ABSTRACT

Title of dissertation:	THE IMPACTS OF FOOD INSECURITY, NETWORKS, AND MARITAL DISSOLUTIONS ON DEMOGRAPHIC PROCESSES IN RURAL MALAWI
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This dissertation consists of three papers that examine topics related to the three components of demography. This research is situated in rural Malawi and I evaluate under-explored mechanisms in demographic and sociological research that aim to explain fluctuations in fertility, the duration of migration spells, and predictors of old-age health. The first paper assesses how famines and food crises might influence the chances of giving birth in subsequent years. Individuals and households in many low-income nations face the prospect, and severe consequences, of food insecurity, yet the effects of exposure to such episodes on fertility are not completely understood; Malawi had a famine in 2002 and major food crisis in 2005-2006. The second paper questions the extent to which the presence of family and friends in a migrant's destination impacts

his or her length of stay in that location after controlling for economic, marital, regional, and period factors that often strongly explain migration patterns. Like in many sub-Saharan African countries, labor migration accounts for a large share of internal and international migration, but recent research has also stressed the effects of marital dissolutions and HIV/AIDS in this process as well. Nonetheless, the role of potential support networks—comprised of family members and friends—on migration patterns has been overlooked. The third paper responds to the National Academy of Sciences' call for more research on aspects of aging in sub-Saharan Africa. While concerns about population aging in sub-Saharan Africa are not new, few scholars conducting research on the continent have examined how marital status and marital dissolutions are associated with health among older individuals despite the fact that these are well known, at least in high-income contexts, to be closely correlated with health outcomes. Thus, I examine the relationship between marital status/dissolutions and health over two years using several self-reported health metrics. In sum, these three papers seek to expand the dialogue on alternative explanations to demographic processes, using the case of rural Malawi.

THE IMPACTS OF FOOD INSECURITY, NETWORKS, AND MARITAL
DISSOLUTIONS ON DEMOGRAPHIC PROCESSES IN RURAL MALAWI

by

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Dedication

To my amazing wife, Rachel,

Thank you for your incredible, and unrelenting, support. I could not have done this without you. All of your advice, editing, and patience will forever be appreciated.

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Introduction: The Case of Rural Malawi

Motivations

Malawi is a small, southeast African nation of approximately 16 million people, with roughly 85% living in rural areas (Malawi National Statistical Office 2011). It is divided into three regions: North, Central, and South, with the respective regional capitals of Mzuzu, Lilongwe, and Blantyre. Malawi gained independence from Britain in 1964 and existed as a single-party state under the rule of Hastings Kamuzu Banda. After Banda lost power in 1994, Malawi became a multi-party democratic state. Malawi is an exceptionally peaceful country, as it is in the small minority of sub-Saharan African (SSA) nations that have not experienced a civil war nor been directly engaged in war with another country in the twentieth and twenty-first centuries. Such a feat could be a reflection of the nationalistic identity of traditional African communalism and friendliness that Banda instilled in Malawians during his reign (Forster 1994), culminating in the country's nickname—"The Warm Heart of Africa" (Malawi Consulate General 2013).

Despite the idyllic portrayal of Malawi, it is one of the poorest and least developed in the world, which is evidenced by its most recent rank of 170th out of 185 nations on the Human Development Index (HDI)—placing the country in the bottom 10th percentile— which has been sustained in retrospective measures of the HDI going back to 1980 (United Nations 2013). Among many factors, this may be partly explained by heavy reliance on agricultural outputs like tea, tobacco, sugarcane, and maize, along with a population that uses arable farmland for subsistence purposes.

Due in large part to a saturated rural labor market in commercial farming (Segal 1985), abundant circular migration flows between the countryside and major cities (including those in neighboring countries) have become (and still remain) almost an expected lifestyle for younger Malawians (Englund 2002). Like many southern African nations, Malawi also experiences a high HIV/AIDS prevalence of an estimated 10.6% of adults 15 to 49 years old (Malawi National Statistical Office and ICF Macro 2011), which has remained relatively stable in the past decade. Migration and HIV are unsurprisingly related, although the causal direction of events is unclear (Anglewicz 2012; Chirwa 1997; Mtika 2007) and some of the highest rates of divorce in Africa also factor into this equation (Reniers 2003). Like most developing countries, Malawi is also largely comprised of younger individuals. In 2008, nearly three million Malawians were less than five years old and over six million were between five and eighteen years (Malawi National Statistical Office 2011). But Malawi is also slowly aging and the majority of gains in person-years lived by adults will stem from those 45 years and older in the coming decades—although not necessarily with rapid reductions in disabilities among the elderly (Payne, Mkandawire, Kohler 2013).

Malawi offers an intriguing venue for demographic research given high fertility rates (near six children per woman), HIV/AIDS prevalence, and migration, in conjunction with population aging and economic vulnerabilities as a result of its dependence on agricultural exports. Malawians, like those in many other SSA nations, are vulnerable to serious environmental events—such as famines—as well, since the nation relies almost exclusively on agricultural exports to sustain its economy and subsistence farming is

widely practiced. Thus, changes in demographic trends are not only subjected to social behaviors and medical interventions, but the physical environment as well.

In short, Malawi may be an ideal place to conduct research in SSA since factors such as civil wars or HIV/AIDS have not solely defined its demographic course as in other countries. Rather, these various demographic considerations create complexity in Malawi's demographic trajectory while not overriding one another. I therefore ask questions that have not been fully evaluated in SSA surrounding the three basic demographic processes. To what extent can a shock like a famine or food crisis impact the likelihood of giving birth? Does the presence of family and friend networks in a migrant's destination location predict the duration of a migration spell? Are marital dissolutions associated with poorer health among older individuals? Using unique longitudinal data from rural Malawi, I will unravel such questions and provide alternative perspectives on factors that influence three different stages of the life course. Although I only examine the case of rural Malawi, these questions can be applied to, and are relevant in, other developing settings.

The Malawi Longitudinal Study of Families and Health and the Migration and Health in Malawi Project

The Malawi Longitudinal Study of Families and Health (MLSFH), formerly the Malawi Diffusion and Ideational Change Project, was initially designed as a couples' survey, in 1998, in three districts—Mchinji, Rumphi, and Balaka—in Malawi's Central, Northern, and Southern Regions, in efforts to better understand household compositions, economic circumstances, and sexual attitudes and behaviors (including those towards HIV/AIDS). The goal of the study was to achieve a representative rural sample of

approximately 1500 ever-married women and 1000 of their husbands. In subsequent waves of 2001, 2004, 2006, 2008, and 2010, new spouses, adolescents, and parents were also sampled (see Watkins et al. [2003] for a depiction of sampling in earlier waves, and Kohler et al. [2014] for a complete project history). More recent waves have collected detailed information on birth histories, financial and non-financial transfers with family members and other individuals, responses to various economic shocks and hypothetical crises, deaths within the household, biomarkers—HIV/AIDS testing and anthropometrics, life course expectations, subjective health metrics, and social participation. Inevitably, sample biases exist due to 20% to 30% attrition between waves due to migration, mortality, absence, or refusal among respondents (Anglewicz et al. 2009; Kohler et al. 2014). As noted above, since most Malawians live in rural areas, the MLSFH captures data on the way the vast majority of Malawians live. These data are widely considered to be among the highest quality longitudinal data in SSA.

In 2013, the Migration and Health in Malawi (MHM) Project was conducted in efforts to provide estimates of former MLSFH participants who migrated to other parts of Malawi alongside a random sub-sample of "non-migrants" who had also recently participated in the MLSFH. 896 migrants who had been interviewed as part of the MLSFH waves in 2004, 2006, 2008, and/or 2010—and 120 of their new spouses—were targeted for sampling at their new location using a similar questionnaire to the MLSFH, although with important additions pertaining to migration. These included acquiring detailed information on family and household migration, creating personal migration histories, and inquiring about lifestyle activities that were not previously asked in the MLSFH. An additional 751, randomly selected "non-migrants" who were found in the village in which

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they were last interviewed during MLSFH fieldwork were target for an interview with the same questions (including migration history). These "non-migrants" often have moved at some point in their lives, or even between the last time they were surveyed in the MLSFH and when they were surveyed in the MHM Project, so these individuals are not necessarily a distinct reference group from the sample of "migrants". This study begins to uncover nuanced aspects of migration processes which is often a difficult task in survey research.

These MLSFH and MHM data sets are ideal for longitudinal analyses pertaining to my research questions on fertility, migration, and health in this dissertation.

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Chapter One

Exposure to Maize Price Fluctuations During a Famine and Food Crisis: The Impact on Fertility in Rural Malawi

Abstract

Research suggests that major economic and environmental shocks are associated with changes in fertility, but whether fertility responses are a consequence of exposure to these shocks, or if other underlying effects are the source of change, remains unclear. Malawi, a predominantly rural and impoverished nation, experienced a famine in 2002 and food crisis in 2005-2006, which respectively affected between one-fifth and one-third of its people. Using retrospective birth histories from the Malawi Longitudinal Studies of Families and Health, and detailed market price data on maize flour, I employ a multilevel, event history approach to evaluate the likelihood of giving birth for these Malawian women between 1998 and 2009. It appears that exposure to maize flour price fluctuations had residual, lingering effects on fertility but not as strongly as expected after the famine of 2002 and food crisis of 2005-2006.

Introduction

In many developing countries, environmental shocks, like famines and food crises, are known to not only influence the decision to have children, but a woman's timing and ability as well. In this paper, I examine how fertility changes around times of widespread food insecurity using the case of Malawi—a small sub-Saharan African (SSA) nation of approximately 16 million people—which is ranked 170th out of 185 countries based on the United Nations Human Development Index (United Nations 2013a). Since over 80% of Malawians live in rural areas (Malawi National Statistical Office 2011), it is no surprise that Malawians extensively use the staples they grow—like maize—for their own sustenance (World Bank 2010). Malawi experienced a famine in 2002 and a severe food crisis (not quite a famine) in 2005-2006 (Devereux 2008; Ellis and Manda 2012) which may have altered women's decisions to give birth. Yet, exposure to these food crises and their effects on fertility in Malawi have not been empirically examined. While there is a large body of research on environmental shocks and their impacts on fertility, most studies have been limited in ability to effectively model either biological or economic exposure to such shocks due to the limitations of survey data and the difficulty in empirically capturing natural experiments.

In this analysis, I use retrospective birth histories and detailed data on maize flour prices in rural Malawian markets from the 2010 wave of the Malawi Longitudinal Study of Families and Health (MLSFH), to examine the relationship between exposure to major episodes of food insecurity and subsequent fertility. While these birth history data are retrospective, they are less than ten years removed from the famine and food crisis, which reduces recall bias and improves the reliability of these analyses. But most importantly, I

have the unique opportunity to exploit monthly information on the extent to which individuals have been vulnerable to large fluctuations in the prices of a major staple essential to the well-being of Malawians. Thus, I build upon compelling demographic works (i.e. Hernandéz-Julián, Mansour, and Peters 2014; Lindstrom and Berhanu 1999; Razzaque 1988) which have convincingly measured period effects as proxies for exposure to famines, and subsequent impacts on fertility and child health outcomes, but not explicitly modelled these affected staple prices in conjunction with period effects. The results are surprising and suggest that exposure to maize flour price fluctuations had residual, lingering effects on fertility but not as strongly as expected after the famine of 2002 and food crisis of 2005-2006.

Theoretical Framework

Fertility is a function of individual, household, and extended family economic decisions (Becker, Duesenberry, and Okun 1960; Becker 1992; Caldwell 1976; Easterlin 1975; Levy 1985; Schultz 1973; Willis 1974). Economic recessions and depressions in developed nations are commonly associated with delays in childbearing (Ryder 1982; Sobotka, Skirbekk, and Philipov 2011) and are even deemed to be a normative response to financial adversity (Rindfuss, Morgan, and Swicegood 1988); but, this does not occur uniformly across populations. It has been shown that across a range of European nations since the 1970s, difficult economic circumstances lower the chance of 20 to 29 year old women having a child, but not for those 30 and above (Neels, Theunynck, and Wood 2013). Also, downward fertility responses to major economic shocks are not immediate, but usually take place a year or more afterward, with a rise in fertility once the effects of the

shock dissipate, often within five years (Mather 2012; Sobotka, Skirbekk, and Philipov 2011). In some cases though—like Russia in the mid-1990s—economic crises do not necessarily even affect fertility (Kohler and Kohler 2002).

Less is known about how environmental shocks, like famines or food crises, impact fertility. This is in part due to the difficulties in measuring exposure to food insecurity, and why it occurs, which lead to substantial difficulties in assessing how food crises actually impact fertility. Sen's famous work (1981) emphasizes that exposure to famines is a result of the failure of legal and other institutionalized outlets to provide food for residents of a region or country. Yet, individuals might be exposed to potentially negative health effects of food insecurity as a result of household, social, communal, or even their own decisions to ration food (Devereux 2001); therefore people in households and social systems with different expectations for rationing, and ration strategies, would experience differing degrees of exposure to the same food crisis.

Famines in Eastern Europe and Asia have also been associated with an increase in stillbirths and miscarriages (Cai and Feng 2005; Kane 1987). Further, in Bangladesh, the destruction of rice crops in 1974 and 1975 led to high rates of mortality for infants conceived in that period as a result of their low birth weight and lack of nutrition (Razzaque et al. 1990), with mortality rates being even higher for children who were *in utero* during the worst parts of the famine, and boys more generally (Hernandéz-Julián, Mansour, and Peters 2014). Demographers have also found evidence suggesting that malnutrition (which may be caused by a famine or a food crisis) and fecundity are closely linked (Bongaarts 1980; Frisch and Bongaarts 1982). More specifically, the combination of poor nutrition, poor living conditions, and hard labor create conditions of subfecundity and thus, lower

total fertility (Frisch 1978). But competing evidence suggests there is no relationship between food intake and childbearing even "in conditions of chronic or endemic malnutrition" (Menken, Trussell, and Watkins 1981, 425).

Additional debate exists with respect to household decisions and fertility during times of food insecurity or environmental change. Fertility might increase after a famine or food crisis since households could decide to have more children in response to increased child mortality or to increase their financial security (through their children's labor) if such a scenario were to occur again (Bongaarts and Cain 1981). This possibility is most commonly, albeit inconsistently, witnessed in developing settings experiencing long-term environmental degradation—not temporary events like famines—as children become increasingly necessary economic resources that can help collect wood and other necessities for families' survival strategies (Biddlecom, Axinn, and Barber 2005; Filmer and Pritchett 2002). However, a more-widely held perspective on fertility demand suggests that if households cannot take care of their own children—let alone adding a child— in difficult financial times, then households will lower their demand for children (Becker 1976). Such households would seemingly want to minimize their overall financial risks during and after food crises, and, since young children require time and economic support, families elect to reduce their desired fertility (Caldwell, Reddy, and Caldwell 1986). Therefore, households make calculated decisions not to bear children during food shortages and/or when grain prices inflate (Clifford, Falkingham, Hinde 2010; Galloway 1988; Menken and Phillips 1990). Yet researchers have had difficulties testing individual and household *exposure* to a food crisis due to data availability, and thus the extent to which the crisis impacted fertility. Instead most analyses are limited to period measures which proxy as exposure to

such crises; evaluating exposure to such instances and the resulting effects on fertility is of utmost importance in this line of inquiry.

Not surprisingly, the impact of famines and food crises on fertility largely depends on the length and severity of the event (Bongaarts and Cain 1981)—in addition to exposure—and may even be "directly proportionate" to these factors (Kane 1987). As in the case of pre-industrial Europe, an estimated 40% to 60% of the variation in fertility from year-to-year was deemed to be determined by changes in grain prices (Galloway 1988); longer, more dramatic increases in grain prices are therefore correlated with lower fertility and steeper declines. Severe famines, like the one Ireland faced in the 1840s, sharply increased mortality rates and significantly diminished the number of births that were expected to have taken place (Boyle and Ó Gráda 1986). For the most part though, fertility rates recover after famines—even if only for a brief period (Das Gupta and Shuzhuo 1999)—and might reach levels higher than the pre-famine period as a response (Bongaarts and Cain 1981). And, of course, not all socioeconomic gradients or even age-groups of women are equally affected by famines: the poorest and wealthiest might be more affected by economic, political, and social instability during a famine and thus, lowering fertility, while younger individuals might choose to delay the onset of marriage and having a child in such times (Razzaque 1988).

Examining the relationship between food insecurity and fertility is an especially important consideration in SSA since roughly 70% of this region's population resides in rural areas (World Bank 2012) where most African rural inhabitants are likely to be vulnerable to drought, heavy rains which may destroy crops and homes, or other environmental shocks depending on the season. However, famines, food crises, and

economic downturns in SSA have been linked to equivocal effects on fertility. For example, famines have been associated with *temporarily* lower levels of marital fertility (Lindstrom and Berhanu 1999) alongside brief drops in fertility rates by over a quarter among famine victims (Kidane 1989) in Ethiopia. More generally there is little evidence to suggest that temporary declines in fertility due to economic shocks turn into long-term trends in sub-Saharan African fertility decline (Coussy and Vallin 1996; Lesthaeghe 1989; Lindstrom and Berhanu 1999; Mason 1993; Peng 1987; Watkins and Menken 1985). Yet, while not explicitly a famine or food crisis, Cameroon's economic crisis spurred at least a 10 year fertility decline (Eloundou-Enyegue, Stokes, and Cornwell 2000).

There is not one set fertility path that populations throughout the world take during major shocks, like famines and food crises. Further, although it has not yet been tested, it is likely that the severity of famines and food crises *within* a country could differ at any given point, which would also impact fertility. Since the impacts of such shocks are unclear, this article seeks to re-examine this debate by providing a methodological and contextual extension of past research by simultaneously evaluating period effects and fluctuations in Malawian staple prices, in a longitudinal, multilevel framework.

Background: Malawi

The 2002 Famine and 2005-2006 Food Crisis

The 2002 famine has been characterized as a such due to excess mortality and illness—including swelling of the body—among adults and children throughout the country. Grain prices were low between 1998 and 2001, but in 2001, the government sold most of its grain reserves and was without effective policies and programs to mitigate the

effects of poor crop yields and the ensuing famine (Mkoka 2002; Phillips 2007); this institutional failure is in line with Sen's (1981) beliefs about why famines occur. The country also experienced heavy flooding in the first few months of 2001 which hurt farmers' private reserves of crops and diminished grain supplies throughout the country. The government's delayed public response to an impending food shortage, alongside limited employment opportunities for Malawians—which would have allowed individuals more disposable income to spend on food, and difficulties in importing food—also contributed to the severity of the effects of these events (Devereux 2002; Stevens, Devereux, and Kennan 2002) that began in January and peaked in May of 2002. As one grandmother interviewed by the BBC put it: "in January the government said we would get free maize, but it was pumpkin leaves that we survived on" (Tenthani 2002). Roughly 3 million people were predicted to have been affected by the famine by September of 2002 (Mkoka 2002).

Just a few years later, about one-third of Malawians—or nearly 5 million people—were reported to be affected by a maize price crisis. The food crisis occurred in part due to government and donor cancellations of some humanitarian food assistance programs (which were developed in response to the 2002 famine [Sykora and Nucifora 2010]), unexpected drought, a reduction of reserve grain, and the subsequent steep increases in food prices (Ellis and Manda 2012; Menon 2007; Phiri 2006). The effects on individuals' livelihoods became noticeable in August of 2005 due to the spike in prices, with a considerable increase in its severity by October which continued through early 2006 until food relief arrived (Menon 2007). Despite a similar pattern leading to the 2002 famine, the government's investment in social programs, such as food and cash transfers, in case

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another famine were to occur, mitigated the impacts of events of 2005-2006 relative to 2002 for the most vulnerable populations—preventing a full-scale famine (Devereux 2008). Yet, the impacts of the food crisis on the population must not be understated, as there were reports of Malawians "eating termites, bamboo seeds, and wild yams to stave off hunger" (Tenthani 2005) as a result of food shortages, leading to both illness and death.

Malawian Fertility Trends

Since the 1960s and 1970s, total fertility rates (TFRs) have been slowly declining in SSA (Garenne and Joseph 2002) and Malawian census data show a slow decline in total fertility from 7.6 to 6 children per woman between 1977 and 2008. However, this decline describes a transition from extremely high fertility to very high fertility and compared to other developing nations during this time period, fertility has declined little (United Nations 2011). The 2010 Demographic and Health Surveys confirm this trend and estimate that the TFR is at 5.7 for the entire nation, although slightly higher at 6.1 in rural areas. Since census data are only collected every 10 years (at best) in Malawi, it is difficult to determine intercensal nuances in fertility trends and even further, whether the famine and food crisis impacted fertility. Further, while it is clear that infants and children are surviving at a much higher rate than in the past, which is contributing to total population growth in Malawi (Malawi National Statistical Office and ICF Macro 2011; Malawi National Statistical Office 2011), no link between declines in infant and child mortality and Malawian fertility have been documented. Age-specific fertility rates have remained remarkably consistent since the early 1990s (Malawi National Statistical Office and ICF Macro 2011). The median age at first birth in Malawi is 18.9 years while the rural median is slightly lower

and the urban median is slightly higher than this overall median. This means that half of Malawian women have a child before they turn 19 years old (Malawi National Statistical Office and ICF Macro 2011). The highest fertility rates have remained among those between 20 and 24 years, and secondly, between 25 and 29 years. This consistent pattern suggests that Malawian women are not delaying births—as a vast portion of the world had begun to do in the 1990s—but rather sticking with cultural norms of early first births and slow drop offs in, but continued fertility as individuals age.

Other Fertility Considerations in Malawi

It is well documented that Malawian women have recently changed their fertility behaviors to account for HIV/AIDS infection or HIV/AIDS-related risks for themselves and their potential children (Hoffman et al. 2008; Noël-Miller 2003; Taulo et al. 2009; Yeatman 2009). Living in an area with high HIV/AIDS prevalence and believing that oneself has a high chance of becoming infected, may even hasten the timing of fertility for women (Trinitapoli and Yeatman 2011). These changes are, at least in part, likely due to the changing social understanding of sexual activity which stems from the diffusion of ideas from the developed world into these rural areas (Watkins 2004). But it is crucial to realize that HIV/AIDS is not solely responsible for recent changes in African fertility rates (Lewis et al. 2004; Rutenberg and Watkins 1997). The introduction of family planning programs and contraceptive technology have been well documented as exogenous factors contributing to fertility declines in SSA (Garenne and Joseph 2002), although the impact of contraception on fertility rates has been far less effective than predicted and seen in other developing regions of the world (Cleland et al. 2006). Leadership problems, economic

stagnation, and slow declines in child mortality (Caldwell and Caldwell 2002) have also hindered fertility declines in SSA. Cultural practices and values—such as young ages at first marriage or religious and familial pressures to produce numerous children (Caldwell and Caldwell 1987)—and partner separation due to employment also can impact fertility rates (Bongaarts, Frank, and Lesthaeghe 1984). While these dynamics may not always lead to fertility declines, the evidence clearly shows that fertility decisions in a sub-Saharan African context like Malawi are affected by a variety of reasons other than the high prevalence of HIV/AIDS.

Hypotheses

Since there is strong evidence—whether through biological, household, or economic mechanisms—that fertility can decrease *or* increase after a famine or a food crisis and that for the most part, these effects are not sustained into long-term trends, this research seemingly faces two competing hypotheses. Nonetheless, the most consistent thread across these competing hypotheses is that those who are most severely affected by food insecurity are less likely to have children soon afterward than those who were still affected, but less severely.

Hypothesis: After the 2002 famine and 2005-2006 food crisis, the likelihood of giving birth for all Malawian women will decrease for several years. Those living in places where staples were more severely affected by these events will have a lower chance of giving birth than those less affected, in subsequent years.

Counter-Hypothesis: After the 2002 famine and 2005-2006 food crisis, the likelihood of giving birth for all Malawian women will increase for several years. Those living in places

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where staples were more severely affected by these events will still have a lower chance of giving birth than those less affected, in subsequent years.

Data

       The data for this study come from the 2010 wave of the Malawi Longitudinal Study of Families and Health (MLSFH). These data retrospectively capture a portion of the picture that neither censuses nor the DHS can—extensive detail in years between 1998 and 2009. The study initially used stratified random sampling method to select districts within each of the three Malawian regions in 1998, and this continued at the village level. The villages selected in 1998 were used in the 2001, 2004, 2006, 2008, and 2010 waves of data. The three districts that have been surveyed are Rumphi in the Northern Region, Mchinji in the Central Region, and Balaka in the Southern Region. Roughly 1300 respondents were sampled in each district in each wave. There has been an attrition rate of about 20% to 30% between waves depending on the region of the country (for an in-depth summary of the survey and sampling, see Kohler et al. [2014]).

       Data from the 2010 wave of the MLSFH are employed to examine the likelihood of giving birth before, during, and after the 2002 famine and 2005-2006 food crisis. The sample is restricted to all women in the 2010 wave who were of reproductive age (15 years to 49 years) in 1998, in order to maximize the number of individuals who were likely to have given birth (whether formally married or not). Respondents were allowed to list up to 25 people comprising their family and household members who may be living or dead, and provided their own fertility histories in the process. Since the 2010 wave was collected between May and August, not all births in 2010 were recorded and are thus not included in

the analyses. I also use detailed market price data from central markets in the MLSFH sample's three regions to evaluate an individual's exposure to the famine and food crisis. These additional data on maize flour prices (in Tambala per kilogram—Tambala are to Kwacha as cents are to dollars) were collected in Southern Region (Balaka), Central Region (Mchinji), and Northern Region (Rumphi) by local informants and other MLSFH researchers for each month between 1999 and 2007.

Methods

I estimate multilevel, discrete-time event history logistic regression models with cross-level interactions and random coefficients to predict the likelihood of giving birth in a given year while accounting for exposure to the famine and food crisis; as such, this is a two-level model with time nested within individuals. Since I define twelve intervals in this analysis (1998 through 2009), and time is a key predictor, the discrete-time approach is more appropriate than a continuous time approach such as a Cox proportional hazards model. Further, with relatively little, and some competing, evidence on the hazard rates of fertility surrounding a famine year, a non-parametric approach is warranted. The twelve year observation window was chosen in order to effectively evaluate fertility trends before and after the famine and food crisis and capture information within and beyond the recent intercensal period. Since these data are retrospective, I do not lose respondents due to migration as is common in panel data. With this data structure, each spell encompasses the person-periods (person-years in this case) from the first interval (1998) to the next (i.e. 1999), and onward until a respondent is truncated from the analyses (by surpassing age 49). Women who have not completed their fertility by 2010 are censored accordingly. Out

of a possible 3798 respondents who participated in the 2010 survey (2234 women and 1564 men), 1384 women comprise this sample which results in 14492 person-year records.

The use of event history logistic regression models to examine the impact of food insecurity on fertility is not new (see Cai and Feng 2005; Eloundou-Enyegue, Stokes, and Cornwell 2000 for similar methodological approaches), but conducting such analyses in a two-level framework with cross-level interactions allows for a more rigorous evaluation of this relationship than previously conducted. The two-level approach—which models a random intercept for individuals—better accounts some of the unobserved heterogeneity between individuals in these models and reduces the dependence that pooling respondents' events has on estimates if multilevel modelling is not applied. But more importantly, including a second-level of time-invariant characteristics (a full approach to modelling is described below) nested within time-varying first-level characteristics, and allowing for a cross-level interaction between famine/food crisis exposure and individual years is more conceptually accurate in assessing the combination of a particular period, exposure, and potential effects on the likelihood of giving birth. Even though this methodological approach does not account for *within*-individual changes, it is an improvement in this line of research.

Variables and Equations

The level-one variables (see Equation 1) in this framework consist of those that are potentially time-varying (and available in the data) for each year from 1998 to 2009: number of children a woman has given birth to (by considering parity at the end of each interval, birth order is factored into this analysis), whether a child died in an interval, and

age of women serve as important controls in these analyses, while a period dummy variable for each year is a key predictor of fertility in these analyses since the events of a particular year (i.e. a famine), could impact the likelihood of giving birth. However, the MLSFH survey is limited in the amount of retrospective time-varying information that would be conducive to this analysis, such as HIV/AIDS status and *specific* timing of children's deaths (which may impact fertility). While HIV/AIDS status is not accounted for in the model, the data can approximate child deaths for 2004 and before, 2005 to 2007, 2008, and 2009. It is important to include at least some information on a child death as such an event could instigate a fertility response—possibly to replace the child. Thus, after controlling for key predictors of fertility, the variables stemming from Equation 1 are primarily used to answer the question: *Did the likelihood of giving birth change from year to year in Malawi?*

(1)

$$\ln\left(\frac{probability\ of\ giving\ birth}{1 - probability\ of\ giving\ birth}\right)$$

$$= \beta_{0j} + \beta_{1j}(\#of\ children) + \beta_{2j}(child\ died) + \beta_{3j}(age) + \beta_{4j}(1998 - 2009\ dummies)$$

This equation nests time-varying items within each individual's stable characteristics—represented in level two. Second-level variables (see Equation 2 below) are assumed to be time-invariant and include household wealth (a normally-distributed, composite score ranging from -4 to 6 factoring in agricultural productivity, land, assets, and income), educational attainment (no schooling, attended primary school [roughly first grade to eighth grade], and attended secondary school or higher [ninth grade onward]), an individual's "flour price history" which refers to one's exposure to living in areas with large fluctuations in the price of maize flour, a Malawian staple.

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The construction of the time-invariant, flour price history variable requires additional assumptions, but is nonetheless an innovative gateway into evaluating exposure to famines and food crises. Based on market prices of maize flour collected from the central market in each of the MLSFH sample regions, I construct a dichotomous variable in order to distinguish levels of exposure to the famine and food crisis—and food security more generally—for residents in all three of Malawi's regions. Without differentiating between these regions—which all were affected by the famine and food crisis—via some way to measure differential exposure to food insecurity I would only be able to examine period and regional effects with less certainty about an individual's exposure to food insecurity. Therefore, based on monthly flour price data collected in each region between 1999 and 2007, respondents are categorized as having severe exposure to flour price fluctuations if they live in a region where maize flour prices were 1.5 times the maximum monthly price (a conventional estimate of a famine or food crisis, see Hernandéz-Julián, Mansour, and Peters [2014]) of the previous year *in both* 2001 or 2002, and 2005 or 2006 (see Figure 1 below). Were this not the case, respondents were categorized as *not* having *severe* exposure to flour price fluctuations. In the end, the flour price data indicate that individuals in Malawi's south and central regions live in an environment that is subject to severe exposure to maize price fluctuations (flour price history=1) compared to individuals in the northern region who are subjected to less severe exposure (flour price history=0); consequently, this variable is treated as time-invariant in the model.[1] Respondents are assumed not to have migrated outside of their *region* between 1998 and 2009, and thus were exposed to such market prices for the duration of the period under study.[2] Lastly, it is plausible to assume that since maize is the staple and the most common crop in Malawi, that price fluctuations

are a consequence of the 2002 famine and 2005-2006 food crisis beyond typical month-to-month and annual fluctuations in market prices of goods (see Devereux 2002; Ellis and Manda 2012). Therefore, after controlling for time-invariant predictors of fertility, Equation 2 asks: *Is an individual's flour price history associated with the likelihood of giving birth?*

$$(2)$$

$$\beta_{0j} = \gamma_{00} + \gamma_{01}(household\ wealth\ [ln]) + \gamma_{02}(education) + \gamma_{03}(flour\ price\ history) + u_{0j}$$

$$\beta_{1j} = \gamma_{10} + u_{1j}$$

$$\beta_{2j} = \gamma_{20}$$

$$\beta_{3j} = \gamma_{30}$$

$$\beta_{4j} = \gamma_{40} + \gamma_{41}(flour\ price\ history)$$

β_{0j} is the random-intercept for the level 1 equation. β_{1j}, the random-coefficient for parity (number of children), is allowed to vary across individuals—for *any* period (not particular years)—rather than affect all individuals equally as would be the case in a conventional discrete-time event history model; further, it is unclear whether having more or less children increases the likelihood of giving birth in this high fertility society, and this random-coefficient accounts for this uncertainty. Conversely, β_{2j} and β_{3j}, the respective effects of a child dying and age, are not allowed to randomly vary across individuals; doing so over-specifies the model.

To answer the primary research question (*Is an individual's exposure to market price fluctuations associated with differing likelihoods of giving birth during and/or after the 2002 famine and 2005-2006 food crisis?*) one must test the cross-level interaction between each year and an individual's maize flour price history to most effectively see whether being exposed to large fluctuation in maize flour prices differentially predicts

changes in the likelihood of giving birth compared to those who did not experience as drastic changes in prices. This question is modeled in β_{4j} above. In the final analyses, estimates without this cross-level interaction are also included. If these last estimates differ by certain years for individuals who were exposed to the market price fluctuations, compared to those who were not, this would provide evidence that exposure to such food insecurity, in Malawi, impacted the chances of giving birth in years between the two most recent censuses. Lastly, with the exception of the period effects in Equation 1 and flour price history in Equation 2, all variables are grand-centered around the mean to more readily interpret the effects of years, one's flour price history, and their interactions.

Results

Descriptive Statistics

Table 1a depicts respondents' characteristics as of 2010. The mean age of the sample is just over 40 years at the last recorded interval. Respondents averaged 4.7 children by the end of 2009. However, over half of the sample between 1998 and 2004, 8.6% between 2005 and 2007, 1.7% in 2008, and 4.0% in 2009 experienced the death of one of their children. Two-thirds of the sample we exposed to maize flour price fluctuations during the famine and food crisis, which is reflected in the fact that these large fluctuations took place in the southern and central region, where two-thirds of the sample resides. 64% of women attended primary school, while slightly more than a quarter report having no education, and a small minority (7.7%) have some secondary level education or higher. Lastly, since the average wealth score for a respondent is positive, this suggests that the average respondent is not in debt.

Table 1a: Descriptive Statistics at Time of Survey, 2010

Categorical Variables	Percent Distributions
Education	
None	28.54
Attended Primary	63.80
Attended Secondary or Higher	7.66
Child Died	
Between 1998 and 2004	53.54
Between 2005 and 2007	8.60
In 2008	1.66
In 2009	3.97
Exposed to Maize Flour Price Fluctuations	66.17
Continuous Variables	Means (Standard Deviations)
Age (last recorded interval)	40.47 (9.72)
Number of Children (end of 2009)	4.79 (2.13)
Wealth Score	0.06 (2.05)
N	1384

Table 1b: Percent of Children Born by Year and Exposure to Flour Price Fluctuations

Year	Percent Distributions Full Sample	Not Exposed to Maize Flour Price Fluctuations	Exposed to Maize Flour Price Fluctuations
1998	18.93 (N=1384)	16.24 (N=474)	20.33 (N=910)
1999	13.90 (N=1360)	15.48 (N=465)	13.07 (N=895)
2000	22.18 (N=1339)	21.81 (N=454)	22.37 (N=885)
2001	16.11 (N=1316)	16.40 (N=445)	15.96 (N=871)
2002	16.24 (N=1229)	17.62 (N=437)	15.55 (N=862)
2003	19.49 (N=1267)	19.34 (N=424)	19.57 (N=843)
2004	18.96 (N=1229)	19.17 (N=412)	18.85 (N=817)
2005	14.32 (N=1208)	11.60 (N=405)	15.69 (N=803)
2006	18.17 (N=1172)	17.97 (N=395)	18.28 (N=777)
2007	16.48 (N=1147)	12.37 (N=388)	18.58 (N=759)
2008	15.38 (N=1118)	15.87 (N=378)	15.14 (N=740)
2009	14.30 (N=1084)	13.21 (N=371)	14.87 (N=713)

Note: Yearly reductions in contributing records reflects individuals censored out of analyses.

Table 1b indicates to percentage of women who gave birth, by year, if they had not been censored out of the analyses (i.e. reaching age 50). Between 14% and 22% of the sample gave birth in any given year, but, after splitting the sample by exposure to maize flour price fluctuations, some differences arise and are the focal points of the multilevel analyses below.

Figure 1 displays the monthly and yearly prices of maize flour, by region, in order to provide a better indication of the timing and implied effects of the 2002 famine and 2005-2006 food crisis for this particular rural Malawian sample. As is common in other settings, maize prices (and other staple prices not shown) shot up during the most severe months of the 2002 famine and 2005 food crisis (which lingered into 2006).

Figure 1: Monthly Changes in Maize Flour Prices (Tambala per Kilogram)
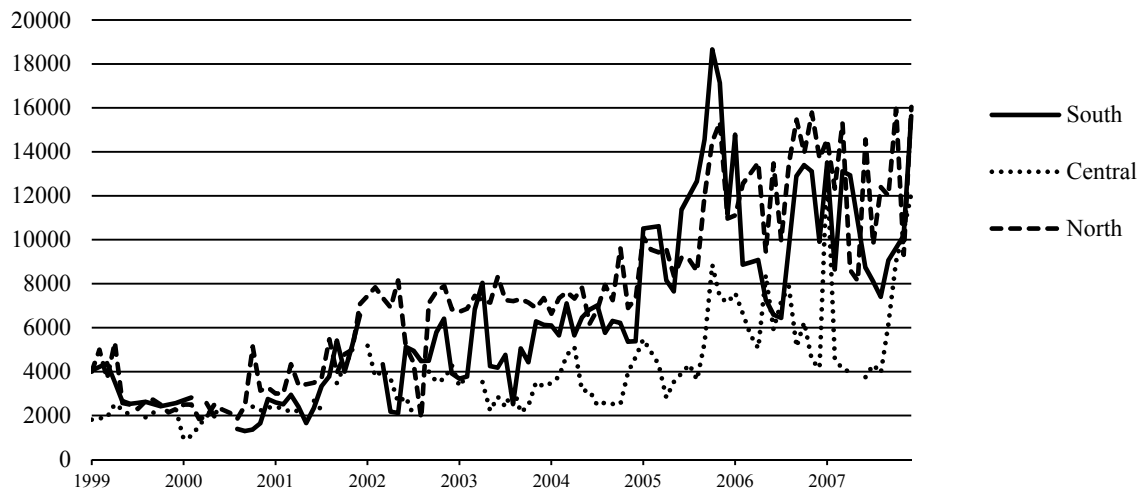
Multivariate Analyses

The multilevel discrete-time event history logistic regression models in Table 2 (below) reveal that the chances of having a birth might be affected by the famine and food crisis, after controlling for a respondent's number of child, age, and whether a child died in a particular interval, alongside household wealth and education. Model 1 includes first and second level variables and the period effects (years) on the likelihood of giving birth are unclear. Relative to 2002 it appears that women were more likely to give birth in 2003, 2004, 2006, and 2007—years all immediately after the 2002 famine and/or 2005-2006 food crisis—while women were less likely to give birth in 1999 and 2000. These results suggest

that fertility rises in the aftermath of major episodes of food insecurity. However, the aim of this paper is not to interpret period effects on fertility without accounting for exposure to a famine or food crisis.

In addition, a child's death and being older all decrease the log odds of having a child in any given interval. Individuals with some education—either some primary or secondary schooling—are significantly less likely to have a child in any given year (p<.05 and p<.001) relative to those without any schooling. But surprisingly, one's household wealth score and exposure to maize flour price fluctuations do not impact the chances of giving birth in a year on their own. These last results leave the door open for the possibility that exposure to maize flour price fluctuations might only be associated with the likelihood of giving birth in particular years, rather than all years.

The most revealing results indeed come from the cross-level interactions in Model 2. While maize flour price histories were not significantly associated with the likelihood of giving birth in *any* year, the positive significant interaction effects found in 2005 (p<.05) and 2007 for maize flour (p<.01) suggest that respondents who were exposed to market fluctuations in these prices are more likely to give birth in intervals *after* the 2002 famine and 2005-2006 food crisis than individuals who were not exposed to these fluctuations. The significant interaction between 1998 and maize flour price fluctuations is curious though, and postulated in the discussion section.

This cross-level relationship is presented via predicted probabilities of having another birth in a given year based on exposure (or no exposure) to fluctuations in maize

Table 2: Multilevel, Logistic Discrete-Time Event History Regression Estimates
of the Impact of Famine/Food Crisis on the Likelihood of Giving Birth

	(1)		(2)	
Level 2 (N =1346)				
Wealth Score	0.01		0.01	
Education				
None	Ref.		Ref.	
Primary	-0.14	*	-0.14	*
Secondary	-0.37	***	-0.37	***
Maize Flour Price Fluctuations	-0.02		-0.24	
Level 1 (N=14492)				
Number of Children	-0.03		-0.03	
Child Died	-0.15	**	-0.15	**
Age	-0.06	***	-0.06	***
Year				
1998	-0.01		-0.30	
1999	-0.36	***	-0.33	
2000	0.31	**	0.15	
2001	-0.08		-0.13	
2002	Ref.		Ref.	
2003	0.28	*	0.15	
2004	0.29	**	0.19	
2005	-0.05		-0.41	*
2006	0.28	**	0.17	
2007	0.22	*	-0.20	
2008	0.15		0.12	
2009	0.14		-0.05	
Cross-Level Interactions				
Maize Flour Price Fluctuations x 1998			0.44	*
Maize Flour Price Fluctuations x 1999			-0.05	
Maize Flour Price Fluctuations x 2000			0.23	
Maize Flour Price Fluctuations x 2001			0.07	
Maize Flour Price Fluctuations x 2003			0.20	
Maize Flour Price Fluctuations x 2004			0.16	
Maize Flour Price Fluctuations x 2005			0.53	*
Maize Flour Price Fluctuations x 2006			0.17	
Maize Flour Price Fluctuations x 2007			0.63	**
Maize Flour Price Fluctuations x 2008			0.05	
Maize Flour Price Fluctuations x 2009			0.30	
Intercept	-1.75	***	-1.59	***
s² (intercept)	0.002	***	0.003	***
	(0.049)		(0.050)	
s² (number of children)	0.011	***	0.011	***
	(0.105)		(0.105)	

Note: * p<.05, ** p<.01, *** p<.001. Estimates from population-averaged models
with robust standard errors are presented. Years are uncentered in Model 1 while years
and maize flour price fluctuations are uncentered in Model 2. Remaining variables are
grand-centered on the mean.

prices in Figure 2. For the majority of intervals, exposure to maize flour price fluctuations

does not impact the probability of giving birth to a child. But in 2005, while the conditional

period effect signals that while the chances of women giving birth decline, these chances

declined significantly *less* (p<.05) for women who were in a region that experienced large

maize flour price fluctuations than for those who were not exposed to these price

fluctuations. The pattern is slightly different in 2007 though. The conditional period effects

Figure 2: Predicted Probability of Giving Birth and Exposure to
Maize Flour Price Fluctuations
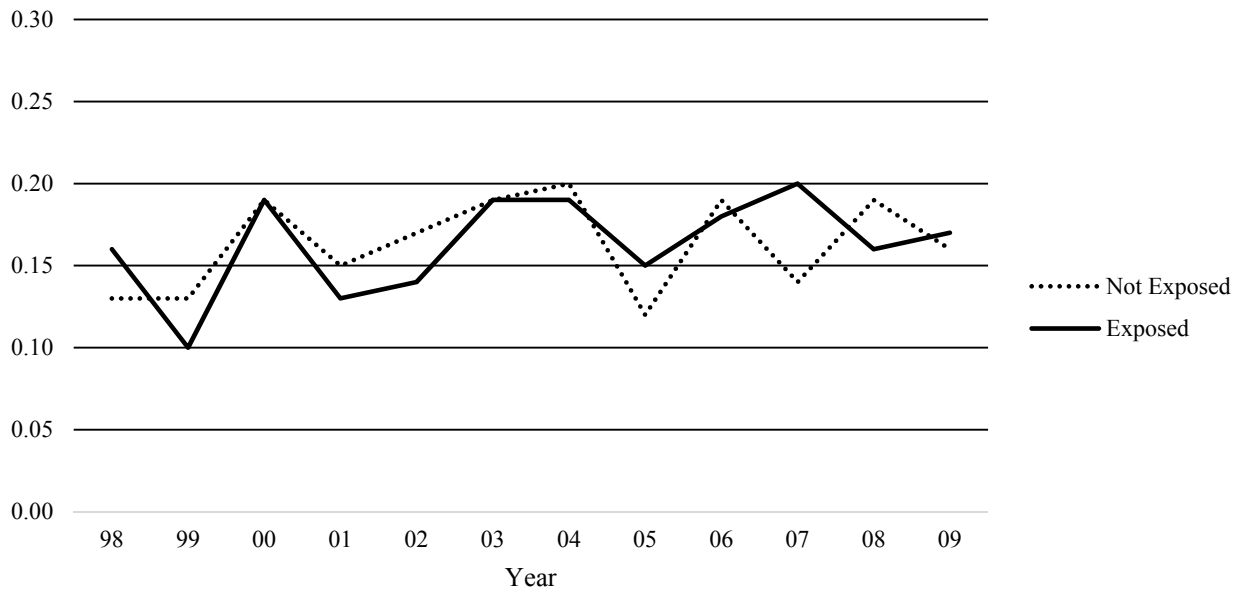
Note: There are significant differences in point estimates in 1998 (p<.05), 2005 (p<.05), and
2007 (p<.01) as per estimates presented in Table 2.

are not significantly associated with the likelihood of giving birth on their own, but this is

likely because of diverging fertility patterns among the two groups. Women who were

exposed to maize price fluctuations not only had about a 5% higher chance of having a

child in 2007, but this is largely because of the decline in the likelihood of giving birth

between 2006 and 2007 for those who were not exposed to the large maize price

fluctuations.

Discussion

The effects of exposure to the 2002 famine and 2005-2006 food crisis are seemingly not followed by extended declines in fertility (Eloundou-Enyegue, Stokes, and Cornwell 2000; Neels, Theunynck, and Wood 2013), or at least delays in fertility (Lindstrom and Berhanu 1999; Ryder 1982; Sobotka, Skirbekk, and Philipov 2011). Being located in a setting that has been historically exposed to large fluctuations in maize flour prices over the years also does not seem to impact the chances of giving birth in *any* particular year. Not surprisingly, factors such as getting older and being more highly-educated coincide with lower chances of a woman giving birth in any year. The death of a child also decreases a woman's chance of giving birth in any year. Yet after controlling for all of these factors, there is still evidence of the chances of childbearing slightly increasing immediately after the Malawian famine and food crisis when only examining period effects.

However, when factoring in an individual's potential exposure to these events—via the interaction effect between an individual's maize flour price history and each year from 1998 to 2009—it appears that there might be a relationship between exposure and changes in the likelihood of giving birth in the following years. The likelihood of giving birth in 2002—or even the two years after the famine—does not seem to be negatively influenced by exposure changes in maize flour prices as a result of the famine. But the higher chances of giving birth in 2005 for those exposed to these price shocks—despite an overall decline in the likelihood of giving birth for all individuals—suggests that Malawian women's fertility decisions in such areas might be more resilient to the effects of a major shock like the 2002 famine. While women in northern Malawi generally have not experienced the large fluctuations in maize flour prices like those in the central and southern regions based

on the conditions set out in measuring the flour price history variable—which might be due in part to more fertile growing conditions in the north—they still experienced some effects of a nationwide famine. Therefore, the steep decline in the chances of giving birth in 2005, both relative to 2004 and to those in the central and southern regions, is intriguing and hints at the sensitivity of fertility among those who experienced a famine, but not the most severe effects. Again in 2007, it appears that fertility is downwardly sensitive as well for those who were in a food crisis (in 2005-2006), but did not experience its worst effects. It is interesting that exposure to these maize flour price fluctuations is actually associated with a significantly higher probability of giving birth since these chances were not collectively lower for all women (as in 2005). This might suggest even further resilience to the effects of food insecurity for women who are in areas that are more exposed to major price fluctuations. The unexpected significant interaction between the year 1998 and exposure to maize flour price fluctuations suggests that these effects could be spurious—since no major events, like a famine, took place in this year. Nonetheless, the effects witnessed in 2005 and 2007 are very likely the result of the famine or food crisis, even if the mechanisms remain vague. In sum, neither the proposed hypothesis nor counter-hypothesis is satisfied: fertility both increases and decreases in the subsequent years after the famine and food crisis, and women's fertility in the most severely affected parts of the country seems to be more resilient than in less affected parts of the country.

The reasons behind why women, or women's household more generally, were more likely to give birth in 2005 and 2007 if they were exposed to large fluctuations in the household staples of maize flour are also unclear. But, if anything, these findings lend support to the idea that fertility might increase after a famine or food crisis, or other

environmental shocks, since children are seen as a future source of economic support and families decide to have children as insurance in the wake of such events (Biddlecom, Axinn, and Barber 2005; Bongaarts and Cain 1981; Filmer and Pritchett 2002). Even though the MLSFH does not provide yearly data on health clinic attendance and/or contraceptive use, one could still reasonably expect that during famine or food crisis years in Malawi, needs such as food, water, and shelter took economic precedence over other needs such as purchasing contraception, as has often been found and theorized among demographers and economists (Becker 1976; Caldwell, Reddy, and Caldwell 1986; Clifford, Falkingham, Hinde 2010; Galloway 1988; Menken and Phillips 1990), alongside evidence of at least temporary (if not long-term) declines in fertility in SSA (Lindstrom and Berhanu 1999; Eloundou-Enyegue, Stokes, and Cornwell 2000). Therefore, it is somewhat surprising that the chance of having a child did not greatly diminish after these shocks but rather, remain the same or rise.

Of course, one must consider that the distinction between these results and most others lies in the fact that micro-level fertility trends are examined in this piece as opposed to national-level total fertility rates. By 2009, it is clear that the chances of childbearing are not considerably higher or lower than in 1998—even after controlling for the obvious predictors pertaining to the aging process, which aligns with the drop in total fertility among Malawian women in this time period. It seems that, on the whole, the 2002 famine and 2005-2006 food crisis did not continue to discourage women from, or lower their chances of, having a child between Malawi's last two censuses. If anything, the results show that fertility for women most severely exposed to the famine and food crisis was more resilient than in other areas. It is important to consider that Malawi's famine and food crisis

were less devastating than the extreme case of Ethiopia in the mid-1980s, and these findings might support Kane's (1987) propositions about the correlation between the strength of a famine and the effect on fertility. Although it is beyond the scope of this paper, future research must ask how severe a famine or food crisis must be in order to drastically impact the likelihood of giving birth during and after these shocks.

However, the MLSFH data and retrospective birth histories hinder the extent to which one could explicitly pinpoint the effects of the 2002 famine and 2005-2006 food crisis. The data cannot depict the timing of fertility, or respondents' motivations, more clearly in these years. This study is also limited to a small sample of rural Malawians whose birth histories are constructed retrospectively and without regard to birth month, and are undoubtedly prone to errors (Potter 1977). Further, I only examine live births since the data do not contain information on miscarriages or stillbirths since these are possible consequences of malnutrition, which biases my ability to fully assess how the household *decision* to have a child is affected by the famine or food crisis. Although I present information on deaths within the household, predicting the effects of famines on infant and child mortality is outside the scope of this paper. Next, the HIV statuses—or even perceived HIV statuses—of these women or their partners are also unable to be included in these discrete-time hazard models, even though the association between HIV and fertility and fertility preferences exists (Hoffman et al. 2008; Noël-Miller 2003; Taulo et al. 2009; Watkins 2004; Yeatman 2009); it is unclear how HIV impacted these individuals' decisions to have children in a given year. Household decisions and the rationale behind having another child are also left unknown, except for assumptions and speculation about age and the life course, cohort, birth order, and education, included in the models. Additionally, the

heaping of births around the year 2000 might be problematic when analyzing these retrospective birth histories since 2000 was the nearest decadal year. Age heaping has been reported as problematic in research on Likoma Island in Malawi (Helleringer, Kohler, and Mkandawire 2011) but an analysis of DHS surveys in low-income countries suggests that birth heaping was not a severe issue in 2000 for Malawi compared to other sub-Saharan African nations (Pullum 2006). Nonetheless, in results not presented, I tested whether birth heaping around 2000 in this study impacted my estimates by randomly distributing births that were reported in 1999, 2000, and 2001 within each of these years. The resulting estimates are nearly identical to those presented in this paper which suggests that possible birth heaping was not a major factor in these analyses. With these limitations in mind, these results still contribute to our knowledge of the impacts of famines/food crises on fertility.

Conclusion

The results presented and the absence of other major events between 2001 and 2009 implies that the famine of 2002 and the food crisis of 2005-2006 had some residual, lingering effects on women's fertility, even if the mechanisms linking these events and fertility are not clear. These findings are substantively important. The relative dearth of micro-level research on the relationship between famines and fertility is likely due to the difficulties in acquiring comprehensive birth histories in many countries that have experienced famines, food crises, or other major economic or environmental shocks for that matter. Although this study is largely exploratory and the results not completely clear, it aims to spur future research on this important relationship. For instance, if economic and environmental shocks are likely to lead to short term fertility increases or declines in

subsequent years, and the demographic jury is still out as to whether these shocks lead to *sustained* fertility trends, this may signal a need for further revisions to current population estimates that predict Malawi will more than double in size by 2050 and be five times larger by 2100 (United Nations 2013b), along with similar consequences in other developing nations. Estimates including the likelihood of environmental and economic shocks could improve future population projections and, in turn, the various policies, such as the availability of schooling or acquisition of staple reserves that are designed to address these projections. More practically, children born in famine or food crisis years may have been malnourished during gestation and afterward, which could have long-term effects on various outcomes such as lower chances of completing high school and worse health (Shi 2011).

The use of multilevel, logistic discrete-time event history regressions with cross-level interactions and a random coefficient for parity builds upon the methodological rigor brought to similar analytical approaches (i.e. Cai and Feng 2005; Eloundou-Enyegue, Stokes, and Cornwell 2000). The analyses presented above better account for unobserved heterogeneity (inherent in this approach) by modeling the intercept for individuals separately from time-varying covariates and allowing parity to vary across individuals, rather than being uniformly distributed. But using a multilevel framework allows for the critical cross-level interaction between one's exposure to characteristics of market prices in their region of residence and a particular, which is a conceptual improvement upon previous work since the flour price history measure is a proxy for the market's sensitivity to environmental shocks that lead to famines and food crises; thus, one can go beyond making assumptions solely about period effects (i.e. Hernandéz-Julián, Mansour, and

Peters 2014; Lindstrom and Berhanu 1999; Razzaque 1988) by estimating period effects coupled with market price sensitivity. However, uncovering mechanisms and even biological exposure to famines and food crises needs to be a priority in survey research. Since these events are generally unpredictable, collecting more detailed measures of a woman's health is necessary for future research examining the relationship between food insecurity and fertility. Such data would only improve our understanding of this relationship.

This piece is an extension of the growing body of literature that is concerned with these implications but ultimately, larger studies of this nature must be conducted across more countries. More importantly, understanding the impacts of a shock like a famine or food crisis on economically vulnerable populations, such as rural Malawians, is a worthwhile endeavor. The opportunity to comprehend the impacts that a major shock has at the national and household levels is important so that governments, non-governmental organizations, and citizens can identify suitable interventions to support families and direct resources into appropriate places during times of higher or lower fertility.

Notes:

[1] Although it is conceivable to measure year-by-year, time-varying flour prices and incorporate these at level one in the model, unavailable data for 1998, 2008, and 2009 do not allow for this possibility.

[2] While younger men are likely to migrate internally and for short durations, including to other regions of Malawi, for employment, no evidence suggests that this is the case for women even though women and men have about an equal chance of migrating to another

district (a sublevel of each region) at some point in their lives (Malawi National Statistical Office 2011). While inter-regional migration inevitably occurs for women—e.g. those who moved to urban centers for employment or to re-unite with their or their spouse's family— this is considerably less likely for the Malawian women in this sample, who live in fairly remote rural communities and marry men from within their home region. Since the data do not contain information to confirm these suspicions, they can only remain as such.

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Chapter Two

The Duration of Residence Spells among Malawians: How Family and Friend Networks Play a Role in Migration

Abstract

Employment, age, marriage, regional, and period effects have been highly salient in explaining migration patterns in African contexts. This paper, however, examines an alternative theoretical perspective on the social determinants of migration in Africa. Considering that many African cultures are guided by strong kinship norms, it is surprising that the effect of the presence of family members on the length of residence spells is relatively unknown on a continent with voluminous migrant flows and strong kinship norms. I begin by asking whether the presence of family members in migrants' destinations impacts the duration of their stay at a location. Then, I explore whether the presence of non-kin—in particular, friends—might also influence the duration of a migrant's stay at a given location, since friends could offer additional sources of support. Using detailed retrospective residence history data on 1069 Malawians from the Migration and Health in Malawi (MHM) Project, I find that the presence of family and friends in a destination location is associated with the duration of one's residence in different ways after accounting for competing theoretical factors.

Introduction

Throughout sub-Saharan Africa (SSA) individuals and families—especially younger ones—migrate frequently, often for employment in urban centers, to rural areas with more fertile soil, and sometimes to neighboring countries that offer a wider array of employment opportunities. While the largest share of African migrants flock from rural to urban areas (Cohen 2004), this is rarely permanent and migration spells in SSA are most often short and cyclical between urban centers and rural areas (Ferguson 1999; Potts 2010). Migration between rural and urban spaces is almost an expected component of one's life (Englund 2002).

However, the duration that African migrants reside at various locations, before moving away, in conjunction with the oft-theorized determinants of the length of migration spells—such as employment and marital considerations—has rarely been explicitly considered in demographic research. Understanding the social determinants of the length of migration spells is also practically important for regions, towns, and villages in African nations since the transience of such sub-populations will determine the spatial distributions and trends of these populations. As it stands, rural and urban planners can only take into account net migration trends when implementing development schemes—like urban renewal or irrigation expansion—since there is little empirical evidence assessing the determinants of *how long* an individual will stay in a particular part of the country (or abroad). By understanding factors associated with the duration of migration spells in developing settings, development schemes could eventually be tailored to the likely length that residents will benefit from projects or how to entice residents to remain in an area longer to maximize the effectiveness of such projects.

Formative research on the duration of residence spells in developed settings made it apparent that younger individuals were less likely to spend longer periods at a destination and those who have stayed at a location for a longer period were less likely to move (Morrison 1967); but variation in these patterns could only be explained by unobserved factors pertaining to particular social contexts (Land 1969). In SSA though, there are several well-known factors—other than job loss, few economic opportunities, age, or time spent in a location—associated with the decision to migrate, but not how long an individual resides at a location. Most notably, divorce and HIV/AIDS infection are closely associated with the chances of an individual migrating (Anglewicz 2012; Chirwa 1997; Mtika 2007; Reniers 2003; Schatz 2005).

This paper, however, examines an alternative theoretical perspective on "push-pull" factors that migrants face in SSA by looking at conditions that might keep an individual around at a destination. Particularly in SSA, many cultures are guided by strong kinship norms (Evans-Pritchard 1951; Kuper 1963; Radcliffe-Brown and Ford 1950). Family members are reliable sources of insurance and support in the absence of formal credit markets—even altruistically in some cases (De Weerdt and Fafchamps 2011). Therefore, the presence of family members in a migrant's next residence would seemingly entice that individual to remain there longer, knowing that there is at least the potential to live around others who are essentially obligated to provide support.

But, the effect that family members have on residence spells is relatively unknown on a continent with both voluminous migrant flows *and* strong kinship norms. It would not be at all surprising that one's networks would be influential in the decision to remain at a location, but migration research in SSA has not often been able to effectively test the

impacts of these networks. Therefore, I begin by asking whether the presence of family members in migrants' destinations impacts the duration of stay at a particular location. Then, I explore whether the presence of non-kin—in particular, friends—might also influence the duration of a migrant's stay at a given location, since friends have been witnessed to offer complementary sources of support compared to family (Aguilar 1999; Cheater 1978), but also act as substitutes in the absence of family members in African contexts (Rodgers 2009). Using detailed and unique, retrospective data on residence histories among rural Malawians, I am able to assess whether the presence of family and friends in a destination location predicts the duration of one's residence after accounting for competing factors.

Networks as Motivation to Stay or Migrate

Migrants are motivated to remain at a location or move for a number of reasons; however, most of this research is focused on the *chances of migrating* as opposed to the *length of migration spells*—the focus of this paper. Nonetheless, the primary theoretical framework for evaluating decisions to migrate is rooted in the neo-classical economics tradition, whereby individuals will migrate if they believe that they will maximize their earnings in the destination compared to what they could earn at their current location (Harris-Todaro 1970; Todaro 1989; Todaro and Maruszko 1987).

Non-economic motivations to migrate have always been important, even if they were not initially an important empirical element of migration theory. Ensuing migration research—often falling under the realm of the "new economics of labor migration"—that explored the extent to which factors like education, gender, risk pooling, and household

needs moderate the chance of migrating, even when wages are higher in another location (i.e. Fields 1982; Stark and Bloom 1985), opened the door for postulations that other factors, such as the role of networks could significantly factor into the decision for non-migrants and even migrants to move, in both developing and developed contexts. For instance, the greater presence of those of the same ethnicity or caste, and those who share a similar language in migrants' destinations in Nepal have been deemed to "play a strong– and probably more important–role" in the decision to migrate than economic considerations (Fafchamps and Shilpi 2013, 409). In the US, it has been shown that the presence of family and community members for Mexican migrants at their destination location increases the chances of an individual migrating there (Massey and Espinosa 1997). For individuals with few community ties in their destination, the effect of the presence of family members will be amplified in the decision to migrate (Winters, De Janvry, and Sadoulet 2001). This is in part due to the process of "cumulative causation", whereby the presence of family and community members leads to additional migrations from family and community members who become increasingly established and able to provide future migrants information and potential jobs (Massey 1990). Thus, having an established group—whether it is comprised of kin or not—at a destination has been shown to increase the chances of an individual migrating there.

Evidence supporting the notion that networks are not trivial, with respect to migration, has indeed been found in SSA, although most of this research has focused on rural-urban, circular migrants. Strong cultural bonds among migrants facilitate migration flows (Oucho 1990) since the "presence of relatives at a destination is sometimes more important than economic motives because prospective migrants must start from a base

before being self-reliant" (Oucho and Gold 1993, 274). This is especially the case for international (and undocumented) migrants who are unlikely to move to a location that even has potentially higher chances of employment, without the catalytic presence of both family *and* friends already in that destination (Muanamoha, Maharaj, and Whyte 2010).

Of course, a substantial body of research has shown that the absence of networks and contacts in a migrant's destination can have negative social, economic, and health effects on an individual. Such is the case in urban SSA settings that are already characterized as having little social cohesion and generalized trust, even among individuals of the same ethnic and national backgrounds (Madhavan and Landau 2011); developing support networks under such conditions is difficult, which reiterates the importance of migrants already having networks in a destination. Some of the severe consequences of the lack of established networks—especially for women and in urban areas—include being left vulnerable, as a result of a minimal support system, to rape, HIV infection, alcoholism, and drug abuse (Dunkle et al. 2004; Hunter 2002; Jewkes and Abrams 2002; Kalichman et al. 2005; O'Connor et al. 2011; Onyejekwe 2004). Therefore, knowing people who could potentially provide support in a destination, would seemingly be an important motivating factor in the decision to migrate again or to stay.

While it is clear that the networks in migrants' destinations matter and that the presence of community members and family influence the chances of moving to, or away from, a location, we know little about how these networks influence the *length* of a migrant's residence in SSA, as noted above. Of the available research in other developing contexts, we see slightly different possibilities than what one would expect. For example, in Egypt, migrants who have more-established social networks in their next destination are

less likely to stay there for longer periods than those with no established networks (Bauer and Gang 2002). In China, migration spells for rural-urban migrants are shortened not by network connections in their current locations, but by pressures from family members who need their labor in home villages (Hare 1999). In light of these findings, it still seems plausible that without a base of support in their destination, having family, friends, community members, or other sources of financial and emotional support where migrants are, is important for these migrants to remain at their location for longer durations.

The Roles of Kin and Non-Kin in sub-Saharan Africa

Like in many SSA nations, strong, traditional kinship norms guide the daily lives of many individuals in Malawi, and the extensive support that kinship systems offer can also quickly evaporate if individuals break these norms. Non-kin—by comparison—such as friends, are often viewed suspiciously (Rodgers 2009) as their actions are not bound by blood-relations. Therefore, it is expected that family members serve as primary, and crucial, financial and non-financial sources of support, which has been shown empirically in Malawi (Kohler et al. 2012). Yet, anthropological research in SSA suggests that despite some mistrust towards friends, they can act as complementary sources of support for individuals (Aguilar 1999). Friends often provide small financial exchanges during funerals (Stefaniszyn 1950; Tew 1951), financial and non-financial security for migrants in the physical absence of family members (Rodgers 2009), and important advice on fertility decisions and contraception (Kohler, Behrman, and Watkins 2001).

In Malawi, the available evidence suggests that non-kin (including friends) are important in providing small amounts of financial assistance to individuals after the death

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of a family member, to discuss HIV/AIDS-related issues, and for emotional support after a divorce (Gerland 2006; Kohler, Behrman, and Watkins 2007; Trinitapoli and Weinreb 2012; Watkins 2004). Friends, in Malawi, are thus comparatively weaker ties, although not necessarily less important as they could offer information, security, or access to other networks—things that family members cannot always do—as Granovetter (1973) theorized.

Malawi and Migration

Malawi is a small, southern African nation of about 16 million residents with over 80% of the population located in rural areas (Malawi National Statistical Office 2011). Malawi is thus fairly densely populated (151 people/km^2 in 2008 [World Bank 2011]) by African standards. Its small size is conducive to internal migration with most migration originating from the countryside. Malawi has a predominantly young population. An estimated 45.8% of its population is under 15 years old, and slightly more than half are of working age—between 15 and 64 (United Nations 2013). The combination of relatively high population density, small geographic size, and a young population that is prone to move for work, presents an ideal setting to study migration.

Since gaining independence from Britain in 1964 until the self-proclaimed "President-For-Life", Hastings Kamuzu Banda, was relinquished of power during Malawi's first multi-party elections in 1994, the Malawian government made clear efforts to redistribute its population to underdeveloped rural areas through (and for) the development of large-scale commercial agriculture (Kydd and Christiansen 1982). The increased intensity of internal migration to such areas during this time suggests that these

efforts were effective, even though such a policy was not explicit (Kalipeni 1992). But internal migration episodes have rarely been permanent for Malawians. Frequent and short-lived stints in rural and urban areas, other than their homes, are often undertaken with the goal of achieving financial security so as to return and settle in their home village one day (Englund 2002). Also, since the late 1980s and early 1990s, Malawians have been less likely to move abroad for employment—typically to the nearby South Africa—due to economic reform, and instead tend to move internally for work. Clearly, economic motivations have strongly influenced migration in Malawi, like in other SSA nations.

However, a growing body of research has shown that push-pull factors in Malawian migration patterns are not only economic, but also related to marriage, divorce, HIV/AIDS, and inheritance patterns. Divorce—especially in tightly knit rural areas—typically leads to migration for one of the partners, and if one partner is a labor migrant, marital instability is also likely (Reniers 2003). Approximately 10.6% of 15 to 49 year olds are infected with HIV/AIDS (Malawi National Statistical Office and ICF Macro 2011) and it is well-known in Malawi, that like in other SSA nations—migrant laborers such as truck drivers, traders, miners, and commercial sex workers, who are likely to engage in risky sexual behavior and expose themselves to larger sexual networks, are at a higher risk of being HIV-positive than non-migrants (Chirwa 1997). This phenomenon could partly be explained by the belief that underdeveloped economic initiatives, specifically in rural areas, have forced younger adults to migrate elsewhere in Malawi as a lifestyle choice, which leads to less adherence to HIV/AIDS preventative efforts and thus contraction of the virus (Mtika 2007). But, it has recently been found that HIV-positive individuals are a select group who are more

likely to migrate than HIV-negative individuals, and that marital dissolution plays a moderating role in this process (Anglewicz 2012).

Further, depending on patrilocal and matrilocal residence patterns, divorce will differentially impact internal migration patterns by gender. As Zulu (1996) and Schatz (2005) indicate, a divorce in southern Malawi—where matrilocal residence patterns exist—is supposed to result in the husband leaving with only his blanket or mat. Without financial resources or children, his survival will depend on migrating to a different part of the region or country for employment or reunification with his family and their resources. Even in non-matrilocal practicing regions, this trend appears to be more common as women gain agency within their households and communities as protective responses to the HIV/AIDS epidemic.

Therefore, in Malawi, non-economic reasons for migration provide valuable empirical insight into residence patterns. Malawi is an excellent context in which to expand migration theory and begin exploring the social determinants of the duration of migration.

Hypotheses

In a country like Malawi, where kinship norms are strong, I expect that the presence of family members at a destination will increase the duration of a migrant's residence in any location, more so than the presence of friends. But having a network consisting of both family and friends prior to migrating will be associated with the longest residence spells; family and friends offer different types of support and therefore provide access to a more diverse network of resources than that of only family or only friends. Thus, I test the following hypotheses in this paper:

Hypothesis 1: The effects of knowing family members or friends prior to moving to a location will lead to longer residence spells there, but the effect of knowing family members will be stronger than that of friends.

Hypothesis 2: The duration of a residence spell will be longer if Malawians knew a greater number of family and friends at the location before they moved, compared to knowing only family members, only friends, or nobody.

Data

To answer these questions, I use data from the Migration and Health in Malawi (MHM) Project, which was conducted between June and September 2013. First, the dataset contains a reference group of "non-migrants" (N=751)—individuals who were originally sampled in at least one wave (2001, 2004, 2006, 2008, and/or 2010) of the Malawi Longitudinal Study of Families and Health (MLSFH) (see Kohler et al. 2014 for a description of that entire project) and had not maintained another residence for six months or more since they were last sampled (therefore they could have lived in other places for less than six months, although this is unknown), or were found again in their original sample village after taking up residence elsewhere in between. These "non-migrants" represent a randomly-selected group of individuals from within the aforementioned MLSFH sites of Malawi's three regions: Rumphi in the northern region, Mchinji in the central region, and Balaka in the southern region. Second, a "migrant" (N=896) comparison group of individuals who had also been previously sampled in the MLSFH but now reside at a different location, along with their new spouses (N=120), are included. These

"migrants" in the MHM Project were tracked down and located in numerous districts throughout Malawi, and not necessarily within each of the MLSFH sample sites.

Respondents were asked comprehensive information on their demographic characteristics, household composition, migration histories, financial and non-financial exchanges, marriages, family mortality, economic circumstances, health and behaviors (including sexuality), probabilistic expectations pertaining to HIV/AIDS transmission, and social participation. However, it is the detailed data on respondents' residence histories that are exploited in these analyses.

Data collection on the residence histories took the form of a roster. Respondents were prompted with the following statement: "Please list all locations where you've resided for six (6) months or more, starting with your current residence and ending with your birthplace. List up to 12 times when you've lived in different places." Respondents were allowed to list the same place more than once as well. For each location, respondents were asked to list the country in which they resided (overwhelmingly, Malawi); if Malawi, which district they resided in; the month and year they moved to that location; age when they moved; up to three reasons (in decreasing order of importance) why they moved; the number of (broadly defined) family members they knew in that location prior to moving; the number of friends they knew in that location prior to moving; their main way of earning money at that location; and whom they lived with at that location. Detailed information is provided for respondents' residence patterns, duration of stay at a location, motivations to move, *potential* sources of support in the destination, employment, and residence at each location. While most of these migration spells are likely to have taken place within Malawi,

a small portion occurred in neighboring countries such as South Africa, Tanzania, Zambia, and Zimbabwe.

Sample

For the purposes of this paper, data on 1069 respondents are analyzed out of a total of 1763 individuals in the MHM Project. Individuals excluded from these analyses are respondents with completely missing information (N=323, those who could not be tracked or who refused to participate), those who had never taken up another residence for six months or more (N=260), those who were less than 15 years old when surveyed in the MHM (N=66), and those who were dropped from the analyses for containing missing data on key variables such as the duration of residence, family and friends known at a location prior to residing there, gender, or age (N=45). Descriptive differences on several time-invariant characteristics relevant to these analyses are compared in Appendix Table 1 for respondents who are either in the analytic sample or were selectively dropped ("Main Sample"), respondents with completely missing information ("Missing"), or those who had never held another residence for six months or more ("Never Moved"). In-depth analyses comparing the differences between the sample missing virtually all information (~18%) and the rest of the sample (~82%) suggest that the two groups are not systematically different from one another (Anglewicz et al. 2015).

Respondents who did not indicate that they had ever resided at a location—other than their current location—for six months or more were necessarily dropped since they would not have known any family or friends prior to moving there, because they were born at that location. Individuals under the age of 15—at the time of survey and when under 15

during a previous move (explained below)—are also dropped since they are considered dependents and thus, their known motivations and networks prior to moving to a new location would nearly completely reflect the characteristics of their parents.

Methods and Variables

To evaluate my hypotheses, I employ logistic regressions using standard discrete-time event history analysis techniques (see Allison 1984) to model the probability that an individual moves from particular residence with respect to a baseline hazard function of the duration of a migration spell. The data are organized into "person-move" format by utilizing up to twelve lines (in effect, all respondents' residences of six months or more). Since most respondents have moved more than once, they contribute multiple records to these analyses. As a result, the 1069 respondents in the analytical sample contribute 2341 person-moves to the discrete-time event history models. The analyses account for multiple observations per many respondents and clustering of residuals by estimating robust standard errors for each individual.

The dependent variable in these analyses is dichotomous—whether a respondent moved from a residence (1) or not (0). However, to model duration, the linear form of the duration variable—years at residence—is incorporated into these models as the baseline hazard function. This duration variable is the number of years in which a respondent resided at a particular location *after moving there and before moving elsewhere for a 6 month or more residence spell*. Individuals who moved to a location and away in the same year (or moved to their current location in the year of the survey) are given a duration value of 0.5; on the whole, respondents who spent only a month at a location or 11 months at a

location are assumed to balance one another out, resulting in a mid-point estimate for duration in these cases. In results not presented, I assessed alternative models specifying a quadratic baseline hazard, such as years squared, which turn out to be less intuitive and worse-fitting than a linear baseline hazard, even though the results are substantively similar to those presented in the text below. Further, although one could use a Cox proportional hazards model to incorporate duration more explicitly as the outcome variable, years at residence is the only measure of duration available and is relatively crude for the purposes of Cox models since too many respondents' length of migration spells are "tied" in these data, resulting in biased regression estimates even after adjusting for these ties via the Breslow or Efron methods (see Allison 2010).

The primary independent variables are whether a respondent knew any family members (None=0, Some=1), and any friends (None=0, Some=1), at the location prior to moving there. These variables were originally coded as "None", "1-5 people", "6-10" people, "10-20 people", and "More than 20 people", but collapsed as described since there are no discernable differences between "none" and the other categories. Additionally, these dichotomous variables produce an ideal interaction effect to test Hypothesis 2 in the form of a categorical variable pertaining to the combined effect of family and friends known at a location prior to moving there: "None", "Some Friends, No Family", "Some Family, No Friends", and "Some Family and Some Friends".

Control variables include gender, age (categorized as 15-24, 25-34, 35-44, and 45+), ethnicity (Yao and non-Yao, since the Yao are predominantly different from all other groups due to their religion [Islam], location [South], and overall economic marginalization), region of a residence spell (South, Central, North, and Other Southern

African Development Community [SADC] Country), most important reason to move (join spouse, divorce/widowhood, employment/agriculture, family/village conflict, and other), job at location (agriculture, non-agriculture, and none), and the period in which one moved to a new residence (1994 or before, and after 1994). These controls not only account for important demographic characteristics that influence migration (i.e. age), but also important stratifying aspects of Malawian society (i.e. gender and ethnicity) and circumstantial factors contributing to migration and length of one's stay (i.e. motivations and employment), and in particular to the Malawian context (i.e. period effects related to the government's population-redistribution schemes). These analyses are conducted for the full sample (women and men pooled), and women and men separately since the networks that female and male migrants have access to could offer different resources and, ultimately, different experiences at a particular residence (i.e. Curran et al. 2005; Hagan 1998; Kanaiaupuni 2000).

Although these analyses cannot control for unobserved time-invariant characteristics that may underlie respondents' residence histories, a critical aspect of these analyses lies in the causal ordering of responses in the residence history data, which reduces endogeneity and ambiguity in the relationships assessed in these analyses. Particularly, the data record one's motivations to move to a particular location, which must often be assumed *post-hoc* in most migration research, are explicit and thus correctly causally ordered. Similarly, the survey asks for the number of family and friends known *prior* to moving, rather than number of family and friends known at the end of residing at a location (which could be higher or lower than when having first moved there). Thus, the influence

of these initial network contacts—and in many cases, one's "social capital"—on the duration of residence are correctly accounted for.

Results-Descriptive

Table 1 provides descriptive characteristics of the analytical sample for this study. Women comprise over half of the sample (57.8%) while men account for the remaining 42.2%. 21.1% of the entire sample were of the Yao ethnic group, while the others (78.9%) consist of non-Yao ethnic groups such as the Chewa, Tumbuka, and Ngoni; this distribution is representative of Malawi's ethnic composition. Within the female sub-sample, those of Yao ethnicity account for a slightly smaller share (17.5%) whereas the opposite is the case for men (25.9%). At the time of the survey, the average age of all respondents was 30.8 years, while the average for women and men were 28.7 and 33.6 years, respectively.

Respondents averaged moving twice (women 1.9 times and men 2.1 times), or in other words they resided in roughly two places for six months or more after initially moving away from their place of birth. Also, respondents spent 8.4 years on average (8.5 for women and 8.3 for men) at each residence.

Of all the residence spells under consideration in these analyses, 33.4% were in Malawi's southern region, 24.8% in the central region, 33.4% in the northern region, and 8.4% in a nearby African nation; this trend is essentially mirrored for women and men, although minor differences exist. For all residence spells, 37.5% took place primarily due to employment or agricultural-related reasons (27.1% for women and 49.3% for men), and another 34.9% of moves were attributed to respondents joining their spouse (44.1% for women and 24.5% for men). The two most common reasons for migration in Malawi

account for the two largest shares of responses. 5.1% of all moves were because of a family or village conflict (5.9% for women and 4.2% for men) and 5.2% were due to divorce or widowhood (8.5% for women and 3.0% for men), which are of course conditional upon having a spouse. The remaining 16.6% of reasons for all moves (14.4% for women and 19.1% for men) include attending school, returning home, moving with parents (very few cases of this since observations for respondents less than 15 years are dropped), hospitalization/health problem, staying with a relative, and "other"—an unknown, residual category.

Once a respondent settled in his/her residence, disparate gender trends in employment emerge. 59.3% of women's migration spells compared to 42.3% of men's included agricultural work. Agricultural work was the primary source of employment in 51.4% of all respondents' migration spells. 55.5% of men's spells included non-agricultural work compared to only 27.7% of women's (40.6% total). 13.0% of women's spells did not include any employment, relative to only 2.2% of men's (8.0% total).

Because this sample is relatively young, 69.9% of all respondents' residence histories began after 1994 when Malawi became a multi-party state (73.0% for women and 66.3% for men). The remaining moves took place in 1994 or before, and, therefore, in a period when the Malawian government schemed to redistribute its population to under-developed rural areas for agricultural purposes. A small fraction took place in the colonial period before 1964, but there are too few cases to warrant an additional category for this variable. These cases are included in the "1994 or before" category.

Finally, in 60.8% of all migration spells, respondents knew some family members (at least one) already at the destination (59.1% for women and 62.7% of men), relative to

Table 1: Descriptive Statistics, Analytic Sample (<15 years excluded)

	Full Sample	Women	Men
Average Age at Survey	30.8	28.7	33.6
	(13.2)	(12.5)	(13.5)
Average Number of Moves	2.0	1.9	2.1
	(1.3)	(1.2)	(1.3)
Average Years at Residence	8.4	8.5	8.3
	(9.8)	(10.0)	(9.6)
Ethnicity			
Percent Non-Yao	78.9	82.5	74.1
Percent Yao	21.1	17.5	25.9
Region (All Moves)			
Percent South	33.4	32.5	34.5
Percent Central	24.8	24.9	24.5
Percent North	33.4	33.7	33.1
Percent Other SADC Country	8.4	8.9	7.9
Motivation to Move (All Moves)			
Percent Join Spouse	34.9	44.1	24.5
Percent Divorce/Widowhood	5.2	8.5	3.0
Percent Employment/Agriculture	37.5	27.1	49.3
Percent Family/Village Conflict	5.1	5.9	4.2
Percent Other	16.6	14.4	19.1
Job at Location (All Moves)			
Percent Agriculture	51.4	59.3	42.3
Percent Non-agriculture	40.6	27.7	55.5
Percent None	8.0	13.0	2.2
Period of Move (All Moves)			
Percent 1994 or Before	30.1	27.0	33.7
Percent After 1994	69.9	73.0	66.3
Family Known Prior to Moving (All Moves)			
None	39.2	40.9	37.3
Some	60.8	59.1	62.7
Friends Known Prior to Moving (All Moves)			
None	38.5	41.9	34.6
Some	61.5	58.1	65.4
Family and Friends Known Prior to Moving (All Moves)			
None	28.5	32.2	24.2
Some Friends, No Family	10.7	8.7	13.0
Some Family, No Friends	10.0	9.7	10.4
Some Family and Friends	50.8	49.4	52.3
$N_{maximum}$ (actual and person-moves)	1069 (2341)	618 (1252)	451 (1089)

Note: Standard deviations in parentheses.

none. Similarly, in 61.5% of all migration spells, respondents knew some friends (at least one) already at the destination (58.1% for women and 65.4% for men), relative to none.

When combining these two variables, in 50.8% of all migration spells, respondents knew some family *and* some friends already at the destination (49.4% for women and 52.3% of men). However, in 28.5% of all migration spells, respondents did not know any family members or friends at their destination (32.2% for women and 24.2% for men). In 10.7% of all migration spells, respondents knew some friends but no family already at their destination (8.7% for women and 13.0% for men). Likewise, in 10.0% of all migration spells, respondents knew some family members but no friends already at that location (9.7% for women and 10.4% for men).

Results-Multivariate

The models of Tables 2, 3, and 4 (below) are designed to test how basic controls (model 1), basic controls and period effects (model 2), basic controls and family and friend connections (model 3), all variables (model 4), and all variables and the interaction of effect of family and friends (model 5) predict the hazard (in odds) of moving away from a residence. Figures 1, 2, and 3 show how the duration of these migration spells are associated with the number of family and friends known at a location prior to moving. These results stem from post-regression estimations of the probability of moving away from a location, with a linear baseline hazard of duration (years), while centering all other variables at their means.

The estimates in Table 2—the full sample which includes both women and men—indicate that knowing some friends prior to moving to a location (relative to none), significantly decreases the odds of moving away from that location in any given year by roughly 40% (p<.001, models 3 and 4) after accounting for controls. However, there are no significant differences in the odds of moving away from a residence depending on whether an individual knew some family members or none at all.

Table 2: Discrete Time Hazard Regression Predicting the Duration of Migration for Full Sample (Hazard Ratios Presented)

	(1)	(2)	(3)	(4)	(5)
Years at Residence	0.96***	0.86***	0.96***	0.86***	0.86***
Male	1.62***	1.40***	1.70***	1.46***	1.46***
Age (15-24)					
25-34	0.48***	0.45***	0.49***	0.46***	0.46***
35-44	0.32***	0.32***	0.33***	0.32***	0.32***
45+	0.25***	0.29***	0.26***	0.30***	0.30***
Yao	0.89	0.81	0.92	0.82	0.82
Region (South)					
Central	2.25***	2.55***	2.26***	2.57***	2.56***
North	0.52***	0.59***	0.52***	0.59***	0.59***
Other SADC Country	0.47***	0.34***	0.49***	0.36***	0.36***
Urban Residence-Malawi Only	1.34	1.24	1.30	1.21	1.21
Motivation to Move (Join Spouse)					
Divorce/Widowhood	0.66	0.71	0.83	0.83	0.83
Employment/Agriculture	0.92	0.84	0.95	0.86	0.86
Family/Village Conflict	0.53**	0.59*	0.64*	0.67	0.67
Other	0.98	0.92	1.11	1.00	1.00
Job at Location (Agriculture)					
Non-agriculture	1.78***	2.08***	1.70***	2.00***	2.00***
None	2.37***	2.40***	2.08***	2.21***	2.20***
Moved After 1994		0.04***		0.04***	0.04***
Family Known Prior to Moving (None)					
Some			0.99	1.08	
Friends Known Prior to Moving (None)					
Some			0.58***	0.63***	
Family and Friends Known Prior to Moving (Some Family and Friends)					
None					1.47**
Some Friends, No Family					0.95
Some Family, No Friends					1.63**
Observations	2235	2235	2235	2235	2235
Wald Chi²	387.5	519.1	410.7	533.7	536.4
BIC	2738.3	2374.6	2724.8	2375.9	2383.6

Note: * p<.05, ** p<.01, *** p<.001. Robust standard errors are estimated.

The interaction effect of whether individuals knew any family, friends, or both family and friends, in model 5, is more revealing. Relative to knowing some family members and some friends already at a residence, it appears that knowing nobody, and some family (but no friends), significantly increases the odds of moving away from that residence by 47% (p<.01) and 63% (p<.01), respectively, even though these two estimates are not significantly different from one another. Further, there is no difference in the odds of moving away whether individuals knew only friends or some family and some friends. Still, post-regression estimations also suggest that those who knew only friends at a location prior to moving there have a significantly lower hazard of moving away compared to individuals who knew nobody (p<.05) or only family (p<.05).

The predicted probabilities that existing family and friend networks at a destination have on the duration of migration are depicted in Figure 1. For instance, if an individual has been at a location for 10 years, he/she has roughly a 10% lower chance of moving away from that location if he/she already knew some friends (and no family) or some family and some friends who were there, compared to if he/she knew no one or only family members, after controlling for gender, age, ethnicity, region, urban location, motivations to move, employment at the location, and period effects. Similarly, it appears that there is a 50% chance an individual will move away from their residence after 10 years if they knew some friends, or some family and friends, there prior to moving. Yet there is still a 50% chance of an individual moving away from their residence after roughly 14 years if they knew no one, or only family members, there prior to moving.

The control variables also suggest that having remained at a location for longer, being a decade older or moving to the northern region or another SADC country (relative

to the southern region), and moving to a location after 1994 (the largest effect) are consistently and significantly associated with a reduced hazard of moving away from a location (models 1 through 5). Conversely, men, those in the central region (relative to the southern region), and individuals working in a non-agricultural position—or not at all— compared to working in agriculture, have significantly higher hazards of moving away

Figure 1: The Impact of Family and Friends on the Duration of a Residency Spell, Full Sample

Note: Estimates account for controls and predictors, which are held at their respective means.
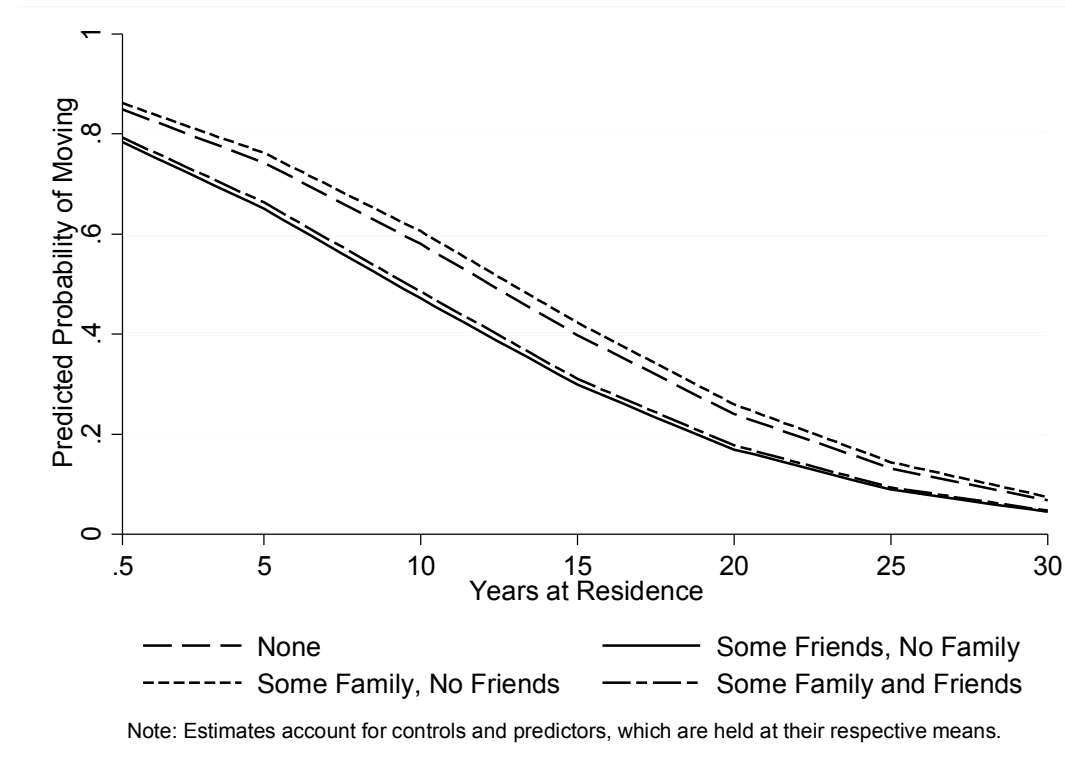
from a location (models 1 through 5). Surprisingly, the effects of living in an urban area in Malawi and divorce/widowhood on the hazard of moving away from a location are negligible.

Table 3 estimates these same effects, but only for women. Despite potential underlying differences in migration experiences for women (compared to a pooled sample as in Table 2), the results in Table 3 are largely analogous to those in Table 2.

It appears that, once again, knowing some friends prior to moving to a location reduces the hazard of moving away in any given year by upwards of 40% compared to knowing no friends at a location (p<.01 in model 3, p<.05 in model 4), after including controls. Still, knowing some family members is not associated with a significantly higher or lower hazard of moving away in any particular year compared to knowing no family members prior to moving to a location.

Table 3: Discrete Time Hazard Regression Predicting the Duration of Migration for Women (Hazard Ratios Presented)

	(1)	(2)	(3)	(4)	(5)
Years at Residence	0.96***	0.87***	0.96***	0.87***	0.87***
Age (15-24)					
25-34	0.47***	0.50***	0.47***	0.50***	0.49***
35-44	0.31***	0.32***	0.32***	0.33***	0.33***
45+	0.15***	0.15***	0.16***	0.15***	0.15***
Yao	0.73	0.82	0.75	0.83	0.83
Region (South)					
Central	2.32***	2.77***	2.36***	2.83***	2.84***
North	0.65**	0.77	0.65**	0.77	0.78
Other SADC Country	0.35***	0.25***	0.36***	0.26***	0.26***
Urban Residence-Malawi Only	1.33	1.06	1.26	1.03	1.04
Motivation to Move (Join Spouse)					
Divorce/Widowhood	0.81	0.78	0.94	0.86	0.84
Employment/Agriculture	1.08	0.93	1.09	0.93	0.93
Family/Village Conflict	0.69	0.73	0.77	0.79	0.79
Other	1.33	1.15	1.39	1.19	1.20
Job at Location (Agriculture)					
Non-agriculture	1.28	1.43*	1.26	1.41*	1.40*
None	2.29***	2.25***	2.09**	2.10**	2.11**
Moved After 1994		0.04***		0.04***	0.04***
Family Known Prior to Moving (None)					
Some			1.19	1.25	
Friends Known Prior to Moving (None)					
Some			0.60**	0.62*	
Family and Friends Known Prior to Moving (Some Family and Friends)					
None					1.29
Some Friends, No Family					0.68
Some Family, No Friends					1.38
Observations	1190	1190	1190	1190	1190
Wald Chi²	182.8	285.5	190.2	288.1	287.2
BIC	1523.8	1349.3	1528.2	1356.8	1363.1

Note: * p<.05, ** p<.01, *** p<.001. Robust standard errors are estimated.

Figure 2 illustrates the interaction effect found in model 5. It appears that the effects of knowing only friends, only family members, or nobody do not significantly impact the hazard of moving away from a location any differently than knowing both some family and friends already at a destination. Post-regression estimations suggest a more-nuanced story. Individuals who knew at least some friends prior to migration to their residence have a significantly lower hazard of moving away in any given year compared to those who did not know anyone, or only family members, prior to moving. Thus, for an individual who knew only some friends prior to moving to their residence and who has lived there 10 years has nearly a 20% lower chance of moving away than someone who has lived at their residence for 10 years but knew either no one or only family members. These differences

Figure 2: The Impact of Family and Friends on the Duration of a Residency Spell, Women

Note: Estimates account for controls and predictors, which are held at their respective means.
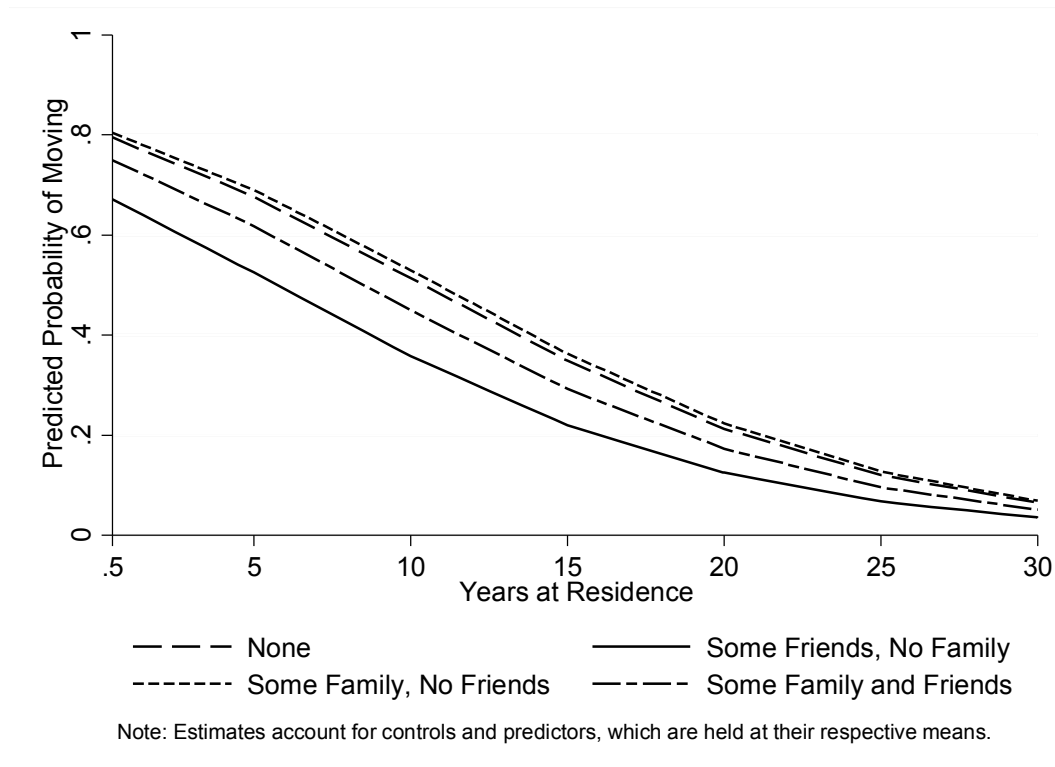
are also similar for individuals who have only been at their residence for five years. It appears that the effects of such networks are more pronounced with respect to the duration of women's migration spells, compared to a pooled sample.

The impacts of the control variables in models 1 through 5 (in Table 3) are similar in both magnitude, direction, and significance compared to those in Table 2. However, the hazards of living in the northern region (relative to the south) and working in a non-agricultural position (relative to working in agriculture) are not consistently associated with their respective decreases and increases in the hazard of moving away from a residence. This might be due to a reduction in statistical power, when conducting sub-sample analyses by gender (in this case, women).

There is an additional twist on the relationship between existing family and friend networks and the duration of migration spells for men. As seen in Tables 2 and 3, it appears that knowing some friends prior to moving translates into a lower hazard (roughly 36%) of moving away from a given residence compared to individuals without an existing friend network prior to moving to a residence in Table 4 (p<.05, model 4). And again, the effects of knowing family members, compared to none, on the hazard of moving away from one's residence are not significant nor significantly different from one another. But the interaction effect in model 5 suggests a different relationship than those seen in the pooled and female sub-sample analyses. Like in Table 2, individuals who knew no family or friends prior to moving to a location, and those who only knew family members, have a significantly higher hazard of moving away from their residence at any time than those with a more diverse network of family members *and* friends. But there is seemingly no significant difference in the hazard of moving away for individuals who knew only friends

prior to moving, compared to those who knew family members and friends. The difference

is unlike what is shown in Tables 2 and 3—the effect of knowing some friends and no

family members does not represent a significantly lower hazard of moving than knowing

no one or only family members.

Table 4: Discrete Time Hazard Regression Predicting the Duration of Migration for Men
(Hazard Ratios Presented)

	(1)	(2)	(3)	(4)	(5)
Years at Residence	0.95***	0.85***	0.95***	0.85***	0.85***
Age (15-24)					
25-34	0.46***	0.38***	0.47***	0.39***	0.39***
35-44	0.33***	0.31***	0.33***	0.31***	0.31***
45+	0.31***	0.39***	0.31***	0.39***	0.39***
Yao	1.01	0.80	1.04	0.81	0.80
Region (South)					
Central	2.24***	2.38***	2.18***	2.34***	2.31***
North	0.39***	0.41***	0.39***	0.42***	0.42***
Other SADC Country	0.65	0.46*	0.69	0.49*	0.48*
Urban Residence-Malawi Only	1.37	1.38	1.43	1.40	1.39
Motivation to Move (Join Spouse)					
Divorce/Widowhood	0.47	0.63	0.64	0.76	0.77
Employment/Agriculture	0.82	0.83	0.84	0.84	0.84
Family/Village Conflict	0.41*	0.48	0.50	0.55	0.55
Other	0.87	0.97	1.02	1.06	1.07
Job at Location (Agriculture)					
Non-agriculture	2.28***	2.83***	2.07***	2.64***	2.64***
None	1.78	2.28	1.67	2.14	2.08
Moved After 1994		0.03***		0.03***	0.03***
Family Known Prior to Moving (None)					
Some			0.81	0.92	
Friends Known Prior to Moving (None)					
Some			0.55***	0.64*	
Family and Friends Known Prior to Moving (Some Family and Friends)					
None					1.64*
Some Friends, No Family					1.23
Some Family, No Friends					1.83*
Observations	1045	1045	1045	1045	1045
Wald Chi^2	224.6	277.0	235.9	286.1	287.1
BIC	1277.2	1092.2	1269.9	1098.6	1104.9

Note: * p<.05, ** p<.01, *** p<.001. Robust standard errors are estimated.

So, Figure 3 suggests that for men, already knowing family *and* friends at their new

residence is associated with significantly longer durations and lower probabilities of

moving away from that residence in subsequent years than knowing no one or only family

members. Yet, it is unclear as to whether diminished statistical power is at the root of the ambiguous effect of already knowing only friends at a location compared to knowing no one, only family, or some family and friends.

Figure 3: The Impact of Family and Friends on the Duration of a Residency Spell, Men

Note: Estimates account for controls and predictors, which are held at their respective means.
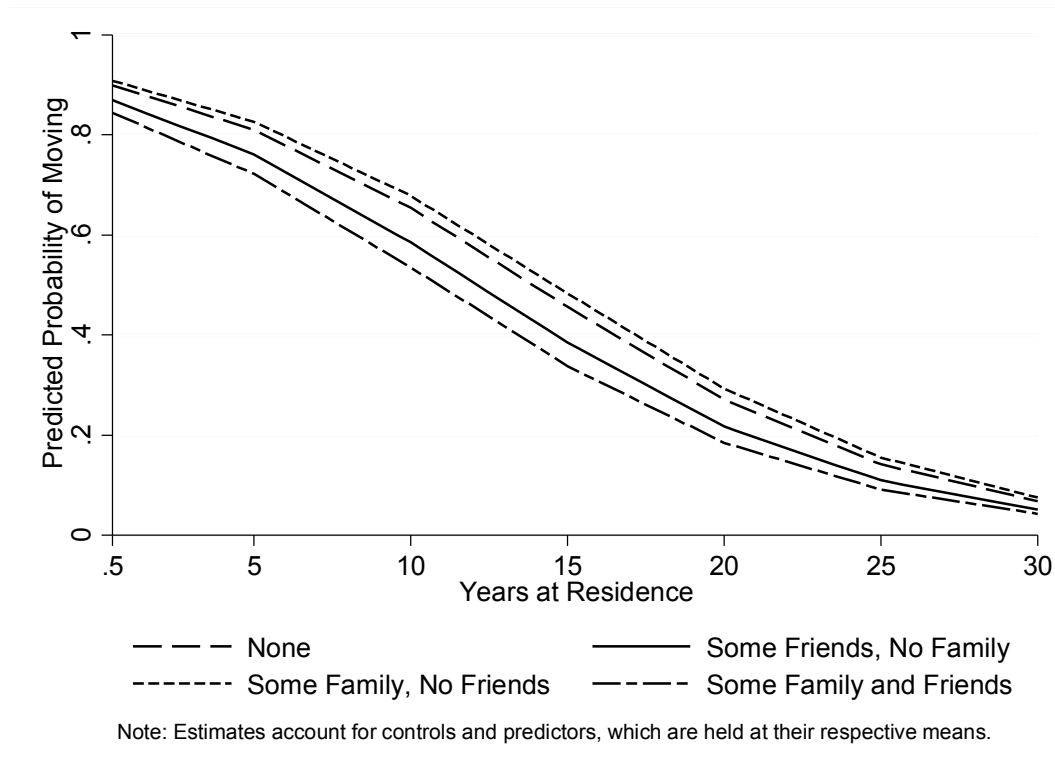
Lastly, while most control variables have roughly the same significance and direction as in Tables 2 and 3, the main differences in Table 4 suggest that men engaged in non-agricultural labor have a considerably higher hazard of moving away from their residence (relative to being engaged in agricultural labor) compared to women. Similarly, the effect of not being engaged in any work is not significantly different from being engaged in agricultural work (although this may be due to the small number of cases of unemployed men).

Discussion

It is not surprising that age, region, employment, and period effects consistently account for a large portion of the reasons why the Malawians in this study are likely to stay for shorter or longer spells at a particular residence, given Malawi's culture and political history. More importantly, after considering these and other factors, the presence of family members and friends in a destination is still substantively associated with the chance of moving to another residence and, thus, the duration of one's stay. Few datasets contain migration histories *and* information pertaining to established social networks that could potentially influence the length that one stays at a particular place.

These analyses contribute to migration theory by measuring the effect sizes that family and friend connections have on residence spells. Given strong kinship norms in sub-Saharan African settings, in which Malawi is not an exception, it is unclear why the effects of the presence of kin on the length of one's stay and chances of moving are not stronger. The results do not fully support Hypothesis 1, which predicted that the effect of knowing family members prior to moving to a new location would have a stronger effect than that of friends in increasing the length of a migration spell. Yet, while I expected that the effects of friend connections in a destination would not be as strong as those of family, they would still be in the same direction: increasing the length of one's stay and thereby reducing the chances of moving in a particular year, which is the case in these analyses. It is unclear as to why this is the case, though. Perhaps it is the *type* or *quality* of kin or friends that matters when moving to a new location; it is certainly possible that one might be indifferent to knowing a distant uncle or cousin in their new residence compared to a good friend.

Hypothesis 2, which tests whether the interaction of family and friends known already at a location prior to moving there impacts the duration of one's residence, is an extension of Hypothesis 1. Hypothesis 2 is only partially supported, since while it is mostly the case that knowing some family members *and* friends prior to moving to a new location is associated with longer migration spells than knowing only family members or no one, these effects are seemingly not significantly different from simply knowing some friends prior to one's arrival. These effects might be biased by relatively small cell sizes—even with many respondents contributing multiple person-move records to these analyses—and thus, substantive effects are hidden by incorrectly accepting the null hypothesis that the effect of family and friends is not different from just friends. Then again, these results suggest that it is friends who are more important in determining Malawians' chances of moving away from their residence as well as the duration of their stay since the effects of friends appear to drive the results for the entire sample and especially for the female sub-sample, although less-so for the male sub-sample.

Social network and qualitative data would be well-suited to solving this part of the puzzle and to see whether the quality and/or type of friends and family differentially impact the migration experiences of women and men. Still, knowing some friends—or friends *and* family—already living at a destination is linked to longer durations of residence. These results counter those found in Egypt, where having no established network connections at a destination actually increases the duration of migration spells (Bauer and Gang 2002). But the MHM Project data cannot confirm whether the duration of migration spells are impacted by family members in other locations who require the labor of migrant individuals back in their home villages, as is the case in China (Hare 1999). If nothing else,

these results suggest that to some extent, having established networks indeed matters for migration spells in Malawi.

However, several important sources of bias exist in the design of these analyses which could be skewing this assessment of how existing family and friend connections impact the duration of residence spells. First, these analyses do not account for many time-invariant, underlying factors—such as the characteristics of districts or villages (among many other possibilities)—which might systematically sort respondents and contribute to the results; it might very well be the case that certain districts are known to retain individuals for longer periods because of favorable working conditions, compared to others. Second, these models cannot incorporate other important time-varying factors, such as HIV infection, wealth, or experiencing other major life-course shocks that are strongly correlated with the likelihood of migrating in the Malawian context. For instance, while data exist on an individual's current HIV status, and for some, their status at a previous testing date in conjunction with earlier waves of data collection, these data are incomplete for all respondents in this sample—since HIV testing and disclosure is voluntary—and even if it is clear that person is HIV positive, it is unknown as to when they became infected; thus, these data cannot be included in the analyses. And of course, these data cannot measure a host of other unknown, yet likely influential competing push-pull factors that change over time for each individual; perhaps a friend already at a destination becomes a spouse, or a business partner, several years into one's stay and dramatically increases the length an individual resides at that location. Third, since the survey design only acquires data on residence spells of six months or more, I inevitably do not capture migrations of shorter lengths, such as seasonal or other cyclical migration that is common to the

Malawian context. Lastly, it is difficult to distinguish with certainty (although possible) between new migrations and return migrations of six months or more and since few respondents resided at more than one location other than their place of birth for more than six months, such migration trajectories are not explicitly modelled as control variables in these analyses.

Conclusion

Despite these limitations, the results of this paper indicate that: 1) knowing some friends prior to arriving at a destination most strongly increases the length of one's residence there, and 2) more research—including ego network mapping, interviews, and ethnographic work—must be conducted regarding the composition of migrants' networks and how the presence, or absence, of certain actors impact migration spells. This paper brings to light that family and friend networks likely have significant impacts on migrants in Malawi—in both large differences in the length of residency spells, in terms of years, and the probability of staying at a location for another year. It is not yet clear how these family and friend connections change one's quality of life at a destination, and this ought to be a key aspect of future analyses in Malawian migration research.

This paper also brings forth possibilities in the development of migration theory. It has been well-documented that established networks in a destination increase the chances of an individual *moving to that destination*, but rarely have migration theorists tested how these networks predict the subsequent duration of one's stay. This study offers a gateway into understanding how the presence of family and friends impact the number of years one stays at a location in Malawi. But when considering the dearth of research on this

relationship in other African contexts and locations around the world—such as the United States, Latin America, Asia and Europe—which have all been the sites of major contributions to migration theory, the effects of existing family and friend connections of migrants must not only be incorporated into future migration studies, but also tested to expand our understanding of how pre-existing social capital impacts migration spells.

Finally, examining the social determinants of *the duration* of migration spells could have practical implications for both rural and urban development in a variety of settings. As in this case of Malawi, the results support the notion that the likelihood of moving after 1994—after the government's large-scale rural development and population redistribution scheme (Kalipeni 1992; Kydd and Christiansen 1982)—was considerably lower than in this previous period. Therefore, in present day, if the Malawian government was examining the viability of major rural or urban development schemes that would require Malawians to move and work, understanding the social factors associated with the length that individuals would likely stay at such locations would be prudent in order to evaluate the extent to which new individuals would have to be recruited to such locations or how to retain those who have already moved. The same could be the case in many developing countries. Assessing how the duration of migration is affected by social factors—such as networks, employment, and marriage, among a host of other considerations—ought to be examined in greater detail for the purposes of advancing theory and potentially informing policy. Although my research questions regarding the impacts of family and friends networks on the duration of migration are narrowly focused, this research will hopefully inspire larger, and more detailed, analyses of the determinants of the duration of migration in other African, developing, and developed countries.

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Appendix

Appendix Table 1: Differences in Primary Demographic
Characteristics Across Sub-Samples

| | | *Sample Type* | |
		Main	Missing	Never Moved
Gender				
	Female	58.6	47.8**	55.4
	Male	41.4	52.2	44.6
Age-Years in 2013		41.4	40.4	44.1*
		(0.45)	(0.89)	(1.07)
Ethnicity				
	Non-Yao	79.5	72.6*	67.7***
	Yao	20.5	27.4	32.3
N (max)		1180	323	260

Note: * p<.05, ** p<.01, *** p<.001 to signify
differences from main sample. Percentages and means are
reported where appropriate.

Chapter Three

The Influence of Marital Dissolutions on Self-Reported Health Metrics of Older Individuals in a Rural African Context

Abstract

The negative relationship between marital dissolutions and health has been well-established in high-income nations. Yet it is unknown in many sub-Saharan African nations, where marriage is nearly universal, whether divorce and widowhood have similar detrimental effects on individual health. Further, as sub-Saharan Africa ages, increasing health and care-giving burdens will fall upon older individuals. I examine the extent to which marital dissolutions are associated with four self-reported health metrics of 922 rural Malawians, aged 45+, using two waves of the Malawi Longitudinal Study of Families and Health. After accounting for health selection bias, it appears that for two measures, marital dissolutions predict worse health. Such findings are intriguing and raise questions about the relative hardship of marital dissolutions compared to other tribulations that Malawians routinely face as a consequence of living in poor, rural areas. These results call for the collection of more-detailed longitudinal data on older Africans.

Introduction

Research from high-income countries (HICs) suggests that one's marital status is closely related to one's health since the companionship, caregiving, and pooling of resources associated with marriage are typically beneficial to an individual. Widows and divorcees are generally more susceptible to health risks than those who are married because of the stress and diminishment of various resources associated with losing a spouse (Pearlin 1989)—and at least in the US, these risks have been exacerbated over the past few decades (Liu and Umberson 2008). Being married is thus generally advantageous to one's health (Anson 1989) even if the health selection effects surrounding marriage have not been resolved (see Land and Yang 2006; Lillard and Panis 1996; Schoenborn 2004; Waldron, Hughes, and Brooks 1996).

However, this relationship has not been as well-examined in low-income countries (LICs). In many sub-Saharan African (SSA) nations marriage is *nearly universal*, and a substantial portion of individuals in a given country *could* be at risk to the adverse health implications associated with widowhood, and, potentially, divorce. On top of this, many SSA contexts are already characterized by high morbidity and mortality as a result of HIV/AIDS, the presence of infectious diseases, increasingly common non-communicable diseases, and inadequate health care systems to address these health concerns. These conditions not only contribute to the chances of an individual experiencing widowhood, but suggest that declines in health after an event like a marital dissolution could be devastating if one cannot access medical treatment. Further, SSA is aging on the whole, yet many older individuals still face pressures to care for grandchildren and other non-kin as a result of the HIV/AIDS pandemic which has claimed the lives of many adult children

and their spouses. The health of older individuals is therefore vulnerable to conditions of high morbidity along with these additional stressors.

In short, older sub-Saharan Africans are subjected to a variety of risk factors that could diminish their health. Surprisingly, the extent to which a stressful event like a marital dissolution is associated with one's health in an aging setting with high rates of marriage, remains unclear. One would expect that a marital dissolution would worsen individual health. Yet by sheer virtue of surviving to older age, and often in impoverished, under-resourced communities with few opportunities for upward economic mobility, it is possible that marital dissolutions might not have as strong of a negative effect on individual health as seen in HICs, compared to the variety of hardships that such individuals have already faced in their lives.

The primary focus of this paper is to explore the effect of marital status and dissolutions on the health of older (45+), rural Malawians. I examine the extent to which the potentially stressful effects of a marital dissolution—and the timing of marital dissolutions—are associated with individual health in a context where marital dissolutions are a deviation from normative expectations. Secondarily, since there are constraints in the number of health metrics collected in survey research in SSA—often in favor of self-reported, single item measures, over composite scales and biometric and anthropometric measures—I evaluate whether experiencing a marital dissolution differentially predicts two self-reported single-item and two composite scale health indicators and explore potential benefits and problems of using self-reported health metrics in this context. It is possible that single-item health measures, which are less costly in survey research, are predicted by marital dissolutions just as well as health scales derived from a number of

items. Alternatively, single and composite-item measures are likely to measure different aspects of one's health. This line of inquiry aspires to better understand the impacts of marital dissolutions on health in a stress process theory framework (Pearlin 1989), but also to evaluate the merits of collecting and employing differing health metrics in answering this research question.

Malawi is one of the least developed countries in the world, with a slowly aging population and an estimated current life expectancy at birth of 51.6 years (United Nations 2013). Almost all Malawians get married—approximately only 2% of men and 1% of women have not been married by age 50 (Malawi National Statistical Office 2011).[1] Yet, at least in rural areas, where this study takes place and where about 85% of Malawians live (Malawi National Statistical Office 2011), a large portion—an estimated 40% to 65%—of these marriages end in divorce; but remarriage, even within two years, is fairly common (Reniers 2003). Nonetheless, marriage is highly valued and idealized in Malawian society with successive generations fondly recalling the stability, desirability, and benefits of marriage in their working years, even if the institution of marriage was not actually as sturdy as it is perceived to have been (Kaler 2001). Marriage offers Malawians access to additional family resources and financial stability, alongside achieving an important cultural goal. But, since nearly all Malawians could be at risk to the *potentially* adverse health effects of union dissolutions, I offer an empirical example of the degree to which these under-explored social processes can influence health outcomes among an already susceptible group—those nearing or beyond the current estimates for life expectancy—over a two year period.

Marital Status and Health

In HICs, those who have experienced a marital dissolution generally face health disadvantages compared to married individuals because of stress and the loss of financial resources that are often associated with dissolutions. Undoubtedly, a change in one's union status has the potential to be an immediate stressor that is often linked to poorer health outcomes in the short-term (Stroschein et al. 2005). Divorcees have a high risk of mortality if they have been divorced for less than five years (Dupre, Beck, and Meadows 2009) and, similarly, widows initially experience worse health, which dissipates over time relative to other unmarried individuals (Lillard and Waite 1995); the timing of a marital dissolution is undoubtedly related to health in important ways.

Yet, the relationship between marital status and health is not uniform. The effects of widowhood on adults are typically linked to increased rates of mortality, long-lasting deteriorated physical health, and often *temporary*—but sometimes *extended*—spells of decreased mental health (Goldman, Korenman, and Weinstein 1995; Stroebe, Schut, and Stroebe 2007). This relationship could be dependent on selection and age disparities between spouses (Choi and Vasunilashorn 2014), and also becomes stronger with age in certain cases (Goldman, Korenman, and Weinstein 1995). In some circumstances, divorcees—regardless of when they were divorced—are deemed to face the most severe health consequences (Verbrugge 1979) while in other instances differences in mortality between unmarried groups are virtually non-existent (Rendall et al. 2011). The health of older individuals has been found to be affected less by widowhood compared to younger widows (Martikainen and Valkonen 1996; Smith and Zick 1996). As with younger individuals (Williams and Umberson 2004; Wu and Hart 2002), there are also gender

differences in health outcomes for the elderly of different marital statuses. For older men, widowhood and divorce are associated with higher levels of disability—even after accounting for socioeconomic status—yet these effects are not found for women (Goldman, Korenman, and Weinstein 1995). Still, marriage is highly protective for the elderly, but divorce leads to slightly higher risks of mortality than widowhood, and, broadly, being unmarried in any state is disadvantageous (Manzoli et al. 2007). The severity of and nuances in this relationship between marital status and health are likely a function of the amount of stressed caused by an event such as a marital dissolution. How long the stress remains afterward, and the availability of resources (Pearlin 1989)— emotional support, financial assistance, and the presence of family and friends—could diminish the health effects of that dissolution.

In comparison to the scholarly output from research in HIC settings, research in SSA on the relationship between marital status and health is limited. With respect to older sub-Saharan Africans, the available research has uncovered analogous results and suggests that the consequences of being widowed, divorced, or single include not only lower self-reported health—although not functional limitations (Kuate-Defo 2006)—but also higher probabilistic expectations of dying in the coming years (Delavande and Kohler 2009). Anthropological research has indicated that the health statuses of older female widows are particularly susceptible to declines. If widowed or not remarried early on in life, women in traditional societies will have few opportunities to develop wealth through livestock, or if widowed later in life, women are often face enormous difficulties maintaining their livestock and livelihoods (Ingstad et al. 1992). These later-life disadvantages for women might be a consequence of being excluded from their husbands' formal and business

networks, and thus having to rely on similarly marginalized women—who likely do not have financial security and the means to provide necessary assistance to a struggling individual (Cliggett 2005). With few economic options, older women may choose to remarry for financial and livelihood security (Sangree 1992). But widowhood is *not always* a predictor of diminished livelihoods among older African women, since inheritance rights and the availability of kin to provide support may offset some of the negative effects of being unmarried (Cattell 2003). Therefore, if an older, widowed woman has not developed strong ties with her spouse's family (Schatz, Madhavan, and Williams 2011)—or even with other women and men in the community (Cliggett 2005)—the stress of a marital dissolution *could* be overwhelming and place undue burdens on these older individuals who are not socially well-positioned to receive support. Without social support, it would appear that widowhood *might* negatively impact women's health. At the same time, little is known about how widowhood or divorce might impact the health of older men. The available research on older sub-Saharan Africans implies that men—whether due to inheritance rights, high rates of re-marriage, and lower observed percentages of living alone (i.e. Bongaarts and Zimmer 2001; Oppong 2006)—could have livelihood advantages over women which could translate into better health outcomes, yet this remains unknown.

More generally, HIV/AIDS has also placed considerable strains on the health of older individuals in SSA.[2] As alluded to above, extended kin (De Weerdt and Fafchamps 2011) and adult children (Peil, Bamisaiye, and Ekpenyong 1989) are two of the most important sources of financial and non-financial support during health crises (which are often associated with marital dissolution) and as individuals age; but the HIV/AIDS pandemic has reduced the potential pool of financial and non-financial support for many

older individuals. Consequently, older individuals—including widows—also often need to take care of younger generations of their family while aging (Makiwane and Kwizera 2006; Schatz 2007), which may further deteriorate their health as a result of an unfavorable household dependency ratio. In addition, despite being past their peak sexual years, older individuals still face some substantial risks of HIV infection (Negin and Cumming 2010). Widowed women, for example, face higher chances of HIV infection than the unmarried (Tenkorang 2014). Even the fear of contracting HIV or a recent death due to HIV/AIDS in the family are associated with declines in health (Bohman et al. 2007), such as lower body mass indices (Ainsworth and Dayton 2003; Dayton and Ainsworth 2004) among older Africans. Perceived HIV infection has also been recently linked to lower mental health outcomes in Malawi (Hsieh 2013). The consequences of HIV/AIDS clearly range from not only the reduction of availability of support for older sub-Saharan Africans, but for their own health statuses as well.

While less common among the oldest individuals, compared to younger individuals, divorce often occurs in the context of HIV/AIDS, although the causal direction is debated. For instance, HIV-positive women, or those in unions with dissimilar HIV statuses, have been found to be more likely to divorce (or become widowed) than other women with the same HIV statuses as their partners (Porter et al. 2004; Schatz 2005). But, those who divorce are also more likely to be HIV-positive (Boileau et al. 2009; Welz et al. 2007). However, in Malawi, divorce has also become a health empowering mechanism for women in polygynous unions (Reniers 2003; Reniers and Tfaily 2008)—which by virtue of being in larger sexual networks increases the chances of becoming infected with HIV and other health consequences—and for women who suspect their partners have been

cheating on them and/or are HIV-positive (Smith and Watkins 2005; Watkins 2004). Divorce is not necessarily an effective strategy for women to protect themselves from contracting HIV though, since single women are sometimes courted through transactional sex by younger men who may have HIV (Izugbara and Undie 2008).

As in HICs, it appears that being widowed or divorced is likely to be disadvantageous to one's health in many SSA settings relative to having the protective effects of marriage. But virtually none of this research has tested if this is the case and whether the relationship between marital dissolutions and subsequent health outcomes endures, or is only temporary.

Population Aging and Health in sub-Saharan Africa and Malawi

It is well known that most SSA nations are aging—despite the impact of the HIV/AIDS pandemic, which has significantly lowered life expectancies at birth (see Cohen and Menken 2006; Heuveline 2004; Zaba, Whiteside, and Boerma 2004)—but also that the aging process has not been and is not projected to be as rapid as in Asian countries (Shrestha 2000; Gerland et al. 2014). In line with population projections between 2010 and 2060, most of Malawi's absolute growth is predicted to come from those between 15 and 64 years. However, those 65 years and older are expected to grow the most, relative to other age groups—nearly 6 times greater in 2060 than in 2010 (United Nations 2013). Thus, older Malawians will account for a larger share of the nation's population, yet will still be responsible for caring for a substantial portion of younger Malawians.

Despite improvements in life expectancy among older Malawians, a recent study of Malawians 45 years and older indicates that men will spend slightly more than half of

their remaining years, and women will spend less than half their remaining years, in good health (Payne, Mkandawire, and Kohler 2013). It remains unknown how potential social factors—such as marital dissolutions—could hinder healthy population aging in a country like Malawi. Further, health services in most sub-Saharan African countries are ill-equipped to combat the burdens of infectious diseases that younger generations are often exposed to, while simultaneously treating non-communicable diseases like cancer or heart disease that older sub-Saharan Africans are increasingly exposed to (Mets 1993; Oldewage-Theron et al. 2008). Migrating to another village or town, which may have better health services, will not necessarily solve this problem since older individuals are unlikely to leave behind their informal support networks (Peil, Bamisaiye, Ekpenyong 1989). In sum, older sub-Saharan Africans face many barriers and challenges to maintaining or improving their health.

Hypotheses

Despite a small body of literature in SSA compared to HICs, similar results on the relationship between marital status and health exist.

Hypothesis 1: The divorced, widowed, and separated will have significantly worse health outcomes than those who are married.

Hypothesis 2: Individuals who recently became divorced, widowed, or separated will have significantly worse health outcomes than those who have been divorced, widowed, or separated for an extended period of time.

Given that there are many challenges for older individuals to maintain their health—such as the threat of and impacts from the HIV/AIDS epidemic in Malawi, harsh

living conditions in rural areas, and minimal access to adequate health facilities—it is conceivable that a counter-hypothesis exists: *union status will not matter for one's health in this context*.

Data and Sample

To test these hypotheses, I use the 2008 and 2010 waves of the Malawi Longitudinal Study of Families and Health (MLSFH), which contains a sample of rural households in Malawi's three regions: North, Central, and South. Since approximately 85% of Malawians live in rural areas (Malawi National Statistical Office 2011), the MLSFH acquires information on the typical livelihood characteristics of Malawians. Cluster-based random sampling was employed to select villages in each of these three regions as well (see Kohler et al. 2014 for complete details of the project and sampling). Roughly 1300 individuals in each region were interviewed in each wave, and about 70% to 80% of those respondents chose to remain in the study in each subsequent wave (Anglewicz et al. 2009; Kohler et al. 2014). Respondents were asked about their marital histories, overall health, household composition, sexual behaviors and attitudes, and HIV/AIDS beliefs, testing, and preventative practices among other topics.

The analytic sample is restricted to 922 individuals (512 women and 410 men) 45 years and older—in 2010—who participated in both the 2008 and 2010 waves, and do not have missing data on dependent and independent variables.[3] Given the current low life expectancy at birth in Malawi, and the difficulties in attaining large enough sample sizes for individuals 65 years and older (who would be considered elderly in other contexts), the

age cut-off of 45 years for inclusion in this sample and being considered "older" is not only practical, but appropriate in Malawi (Payne, Kohler, and Mkandawire 2013).

Methods and Dependent Variables

The value of including fewer health (and self-reported health) survey items in questionnaires, rather than more, in developing contexts—where costs of data collection are high—has been raised (Kuhn, Rahman, and Menken 2006), since single-item health instruments fare well compared to composite measures. Thus, to more robustly test the relationship between marital dissolutions and health in this SSA context than others have done, I employ two single-item and two composite scale self-reported health outcomes (which are all dichotomized for the purposes of these analyses). In the first set of analyses, I conduct logistic regressions with only the 2010 data to establish if there is a cross sectional relationship between marital status and four self-reported health outcomes. Then, in the second set of analyses I again use logistic regressions, but with lagged dependent variables (i.e. health in 2008) and other 2008 predictors and controls to assess the impact of marital status and transitions on health in 2010. This method reduces the possibility that marriage leads to better health or better health leads to remaining married; 2010 health is the dependent variable while 2008 health (the lagged dependent variable) is in fact a control variable. Robust standard error estimates are used in these lagged dependent variable models to account for the clustering of residuals and some of the bias inherent in estimates derived from this method. Further, while the issue of false self-reporting of health is a source of bias, false reports decrease with the severity of an individual's health (Baker, Stabile, and Deri 2004). Self-reported health is also a strong predictor of mortality (Idler

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and Benyamini 1997; Kaplan and Camacho 1983) *and* elderly mortality (Mossey and Shapiro 1982) more specifically.

The first two outcomes are single-item measures which I label "General Health" and "General Health Compared to 2 Years Ago" (sometimes referred to as "retrospective health" in the text), with responses dichotomized into the outcomes of Poor/Fair/Good (=0) and Very Good/Excellent (=1) for logistic regression. These respectively stem from the questions: 1) "In general, would you say your health is…"; and, 2) "How would you compare your health today to your health two years ago?". Although two years might seem like a short interval to self-evaluate one's health in the retrospective measure, this likely represents a significant amount of time to respondents in this study who are either approaching Malawi's current life expectancy or are already beyond it. The other two measures come from the continuous outcomes of the SF-12 physical and mental health scales, but are dichotomized as to whether a respondent is at or above the mean score (=1) for his/her age group (45-54, 55-64, 65+) or below the mean (=0). The SF-12 includes 12 self-reported health questions (including the "General Health" measure above) and these items are weighted differently for the mental and physical health scales. The SF-12 health measures are considered robust indicators of an individual's health in comparison to the expanded SF-36, and anthropometric indicators as well (Ware, Kosinski, and Keller 1996), and in many different settings around the world (Gandek et al. 1998).

Most of these measures are not strongly and positively correlated with one another, which suggests that these items are not redundant (see Table 1).

Table 1: Pair-wise Correlations of 2010 Health Outcomes

	General Health	General Health Compared to 2 Years Ago	SF-12 Mental Compared to Age Mean	SF-12 Physical Compared to Age Mean
General Health	-			
General Health Compared to 2 Years Ago	0.43	-		
SF-12 Mental Compared to Age Mean	0.28	0.11	-	
SF-12 Physical Compared to Age Mean	0.43	0.26	0.23	-

Control and Independent Variables

The control variables in these models include gender, age, ethnicity, educational attainment, a modified household dependency ratio, one's number of marriages, and the perceived chance of being HIV-positive. As noted in the literature review, gender predicts health outcomes for different ages and measures of health. Explicitly testing the effects of gender *and* marital status (as an interaction or sub-sample analysis) are outside the scope of this paper due to insufficient cases of marital dissolutions by gender and, thus, gender is at least a necessary control.[4] In the cross-sectional logistic regression models, respondents' ages in 2010 are used, while the lagged dependent variable models include respondents' ages in 2008. Ethnicity is dichotomized into respondents either belonging to the Yao tribe or "other tribes" (Chewa, Tumbuka, Ngoni, Lomwe, Sena, Tonga, and other). The Yao are Muslim (in a predominantly Christian country), live almost exclusively in Malawi's southern region, and are economically marginalized compared to other groups; since the Yao are a unique, yet populous group, accounting for ethnicity is necessary to minimize potential health selection effects. Educational attainment—a widely used health correlate—is categorized into none, primary, and secondary attendance. Household wealth and region are not included in these models because of serial correlation issues when alongside the ethnicity and educational attainment variables. Since this paper does not test

important moderators in stress process theory—rather only self-reported health and marital dissolutions as proxies for this process and timing of stress over two years—a modified dependency ratio of the number of household members 45 years and older, and under 15 years, relative to those between 15 and 44 (inclusive) for each year to account for the amount of stress—in the form of "dependents"—is included as a control in all models. The data do not allow for the consideration of the presence of non-household members in these individuals' lives. The number of times an individual has been married is also controlled for since it is unclear whether fewer or a greater number of marriages (and thus, dissolutions) predict health in the Malawian context. Additionally, because the threat of HIV infection is known to be associated with stress and mental health more generally, I include a dichotomous categorical control of whether an individual believes he/she has no chance or some chance of being HIV-positive.[5] Lastly, and only in the longitudinal models, the respective health outcome *of the previous wave* (2008) is controlled for to further minimize health selection bias in 2010.

The independent variable in the cross-sectional analyses is the respondent's current marital status, which is dichotomized as either being married or separated/divorced/widowed. Although the effects of divorce and widowhood on health are at times equivocal in the literature and are different processes, there are insufficient cases to warrant separating these marital dissolutions within the regression models. These last three categories are combined as a consequence of the comparatively small cell sizes of currently separated or divorced individuals. Marital statuses are presented separately in the descriptive statistics. However, the amalgamation of these marital statuses is conventional in health research in SSA and separations, divorces, and widowhood still

represent distinct livelihood shocks to an individual relative to marriage. By 2010, all of the respondents had been married which supports the notion that marriage is nearly universal in Malawi. For the lagged dependent variable models, the independent variable is dynamic and depicts respondents' marital status/transitions over the two waves of data (between 2008 and 2010): continually married/became married, continually divorced/widowed/separated, and became divorced/widowed/separated in order to distinguish potential health differences with respect to the duration of a marital dissolution (i.e. Dupre, Beck, and Meadows 2009; Lillard and Waite 1995; Stroschein et al. 2005).

Results-Descriptive

The sample of 922 individuals aged 45 and older in 2010 (see Table 2 below) is unevenly split along gender lines as 55.5% are women while 44.5% are men. The mean age of the sample in 2010 is 59 years—over seven years older than the current life expectancy at birth in Malawi. Slightly over a quarter (26.4%) are of the Yao tribe while the remainder come from other ethnic groups. Over half (58.2%) of the sample has at least some primary education, whereas 36.6% have no education, and only 5.2% have attended secondary school. 42.7% and 32.2% of respondents believed they had *a chance* of being HIV-positive, in 2008 and 2010, respectively. The household dependency ratio in 2008 indicates that respondents averaged 1.5 people under 15 years or 45 years and older to every one person aged 15 to 44 years; this ratio dropped to 1.3 in 2010. Respondents in the analytical sample averaged having been married 1.7 times in both 2008 and 2010. In 2010, 76.5% of respondents were married, while 23.5% were separated, divorced, or widowed. However, 17.7% of this group had been continuously separated, widowed, or divorced

between 2008 and 2010, while 5.9% *became* separated, widowed, or divorced between the

two waves.

Table 2: Analytic Sample Descriptive Statistics (Percentages and Means with Standard Deviations)

Gender	
Female	55.5
Male	44.5
Ethnicity	
Non-Yao	73.6
Yao	26.4
Education	
None	36.6
Primary	58.2
Secondary	5.2
Perceived Chance of Being HIV+ in 2008	
None	57.3
Some	42.7
Perceived Chance of Being HIV+ in 2010	
None	67.8
Some	32.2
Marital Status in 2010	
Married	76.5
Separated/Divorced/Widowed	23.5
Marital Status 2008-2010	
Continuously/Became Married	76.5
Continuously separated/divorced/widowed	17.7
Became separated/divorced/widowed	5.9
General Health in 2008	
Poor/Fair/Good	47.2
Very Good/Excellent	52.8
General Health in 2010	
Poor/Fair/Good	40.7
Very Good/Excellent	59.3
General Health Compared to 2 Years Ago	
Poor/Fair/Good	51.4
Very Good/Excellent	48.6
SF-12 Mental Compared to Age Mean in 2008	
Below Mean	43.8
At or Above Mean	56.2
SF-12 Mental Compared to Age Mean in 2010	
Below Mean	42.2
At or Above Mean	57.8
SF-12 Physical Compared to Age Mean in 2008	
Below Mean	38.0
At or Above Mean	62.0
SF-12 Physical Compared to Age Mean in 2010	
Below Mean	41.3
At or Above Mean	58.7
Age in 2010	59.0 (11.3)
HH Dependency Ratio in 2008	1.5 (1.5)
HH Dependency Ratio in 2010	1.3 (1.3)
# Marriages as of 2008	1.7 (1.0)
# Marriages as of 2010	1.7 (1.0)
N	922

In both 2008 and 2010, over half (52.8% and 59.3%, respectively) of the respondents reported that their health was "Very Good" or "Excellent". This suggests that the health of respondents may have improved over these two years. But, less than half of respondents (48.6%) in 2010 indicated that their health was better than in 2008 when asked to retrospectively gauge their health. For the SF-12 mental and physical health scales in 2008 and 2010, the majority of respondents scored at or above the mean for their age group (45-54, 55-64, 65+), but between waves these scores declined for both mental and physical health which is expected with the passing of time for an older sample.

Results-Multivariate

The logistic regression models in Table 3 (below) test Hypothesis 1—separated, widowed, and divorced individuals will have significantly worse health outcomes than married individuals—to see if a cross-sectional relationship between marital status and health exists in 2010, net of gender, age, ethnicity, the household dependency ratio, one's number of marriages, and the perceived chance of being HIV-positive. Being separated, widowed, or divorced in 2010 is only negatively associated with one's general health ($p<.001$). While the magnitude of coefficients in the retrospective health, SF-12 mental, and SF-12 physical models are smaller and not significant, the negative direction of these coefficients remains the same.

Men appear to have significant health advantages over women in models 2 and 4 ($p<.05$ and $p<.01$). Becoming a year older is significantly and negatively associated with health in all models. Being a member of the Yao ethnic group—despite their marginalized social and economic positions in Malawi—is only negatively associated with the General

Health outcome (p<.01, model 1). Educational attainment is generally not significantly associated with health, except if an individual has attended primary school then they have higher log odds of their mental health score being at or above the age mean (p<.05), or if an individual attended secondary school then they have higher log odds of their physical health score being at or above the age mean (p<.01). Being in a household with a higher dependency ratio is, surprisingly, positively associated with better general health (p<.05), but is null with regards to the other health outcomes. One's number of previous marriages is also not significantly associated with any health outcome. Lastly, believing oneself to have *a chance* of being HIV-positive is only negatively associated with one's mental health (p<.001).

Table 3: Cross-Sectional Logistic Regressions Predicting Health Outcomes in 2010

	Self-Reported Health Outcomes			
	General Health	*General Health Compared to 2 Years Ago*	*SF-12 Mental Compared to Age Mean*	*SF-12 Physical Compared to Age Mean*
	(1)	(2)	(3)	(4)
Male	0.28	0.33*	0.19	0.49**
	(0.16)	(0.16)	(0.16)	(0.16)
Age in 2010	-0.05***	-0.03***	-0.02*	-0.02*
	(0.01)	(0.01)	(0.01)	(0.01)
Yao	0.55**	0.32	0.28	0.1
	(0.19)	(0.18)	(0.18)	(0.18)
Educational Attainment (No School)				
Primary	0.00	0.11	0.35*	0.13
	(0.18)	(0.16)	(0.17)	(0.17)
Secondary	0.73	0.21	0.25	1.21**
	(0.39)	(0.34)	(0.33)	(0.43)
HH Dependency Ratio in 2010	0.11*	0.05	0.05	0.01
	(0.05)	(0.05)	(0.06)	(0.05)
# Marriages as of 2010	-0.04	-0.05	0.1	-0.11
	(0.08)	(0.07)	(0.08)	(0.07)
Some Perceived Chance of Being HIV+ in 2010	-0.24	-0.01	-0.58***	-0.14
	(0.16)	(0.15)	(0.15)	(0.15)
Separated/Divorced/Widowed in 2010	-0.66***	-0.23	-0.30	-0.34
	(0.18)	(0.18)	(0.18)	(0.18)
N	916	916	916	916
Wald Chi²	94.55	36.85	36.87	44.78
Pseudo R²	0.09	0.03	0.03	0.04

* p<.05, ** p<.01, *** p<.001. Robust standard errors and estimates are presented.

The results of Table 3 are not clear as to whether being separated, widowed, or divorced is linked to worse health along different types of metrics based on these cross-sectional analyses. The lagged dependent variable models in Table 4 (below) build upon the foundation set in Table 3 by controlling for one's health in 2008 (and thus, health selection bias) and testing whether a union dissolution predicts significantly worse health, alongside being separated, widowed, or divorced for an extended period of time (Hypothesis 2).

After controlling for potential health bias and other common or expected predictors of health, using a dynamic measure of one's marital status is illuminating. Compared to being continuously (or recently) married, being separated, widowed, or divorced continuously between 2008 and 2010 (experiencing a marital dissolution prior to 2008) decreases the log odds of being in better general health ($p<.05$) but does not predict better or worse retrospective, SF-12 mental, or SF-12 physical health outcomes for Malawians in 2010. Moreover, *becoming* separated, widowed, or divorced between 2008 and 2010 also predicts worse general health ($p<.01$) *and* worse general health compared to two years prior ($p<.05$)—the interval in which these respondents experienced a marital dissolution—relative to continuously (or recently) married individuals. Only for the retrospective health measure does *becoming* separated, widowed, or divorced predict significantly worse health than for those who were *continuously* separated, widowed, or divorced since 2008 (based on post-estimation tests). Yet, becoming separated, widowed, or divorced between 2008 and 2010 still does not predict being above or below one's age group mean for SF-12 mental or physical health scores in 2010.[6]

The impact of the control variables on health outcomes are slightly different in the lagged dependent variable approach in Table 4 compared to the cross-sectional approach in Table 3. Gender is only significantly associated with physical health for older Malawians; being a year older is only negatively associated with the two single-item health measures (p<.001), rather than all four measures; education—particularly having attended secondary school—only predicts better physical health (p<.01); one's household

Table 4: Lagged Dependent Variable Logistic Regressions Predicting Health Outcomes in 2010

| | Self-Reported Health Outcomes | | | |
	General Health	General Health Compared to 2 Years Ago	SF-12 Mental Compared to Age Mean	SF-12 Physical Compared to Age Mean
	(1)	(2)	(3)	(4)
Male	0.27	0.29	0.24	0.40*
	(0.17)	(0.16)	(0.16)	(0.16)
Age in 2008	-0.04***	-0.03***	-0.01	-0.01
	(0.01)	(0.01)	(0.01)	(0.01)
Yao	0.56**	0.3	0.3	0.12
	(0.19)	(0.18)	(0.18)	(0.18)
Educational Attainment (No School)				
Primary	-0.06	0.06	0.28	0.17
	(0.18)	(0.17)	(0.17)	(0.17)
Secondary	0.56	0.08	0.08	1.26**
	(0.39)	(0.35)	(0.34)	(0.42)
HH Dependency Ratio in 2008	0.01	0.04	-0.01	0.03
	(0.05)	(0.05)	(0.05)	(0.05)
# Marriages as of 2008	-0.11	-0.04	-0.08	-0.14
	(0.07)	(0.07)	(0.07)	(0.07)
Some Perceived Chance of Being HIV+ in 2008	0.14	-0.13	0.13	0.23
	(0.15)	(0.14)	(0.14)	(0.15)
Marital Status 2008-2010 (Continuously/Became Married)				
Continuously separated/divorced/widowed	-0.45*	0.01	-0.21	-0.26
	(0.21)	(0.20)	(0.20)	(0.21)
Became separated/divorced/widowed	-0.91**	-0.74*	-0.40	-0.03
	(0.33)	(0.32)	(0.31)	(0.31)
Health in 2008				
General Health	0.73***	0.44**		
	(0.15)	(0.14)		
SF-12 Mental Compared to Age Mean			0.54***	
			(0.14)	
SF-12 Physical Compared to Age Mean				0.93***
				(0.15)
N	922	922	922	922
Wald Chi²	113.14	49.06	37.95	85.06
Pseudo R²	0.10	0.04	0.03	0.07

* p<.05, ** p<.01, *** p<.001. Robust standard errors and estimates are presented.

dependency ratio is no longer significantly related to health; and one's perceived chance of being HIV-positive in 2008 has no impact on one's health in 2010. But similarly, the effects of ethnicity remain significant only in model 1 and one's number of marriages remain insignificant throughout. Finally, each lagged health outcome (i.e. 2008 General Health) is positively and significantly associated with the corresponding health outcome in 2010: being in good health in the past predicts good health in the future.

Discussion

The results of these analyses suggest that being separated, widowed, or divorced and *recently* becoming separated, widowed, or divorced are associated with worse health compared to married individuals for the single-item, self-reported health outcomes among this sample of rural Malawians. Also, becoming separated, widowed, or divorced is deleterious to one's health relative to being continuously divorced when evaluating one's retrospective health. Marital status did not predict the dichotomized SF-12 mental and physical health scores, though. Therefore, Hypotheses 1 and 2 are partially supported. However, these results are intriguing as both the significant and insignificant negative effects of marital dissolutions on health outcomes offer an avenue forward in theoretical and methodological development

Since the single-item health metrics—"General Health" (in models 1 and 2) and "General Health Compared to Two Years Ago" (in model 2)—are sensitive to respondents' union statuses or transitions, while the dichotomized SF-12 mental and physical health outcomes are not, one plausible explanation could be that marital dissolutions are simply not that strongly associated with worse health outcomes despite the literature from HICs

suggesting that this is a robust relationship. If this is the case, then it still remains unclear as to why marital dissolutions might not strongly predict one's health in the rural Malawian context. Selection into surviving to advanced ages (45+) in Malawi could have strong explanatory power. If rural Malawians are able to survive in a subsistence agricultural society, with little access to medical facilities or practitioners through most of their lives, and endure the most devastating part of the HIV/AIDS epidemic (the 1990s and early 2000s) when many of these individuals still would have been sexually active and their social support networks became depleted, then experiencing a marital dissolution might not be as detrimental of an event in this context compared to HIC settings where most individuals have not faced such hardships prior to a marital dissolution. While testing this hypothesis is beyond the realm of these data, this possibility must be tested in future research and in a comparative manner between HICs and other LIC settings.

Another explanation rests in the possibility that since the insignificant logit coefficients for the static marital status (in Table 3) and dynamic marital status (in Table 4) measures are negatively associated with each health outcome (with the exception of being continuously separated/widowed/divorced in model 2 of Table 4), a Type II error is witnessed as a consequence of the relatively small sample size and portion of rural Malawians who are not married, along with issues of unobserved heterogeneity in all analyses. Thus, the conventional theoretical framework on the impacts of marital dissolutions for individual health (Anson 1989; Land and Yang 2006; Lillard and Panis 1996; Schoenborn 2004; Stroschein et al. 2005; Waldron, Hughes, and Brooks 1996) would be supported in this rural Malawian research (as in earlier studies situated in Malawi and Cameroon [Delavanade and Kohler 2009; Kuate-Defo 2006]). If this were the case, then

scholars and future research must attain larger samples of older sub-Saharan Africans (or Malawians more specifically)—perhaps even oversampling on older individuals who are not married—to test whether these results are indeed a result of a Type II error or if they are robust. Additionally, testing a large share of individuals who have recently experienced a marital dissolution will allow for more effective analyses in reducing health selection issues in a longitudinal framework (such as fixed effects modelling).

A third feasible explanation for these differing results lies in the measurement of these four self-reported health outcomes. While the first two are single-item responses, the last two—dichotomized SF-12 mental and physical health scores compared to age group mean—are generated from twelve items and widely considered to be highly robust indicators of health, even in comparison to biometric and anthropometric measures (Gandek et al. 1998; Ware, Kosinski, and Keller 1996). If one is to believe that the two SF-12 outcomes are more robust, or better, indicators of these Malawians' health than the two single-item measures, then it would seem that marital dissolutions might only predict certain aspects of one's health rather than a more holistic measure. This would seem to counter the stance of Kuhn, Rahman, and Menken (2006), who argued—using data from Bangladesh—that simpler measures of individual health, like effective single-item self-reported indicators, need to be considered in favor of multi-item and observed (biometric or anthropometric) indicators (which do not necessarily measure health any more comprehensively than single-item measures) in sub-Saharan African research in order to make data collection less expensive with little-to-no compromises in the ultimate measurement of health outcomes. If anything, the results of this paper suggest that different self-reported measures of health are not substitutes, but rather give insight into various

aspects of individual health. More research on the extent to which standard health measures in surveys are analogous, and potential substitutes for the purposes of saving costs in data collection is necessary in future SSA research.

Although inconsistencies between single-item and multi-item measures have been found with respect to marital status in past sub-Saharan African research on this relationship for individuals (Kuate-Defo 2006), little has been discussed about these discrepancies except for the need to conduct longitudinal analyses. Additional longitudinal research including a multitude of health outcomes is now necessary in order to gain an in-depth understanding of the discrepancy in the relationship between marital dissolutions and health.

The results of these analyses may stem from several limitations that ought to be remedied in future assessments of the relationship between marital dissolutions and health in both sub-Saharan African nations and other LICs when attempting to build upon the theoretical framework on this relationship witnessed in HICs. As noted earlier, longitudinal data consisting of larger samples of older individuals, and older individuals who have experienced marital dissolutions are necessary to achieve enough statistical power to discount potential Type II errors and more rigorously account for unobserved heterogeneity (i.e. via fixed effects modelling over multiple waves). Larger samples would also allow such analyses to further test stress-process theory through interaction effects between marital dissolutions and buffering or aggravating (moderating) factors such as the number of dependents or working age individuals, gender, and HIV/AIDS status—rather than treating these factors only as controls. As such, in results not presented, the MLSFH data

do not show any significant relationship between these interactions and health, which is likely a consequence of sample size rather than contextual substance.

In an ideal situation, the data would be able to account for a deeper understanding of respondents' changing family circumstances and spouses' backgrounds. For instance, knowing who provides support to divorcees or widows *outside* of the household might provide greater insight into who supports individuals in the aftermath of a marital dissolution, but the MLSFH only offers information on such transfers within a household; complete network studies on older Malawians and their support networks would enlighten this unmeasured, yet important aspect of social support. Additionally, while the MLSFH data allow for the matching of spouses (where available), there are not enough cases to warrant inclusion of spousal characteristics in these analyses; examining couples' (and former couples') characteristics in future research would further reduce the explanatory uncertainty in health outcomes for older individuals.

Lastly, by collecting larger sample sizes over time, a greater share of older individuals' mortality will be captured and the relationship between marital dissolutions and death can be effectively evaluated. The MLSFH data do not contain enough individuals meeting the criteria for this study in 2008 who died by 2010. So far, the best manner in which to approximate mortality with these (and other data) has been with regards to subjective expectations of mortality in light of union status (Delavande and Kohler 2009).

Conclusion

The primary goal of this paper was to examine whether experiencing a marital dissolution—and the timing of a dissolution—in a rural sub-Saharan African context is

associated with worse health outcomes compared to being married, as is found in many HIC settings, in order to theoretically and empirically build upon this body of research. While these analyses cannot determine any causal paths and include only a small sample of rural Malawians, the intriguing results suggest that marital dissolutions might not be as impactful on the health of individuals in places like rural Malawi compared to locations in the US and Europe. But at the heart of this, selection into surviving to advanced ages in Malawi might outweigh the detrimental effects of a marital dissolution. Also, the difficulties in collecting large enough sample sizes of older sub-Saharan Africans alongside detailed and invasive health data might be hindering these types of analyses from occurring more frequently in other countries, in addition to biasing the estimates in these models as a result of these sampling limitations in the MLSFH.

Understanding the social determinants of health among older individuals in aging countries like Malawi or more generally, sub-Saharan Africa, will become increasingly necessary as more individuals survive into old age. In settings with limited access to medical facilities or formal care, and among individuals with little disposable income to pay for treatment, older individuals are at a high risk of health decline. Although more research is necessary, a practical step could be to ensure that doctors, nurses, and other health workers vigorously ascertain the marital status and timing of a recent divorce or widowhood for older individuals throughout Malawi, in health risk assessments. It is not as if Malawians need to be convinced that marriage might be good for one's health, as much of the HIC literature suggests, since nearly all Malawians get married and a substantial portion re-marry after a dissolution. But, based on these analyses and despite their limitations, the period after individuals experience a marital dissolution appears to

offer a critical window in which health practitioners can identify and possibly intervene in the health of such individuals. Researchers must also continue to identify how social determinants—like marital status and transitions—might impact older individuals' health which will help scholars, and eventually policy makers and NGOs, ascertain the most vulnerable individuals in such settings. A broader and more comprehensive understanding of these phenomena can be utilized to improve health outreach programs.

While much of sub-Saharan African population research has often focused on HIV/AIDS, trends in infant and child mortality, and consequent changing family structures (and combinations of these), little research has explicitly examined the overall health of those who are often left keeping the fabric of communities together—the elderly. Investing in longitudinal research targeted at older populations will only contribute to a better understanding of how sub-Saharan African countries are aging and the factors hindering this demographic process.

Notes:

[1] This trend has been consistently found in Malawi's 1977 (initial), 1987, and 1998 censuses in addition to the 2008 edition.

[2] Malawi has an estimated HIV/AIDS prevalence of 10.6% of adults 15 to 49 years old (Malawi National Statistical Office and ICF Macro 2011).

[3] The differences between the eligible sample that has missing data (and are therefore excluded from the analyses) as well as individuals who were lost between 2008 and 2010 due to attrition can be found in the Appendix.

[4] In results not presented, interactions between a dichotomous marital status measure (which sufficiently increases the number of cases of divorce, widowhood, and separation for analyses by gender) and gender were not significantly associated with health outcomes, although this might be due to the small sample size.

[5] Although HIV status is available in the 2008 MLSFH data, a large portion of respondents refused to be tested as part of the MLSFH study and testing was not performed in 2010. Thus for the purposes of this paper, actual HIV status is an unreliable variable. Additionally, it would be ideal to control for a recent HIV/AIDS-related death in respondents' families since this could impact health. But the MLSFH only collected data on mortality in households, and roughly 2.5% of respondents experienced an HIV/AIDS-related death in their households between 2008 and 2010, leaving too few cases to justify inclusion as a control variable. In results not presented, inclusion of this variable does not alter my conclusions nor is it significantly associated with health.

[6] For each model, the original SF-12 mental and physical health scores were tested with ordinary least squares regressions with the same results for the effects of marital dissolutions.

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Appendix

Appendix Table 1: Analytic and Missing Sample Descriptive Statistics (Percentages and Means with Standard Deviations)

	Analytic Sample	Missing	Significantly Different
Gender			
Female	55.5	60.3	
Male	44.5	39.7	
Ethnicity			
Non-Yao	73.6	70.6	
Yao	26.4	29.4	
Education			
None	36.6	42.1	
Primary	58.2	54.2	
Secondary	5.2	3.6	
Perceived Chance of Being HIV+ in 2008			
None	57.3	61.9	
Some	42.7	38.1	
Perceived Chance of Being HIV+ in 2010			
None	67.8	72.8	
Some	32.2	27.2	
Marital Status in 2010			**
Married	76.5	68.2	
Separated/Divorced/Widowed	23.5	31.8	
Marital Status 2008-2010			
Continuously/Became Married	76.5	74.7	
Continuously separated/divorced/widowed	17.7	20.7	
Became separated/divorced/widowed	5.9	4.6	
Age in 2010	59.0 (11.3)	61.0 (11.2)	**
HH Dependency Ratio in 2008	1.5 (1.5)	1.3 (1.5)	
HH Dependency Ratio in 2010	1.3 (1.3)	1.2 (1.2)	
# Marriages as of 2008	1.7 (1.0)	1.8 (1.0)	
# Marriages as of 2010	1.7 (1.0)	1.8 (1.0)	
N	922	370 (max)	

* p<.05, ** p<.01, *** p<.001

Appendix Table 2: Analytic and Attrition Sample Descriptive Statistics (Percentages and Means with Standard Deviations)

	Analytic Sample	Attrition	Significantly Different
Gender			**
Female	56.9	49.4	
Male	43.1	50.7	
Ethnicity			
Non-Yao	72.8	70.1	
Yao	27.2	30.0	
Education			
None	38.0	40.5	
Primary	57.2	53.9	
Secondary	4.8	5.6	
Perceived Chance of Being HIV+ in 2008			
None	58.4	61.5	
Some	41.6	38.5	
Marital Status in 2008			
Married	78.6	79.4	
Separated/Divorced/Widowed	21.2	20.7	
Age in 2008	57.6 (11.2)	59.4 (12.7)	**
HH Dependency Ratio in 2008	1.5 (1.5)	1.4 (1.6)	
# Marriages as of 2008	1.8 (1.0)	2.1 (2.7)	**
N	1290 (max)	383 (max)	

* p<.05, ** p<.01, *** p<.001

Conclusion

The three papers comprising this dissertation were designed to offer insight into the components of the demographic equation—fertility, migration, and old age health (with mortality looming in the distance)—and thus, three aspects of the life course. But these papers were developed to answer, what I believe are, highly relevant demographic questions in Malawi (and other sub-Saharan African contexts), that have surprisingly not been answered. I feel fortunate to have been granted the opportunity to explore such questions, and hope that my efforts spur more-detailed research within the academic community.

The first paper of this dissertation was motivated by the fact that most Malawians survive via subsistence agriculture, and that it seemed necessary to examine how a famine would impact individuals' livelihoods. I wanted to examine these effects on fertility given prior biological and social explanations for this relationship, but also considering that Malawi had two episodes of major food insecurity since 2000 and no demographic research was available to complement the existing economic and policy research on this topic. The results suggest a story of "fertility resilience" among those living in regions exposed to the most severe staple price shocks, but also that in general, the likelihood of giving birth appears to decline, albeit briefly and in a delayed manner, after Malawi's famine in 2002 and food crisis in 2005-2006. If nothing else, these results bolster the literature that food insecurity is associated with fertility—even if the causal mechanisms are still not completely clear—but that there is much more that we must learn about how women and households form survival strategies during times of food insecurity, and *why* we witness effects on fertility.

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The second paper of this dissertation sought to understand perhaps one of the more basic determinants of how long individuals stay at a particular location before migrating: the presence of family and friends. With so much emphasis on how marriage, HIV/AIDS, and/or employment predict the chances of migrating in African settings, coupled with the notion that kin and non-kin function as an informal type of insurance, it was necessary to seek out how the effects of family and friends might contribute to our knowledge of factors associated with migration and the duration of such migration spells. The results were surprising given the available literature on social norms and relationships with kin and non-kin in a variety of African nations, including Malawi. Who would have thought that the presence of friends at a destination would be more of a factor in increasing the length of one's stay, compared to family members? Such results indicate that there is plenty of room to build upon migration theory, especially with regards to exactly *how* existing network contacts impact the likelihood of out-migration.

The goal of the third paper was to contribute to a growing dialogue on the social determinants of aging in sub-Saharan Africa, since Malawi and the region are slowly aging and little is known about how certain shocks might impact the health of older individuals. Marital dissolutions became a theoretical gateway into assessing this relationship since nearly all Malawians get married and, at some point, they could be subjected to the *possibly* detrimental effects that widowhood, divorce, and separation have on individual health, based on literature in high-income countries. The analyses do not readily support the relatively robust findings of research in high-income settings though. But, the more important question at stake might be: who are those who survive to old age in a resource-poor country like Malawi? Marital dissolutions might simply not be considered a major

shock to an individual who has survived famines, the depletion of their family due to HIV/AIDS mortality, or severe economic hardship. Understanding such selection issues might take researchers a step further back into evaluating the social determinants of aging in places like Malawi. Early life conditions could easily play an important role in this process, as found in many other low to middle-income countries around the world, so acquiring such data will be crucial to future survey projects.

It is evident that to build upon the research presented in this dissertation, more-detailed information on fertility histories and "shock" histories, migration histories, and early life characteristics are necessary to close the gap between the observed relationships and informed speculation as to why these relationships exist. But extensive anthropological or ethnographic research will shed the most light on these "black boxes"—the mechanisms behind these relationships. In an ideal situation, my research would inform qualitative work which would be used to better design representative surveys.

Yet, while the clock is ticking relatively slowly in sub-Saharan Africa to embark upon in-depth studies on the aging process since most countries are not aging rapidly, and there is no immediate need to refine how we measure migrations since there will always be voluminous internal and international migration flows in many sub-Saharan African countries, surveys ought to be readily equipped to measure exposure to a variety of economic, agricultural, and human shocks since these could happen at any time. This is not to say migration and old-age health are not important research topics in sub-Saharan Africa, but that increased frequency and severity of droughts, food crises, and famines in low-income nations have been well-documented in recent years. The time to implement such measures in survey research is now, to better understand how parents and their children

will be affected by exposure to such shocks in the short, medium, and long-term, so that effective interventions can be developed. Even then, if human benefits can be derived from increased research efforts towards understanding migration patterns or the determinants of old age health, these efforts would be well-suited to being conducted in the poorest, least healthy, and least developed settings in the world—places like Malawi—where increased academic and public attention could make the largest impacts on individuals' lives.

With this said, there will always be skeptics of such idealistic research agendas or even those who question what we could possibly learn, in the field of population research, from such a country like Malawi that *seems* politically and economically insignificant. However, I am optimistic about raising the standard of this type of research in the world's poorest countries in order to better inform policy makers and non-governmental organizations—those with power to change a country's path—of how to intervene in vulnerable individuals' lives and improve their livelihoods. Malawi, if anything, is a country that has incredible human potential; its people deeply care deeply for one another, work incredibly hard, and endure through famines, floods, epidemics, recessions, and widespread financial mismanagement at all levels of government. So, studying the determinants of the basic aspects of human life: birth, migration, and ultimately, death ought to be valued in a place where perhaps even the simplest intervention could dramatically improve the lives of its residents. If we, as social scientists, can pin down—or come close to pinning down—causal factors impacting these aspects of the demographic equation and implement interventions in one of the poorest and least developed countries in the world, I am sure that Malawians could thrive.

It has been a privilege to once again explore Malawian social life and population concerns in my graduate career. Although the research in this dissertation has its limitations, with any luck this work will inspire others to build upon it and continue to put Malawi in the global public's mind. *Zikomo kwambiri*.

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