Idiosyncratic shocks, risk management and welfare dynamics in rural Ghana

Felix Naschold*, Thomas Walker**, Christopher B. Barrett***, and Robert Osei****

*Visiting Assistant Professor, Department of Economics and Finance, College of Business, University of Wyoming, Laramie, WY 82071. Email: fnaschol@uwyo.edu (corresponding author)

**PhD candidate, Dyson School of Applied Economics and Management, Warren Hall, Cornell University, Ithaca, NY 14853-7801 USA

*** Stephen B. and Janice G. Ashley Professor of Applied Economics and Management, International Professor of Agriculture, Charles H. Dyson School of Applied Economics and Management, 315 Warren Hall, Cornell University, Ithaca, NY 14853-7801 USA,

****Senior Research Fellow, Institute of Statistical Social and Economic Research, University of Ghana, P. O. Box LG 74, Legon, Ghana.

15 July 2011

Selected Paper prepared for presentation at the Agricultural & Applied Economics Association's 2011 AAEA & NAREA Joint Annual Meeting, Pittsburgh, PA, July 24-26, 2011

Introduction

Identifying who moves in and out of poverty over time has been the focus of a growing literature on household level poverty dynamics. A central theme of this literature has been the role of shocks and their impact on households ex ante and ex post risk management strategies. Shocks and strategies to mitigate their impact affect household level welfare dynamics. Success or failure to prevent and to deal with shocks determines whether households are able to escape and remain out of poverty or whether they continue to be or become poor as a result of adverse events. In turn, this success and failure is determined by households ability to access effective insurance mechanisms, both formal and informal. The more effective and accessible these mechanisms are the greater is the chance to recover from negative shocks and to improve well-being over time. Conversely, households with limited access to any type of insurance mechanism will find it harder to weather shocks and avoid chronic poverty.

From a policy perspective and to identify how to improve access and effectiveness of mechanisms that households can use to manage risk we need to distinguish between the two different types of risk that households are exposed to. Covariate risk such as drought, rainfall, pests or civil war affect the entire population. As a consequence efforts to deal with covariate risk have to look beyond the geographic location or population and focus on risk pooling across larger areas and populations. Covariate risks have been the focus of much of the existing literature (Rosenzweig 1988; Hoddinott and Kinsey 2001; Dercon 2004; Newhouse 2005; Alderman *et al.* 2006; Hoddinott forthcoming).

Despite the predominant focus in the welfare dynamics literature on covariate risk evidence suggests that idiosyncratic risk often dominates covariate risk. Townsend (1994) finds this in rural India. Deaton's (1997) and Kazianga and Udry's (2006) results corroborate this for South Africa and Burkina Faso. Lybbert et al. (2004) find that this even holds among pastoralists in southern Ethiopia, a population that is subject to highly covariate rain, epidemiological and range ecological shocks. Similarly, our survey and focus groups from rural Ghana suggest that covariate shocks were few during the study period 1997 to 2009 but indicated numerous household-specific shocks.

Unlike covariate risk exposure to idiosyncratic shocks can be insured against within a population or location. The largely unanswered empirical question that remains is which types of local insurance mechanisms are available and which one are effective in mitigating exposure to idiosyncratic risk and shocks. One key contribution of our paper is, therefore, to focus on household-specific risk and its impact on household level welfare dynamics. The main questions we address in this paper is how idiosyncratic shocks affect welfare dynamics paths and whether those effects are mitigated differentially by different risk management strategies.

Facing uninsured risk ex ante and being forced to cope with consequences of risk ex post households employ a range of strategies to minimize their exposure to risk and to smooth their consumption over time. Autarkic households might be able to self-insure through savings and precautionary savings. Others may have access to other risk management strategies such as informal and formal insurance and credit, social networks, and labor market access and income diversification. Existing studies focus on any one of these insurance mechanisms.

Given access to insurance mechanisms households maximize their welfare by smoothing their consumption over time. Insurance can come from a variety of sources: self insurance and asset accumulation through own savings (Dercon 1998; Kazianga and Udry 2006), selling buffer stocks (Lim and Townsend 1998), pre-cautionary savings (Kimball 1990; Carroll 1998), or through selling assets and livestock. However, households typically cannot fully insure against fluctuations in income. Hence, they are forced to adopt coping strategies that reduce their welfare temporarily or permanently, for instance, by selling off important productive assets such as bullocks in India (Rosenzweig and Wolpin 1993), taking children out of school or by having to drop their food consumption to levels that cause irreversible damage to children's growth and development (Alderman *et al.* 2006).

Social networks provide another mechanism to mitigate the effect of idiosyncratic shocks. Social visibility can affect welfare dynamics in at least six ways. It can prevent asset decumulation post shock, mitigate the need for precautionary, liquid savings for self-insurance, foster productivity through ex ante risk management, improve social learning about promising employment, marketing or technological opportunities, enhance the security of land tenure, and facilitate access to micro credit based on group lending principles. Through any or all of these mechanisms, social visibility may affect the asset accumulation path followed by households by increasing the expected net returns to assets, reducing asset risk, or both. Vanderpuye-Orgle and Barrett (2009) examine the importance of social networks in managing risk for households in rural Ghana. They find that those who are socially invisible and who suffer a farm shock or theft - idiosyncratic shocks that are informally insured among the socially visible - are considerably more likely to fall into a poverty trap than are otherwise identical persons who do not suffer shocks or who are socially visible.

Diversification of income sources represents another informal mechanism to insure against risk. Where formal insurance access is limited, as is the case in most rural areas, income diversification is the norm rather than the exception (Reardon 1997, Davis et al. 2010). The reasons for households to diversify their income are multiple. For some households diversification may be driven by necessity and to ensure survival. The expected return to a diversified portfolio of low-return crops may be lower than for a single high-risk and higher return crop but when other types of insurance mechanisms are weak household may choose the former. Or households may be forced to enter other income generating activities as a consequence of negative shocks. In contrast, other, typically better-off households may be prompted to diversify out of choice either by trying to get the highest return to their investment by combining several high-return activities, or in order to strategically accumulate assets as they move from farm to non-farm activities and as they prepare to and then migrate to cities (Ellis 1998, 2000a and 2000b, and Barrett e*t al*. 2001).

Our paper goes beyond the existing studies by examining each of these risk management strategies individually as well as jointly. This allows us to both assess the relative importance of these mechanisms as well as identify complementarities between them. This extension beyond an individual risk management mechanism allows a more appropriate modeling of the behavior of households that face risk as when one or more risk management mechanisms are unavailable households resort to other mechanisms. Evidence from rural Pakistan, for example, suggests that interpersonal transfers partially make up for missing access to formal financial institutions (Behrman *et al.* 1997).

Context: The four villages 1998-2009

The four communities studied in this paper are located in Akwapim South district, a hilly rural area in southern Ghana. The study area is less than 30 miles from Ghana's capital city, Accra, but too far for community members to regularly commute for work. The four communities are large villages, or clusters of smaller villages, with estimated populations of between 700 and 2,500. They were selected in 1997-98 for a study of farmers' decisions to start pineapple farming for export. Two of the communities lie on sealed roads and close to small towns, while the others are in a remote valley on unsealed roads. Since the communities were selected purposively to provide a representation of the range of economic conditions in the district, their economic and social characteristics are quite different. Nevertheless, all four communities are within the same geographic region and climatic zone, have a common history, and share the same markets.

The patterns of employment and economic activity in the communities align closely with their geographic characteristics. In the two remote communities, most households are employed in farming. Some of this farming is commercial, the bulk of which is growing pineapple for export or domestic processing. Most of the remaining produce grown is consumed within the household, with any surpluses being sold on the street or in town markets. In the other two communities, there are fewer farmers and more wage workers. Some of these are employed by the government and local businesses; the remainder are self-employed in occupations like taxi driving and hairdressing.

The economic situation in these communities has evolved, and continues to evolve, at a rapid pace. In the decades following World War II, the area was central to Ghana's cocoa industry, but over time this industry has declined. In the early to mid 1990s, the area was the epicenter of Ghana's nascent export pineapple industry. Through the late 1990s and early 2000s, the export industry boomed, migrants came to the communities to work in the fields, and in the case of at least one of the communities, almost everyone was involved in pineapple cultivation in some way (Fold and Gough 2008). However, a rapid change in market conditions in Europe around 2005 dramatically cut demand for Ghanaian pineapples. Between 2005 and 2009 many farmers in the study area abandoned pineapple cultivation and, in some cases, migrated out of the community. Since contracts were often made by word-of-mouth, farmers had no guarantee of payment by the buying companies. Payments were often made months after delivery (Fold and Gough 2008, pp. 1692-93). Accordingly, there are numerous cases in our data of farmers reporting large contract defaults, with amounts unpaid sometimes running into the thousands of dollars. In the years since 2005 the people in the study area have moved on to other investments, or adapted to the new export market conditions. Anecdotally, however, the shock had a significant impact on the welfare of the community. In the analysis below, we will examine how households coped with this and other others they faced in the decade prior to 2009.

Another recent economic change has been the encroachment of urban areas. In two of the communities, nearby town centers have expanded, and demand for rented housing and (in the case of one community) land for housing has pushed up the price of land. This, too, has caused a shift in the pattern of land usage, with some farmers in that community selling almost all of their land and shifting to wage work or semi-retirement.

Aside from these shocks, the community members reported in pre-survey meetings and post-survey focus group interviews that there were no significant common shocks during the last decade. Agricultural conditions have been within the normal range of fluctuation, and the political situation has been stable (with only one peaceful change of government, in 2009). There have been no notable outbreaks of disease among individuals, livestock or crops, although cases of malaria, dysentery and other ailments remain common.

Although the district has been occupied by a single ethnic group, the Akwapim, for over 200 years, migration is commonplace. Individuals migrate to towns and cities in search of work, or to join their spouse's family after marriage, and a number of households reported holding land in different regions of Ghana. In our sample, around 17 percent of respondents had migrated from another region to live permanently in the study area. Since land is held in family and clan lineages, and land sales are rare, migrants typically rent land for farming.

Since most households do not satisfy the criteria to access formal lending sources or insurance, individuals rely on their own savings, and on each other, to cope with shocks (Walker 2011). There are two main sources of support used by community members: family and friendship networks, and mutual assistance groups. We will briefly describe these in turn – first, the structure of the household and patterns of exchange therein, and second, the main sources of support from other households.

Families in the district are interdependent and exchange gifts and loans in order to help cope with shocks. Individuals live in compounds, a conglomerate of houses containing more than one household (typically linked by kinship). A few men continue to practice traditional polygamy, with each wife and her descendants usually living separately. For the purposes of this study, we treat such families as one household unit.

It is traditional in the study area for men to be the main breadwinners and to be responsible for covering the cost of food and household supplies. However, men and women often maintain separate finances. Previous research has established that spouses do not fully share information on their farming activities or earnings (Goldstein *et al.* 2002). Reflecting this, they do not appear to fully insure each other against income shocks. Using earlier household survey data from these communities, Goldstein (1999) was able to reject risk-sharing at the intrahousehold level. In part, this may be due to the relative rarity of large shocks idiosyncratic to just one spouse. For large shocks, individuals often turn to their extended family and friends for support.

Informal and religious groups are common in the study communities, and these groups play a substantial role in the system of informal support. Foremost, a majority of individuals actively attend religious ceremonies, at churches or mosques. Religions are diverse in the communities and there is widespread tolerance between religions. Individual religious groups have strong ethics of sharing and mutual support, typically extending aid to families in need and raising funds from community members for charity within the village and elsewhere.

Individuals are also commonly involved in farmers' groups or other support groups, which may provide assistance to those in need in the form of labor, finance or training. Of our respondents, 45 percent

reported being a member of at least one support group of any sort, and 18 percent a member of a church group. Individuals in our study reported joining such groups in search of assistance, and reported receiving help from these networks in times of need. Such groups may also form the basis of friendship links that are used for mutual insurance. Indeed, while Goldstein (1999) was able to reject the hypothesis of intrahousehold insurance in these communities, he was unable to reject the hypothesis of risk sharing between village members of the same gender, suggesting that gender-specific groups may be operating effectively as coinsurance networks.

Data

Our data were collected in the Akwapim South District in rural Eastern Ghana and cover the period between 1998 and 2009. The first wave of the panel was collected in 1997-98. For the 2009 wave we revisited as many of the original 213 households as possible. A substantial number of these households no longer existed. And for those that did the data do not contain all necessary variable for both years. Our final panel includes 127 households.

The dataset we use in this paper summarizes data at the household level. The 2009 wave was administered in five rounds. Where appropriate we average values over the five rounds, for example, in compiling the consumption data.

Consumption aggregates were constructed by household and then divided by household size in per adult equivalents. Household consumption includes all expenditures other than a set of lumpy items or items that do not contribute to the level of well-being including health expenditures, purchases of financial assets, marriage and dowry expenses, purchases of furniture, appliances, mobile phones, bicycles, motor vehicles, as well as court fees, gifts and transfers, funeral and birthday expenses and house and land rents. All monthly household expenditures as well as the assets expressed in currency were deflated by the CPI and converted into 2009 Ghanaian Cedi.

Table 1 Household expenditure per adult equivalent (2009 Cedi and US$)

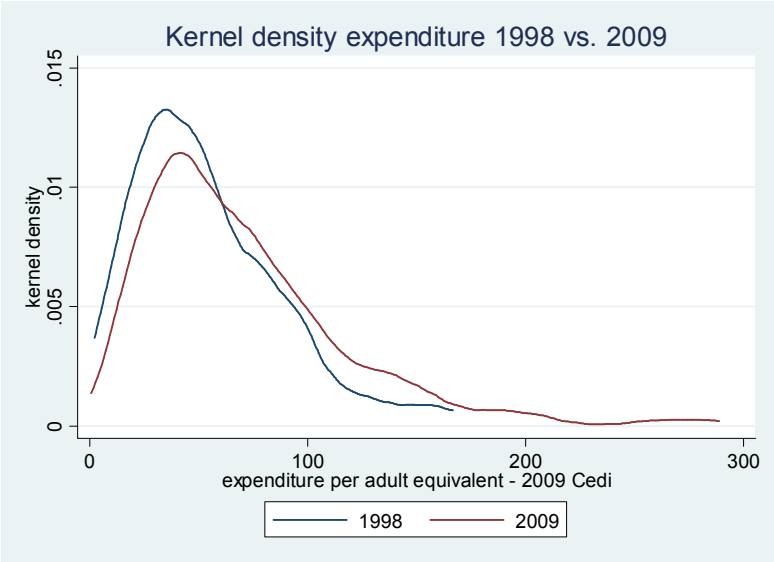
	1998			2009		
	Cedi	US$		Cedi	US$	
	per month		per day	per month		per day
Darmang	55.49	38.27	1.28	58.11	40.08	1.34
Pokrom	64.33	44.37	1.48	54.53	37.61	1.25
Oboadaka	54.75	37.76	1.26	53.15	36.66	1.22
Konkunuru	63.21	43.59	1.45	68.95	47.55	1.59
All villages	59.23	40.85	1.36	58.92	40.63	1.35

Table 1 shows that for the villages as a whole expenditure levels have remained almost constant between 1998 and 2009 at around 59 Cedi. Levels of expenditure are low at an average of $1.35 per adult equivalent per day at 2009 prices. Underlying this overall stagnant trend are divergent patterns across villages. Expenditure levels rose in Darmang and Konkonuru whereas they fell in substantially in Pokrom and slightly in Oboadaka. This pattern likely reflects the fact that Konkunuru and Darmang are

characterized by more dynamic economies with better infrastructure and that these two villages have moved out of agriculture and become more urbanized over the study period.

The empirical distributions in Figure 1 for household expenditure per adult equivalent for the whole sample show a right-ward shift between 1998 and 2009. This suggests a slight improvement in expenditure levels which seemingly contradicts the figure in Table 1. However, the averages in Table 1 are partly driven by a few large outliers. For example, if we take out the three richest households that have per monthly adult equivalent expenditure greater than 300 Cedis out of the sample then average expenditure levels for the remaining households increased from 54.1 Cedis in 1998 to 57.8 Cedis in 2009.

Figure 1 Kernel density of expenditure



The empirical analysis below includes a number of household level control variables. The age and sex of the household head control for lifecycle and gender effects. Whether the respondent or his/her parents have held a village office, whether the respondent is the first in the family to live in the village and whether he/she had previously been in foster care act as a proxy for the social status in the village and for the strength of social networks over and above the degree of social visibility discussed below.

To examine the role of different sources of idiosyncratic risk on household welfare dynamics we designed the shocks module of the 2009 survey to ask for detailed recall information on the frequency and the monetary value of 20 negative and 9 positive shocks that have affected the household since the first wave of the panel in 1998. This creates a large number of variables. For instance, for the typical household with two respondents and 12 years of recall information we have 2*(20+9)*12 = 696 variables each for the number of shocks and the value of these shocks. To keep the analysis tractable we first summed shocks within each household from all respondents in that household. Second, we combined them in across time by aggregating shocks across all 12 years. Third, we created summary shock variables for three categories of negative and two categories of positive shocks as described in the table below. Finally, we created overall variables for the total number of shocks a household

experienced and for their total value for each of time period. Our analysis below begins by using these aggregate shocks before disaggregating by category of shock.

Table 2 Categorization of negative and positive shocks

	Family/Personal	Business/Job	Agriculture/Livestock
Negative shocks	death of the household head or spouse, death of a household member, illness of injury o a household member, medical expenses, loss of home, divorce or separation, funeral expenses, division of property, cut-off of remittances, withdrawal of government or NGO assistance	Loss of regular job, loss of productive asset, loss of contract/default, failure/bankruptcy of business	Crop loss due to drought, crop loss due to disease, crop loss due to other reasons, livestock loss due to death, livestock loss due to theft
Positive shocks	New or increased remittances, inheritance, large gift or lottery win, receipt of dowry or brideprice, scholarship for child's education, new government or NGO program	New regular job for household member, young person worked, gain from business activity	

Table 3 gives an overview of the aggregate value and number of negative and positive shocks for households over the period spanned by the panel. Positive shocks were very rare with family and business shocks about equally frequent. The overall number of positive shocks per household over the 12 year period was only 0.18. The value of positive shocks was also very small with an average total of 134 Cedi per household which is only slightly more than the average monthly consumption level of two adult equivalents.

Negative shocks were more frequent as well as larger. On average every third household suffered from an agricultural or livestock shock. These types of shocks were also smallest in magnitude with a size equal to the monthly per adult equivalent consumption level. Two thirds of households experienced a family shock. Moreover, the average size of the shock was almost six times as large as the agricultural shocks. The frequency of business shocks fell in between the two other shock categories but their value was largest of the three categories at an average of 490 Cedi. Combining all three negative shock categories households suffered on average 1.39 shocks with an average aggregate value of 877 Cedis which is about 15 months worth of average per adult equivalent consumption. This translates to around US$600 at 2009 prices.

Table 3 Value and Number of negative household level shocks 1998-2009

	Value of Shocks (in 2009 Cedi)		**Number of Shocks**	
	Mean	Standard deviation	Mean	Standard deviation
Negative Shocks				
All household shocks	877	2625	1.39	2.18
Family shocks	329	1332	0.65	1.21
Business shocks	490	2024	0.42	0.94

Agricultural and Livestock shocks	58	233	0.32	0.88
Positive Shocks				
All household shocks	134	1036	0.18	0.63
Family shocks	70	684	0.08	0.36
Business shocks	64	784	0.1	0.41

The dataset also contains information on different risk management strategies: social networks, self-insurance, access to loans in an emergency, and income diversification.

To capture the effect of the size of respondents' social networks, or their 'social visibility' we summarize each individual's linkages with other survey respondents into an index. In the 1998 survey respondents were presented with seven individuals from the same villages that were randomly drawn without replacement. Respondents then indicated whether they know these random matches.[1] The aggregate of these responses, therefore, contain information on both directions of links between individuals. The random sampling of matches makes the identified links representative of a respondent's extant social links. However, a potential drawback of random sampling is that we might not reliably capture the size of individuals' social networks.

The methodology for collecting the social links that form the basis of our social visibility indices differs between 1998 and 2009. In contrast to the random matching of seven individuals in the 1998 survey the 2009 instrument contains a full census of all social linkages between all respondents in a village. To eliminate differences created by the data collection method that may have exaggerated any prospective change in network sizes over time we rescale the 1998 data by multiplying all 1998 measures by the ratio of the mean of the 2009 and the mean 1998 social visibility index. This also helps to more accurately proxy the size of individuals' social networks in 1998. Even if we don't want to make the strong assumption that mean network size (measured as number of connections) is unchanged over time this still offers a useful approach. This is because our transformation of the 1998 data preserves both the ordering of and the proportional distance between network size measures in the 1998 observations. The transformed location of that distribution is arbitrary, but its scale and spread is preserved as is the continuous nature of our social visibility indices.

We used the survey responses to the social network questions to measure an individual's social network in two ways. The first method follows Vanderpuye-Orgle and Barrett (2009 ADR) and derives a social visibility index using uni-directional links from all respondents to an individual to calculate the proportion of respondents who know an individual when presented as a random match.

Let J be the total number of respondents who were presented with individual i as a random match. Let K_{ij} denote an indicator variable equal to one if respondent j knows individual i and zero otherwise. Then, the one directional social visibility index based on random matches, *D1*, can be expressed as

[1] The survey made the distinction between actually knowing a person and knowing of a person using the Akan translation of "having heard of a person".

$$D_1 = \frac{\sum_{j=1}^{J} K_{ij}}{J} \qquad D_1 \in [0,1]$$

Secondly, one can measure social visibility in the other direction, namely the proportion of the matches a respondent knew. Let κ_{ik} be an indicator variable equal to one if respondent *i* knows a presented random match and let L be the number of matches an individual was presented with. For 1998 L equals 7, for 2009 L is equal to the total population in the village. Then this index takes the form

$$D_2 = \frac{\sum_{k=1}^{L} \kappa_{ik}}{L} \qquad D_2 \in [0,1]$$

Another mechanism to insure against risk is to accumulate own savings. We proxy this ability to self-insure by the total amount of the financial savings a household has accumulated. These include funds in susu, money owed by others, deposits in bank accounts and holdings of stocks, valuables and currency.

Access to loans in an emergency represents another potential mechanism to cope with negative shocks ex post. This mechanism was captured by asking respondents whether and how they could obtain a loan of 50 Cedi within a week.

Income diversification provides another mechanism of coping with risk ex ante and ex post. We would expect households with constrained access to other insurance mechanism to rely on a greater diversity of income sources. We measure livelihood diversification in two ways. First, we construct a continuous livelihood diversification index based on the shares of income from five sources: wage income from working for someone else, profits from non-farm businesses, profits from the farm in the village, profits from farms outside the village, and other incomes such as pensions, gift or inheritances, lottery winnings or sales of land. These shares are summarized into a Herfindahl index of income diversification. Let *N* denote the total number of *i* income sources and s_i stand for the share of income source *i* in total household income. Then the index takes the form

$$H = \sum_{i=1}^{N} s_i^2$$

This index is bounded by zero and one and a smaller value of the index implies a higher degree of income diversification.

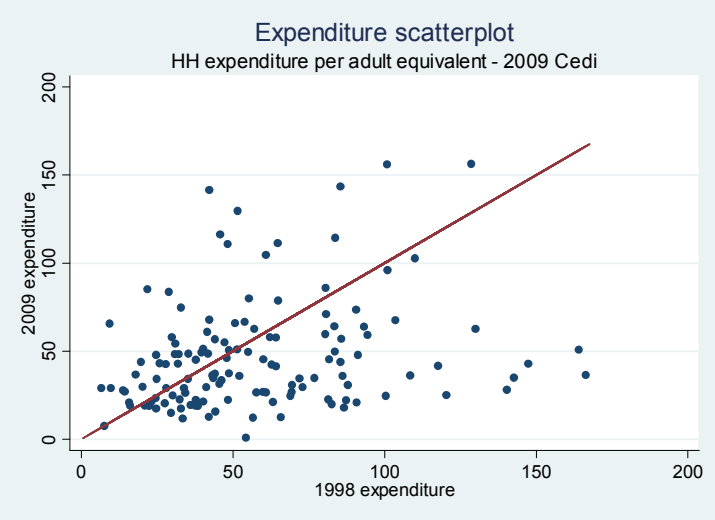
The second way we model income diversification is through the total number of household income sources. This total number is made up from farm sector diversification represented by the number of crops sold, non-farm diversification indicating the number of non-farm income sources, the number of sources of labor income, income sources from outside the village and any other sources of income.

The degree of income diversification affects the extent to which a household can self-insurance against bad risk. However, greater diversification does not imply that a household is more likely to participate in higher-return non-farm activities. The continuous nature of the index also means that we don't need to assign households into different diversification categories. Instead we can use it to construct interaction variables with other insurance mechanisms and with shocks.

Results: welfare dynamics 1998 – 2009

Figure 2 plots household expenditure per adult equivalent on the vertical axis against its twelve-year lagged value on the horizontal axis. The observations are relatively evenly distributed on either side of the 45 degree line. There are slightly more observations in the bottom right part than in the top left part of figure 2. This reflects that at the top end of the distribution negative changes in expenditure were slightly larger than positive changes between 1998 and 2009. In any case the scatterplot in figure 2 shows no immediately discernible welfare dynamics pattern and presents a priori evidence against nonlinear welfare dynamics and multiple dynamic equilibria.

Figure 2 Household expenditure 2009 vs. 1998



The whole sample

Table 4 summarizes the results for the AR(1) regressions of the whole sample. The parametric models as well as for the nonparametric and the semiparametric regressions all suggest a single stable dynamic equilibrium for household expenditure for these rural Ghanaian households. The predicted long-term equilibrium levels of expenditure are low at between 45 and 50 Cedis per adult equivalent per month.

Table 4 Welfare equilibria - whole sample

	Location of Stable Expenditure Equilibrium (in 2009 Cedi per adult equivalent)
Nonparametric Regression	
Penalized Spline	45
Lowess	50
Parametric Regression	

4th order polynomial	45
3rd order polynomial	48
Semiparametric Regression	
PLM Penalized Spline	47

The estimated recursion diagrams in Figure 3, Figure 4 and Figure 5 show graphical representations of the results from Table 4. The central line displays the estimated welfare dynamics path. Its nearly linear shape suggests that we don't need to model welfare dynamics in a fully flexible manner.

Figure 3 Welfare Dynamics - Nonparametric penalized spline

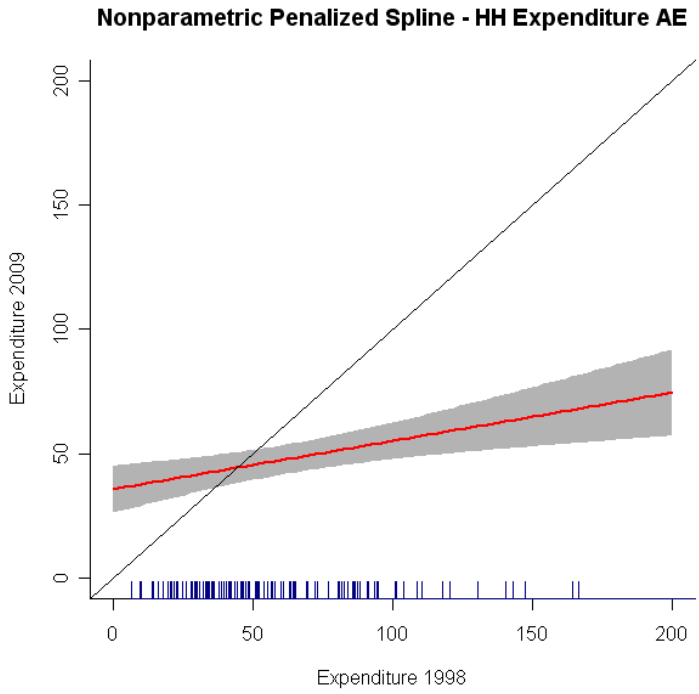


Figure 4 Welfare dynamics - Parametric regression

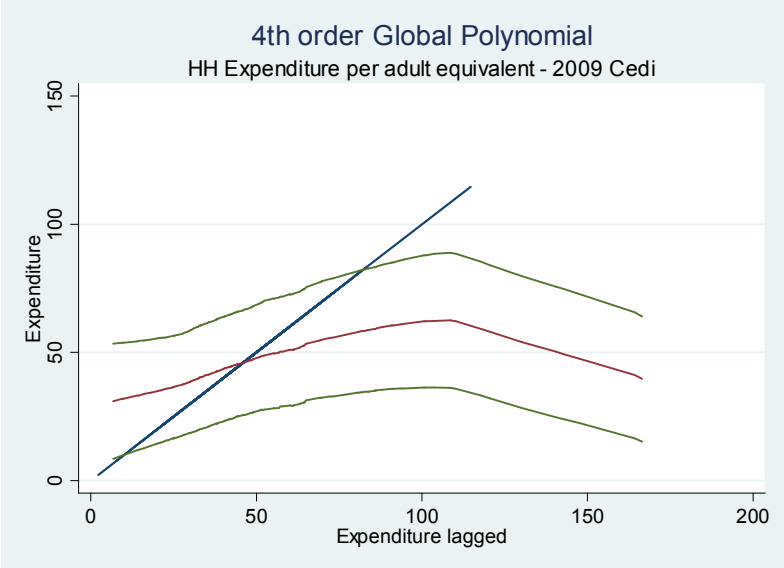
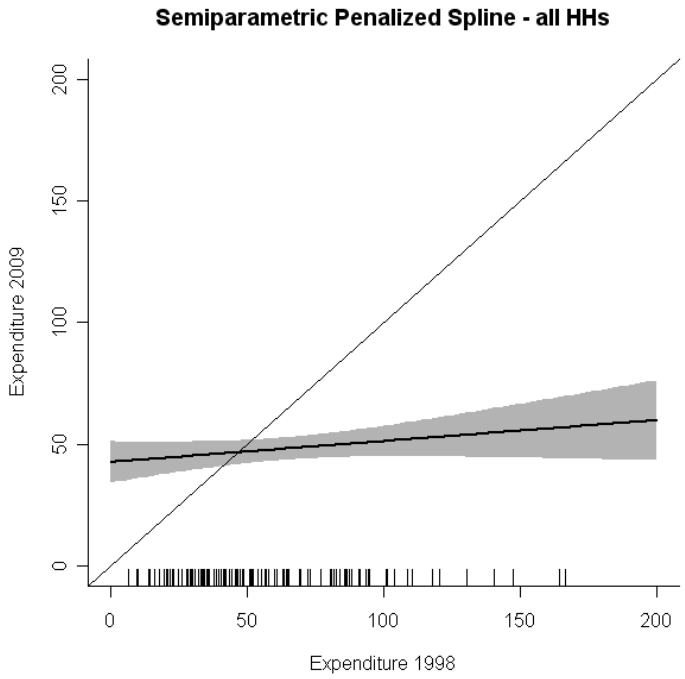


Figure 5 Welfare dynamics - semiparametric penalized spline



Disaggregating results by different types of heterogeneity

Disaggregating the results by subgroup shows some clear differences in the equilibrium expenditure levels. However, hardly any of the differences in equilibria in Table 5 are statistically significant. Most likely this is due to the very small sample sizes of the subgroups.

Among the villages more urbanized and more dynamic Darmang and Konkonuru have higher equilibria than more rural and less accessible Oboadaka and Pokrom.

Table 5 Welfare Equilibria - by subgroup

	Number of observations	*Location of Stable Expenditure Equilibrium (in 2009 per adult equivalent)*
By Village		
Darmang	37	45
Konkonuru	27	50
Oboadaka	31	32
Pokrom	32	42
By Social Visibility		
Low (D mean < 0.68)	48	52
High(D mean > 0.68)	79	48
By Credit Access		
Can get GHC50 loan	110	43
Can't get GHC50 loan	16	32
By self insurance		
HH Savings < US$500 PPP	39	42
HH Savings > US$500 PPP	88	44
By occupation type		
Pineapple farming HHs	17	38
Other farming HHs	76	43
Non-farm HHs	30	35-90
By Income diversification		
Herfindahl < 0.8	70	44
Herfindahl > 0.8	57	52
Fewer than 2 income sources	74	35
2 or more income sources	53	65

The size of one's social network appears to have little impact on the location of the expenditure equilibrium. If anything a higher average social visibility index of household heads and spouses seems to be related to (statistically insignificantly) lower predicted expenditure.

The ability to access credit seems to affect projected expenditure levels as expected. Households that claim to be able to get a 50 Cedis loan with a week are expected to be slightly better off than households who could not get a loan. Again, the differences are not statistically significant which is not surprising given the small sample size.

Self-insurance in the form of own savings appears to be mildly positively related with well-being. Households with financial savings larger than $500 PPP at 1993 prices have an equilibrium expenditure level of 44 vs. 42 for households with smaller savings.

There are some differences in welfare equilibria by type of employment. Pineapple farmers are expected to be slightly worse off than other farming households. During the late 1990s the opposite was true as pineapple farmers benefited from the export boom. However, in 2004/05 pineapple growers'

fortunes started to reverse as demand for Ghanaian pineapples plummeted as consumers in Europe began favoring different varieties grown predominantly in Latin America. The demand shock for pineapples had fully affected respondents by the time of our 2009 survey. Non-farm households are characterized by a high degree of heterogeneity in livelihood activities ranging from unskilled labor and subsistence farmers to steady formal sector employment. This heterogeneity is reflected in the large range of predicted expenditure levels of between 35 and 90 Cedis per adult equivalent per month.

Income diversification appears to have a subtle overall effect on households' predicted long-term expenditure. Households whose Herfindahl index of income shares lies below 0.8, that is, households that have more diversified income shares, have a projected equilibrium of 44 Cedi compared to 52 Cedi for households with Herfindahl indices larger than 0.8.

We find the opposite effect if we express income diversification in terms of the simple number of income sources. Households with fewer than two incomes sources have an expected per adult equivalent expenditure of 35 which is only roughly half the level that households with two or more income sources enjoy. A priori there is no reason to believe that income diversification would necessarily lead to greater well-being. Indeed, in principle households with a single income source whether in the form of a government job or highly specialized contract farming such as pineapples could enjoy the highest returns and levels of well-being. But that would only hold either in the absence of risk or with risk and high levels of insurance. The fact that households with a larger number of income sources appear to be better off points towards the presence of risk and the even the whole range of existing insurance mechanisms being incomplete.

Stratifying the sample by expenditure levels we observe large differences in expenditure equilibria across the distribution. Table 6 shows the corresponding estimates from a parametric quantile regression. The 75th percentile has a substantially higher predicted expenditure level than the median with 69 Cedi vs. 38 Cedi. The 25th and 10th percentile are correspondingly lower again at 26 and 20 Cedis, respectively.

Table 6 Welfare equilibria - by quantiles

	Number of observations	*Location of Stable Expenditure Equilibrium (in 2009 Cedi per adult equivalent)*
All Shocks (1998-2009)		
75th percentile	127	69
Median	127	38
25th percentile	127	26
10th percentile	127	*20*

Results: The effect of idiosyncratic shocks and interactions shocks and risk management mechanisms

Idiosyncratic shocks have a negative effect on household expenditure levels. This result is robust across different time lags and for different types of shocks. The first column in Table 7 summarizes the regression results for shocks that occurred at any time during the panel period 1997-2009. The detailed regression output is given Table 8. The negative effect on household expenditure levels is statistically significant for all shocks and for agricultural and livestock shocks.

Table 7 Negative shocks and welfare & interactions between negative shocks and insurance mechanisms

	Shock	Shock Interaction terms			
		Credit access	Self-insurance	Social visibility	Income diversification # of income sources
All shocks	-*	+	+**	+*	-
Family shocks	-	+	+**	+	-
Business shocks	-	+	-	-	+
Agriculture and livestock shocks	-**	+	+	+*	-

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

To examine the effectiveness of the different insurance mechanisms on mitigating negative shocks we need to look at the interactions between shocks and the risk management strategies. These interactions are summarized in columns 2-5 in Table 7.

The positive signs in column 2 suggest that access to credit helps mitigate the negative effect of all types of shocks. However, none of these effects are statistically significant. This could reflect the small sample or the relatively small average effect of shocks on 12-year welfare dynamics and the small effect of insurance mechanisms to protect households' well-being. It could also be because of the loan amount that was asked about in the survey (50 Cedi) was relatively small compared the size of household shocks. Thus, households who could only barely get 50 Cedi would register as 'having access to credit' but the amount of credit was insufficient to overcome the shock.

Self-insurance in the form of household savings also helps to reduce the impact of negative shocks. This effect is statistically significant at the 5% level for all shocks and for family shocks even in this small sample. Household savings appear to be insufficient to mitigate the effect of negative business shocks. This may be because, although less frequent, business shocks are on average the largest shocks a household experiences often caused by failing businesses and unfulfilled contracts in the pineapple industry.

The degree of social visibility has a positive and statistically significant effect on mitigating negative household shocks for shocks overall and for agricultural and livestock shocks. The effect is also positive but not statistically significant for family shocks. And as for self-insurance, social networks do not seem to be strong enough to help overcome large business shocks. Though again, this effect is not statistically significant.

The effect of income diversification on mitigating shocks is in the opposite direction to the effect of household savings and social visibility. Theoretically it could go either way depending on the root cause for diversification. If diversification primarily functions as an insurance strategy then we should expect a positive effect on mitigating shocks. However, income diversification could also be a reflection of households pursuing multiple low return activities rather than specializing in fewer higher return endeavors. In such a situation the negative effect makes sense: more diversified households get lower returns than less diversified households and therefore are less able to weather shocks. This is the pattern we observe for shocks as a whole and for family and agricultural shocks. The one exception is again with respect to business shocks. The positive effect of the number of income sources on mitigating the impact of business shocks could reflect the fact that households operating a business use income diversification primarily as an insurance mechanisms for when their main business income falls short.

Table 8 Parametric Regression Results – Interaction of shocks and insurance mechanisms

Interaction Shocks & Mechansims. Value of Shocks. All years.
Dependent Variable: Change in Expenditure per adult equivalent 1997-2009

VARIABLES	(1) All shocks. Herfindahl	(2) All shocks. # income sources	(3) By shock type. Herfindahl	(4) By shock type. # income sources
monthly HH expenditure 2009 Cedis per adult equivalent lagged one time period	-0.922	-0.683	-0.992	-0.686
	(0.277)	(0.392)	(0.258)	(0.414)
lagged monthly HH expenditure 2009 Cedis per adult equivalent squared	0.00638	0.00254	0.00759	0.00273
	(0.655)	(0.851)	(0.592)	(0.846)
lagged monthly HH expenditure 2009 Cedis per adult equivalent cubed	-5.01e-05	-2.79e-05	-6.10e-05	-3.27e-05
	(0.519)	(0.704)	(0.423)	(0.674)
lagged monthly HH expenditure 2009 Cedis per adult equivalent quartic	7.52e-08	4.64e-08	1.04e-07	6.23e-08
	(0.493)	(0.656)	(0.345)	(0.579)
total value of family/personal/social shocks			-0.0607	-0.0564
			(0.224)	(0.276)
value_family_all12_sq			-5.63e-07**	-4.00e-07
			(0.0246)	(0.109)
total value of business/job shocks			-0.0158	-0.0141
			(0.542)	(0.478)
value_business_all12_sq			4.11e-07**	2.12e-07*
			(0.0177)	(0.0753)
total value of agriculture/livestock shocks			-0.0717**	-0.0761**
			(0.0399)	(0.0177)
value_ag_all12_sq			1.55e-05	1.89e-05
			(0.407)	(0.259)
mean visibility index - proportion of time individual presented as random match	75.91	76.16	91.92	85.50
	(0.196)	(0.156)	(0.151)	(0.155)
vis_count1_sq	-106.7**	-95.20**	-119.4*	-109.3*
	(0.0417)	(0.0457)	(0.0566)	(0.0590)

vis_count1_value_fam_all12			0.00730	0.0151
			(0.645)	(0.385)
vis_count1_value_bus_all12			-9.04e-05	-0.00772
			(0.990)	(0.315)
vis_count1_value_ag_all12			0.0568*	0.0376*
			(0.0573)	(0.0807)
can get GHC50 in a week - at least one HH respondent	-32.03	-40.74**	-35.29	-44.17*
	(0.127)	(0.0496)	(0.150)	(0.0759)
insuremergency_value_fam_all12			0.0489	0.0501
			(0.302)	(0.303)
insuremergency_value_bus_all12			0.0210	0.0173
			(0.366)	(0.373)
insuremergency_value_ag_all12			0.0317	0.0347
			(0.290)	(0.200)
value of financial savings in 1993 PPP$	0.00736*	0.00941**	0.00582	0.00860
	(0.0861)	(0.0239)	(0.296)	(0.122)
selfinsure_93dollar_sq	-2.15e-07	-3.11e-07**	-1.70e-07	-2.80e-07
	(0.151)	(0.0369)	(0.378)	(0.148)
selfinsure_93do_value_fam_all12			3.39e-06**	1.52e-06
			(0.0319)	(0.305)
selfinsure_93do_value_bus_all12			-4.19e-06	-3.38e-06**
			(0.116)	(0.0111)
selfinsure_93do_value_ag_all12			6.01e-06	3.17e-06
			(0.534)	(0.758)
income diversification - Herfindahl index - average of HH respondents	8.825		13.18	
	(0.377)		(0.383)	
Herfindahl_value_fam_all12			0.0116*	
			(0.0791)	
Herfindahl_value_bus_all12			-0.00943	
			(0.171)	
Herfindahl_value_ag_all12			-0.0494	
			(0.239)	
Age in years	-0.521	-0.822*	-0.430	-0.797
	(0.270)	(0.0777)	(0.416)	(0.118)
squared age	-0.0182	-0.00613	-0.0309	-0.0166
	(0.330)	(0.728)	(0.165)	(0.421)
highest grade HH head	0.397	-0.133	0.0676	0.00663
	(0.784)	(0.924)	(0.965)	(0.997)
squared highest grade HH head	0.538	0.561	0.401	0.508
	(0.185)	(0.187)	(0.398)	(0.284)
occupation type HH head	7.636	5.479	9.302	7.785
	(0.199)	(0.312)	(0.147)	(0.220)
fostered HH head	-6.028	-4.157	-5.029	-3.205
	(0.354)	(0.509)	(0.429)	(0.615)
HH head in village for longer	15.65	16.96	14.22	19.44
	(0.133)	(0.105)	(0.211)	(0.110)
HH head's mother held village office	5.748	12.54*	8.295	8.368
	(0.400)	(0.0770)	(0.396)	(0.356)
HH head's father held village office	-4.322	-1.436	-1.057	1.861
	(0.564)	(0.848)	(0.898)	(0.835)
HH head holds village office	12.78	12.02*	12.46	11.99
	(0.107)	(0.0950)	(0.153)	(0.129)
year== 2009.0000	0	0	0	0
	()	()	()	()
village== Pokrom	-2.863	-3.214	0.393	-5.856

	(0.804)	(0.763)	(0.974)	(0.609)
village== Oboadaka	-21.89**	-27.22***	-20.63*	-25.54**
	(0.0355)	(0.00720)	(0.0532)	(0.0174)
village== Konkunuru	-8.287	-0.994	-8.040	-1.370
	(0.413)	(0.916)	(0.421)	(0.885)
total value of all negative shocks	-0.0359*	-0.0307*		
	(0.0520)	(0.0818)		
value_all_all12_sq	-7.34e-08	-2.00e-08		
	(0.364)	(0.807)		
vis_count1_value_all_all12	0.00573*	0.00411		
	(0.0796)	(0.231)		
insuremergency_value_all_all12	0.0277	0.0274		
	(0.124)	(0.109)		
selfinsure_93do_value_all_all12	1.23e-06**	1.66e-07		
	(0.0423)	(0.754)		
Herfindahl_value_all_all12	0.00296			
	(0.148)			
number of income sources - average of HH respondents		10.77***		10.98***
		(0.00149)		(0.00842)
numincsources_value_all_all12		-0.000327		
		(0.379)		
numincsources_value_fam_all12				-0.000765
				(0.528)
numincsources_value_bus_all12				0.00134
				(0.145)
numincsources_value_ag_all12				-0.00885
				(0.356)
Constant	49.96	35.22	48.07	37.68
	(0.139)	(0.282)	(0.194)	(0.322)
Observations	126	126	126	126
R-squared	0.746	0.766	0.775	0.791

Robust p-values in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Conclusions

Risk and uncertainty diminish the current level of economic well-being as well as prospects for the future. This is particularly true when livelihood generating activities are highly stochastic, as they are for many rural households in developing countries, and when mechanisms to insure against risk are either non-existent or insufficient. While households face two distinct sources of risk, covariate and idiosyncratic, the latter often dominates and requires different strategies to mitigate.

In this paper we examined the importance of idiosyncratic risk for households in rural Ghana and examined the effectiveness of various risk management strategies in mitigating this risk. The households in our survey have experienced slight improvements in their economic well-being between 1998 and 2009. However, they remain poor with an average expenditure level per adult equivalent of 59 Cedis or $1.35 in 2009 prices. Their estimated long-term future level of well-being is of similar magnitude. Households in the two villages with better access to markets and outside labor opportunities fare considerably better than those in the two more remote communities.

In addition to being poor the survey households face considerable exposure to negative idiosyncratic shocks with the average household losing close to 900 Cedis due to family, business and agriculture and livestock shocks during 1997-2009. Having experienced a shock is strongly related to lower growth in consumption.

Households use a variety of mechanisms to try to prevent and deal with negative shocks including support from social networks, self-insurance in the form of savings, accessing credit and diversifying livelihood activities. Our results suggest varying degrees of effectiveness for these mechanisms. Having own savings and being able to draw on larger social networks offers a statistically significantly better chance of overcoming the consequences of negative shocks. Credit access also seems to help though the evidence is less strong. A greater diversity of income sources is associated with greater gains in expenditure but income diversification does not seem to help in overcoming shocks. This could be a reflection of many households diversifying into low-return activities that are positively correlated.

Overall our results suggest some effectiveness of these formal and informal insurance mechanisms. However, even in their combination they are not sufficient in helping households overcome negative shocks and to ensure sustained improvement in well-being over time.

References

Alderman, H., J. Hoddinott and B. Kinsey (2006). "Long term consequences of early childhood malnutrition." Oxford Economic Papers **58**(3): 450.

Behrman, J., M. Rosenzweig and A. Foster (1997). "The Dynamics of Agricultural Production and the Calorie-Income Relationship: Evidence from Pakistan." Journal of Econometrics **77**: 187-207.

Carroll, C. D. (1998). "How important is precautionary saving?" Review of Economics & Statistics **80**(3): 410-419.

Deaton, A. (1997). The analysis of household surveys: A microeconometric approach to development policy. Baltimore, Johns Hopkins University Press.

Dercon, S. (1998). "Wealth, risk and activity choice: cattle in Western Tanzania." Journal of Development Economics **55**: 1-42.

Dercon, S. (2004). "Growth and Shocks: Evidence from rural Ethiopia." Journal of Development Economics **74**(2): 309-329.

Fold, N. and K. M. Gough (2008). "From smallholders to transnationals: The impact of changing consumer preferences in the EU on Ghana's pineapple sector." Geoforum **39**: 1687-1697.

Goldstein, M. (1999). Chop Time, No Friends: Intrahousehold and Individual Insurance Mechanisms in Southern Ghana. Berkeley and New Haven, Department of Agricultural and Resource Economics University of California, Berkeley and The Economic Growth Center Yale University.

Goldstein, M., A. De Janvry and E. Sadoulet (2002). Is a Friend in Need a Friend Indeed? Inclusion and Exclusion in Mutual Insurance Networks in Southern Ghana.

Hoddinott, J. (forthcoming). "Shocks and their consequences across and within households in rural Zimbabwe." Journal of Development Studies.

Hoddinott, J. and B. Kinsey (2001). "Child Growth in the Time of Drought." Oxford Bulletin of Economics and Statistics **63**(4): 409-436.

Kazianga, H. and C. Udry (2006). "Consumption smoothing? Livestock, insurance and drought in rural Burkina Faso." Journal of Development Economics **79**(2): 413-446.

Kimball, M. S. (1990). "Precautionary Savings in the Small and in the Large." Econometrica **61**(3): 53-73.

Lim, Y. and R. Townsend (1998). "General equilibrium models of financial systems: Theory and measurement in village economies." Review of Economic Dynamics **1**(1): 59-118.

Lybbert, T., C. B. Barrett, S. Desta and D. L. Coppock (2004). "Stochastic wealth dynamics and risk management among a poor population." Economic Journal **114**: 750-777.

Newhouse, D. (2005). "The persistence of income shocks: Evidence from rural Indonesia." Review of Development Economics **9**(3): 415-433.

Rosenzweig, M. and K. I. Wolpin (1993). "Credit Market Constraints, Consumption Smoothing, and the Accumulation of Durable Production Assets in Low-income Countries: Investments in Bullocks in India." Journal of Political Economy **101**(2): 223-244.

Rosenzweig, M. R. (1988). "Risk, implicit contracts and the family in rural areas of low-income countries." Economic Journal **98**: 1148-1170.

Townsend, R. (1994). "Risk and Insurance in Village India." Econometrica **62**: 539-591.

Vanderpuye-Orgle, J. and C. B. Barrett (2009). "Risk management and social visibility in Ghana." African Development Review **21**: 5-35.

Walker, T. F. (2011). Risk Coping, Social Networks and Investment in Rural Ghana. Department of Economics. Ithaca, Cornell University. **Unpublished PhD Dissertation**.