meanings and experiences of scarcity. Upon returning to the US, we developed a coding scheme through rounds of open coding that could be applied to both the fertility- and scarcity-related transcripts (a total of 80 transcripts; Table 1). This became useful for examining thematic overlap between the management of scarcity and attitudes toward pregnancy prevention. The theme of uncertainty was present throughout the data, and the

evidence was complementary between the two topics; in other words, discussion of fertility revealed that childbearing decisions are affected by uncertain and scare resources, and vice versa.

Developing a Survey Measure of Uncertainty

Substantive and Theoretical Foundations

In light of our preliminary findings and the ongoing debate regarding uncertainty and fertility, we embarked on a second summer of research with the goal of first achieving better conceptual clarity (i.e. identifying relevant domains of contextual uncertainty) and then developing and testing a block of survey items. The first step was to define the relevant domains of uncertainty and the substantive questions we could ask of participants in a rural setting that we knew had high levels of scarcity, and where we expected high levels of uncertainty. Could people articulate their actions and perspectives towards uncertain future events? Were these discussions likely to exhibit variation within a structured survey questionnaire?

For this exploratory work, we developed a semi-structured interview guide for in-depth interviews. First, I conducted a content analysis of the scarcity transcripts from the previous summer to identify the relevant domains of inquiry. Four domains—health, land, food, and schooling—emerged as the primary and most significant resource domains for household decision-making and well-being. From that point we used purposive sampling to conduct 22 in-depth interviews with women (N=13) and men (N=9), and asked about characteristics of and strategies for dealing with uncertainty within the four life domains. The interviews investigated the respondent's available strategies, future expectations, planning behaviors as well as their response to hypothetical adverse events within each life domain. For example, for health we asked about a child being hospitalized and a funeral taking place in the community. Each of

these scenarios was easily understood by respondents and represented uncertain, but potentially likely, events. Overall, the interviews gave us a clear understanding of the most common managing strategies and the types of questions most likely to elicit variability. For example, asking how much of a setback a particular scenario would be almost always garnered the response that it would be a "big problem." However, with further probing it became clear that *how long* it would take to recover from a setback was a dimension of managing that had variation.

Content of the Structured Questionnaire

After the qualitative interviews, the next step involved constructing a survey measure of uncertainty and its dimensions. Using the qualitative data, we were able to develop the content of questions, and were aware of some questions that were likely to vary across respondents. As a starting point for measuring the theoretical and conceptual dimensions of uncertainty as a perceived construct, we used a study by Ashill and Jobber (2009) who measure three dimensions of uncertainty: state, effect, and response uncertainty (see Milliken 1987). When considering an uncertain outcome, a person can be uncertain as to the state (or the characteristics and likelihood) of that phenomenon, the effect of that phenomenon on one's own condition, and the possible responses available to address the phenomenon. Thus this conceptualization deals with the *perceived* uncertainty held by managers rather than an objective measure of uncertainty in their environments. Ashill and Jobber (2009) measured the three dimensions of uncertainty by asking business managers a series of questions about both actual and hypothetical circumstances to evaluate their knowledge of a particular good's market conditions (state uncertainty), the effect of market changes on that good's value (effect uncertainty), and how they would respond as business managers should changes occur (response uncertainty). For our survey measure, instead

of asking about economic markets, we asked about the life domains of health, land, food, and schooling. The questions are organized to capture state, effect, and response uncertainty, as well as questions useful for assessing the respondent's relative disadvantage and vulnerability.

The uncertainty items are broken into three groups: (i) future expectations and pressing concerns regarding land, food, health and schooling (the *state* and urgency of future outcomes); (ii) planning behaviors, confidence in one's ability to achieve desired outcomes, and one's general outlook towards the future (their ability to *respond* to uncertain events); and (iii) the consequences associated with facing a financial crisis of 5000 Malawian Kwacha (roughly $20 USD). Regarding the latter, we asked the respondent about strategies they had used previously, had available, and preferred when managing a financial crisis. We also asked how long it would take to recover from spending 5000 MK. Together, the questions of strategies and recovery time were meant to assess the effect a crisis would have on the individual (i.e. effect uncertainty). The expected recovery time is the most direct measure of perceived effect uncertainty. However, the ability to distinguish used, available, and preferred strategies allows us to not only assess the effect of a crisis but also the current state of vulnerability. In the first group of questions meant to assess state uncertainty, we included four items to assess one's general outlook towards the future. Answers ranged on a 3-point scale from agree to disagree and statements claimed that: (i) things generally work out, (ii) my future feels bright, (iii) since you can't predict the future, why plan for it?, and (iv) my partner makes decisions in the best interest of the household. These questions are useful for highlighting complementary and contradictory patterns that tie together each of the measured dimensions of uncertainty. In total we developed a block of 27 survey items which we asked of 767 respondents (women and men) in UTHA's cohort survey.

Comments Regarding our Measurement Approach

As a first measure of uncertainty, a few comments should be made regarding our approach. First, while our ultimate goal is to measure the impact of uncertainty on fertility outcomes, we did not ask participants to link uncertainty directly with fertility in our survey questions. Our goal was to develop a measure of an individual's contextual uncertainty pertaining to significant life domains in a low-resource context, and then to tie this measure to fertility outcomes in future analyses. While this is potentially more risky in the sense that our data cannot speak directly to fertility outcomes until we conduct further analysis, from a research standpoint it seemed a more sound approach to measure distinct constructs (and assess the relationship in the course of data analysis) than to guess how the relationships might be operating and rely in participants' insights.

Second, we developed and piloted three versions of the uncertainty measure: one only asking about the domain of health, one focused on the temporal dimensions of uncertainty (for example managing food for tomorrow versus land availability in the future), and a third measure investigating all four life domains (school, land, food, and health). In the end, we implemented the third measure as it gave the most comprehensive view of an individual's situation and was the easiest for respondents to answer. Eventually we will refine the measure of uncertainty to a set of 10-15 items. However, for the first measure we wanted to make sure we had sufficient data to test the dimensions and constructs being measured, and observe patterns in light of our initial expectations.

Third, in developing the measure of uncertainty, it became particularly challenging to tease out the importance of vulnerability from a measure of uncertainty. Therefore, we measured both vulnerability and uncertainty in consideration of the effects of uncertainty within a low-resource setting. First, there is a question of whether present vulnerability (i.e. scarcity)

contributes to greater uncertainty towards the future. Is it possible to have individuals with minimal vulnerability who are nevertheless highly uncertain towards the future? Presented as a grid (Table 2), individuals hypothetically may fall in to one of four categories: high vulnerability/high uncertainty, high vulnerability/low uncertainty, low vulnerability/low uncertainty, low vulnerability/high uncertainty. Do these four groups exist?

Table 2 Group Orientations: Uncertainty & Vulnerability

	Low Vulnerability	High Vulnerability
Low Uncertainty	Group I	Group II
High Uncertainty	Group III	Group IV

Secondly, we hypothesize that respondents with high vulnerability will be most heavily affected by (adverse) uncertain events. In other words, while uncertainty is likely to impact all respondents in some way, the consequence of an uncertain condition (e.g. a hospitalization) is likely to be much greater for an individual who is already in a vulnerable situation with minimal buffers to confront an adverse event. Therefore, by constructing a measure of uncertainty that includes measure of vulnerability, we will be able to investigate in future analyses the link between present vulnerability and future uncertainty, and identify individuals who are most at risk of detrimental consequences amidst uncertainty

Results

In the following section we present the descriptive findings from our developed measure of uncertainty by investigating the distinction between uncertainty and vulnerability while also examining some intriguing and contradictory patterns among the dimensions of uncertainty (state, response, effect) and in light of vulnerability. First we consider where uncertainty is directly present in the data, and by contrast, the groupings with very little stated uncertainty. Next we consider patterns of vulnerability by investigating the strategies used in terms of their quality and quantity. Finally, we examine the patterns between response uncertainty, in particular

future optimism and levels of confidence, and levels of perceived disadvantage (a component of our vulnerability measures).

Uncertainty: "I don't know" and "not confident at all"

Our measures of uncertainty represent two primary categories (response and state uncertainty), and we construct effect uncertainty directly with the question of a required recovery period, and through the proxy of evaluating present vulnerability (Table 3). We consider uncertain responses as the answer "I don't know" and also the answer "not confident at all" when asking about one's ability to achieve desired outcomes. Comparing each of the three dimensions of uncertainty – state, response, and effect – state uncertainty, in particular the expectations of future outcomes, show the highest levels of uncertainty. Respondents struggled most when assessing whether a hospitalization would be likely or unlikely within the next year (38% of respondents responded "don't know"). The other four expectations regarding land, schooling (delayed and completing), and hunger range from 6% to 15% of respondents who are uncertain. Within response uncertainty, the strict answer of "I don't know" has at most 3% of respondents (confidence that all remaining children will complete secondary school). However, the expanded definition to include "not confident at all" increases the levels of uncertainty. Respondents are least confident that their remaining children will complete school (15%). On the other hand, roughly two-thirds of respondents are very confident that they will be able to achieve the stated outcomes. Surprisingly, less than 1% of respondents expressed effect uncertainty when measured solely as the recovery period required for spending 5000 MK.

Table 3 Items Measuring Uncertainty

Uncertainty						
Item	Expectations of the Future (State Uncertainty)	*Considering your current situation, how similar will it be in…*	Very Different	Somewhat Diff.	The Same	Don't Know
1		One year	19	55	21	4
2		Five years	58.5	23	11	7
3		In 5 years, what will be your most pressing concern? (Choose ONE)	**Finances** 31	**School** 7	**Land** 20	
			Food 13	**Health** 5	**None** 13	DK. 7
		Is it likely or unlikely that...	Likely	Unlikely		Don't Know
4		One child will complete school	67	19		11
5		Have enough land for children	55	36		6
6		One child will delay school	66	24		7
7		Household member will be hospitalized in the next year	29	32		38
8		Household will experience a hungry season	46	38		15
Item	Response Uncertainty	*How confident are you that you will…*	Very Confident	Somewhat Conf.	Not Conf. at all	Don't Know
9		Secure enough land for children	62	9	13	2
10		All (remaining) children will complete school	59	9	15	3
11		Prevent household hunger	66	12	10	1
12		Adapt to the unexpected	62	12	14	1
		How often do you…	Always/ Often	Rarely	Never	DK.
13		Budget for the month	19 / 16	17	45	0
14		Budget for unknown but likely events (e.g. funerals)	12 / 11	11	65	0
15		Budget for known but distant needs (e.g. school fees)	20 / 12	14	51	0
16	Effect U.	Days needed to recover from 5000MK	Min/Max	Median	Not a setback	Don't Know
			1 / 365	8	3	0

Cells not included: Item 3: Intimate Relationship (3%), Parenting (0%)

Vulnerability: Quantity and Quality of Strategies

In contrast to the levels of uncertainty within the previous block of items, the measures of vulnerability (Table 4) show very little uncertainty. One exception pertains to the value of one's reserve wealth; 10% of respondents indicated that they had some reserve but were uncertain how much money it would bring them.

Table 4 Items Measuring Vulnerability

Vulnerability						
Item		*Are you better, the same, or worse than your…*	Better than	Same As	Worse Than	Don't Know
17		Relatives	14	26	58	0
18		Community Members	12	34	53	0
19		*Most pressing current concerns (Choose all that apply)*	**Finances**	**Land Scarcity**	**Poor Health**	
			67	37	23	
			Food	**School**	**None**	DK.
			51	15	12	0
20	**What if you needed 5000 MK ($20 USD) tomorrow?**	If you needed 5000 MK tomorrow, what strategies are **available** to you? (Choose all that apply)	**Casual Labor**	**Sell Livestock**	**Use Reserve**	
			72	24	15	
			Borrow w/ Int.	**Borrow w/o Int.**	**Other**	Don't Know
			17	31	5	3
21		What are the **preferred** strategies for getting the needed 5000 MK? (Choose all that apply)	**Casual Labor**	**Sell Livestock**	**Reserve Money**	
			64	19	9	
			Borrow w/ Interest	**Borrow w/o Interest**	**Other**	Don't Know
			9	17	3.6	1
22		Strategies used during the most recent hungry season (Choose all that apply)	**Harvested in the Dimba**	**Casual Labor**	**Borrowed Money**	
			63	47	8	
			Rationed Meals	**We had enough**	**Sold Something**	Don't Know
			19	10	9	0
23		Has some form of reserve intended for unexpected financial needs	Yes	No		DK Amt.
			47	42		10

Not included: Item 19: Intimate Partner (15%), Parenting (9%); Item 22: Material Reserve (6%)

The vulnerability questions are set up in a value-free manner. That is, we do not ask participants to rank-order individual strategies. Taking in to account our qualitative understanding of strategies and the associated consequences, we might expect that borrowing from local moneylenders requiring high interest rates is worse than doing casual labor -- piecework conducted for community members or businesses that is usually obtained on a daily or

short-term basis. However, if an individual has the ability to recover funds quickly then borrowing would be preferred since casual labor prevents the preparation of one's land and can contribute to low crop yields. Although these exceptions make it difficult to objectively evaluate a strategy's quality, we can descriptively examine the perceived quality (i.e. preference for) and quantity of an individual's strategies. In future analyses, we may find that the diversity of one's strategies (i.e. the quantity) matters more than the specific options available (i.e. the quality).

First, we examine the quantity and prevalence of the available strategies (Table 5). The majority of respondents (58%) indicated that they had only one available strategy, followed by 19% of respondents with two available strategies and 13% with three available strategies. Casual labor was both the most widely available and the most widely preferred, as seen in the second row of data. From

Table 6 we see a reduction the strategies preferred. 80% of respondents indicated only one preferred strategy, followed by 9% of respondents who indicated they had two preferred strategies. Overall, the diversity of available and preferred strategies is low for individuals.

We can assess the perceived quality of strategies by examining the extent to which they were preferred for meeting a financial crisis. Comparing differences in available versus preferred strategies, borrowing with interest and borrowing without interest showed the greatest proportional reduction when indicated as a preferred strategy (47% and 45% respectively). In other words, while 31% said they *could* borrow without interest, only 17% said this would be a *preferred* strategy for obtaining 5000 MK. This difference is a 45% reduction from total availability. Interestingly, we find that only 1-4% of respondents for any given strategy indicated that it was preferred but not available (assessed by matching available and preferred strategies within individuals). Across the vast majority of cases, the strategies that an individual deemed

available were also strategies they preferred (90% of cases on average). Rather than representing access to several preferred strategies, this conformity arises because individuals are most likely to have only one preferred strategy in total. As seen in Table 6, 80% of respondents had only one preferred strategy while 58% had only one available strategy.

Table 5 Comparing Available & Preferred Strategies

	Casual labor	Sell livestock	Use reserve	Borrow w/ int.	Borrow w/o int	#	Available % (N)
Available Strategy	72%	24%	15%	17%	31%	**1**	**58 (447)**
Preferred Strategy	64%	19%	9%	9%	17%	**2**	**19 (149)**
% difference	-8%	-5%	-6%	-8%	-14%	**3**	**13 (100)**
% reduction from total	11%	21%	40%	47%	45%	**4**	**4 (33)**
% preferred, but not available	2%	2%	1%	2%	4%	**5**	**2 (17)**

Furthermore, we can assess the quality of a particular strategy based on its level of preference when only a small number of preferred strategies were chosen. For example, among individuals that preferred only one strategy, 68% of them preferred casual labor. Among individuals with two preferred strategies, 74% preferred casual labor and 52% preferred borrowing from a friend or relative without interest (keep in mind the total percentages will reflect the number of strategies preferred). The number of cases diminishes substantially after the first group, but even so, we can see that casual labor is usually the top preferred strategy followed by borrowing without interest. As more strategies are preferred, selling livestock (this includes chickens and other small animals) becomes a popular strategy.

Table 6 % preferring the strategy, stratified by the Total # of preferred strategies

#	Total Preferred % (N)	Casual labor	Sell livestock	Use Reserve	Borrow w/ int.	Borrow w/o int.
1	**80 (612)**	68%	15%	4%	3%	10%
2	**9 (67)**	74%	32%	15%	25%	52%
3	**3 (21)**	67%	57%	52%	52%	71%
4	**2 (18)**	100%	67%	100%	44%	88%
5	**5 (5)**	100%	100%	100%	100%	100%

Percentages will sum to 100 times the total number of preferred strategies

Response Uncertainty & Perceived Disadvantage: Optimism, Confidence and a Lack of Budgeting

Confidence, Optimism, and Disadvantage

Finally we consider two interesting patterns between uncertainty and vulnerability: (i) high optimism and confidence amidst perceived disadvantage (Table 7), and (ii) very little budgeting in spite of (or because of) scarce resources (Table 3). Overall, a majority of participants thought themselves to be worse off relative to community members (53%) and relatives (58%). Participants largely endorsed optimistic responses to the four questions assessing thoughts about the future. Two in particular – things work out, and my future feels bright – can be thought of directly as measuring optimism, or a positive future outlook. It is striking that 82% of respondents who said they were worse off than their community members also said that "things work out" in the future. However, the bivariate associations are not statistically significant based on a chi-square test of the distributions. Similarly, 67% of respondents who considered themselves disadvantaged also stated that their future seemed "bright", and this bivariate associate was statistically significant.

As part of response uncertainty, we also asked individuals how confident they were in their ability to accomplish future goals. In every case roughly two-thirds of respondents felt very confident that they could achieve the stated goals – goals we know to be common challenges in the study area. The bivariate associations between areas of confidence and the distribution of relative disadvantage are all statistically significant. As an example, among disadvantaged respondents, 59% also said they were very confident they would have enough land to pass on to their children: we see optimism and resilience amidst severe disadvantage. This coincides with the expectation that one's life will look "very different" in five years (58%). Additionally, when

asked how similar or different the respondent's life situation will be in five years, 58% expected it to look very different.

Table 7 High Optimism and Confidence amidst Disadvantage

Do you agree, disagree, or neither disagree or agree...	Agree	Disagree	Don't know	Proportion of disadvantaged who agree/ are "very confident"
ThingsWorkOut	83	12	1.3	82%
BrightFuture	72	19	1.4	67%*
How confident are you that you will…	Very Confident	Not Confident at all	Don't Know	
Secure enough land for children	62	13	2	59%*
All (remaining) children will complete school	59	15	3	54%***
Prevent household hunger over the next year	66	10	1	60%***
Adapt to the unexpected	62	14	1	59%***
Are you better, the same, or worse than your…	Better than	Worse Than	Don't Know	
Relatives	14	58	0	
Community Members	12	53	0	
How similar will life be 5 years from now?	Very Different	Basically the same	Don't Know	
	58.5	11	7	

Budgeting for expected and unexpected needs

Thus far we've seen high levels of confidence, optimism, and low levels of uncertainty for how to meet a financial crisis. However, to assess response uncertainty in regards to behavior, we asked respondents whether they budget (or set aside resources) for the month, for distant but known needs such as school fees, and for expected but uncertain needs such as funerals. Despite frequent discussions during focus groups and in-depth interviews of the importance of budgeting for the household when managing scarcity and planning for children, very few people ever budget for the month or the distant future (whether for expected or uncertain events) (Table 3). Fewest participants reported budgeting for likely but uncertain events. Furthermore, the bivariate associations between agreement with the statement: "since the

future is uncertain, why plan?" and with various budgeting behaviors are only statistically significant when comparing the above statement and budgeting for expected buy uncertain events. In our qualitative interviews, a common response to budgeting for expected but uncertain needs was that they will plan for the things they know will happen and will "deal with it when it comes" regarding events which are likely but uncertain in their timing. The question remains for future analyses the extent to which this mindset is a function of present scarcity (allocating scarce resources to the known and immediate needs), or a function of a broader uncertainty mindset that pertains to other life domains, such as unintended pregnancy and contraception. Do individuals also fail to act on consequences that are possible but perceived as uncertain (or at the very least, unlikely to happen soon)?

Discussion

This work represents a first attempt to describe the conceptualization and methodology for measuring uncertainty in rural Malawi. We have also presented some initial results and intriguing patterns found in the descriptive data. First, uncertainty is expressed most when participants are asked about future expected outcomes (state uncertainty), and is lowest when asked about their future outlook and confidence in their abilities (response uncertainty). Second, in assessing respondents' perceived abilities to cope with future needs, most are highly confident in their abilities and a majority maintain a positive future outlook. This confidence about the future exists alongside perceived and objective disadvantage. The majority of respondents consider themselves to be worse off than their community members and have only one or two available and preferred strategies for meeting a financial crisis. Finally, despite high levels of confidence, a majority of respondents never budget for the household.

Measuring Uncertainty and Vulnerability

Ashill and Jobber (2009) measure three dimensions of uncertainty – state, response, and effect – among business managers. We used qualitative data to define the salient life domains pertaining to household well-being, and consider how these domains are subject to uncertainty. We then constructed the survey measure in a manner similar to Ashill and Jobber. In the course of constructing the questions, we came to view the combination of uncertainty and vulnerability as key to understanding the three dimensions of uncertainty. Asking about one's expected future and future outlook is likely to take into account present and past realities defined by scarcity. Asking about vulnerability became a means of assessing participants' present disadvantage but it can also be viewed as a proxy for the effect an adverse event would have on a household (i.e. effect uncertainty).

Optimism, Confidence, Disadvantage

Our data suggests that high optimism and confidence coincide with high levels of disadvantage (response uncertainty). Is this optimism irrational? Frye (2012) in her study of education and the "bright future" narrative finds that pursuing a "bright future" is as much a part of individual identity construction as it is an objective reflection of a material reality or set of possibilities for young adults in Malawi. It may also be that chronic scarcity contributes to optimism towards the future because individuals are conditioned to manage scarcity on a short-term basis, are acclimated to a climate of uncertainty and therefore maintain confidence that "things will work out" in the future, even though the means for accomplishing a desired goal may not be readily available.

Vulnerability: Available and Preferred Strategies

We find that for most individuals, their available strategies are also their preferred strategies suggesting that an available strategy is in part defined by what is a preferred, or

acceptable, strategy. In our qualitative interviews, some respondents felt that borrowing with interest should never be an option. Thus when asked if they *could* use moneylenders to meet a financial need they had a very high threshold for the circumstances in which they would consider borrowing in this way. The high correspondence between preferred and available strategies could also be a measurement error based on interviewer training. Originally our goal was to measure which of the available strategies were actually preferred. Ultimately, we allowed respondents to answer available and preferred strategies as independent questions. It is possible that interviewers administered the question in such a way as to encourage respondents to define preferred strategies based on their subset of available strategies.

The Relationship Between Vulnerability and Uncertainty: What might budgeting behavior tell us?

Vulnerability is a closely linked factor to uncertainty. Those who are most vulnerable are likely to be those most affected by (adverse) uncertain outcomes. Empirically, uncertainty may be a function of vulnerability. Experiences of vulnerability may contribute to higher levels of perceived uncertainty, and managing vulnerability may directly influence one's management of uncertain outcomes. Regarding the latter, budgeting behavior is one potential example of uncertainty as a function of vulnerability. Budgeting behavior is minimal across respondents. However, it is lowest when managing events that are expected but uncertain in their timing. This may be partially a behavior in light of uncertainty but also a behavior based on present scarcity. Recent work in behavioral economics claims that a "scarcity mindset" exists for individuals who lack their desired resources whether it be time, money, or social ties (Mullainathan and Shafir 2013). The scarcity mindset causes individuals to "tunnel" their vision and priorities to that which is most scarce in the moment while crowding out potentially important decisions not immediately relevant. In the context of rural Malawi, vulnerable individuals are experiencing

pronounced scarcity and present insecurity. Consequently, they are likely to be focusing most heavily on managing the known needs of the present to the detriment of managing for uncertain, but potentially impactful, future events. When measuring uncertainty of HIV status and fertility, Trinitapoli and Yeatman (2011) find that the desired timing of a birth accelerates for individuals who are relatively more uncertain about their status – suggesting a reaction of urgency and prioritization of fertility. It may be that in household management, uncertainty amidst scarcity further reinforces the urgency associated with managing scarce resources; it may also be that unlikely events such as funerals and hospitalizations do not warrant the same level of priority despite their uncertain quality. Given the potential links between vulnerability and uncertainty, we have assessed each carefully for future analyses.

Limitations

Our measure of uncertainty is geared towards household decision-makers in a rural and poor area of Malawi. Consequently, while some of the work pertaining to uncertainty and fertility in sub-Saharan Africa deals with young adults and/or urban, educated individuals, our measure does not address this population. On the other hand, much of sub-Saharan is still dominated by rural poor similar to those within our study population. Particularly in regards to adolescents, our cohort sample of women and men contains only 92 never-married, adolescents. Furthermore, our questions were difficult for adolescents to answer. Without a household to manage they found it particularly difficult to define their future expectations pertaining to land, child schooling, and preventing hunger when these are hypothetical realities. While their situation may represent the greatest degree of state, response and effect uncertainty, we believe that adolescents' lack of knowledge and formulated expectations was conceptually distinct from

the stated uncertainty of a household decision-maker who is actively managing and considering future possibilities.

We plan several revisions and additions to future waves of data collection. First, we asked about expected change or stability in the respondent's current situation. However, we failed to ask whether they expected those changes to be positive or negative for their household situation. Such a question will illuminate whether the expected changes reflect more the respondent's prevailing optimism or their perceived disadvantage. Second, upon further reflection, the statement that, "nobody can predict the future, so why plan for the future?" is likely poorly constructed. Respondents could agree or disagree based on two dimensions: that the future cannot be predicted or that you need not plan for it. While we have yet to find someone who felt they could predict future events, the question can be refined to focus clearly on the need for planning in light of uncertain futures. Finally, further work is needed in developing a direct measure of effect uncertainty. Currently we ask about time needed to overcome a financial crisis, and we use vulnerability as a proxy for effect uncertainty. However, greater variation in the perceived consequences of an uncertain outcome would strengthen our understanding of this dimension.

Future Steps

Moving forward we will refine the set of questions and apply rigorous analysis to the gathered measures. Methodologically, we will conduct principal components analysis and confirmatory factor analysis to develop a three-part scaled measure of uncertainty (response, state, and effect), and a measure of vulnerability. Empirically we will then assess the measure of uncertainty in regards to the health outcomes of interest with special emphasis on fertility

outcomes (contraceptive use, desired fertility and timing, and births). We have planned to collect a second wave of uncertainty measures during the UTHA's next cohort survey wave. Following the second wave, we intend to gather further qualitative interviews by sampling from "typical" and "anomalous" cases as defined by multivariate regression of uncertainty on fertility outcomes. This is in line with the systematic anomalous case analysis (SACA) proposed by Axinn and Pearce (2006). As alluded to in the results and discussion, questions exist regarding the link between vulnerability and uncertainty. Furthermore, we intend to more examine the patterns of optimism, planning behavior, and expectations to understand better the apparent contradictions among those who self-report as relatively disadvantaged.

Conclusion

While scholars claim that uncertainty is a key characteristic of sub-Saharan Africa, and a potentially strong influence on fertility, research remains sparse. Furthermore, the existing work represents an unresolved debate as to whether uncertainty accelerates, delays, and/or increases fertility. Ultimately we intend to use our measure of uncertainty to assess the relationship between uncertainty and fertility. However, one factor contributing to the limited research is the lack of measures available for structured survey inquiry. To this end, we've drawn on advancements in disciplines outside of demography, public health, and the social sciences, to develop a measure that can be used in rural Malawi. Our descriptive results suggest that the dimensions of uncertainty are closely linked to experiences of scarcity, and that among the measured dimensions of uncertainty both contradictory and complementary patterns exist.

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