Don't Fear the Reaper: Analyzing the Effect of Health on Microfinance Participation

Sam Thompson

Abstract

The randomized introduction of microfinance to neighborhoods surrounding Hyderabad, India provides an opportunity to analyze the relationship between health and an individual's decision to borrow. Employing the Abdul Latif Jameel Poverty Action Lab's data from the aforementioned randomized controlled trial (RCT), I find that healthy individuals (those who lose fewer than 15 working days a year to illness) are significantly more likely to participate in microfinance. Accounting for intra-neighborhood correlation, however, the inclusion of clustered standard errors reduces the significance of said findings. This result suggests the importance of local networks in influencing investment and has broader policy implications in the need to construct a more localized, holistic model for developmental aid.

I. Introduction

The first of the United Nations' Millennium Development Goals sets the ambitious target of eradicating extreme poverty and hunger. Established at the General Assembly's Millennium Summit in 2000, the first of eight goals specifically calls for halving the proportion of people living on less than 1.25 dollars a day, achieving full and productive employment for all, and halving the proportion of people who suffer from hunger, all by 2015 [1]. Rising alongside this global target are a myriad of developmental solutions seeking, with the best of intentions, to mitigate the world's socioeconomic disparities. Proliferating from 7.6 million to 137.5 million participant families between 1997 and 2010,[2] microfinance (an initiative characterized by small loans given to the impoverished) is perhaps the most prominent of the proposed panacea for the United Nations' social and economic development tar-

[1] United Nations Development Programme, United Nations Millennium Development Goals (2000).

[2] 137 Million of World's Poorest Received a Microloan in 2010." Microcredit Summit Campaign (2010). *http://www.microcreditsummit.org/news/29/137-million-of-world-s.html* (accessed November 10, 2013).

gets. That being said, are such microloans, in fact, a cure-all?

Seeking to answer this question, the Massachusetts Institute of Technology's Abdul Latif Jameel Poverty Action Lab (JPAL) conducted a randomized controlled trial with Spandana, a microfinance institution hoping to establish itself in Hyderabad, India. Ensuring a gradual introduction of Spandana into the region, JPAL isolated the "treatment" of microcredit availability and thereby quantified its effect on the rural communities to which it was offered. While ultimately uncovering microfinance's limited role as a developmental panacea (there was no significant effect on either the expected social outcomes or on the likelihood of starting a business), JPAL's study was plagued by a conspicuous weakness: microfinance participation among eligible borrowers was only 27 percent.[3] Surprised by such low participation for a program that, in its onset, was so hailed that its founder won the Nobel Peace Prize, I raise the question as to what impedes an individual's participation in such aid initiatives as microfinance.

Establishing a behavioral foundation, I maintain that even the most impoverished function as rational economic actors in the pursuit of happiness and the avoidance of suffering. As such, their decisions are made on the margin. Because the impoverished frequently live in environments beset by complex vulnerability, they may lack faith in their ability to reap long run marginal benefit. In this way, cumulative risk skews the poor's decision making process towards immediate gratification and away from longer term aid initiatives. Specifically, my study analyzes the relationship between health (the lack thereof posing a significant risk factor) and microfinance participation with the hypothesis that healthy individuals will be more likely to take microloans.

Because this study is largely an addendum to JPAL's analysis of microfinance efficacy in Hyderabad, India, I employ the same data set but instead seek to isolate health as a factor in their relatively low program participation. Manipulating existing statistics to serve this purpose, I created a dummy variable ("healthy") that tested positive if an individual had lost fewer than fifteen working days to illness in the previous year. The number fifteen was selected because it is the median value above which the number of days ill increases dramatically. This metric for health functioning as the model's key explanatory variable, the threat of endogeneity is mitigated by both the nature of the

[3] Abhijit Banerjee and others, "The Miracle of Microfinance? Evidence from a Randomized Evaluation," Abdul Latif Jameel Poverty Action Lab (2013).

source experiment and the inclusion of various controls in the model. To preserve exogeneity in the initial study, JPAL randomly selected 104 participant neighborhoods, 52 of which were again randomly selected to receive the treatment: the introduction of Spandana. Such random assignment of the treatment and control groups ensures variation in the variables of interest. Additionally, the inclusion of wealth, age, education, marital status, and the presence of children under the age of two as controlling factors helps quantify otherwise unobservable variation in the model. This, coupled with the admission of insurance, titled home ownership, and government and family assistance as additional covariates, works to prevent correlation between the model's error term and its variables, thereby ensuring exogenous variation.

First assuming the independence of individual characteristics, my parameter estimates suggest a 2.9 percent increase in the likelihood of microfinance participation for a "healthy" individual. This finding is both statistically (at the 1 percent significance level) and economically significant as one of many risk factors impeding investment. Similarly significant factors indicated in this study are insurance ownership as well as the receipt of government assistance. This result is logical considering that both insurance and welfare programs seek to mitigate risk. A healthy individual with both insurance and government welfare functioning as safety nets may be even more confident in his or her ability to realize a long run return on investment and thereby more willing to take a microloan.

Addressing the potential for peer-group effects, I incorporate clustered standard errors into this study's final model. While "healthy" individuals remain 2.9 percent more likely to participate in microfinance, this result is statistically significant at only the 10 percent level. Similarly reducing the significance of both government assistance and insurance, these results suggest the influence of the local community on individual marginal analysis. When considering the channels of influence provided by a peer-group, this change is logical. For example, the presence of an informal insurance network or the "bandwagon effect" of neighbors participating in microfinance may partially account for variation in individual willingness to invest.

While the convoluted nature of both health and neighborhood effects impair my ability to assert complete causality, the policy implications regarding the restructuring of foreign aid remain profound. In whole, the increasing economic significance of layered risk mitigation

illustrates the importance of a more holistic aid program that may alleviate the complex vulnerabilities plaguing the impoverished and thus increase the efficacy of existing aid initiatives. Additionally, diminishing statistical significance upon the inclusion of clustered standard errors suggests the importance of aid initiatives tailored to local environments.

The remainder of this study is organized into the following sections: background, data, empirical model, results, and interpretation and conclusion. In discussing this study's background I will define the structure of traditional microfinance initiatives and explore existing literature concerning the market repercussions of risk. Next, the data section further elucidates the nature of the JPAL study to which this paper functions as an addendum and discusses potential measurement shortfalls. The empirical model section explicitly defines the econometric model and discusses how it conforms to the underlying economic theory while also addressing potential sources of bias. Following this, the results portion will include a preliminary interpretation of both the summary statistics and the regression analysis in order to establish a mathematical foundation for subsequent conclusions. Finally, the potential for causality and the broader policy implications of this study's findings will be discussed in the interpretation and conclusions portion.

II. Background

Built upon the perceived economic empowerment to be attained by universal access to credit, microfinance is fundamentally a program by which small loans are granted to poor individuals previously barred from formal banking services. Founded by Dr. Muhammad Yunus of Chittagong University in Bangladesh, Grameen Bank represents the traditional model for microfinance institutions. Specifically, Grameen loans to small groups of women who meet regularly and share liability for one another's debts. Loans are given solely to women based on the notion that they will be more likely than their male counterparts to invest in the family, thereby cultivating such social benefits as improved health and education in addition to more general financial growth. Collective responsibility and social pressure function to incentivize screening of potential group members (thus shifting the burden away from lenders) and ultimately cover the expenses if an individual borrower defaults. Consequently, Grameen is renowned

for extremely low default rates and is thereby able to charge similarly low interest rates. Spandana, the microfinance institution posing the subject of this particular study, follows the Grameen model in that it loans only to small groups of eight to ten women on the basis of shared liability.

The inherently small nature of microloans coupled with their gradual repayment rates make participation in microfinance institutions a decidedly long term investment. The social and economic costs associated with group lending make evident the marginal cost of borrowing; therefore, the key to augmenting microfinance participation is illustrating its long run marginal benefit. The importance of forward-thinking marginal analysis is made evident in the Hyderabad study through a disparity in results between the "business-minded" and not. Specifically, "fifteen to eighteen months after gaining access [to microfinance], households are no more likely to be entrepreneurs (that is, to have at least one business), but they are more likely to start more than one business, and they invest more in the businesses they do have."[4]

Recognizing this difference, the question then becomes how best to instill in an individual a mind for business, for this cadre of entrepreneurs has the most distinct marginal benefit and therefore the greatest participation incentive. The broader economic theory underlying this study is the notion that what distinguishes business and non-business minded individuals is the relative temporal depth of marginal analysis. In this way, holistic risk mitigation is essential as "a sense of stability may be necessary for people to be able to take the long view." [5]

Presently, there is a growing literature concerning the tendency of risk to skew an individual's cost-benefit analysis towards immediate gratification. Logically, if one lacks faith in the ability to realize investment returns, he or she may be unwilling to forego short term "happiness" (be it in the form of satellite television or tobacco) in pursuit of long term goals. Because farming constitutes the primary profession in much of the developing world, a few studies specifically address agricultural risk factors like fluctuations in crop price and rainfall. The Journal of Risk and Insurance published one such study addressing the effect of crop-price indemnified loans both on farmers' decision to

[4] Abhijit Banerjee and others, "The Miracle of Microfinance? Evidence from a Randomized Evaluation," Abdul Latif Jameel Poverty Action Lab (2013)

[5] Abhijit Banerjee and Esther Duflo, "Poor Economics: A Radical Rethinking of the Way to Fight Global Poverty" (New York: Public Affairs, 2012), 215.

borrow and their subsequent production choices. Specifically, Karlan, Kutsoati, McMillan, and Udry randomly designate treatment groups to whom they offer loans under the provision of partial forgiveness should crop prices fall below a specified threshold. To establish a basis for comparison, they also offer a more traditional loan (lacking the forgiveness component) to randomly selected control groups. Unfortunately, while there was an economically significant increase of 23.1 percentage points in agricultural investment among the treatment group (although not statistically significant upon the inclusion of all control variables), take-up of both loan structures was so high that a lack of variability in the key explanatory variable introduced bias.

Moving beyond specifically agricultural risk factors, the broader cost of fear poses a similar impediment to investment. In "The Cost of Fear: The Welfare Effects of the Risk of Violence in Northern Uganda," Marc Rockmore emphasizes intangible risk factors, for "the near-exclusive focus of the literature on the experience of violence ignores their losses due to persistent insecurity and uncertainty."[6] First employing geo-spatial data on violent activity to construct a model of real (the probability of a community being attacked in 2004) and perceived (apparent insecurity within the area) risk, Rockmore proceeds to analyze the relationship between the aforementioned model's fitted values and geographic welfare effects. Proxying welfare in terms of per capita household expenditure, there is a statistically significant decrease in consumption of three and eight percent for households exposed to objective and subjective risk, respectively.[7]

In a similar study, Londona, Mora, and Verwimp postulate that "the threat of violence or the anticipation of violent shocks oblige rural households to revert to subsistence agriculture and shift portfolio to less risky, but also less profitable activities."[8] Empirically analyzing this notion, the authors employ municipal data regarding military action against the civilian populace averaged between 1998 and 2008, the percentage of municipal hectares devoted to coca cultivation, the percentage of land allocated to coffee, and a variety of other economic covariates to model the relationship between risk and coffee produc-

[6]Marc Rockmore, "The Cost of Fear: The Welfare Effects of the Risk of Violence in Northern Uganda," Households in Conflict Working Paper 109 (2011), 2.

[7]Ibid., 20.

[8]Ana Londono, Juan Mora, and Philip Verwimp, "Abandoning Coffee under the Threat of Violence and the Presence of Illicit Crops. Evidence from Colombia," Households in Conflict Working Paper 150 (2013), 2.

tion.

Recognizing that "abandoning coffee production is an extreme strategy households may adopt to mitigate the impact of shocks or to reap the short-term benefits of coca production,"[9] this relationship applies to my study as an example of the broader tendency of risk to skew marginal analysis towards short-run benefit. While the regression statistics suggest that an increase in one standard deviation of average military action coincides with a 0.02 standard deviation decrease in the percentage of land devoted to coffee production,[10] the inherent difficulty of quantifying the amount of illegal coca production impedes the authors' ability to move beyond conjecture in terms of the farmers' transition from long-run to short-run profitability as embodied in the shift from coffee to coca cultivation.

Slight biases notwithstanding, these studies are exceedingly relevant as the threat of violence poses a level of uncertainty comparable to poor health, and "the literature on choice under uncertainty provides a framework for understanding the role of risk in household decisions."[11] My paper improves upon the existing research, however, by employing a specific aspect of the larger, often intangible vulnerability networks to a partial explanation of Spandana's conspicuously low participation rates. From a policy perspective, my study further advocates "the importance of subjective risk [in] the provision [that] aid may need to be reconsidered."[12]

III. Data

As mentioned above, this study functions as an addendum seeking to partially explain low participation rates among eligible borrowers in JPAL's analysis of microcredit efficacy: "The Miracle of Microfinance? Evidence from a Randomized Evaluation." Consequently, I utilize JPAL's data set in analyzing health as an impediment to borrowing among their targeted sample population. More specifically, I derived both demographic statistics and loan information from a comprehensive endline survey conducted three years after the controlled

[9] Ana Londono, Juan Mora, and Philip Verwimp, "Abandoning Coffee under the Threat of Violence and the Presence of Illicit Crops. Evidence from Colombia," Households in Conflict Working Paper 150 (2013), 2.

[10] Ibid., 27.

[11] Marc Rockmore, "The Cost of Fear: The Welfare Effects of the Risk of Violence in Northern Uganda," Households in Conflict Working Paper 109 (2011), 3.

[12] Ibid., 26.

introduction of Spandana.

Considering the study's setting in rural communities surrounding Hyderabad, India, there was no accurate census data. As a result, JPAL commissioned a hasty baseline survey in order to attain basic information by which to determine eligible neighborhoods. With the intention of surveying 20 households per neighborhood, field officers mapped prospective communities and selected every nth house. Ultimately, 2,800 households were surveyed and 104 neighborhoods deemed eligible. Of these, communities were paired by common characteristics with one of each couple allocated to the treatment group to host a newly created Spandana branch. With the experimental groups thus created, field officers conducted two comprehensive household surveys (65 homes per neighborhood for a total of 6,850) spaced one and three years following the initial introduction of Spandana. The homes selected were those with the highest likelihood of having borrowed: residents of the area for a minimum of three years with at least one woman between the ages of 18 and 55. The latter of these two assessments constitutes the final endline survey from which I derived my cross-sectional data set.

While the comprehensive nature of the endline survey largely mitigates the threat of sampling error (nearly every household eligible to receive a microfinance loan was assessed), survey data is inherently flawed due to the prevalence of measurement error. Namely, while the dependent variable is a simple question of whether or not the individual has taken a microloan in the past three years, the key explanatory variable (the number of days lost to illness in a year) is more difficult to precisely recall. Because I opted to construct a binary variable deeming "healthy" those individuals with fewer than 15 working days lost to illness, such rounding error is significant on the margin of healthy and unhealthy. That being said, there should be an equal likelihood that surveyed individuals either under or overestimate the number of days ill, so the overarching effect should be minimal. Additionally, rounding error in the endline survey is prevalent in the valuation of one's household assets. Similar to the reported number of sick days, issues arise on the margin of low and medium wealth (1,700 rupees). As may be referenced in the attached summary statistics (Appendix A), the percentage of individuals deemed to be of medium wealth and the percent considered of low wealth are fairly equal. Considering the relative poverty that makes these neighborhoods desirable for microfinance involvement, these findings could potentially be skewed to-

wards higher wealth by social desirability bias. Furthermore, the percentage of households receiving family assistance (conspicuously low despite the historic prevalence of such informal insurance networks), may also suggest a slight social desirability bias towards perceived self reliance.

Ultimately, the meticulous construction of the randomized controlled trial from which my data is derived reaffirms its ability to produce useful results. While some measurement error may stem from the data being survey based, rounding error and social desirability bias should have minimal effects on the few explanatory variables that require more specific reflection. Namely, rounding may conceivably occur either above or below the true value, and the relatively uniform poverty of the area in question should minimize the desire to artificially inflate one's wealth. Otherwise, the comprehensive screening of randomly selected control and treatment groups should ensure a representative sample with sufficient variation in the explanatory variables to produce meaningful results.

IV. Empirical Model

Utilizing the econometric model depicted below, I empirically analyze the relationship between health and an individual's willingness to participate in microfinance. Accounting for both formal and informal risk mitigation tactics, I include ownership of an insurance policy (be it life, health, or property) and the receipt of government or family assistance as additional explanatory variables. Additionally, I incorporate a variety of controls into the model to minimize disparities in individual characteristics and economic circumstances thus isolating variation in the aforementioned explanatory variables.

$$Micro_i = \alpha + \delta_1 Health_i + \delta_2 Insure_i + \delta_3 Govassist_i + \delta_4 Famassist_i + \beta X_i + \epsilon_i \tag{5}$$

This being a linear probability model, the outcome of interest, *Micro*, is a binary variable indicating whether an individual has taken a microloan in the past three years. The primary explanatory variable, *Health*, is also a binary variable answering affirmative if an individual has lost fewer than 15 working days to illness in the past year. The three insurance network variables, *Insure*, *Govassist*, and *Famassist*, are again binary variables indicating whether an individual has any

insurance policy, receives any type of assistance from the government or from their family, respectively.

As discussed in the above literature review, both objective and subjective risk —such as crop price fluctuations or fear—influence household production decisions. Assuming rational economic actors, individual decisions are made on the margin. Therefore, such complex vulnerability affects choice by distorting perceived marginal cost and benefit. This model coincides with the overarching economic theory in that health is the culmination of a broad range of risk factors, the severity of which could shift marginal analysis away from long-run investment and towards more immediate gratification. The presence of both formal and informal insurance networks work to mitigate the risk of poor health and should therefore be included in the model as indicators of the long run decision to participate in microfinance.

To isolate variation in the key explanatory variable, this model includes controls for such factors as wealth, education, age, marital status, and the presence of children under age two. Given the intangible nature of perceived risk, it is important to consider these factors, as, for example, married individuals or those with children might be inherently risk averse. Also, the conspicuous absence of a gender variable is worth noting. Embracing a traditional microfinance model, Spandana solely issues loans to small groups of women. Despite this, the individuals compiling the data set collected a holistic census including both men and women. To better isolate the decision making process of the eligible females, I drop all male variables and solely analyze these factors among the female sample.

Potential shortfalls of this econometric model stem both from its being a linear probability model and from specification error in the form of omitted variable bias. While later testing of the parameter estimates addresses a common shortcoming of such models by verifying that no individuals have predicted probabilities of microfinance participation above one hundred or below zero percent, all linear probability models are inherently heteroskedastic. While this poses no threat of biased estimators, I am forced to include heteroskadisticity-robust standard errors in later regression analysis to preserve my ability to infer causality. Additionally, to better isolate the effect of microfinance introduction, JPAL formed treatment and control groups at the neighborhood level based on similarities in myriad controls. As such, Model 5 incorporates clustered standard errors in order to address the potential for intra-neighborhood correlation. The prominent

reduction in statistical significance suggests that the previous models wrongfully attribute willingness to invest entirely to personal characteristics while ignoring peer-group effects within one's village. Just as Moulton's Problem suggests that students' test scores are correlated with the composition of their classroom, [13]residents' propensities to invest are correlated with the composition of their community. In this way, an improved model for neighborhood characteristics is necessary to avoid under-specification.

Furthermore, while a randomized controlled trial would typically function to minimize disparities in individual characteristics (or at least ensure their random distribution), the original treatment and control groups were differentiated by the introduction of microfinance, not health characteristics. Consequently, despite my controlling for a variety of contributing factors, the convoluted nature of any health metric means that the model is likely underspecified. In this way, potential correlation between my unobserved error term and my key explanatory variable prompts omitted variable bias and threatens the assumption of exogenous variation. That being said, JPAL and Spandana's initial selection of neighborhoods was based on a common set of criteria defining ideal candidates for microfinance. In this way, while JPAL's experimental design of treatment and control groups is not directly beneficial to the question of health, the selection of neighborhoods based on similar criteria and the subsequent randomized introduction of Spandana within said sample help preserve the exogeneity of the health variable. Even still, health being an inherently convoluted notion, the selection of such a proxy variable as the number of days lost to illness poses an obstacle to causal inference. Coupling the endogeniety posed by this health metric with the under-specification of neighborhood composition, I am unable to establish direct causality between health and willingness to invest. Despite this, a comparison between Models 4 and 5 provides insight as to the influence of peer-group effects on microfinance participation.

V. Results

Overall, both my summary statistics and early regression analysis allude to a significant relationship between health and an individual's willingness to borrow. As may be referenced in Appendix A, there is

[13]Brent Moulton, "Random Group Effects and the Precision of Regression Estimates." *Journal of Econometrics* 32 (1986): 387-97.

a three percentage point increase in microfinance participation among those individuals deemed healthy. Regression analysis, in turn, reaffirms the trend suggested in the summary statistics as healthy women are 2.9 percent more likely to take a microloan. That being said, the incorporation of clustered standard errors reduces the explanatory variables' statistical significance. In this way, correlation within neighborhoods accounts for some of the perceived variation between health and microfinance participation.

First analyzing the summary statistics to determine whether the key explanatory variable is sufficiently exogenous and that the data generally coincides with underlying theory, the basic study proves valid and worthy of further regression analysis. Health being the primary explanatory variable, the disparity in participation between healthy and unhealthy demographics coincides with the notion that risk impedes the pursuit of long term goals. Hoping to isolate health as a source of exogenous variation, other variables should ideally remain fairly constant across the healthy and unhealthy groups. While there is some variation in the risk mitigating variables, the other covariates remain largely consistent between said groups, thus reinforcing the validity of the experimental design.

A noticeable exception, however, is the prominent increase in the percentage owning insurance among healthier individuals. As with the outcome of interest, the increase in insurance among the healthy may be partially attributed to a longer term marginal analysis. If an individual is healthy, perhaps he or she is more likely to have hope for the future and therefore consider the long term benefits of an insurance policy. While such correlation between explanatory variables hinders my ability to fully establish exogenous variation, it is better to include insurance in the model so as to empirically account for such a significant factor and thereby avoid the more damning effect of correlation between the unobserved term and the independent variable. The remaining two factors in which there are slight disparities in healthy and unhealthy samples are low wealth and medium wealth. Determined by the value of household assets, the demarcation between low and medium was based on the percentiles within the larger sample. Specifically, those individuals with household assets below the 50^{th} percentile are deemed "low wealth," while those between the 90^{th} and 50^{th} percentile are "medium wealth." Despite the logical, positive effect of wealth on health, the disparity is relatively small and should not significantly skew the results. Beyond the factors

discussed above, the "constant" variables remain consistent between the healthy and unhealthy groups, thereby more effectively isolating health as an exogenous explanatory variable.

Thus able to largely isolate variation in health *ceteris paribus*, regression analysis poses the next step in quantifying the proposed relationship between this comprehensive risk factor and microfinance participation. As illustrated in Appendix B, the naïve regression (Model 1) of health on microcredit history yields a 3.1 percent increase in the likelihood of having paid off a microloan within the past three years for those individuals deemed "healthy." This parameter estimate is valid at the 1 percent significance level; therefore, we have significant evidence to reject the null hypothesis that there is no relationship between health and microfinance participation. Model 2 incorporates formal risk mitigating systems such as insurance and government assistance as additional explanatory variables. In this regression, the parameter estimate for health decreases only slightly to 3.0 percent while both government assistance and insurance pose similarly significant factors at the 1 percent significance level. Prompting a 2.0 and 2.2 percent increase in the likelihood of microfinance participation, the inclusion of an insurance policy or government welfare program (respectively) pose economically significant forms of formal risk mitigation.

I include more informal risk mitigation in Model 3 through binary variables indicating titled home ownership and the receipt of family assistance. While these may be underestimated due to social desirability bias in survey responses, neither of these variables bears statistical or economic significance. Despite including an additional two variables, health and the two formal risk mitigating factors remain extremely stable between Models 2 and 3. Model 4 incorporates all controlling factors (wealth measured in the value of household assets, marital status, children under age two, age, and education) and thereby constitutes my fully specified model. Both health and government assistance remain stable across the latter two regressions whereas the return to insurance increases slightly (2.0 to 2.2 percent) upon the inclusion of the controls. Finally, Model 5 mirrors the fully specified regression but includes clustered standard error as a means to account for intra-neighborhood correlation.

While the parameter estimates are the same as those in Model 4, an increase in standard error proves detrimental to the model's statistical significance. Despite the consequent inability to infer causality

between health and propensity to invest, the disparity between Models 4 and 5 remains telling in terms of the need to craft localized aid initiatives that consider neighborhood composition.

Fundamentally, my regression analysis suggests that being "healthy" is correlated with a 2.9 percent increase in willingness to participate in microfinance. This parameter estimate remains stable throughout all five models in economic significance. While an increase in participation probability of only 2.9 percent may appear inconsequential, the underlying economic theory suggests that health is but a singular aspect of a multi-faceted vulnerability network impeding long-term investment. All five models' remarkably low correlation coefficients reaffirm this notion. Even when including all controls, the model only explains 0.6 percent of the variation in microfinance participation. That being said, when aid initiatives bolster health in conjunction with insurance and more general government assistance, the effect compounds to a 6.5 percent increase in willingness to participate. In this way, more risk factors must be empirically identified in order to account for more variation in microfinance uptake.

VI. Interpretation and Conclusion

Pursuing a more holistic model for developmental aid, this study addresses the broader effect of risk mitigation on the willingness of an individual to forego short term "happiness" in pursuit of long term goals. As discussed above and illustrated in Appendix B, this model suggests a 2.9 percent increase in willingness to take a microloan among "healthy" individuals (valid initially at the 1 percent significance level and later at 10 percent). Despite the economic significance of this result, I hesitate to infer causality due to the threat of omitted variable bias inherent both in using the number of working days lost to illness as a singular proxy for the convoluted notion of health and in neglecting to model peer-group effects.

The reduction in statistical significance stemming from the incorporation of clustered standard error suggests the correlation between such peer-groups and propensity to invest. By failing to account for the Moulton Problem of intra-group correlation, I overestimate the reliability of group-level parameter estimates. Be it through informal insurance networks or a psychological "bandwagon effect," the intricacies inherent in quantifying individual motivation within a neighborhood hamper one's ability to isolate health as an exogenous, causal

factor.

Rather, while this study specifically analyzes the effect of health on microfinance participation, it constitutes a limited step in establishing a broader causal relationship between myriad risk factors and the exploitation of existing aid initiatives. In this way, while the complexity of one's willingness to participate relegates these findings to a state between correlation and causation, the policy implications remain profound. A positive relationship between health and willingness to participate should influence the structure of developmental programs by incorporating such risk mitigating components as insurance to supplement traditional capital inflows. Additionally, the prominence of intra-neighborhood correlation affirms the need for a nuanced understanding of village composition so as to increase aid efficacy through more localized programs.

This model's extremely low correlation coefficient elucidates the need for a multi-faceted approach to explaining variability in microfinance participation. Further research should be conducted to identify significant risk factors impeding long-run marginal analysis. Furthermore, the complex nature of local vulnerability networks asserts the need for replication within different communities, for geographic disparities may alter the relative importance of certain risk factors. With thus localized models of risk, the international aid community must develop a more holistic developmental package by which to mitigate community risk and thereby augment participation in (and the consequent efficacy of) conventional aid programs like microfinance. To foster grassroots economic development, companies like Spandana must move beyond a paltry 27 percent participation rate among eligible borrowers by alleviating risk that otherwise relegates the impoverished to short-run marginal analysis. First improving the health of rural residents in Hyderabad, India, Spandana and the Abdul Latif Jameel Poverty Action Lab must continue to develop a holistic model of risk so as to facilitate localized growth.

References

[1] "137 Million of World's Poorest Received a Microloan in 2010." *Microcredit Summit Campaign* (2010). http://www.microcreditsummit.org/news/29/137-million-of-world-s.html (accessed November 10, 2013).

[2] Banerjee, Abhijit and Esther Duflo, "Poor Economics: A Radical Rethinking of the Way to Fight Global Poverty." New York: Public Affairs, 2012

[3] Banerjee, Abhijit, Esther Duflo, Rachel Glennerster, and Cynthia Kinnan. "The Miracle of Microfinance? Evidence from a Randomized Evaluation." Abdul Latif Jameel *Poverty Action Lab* (2013) http://www.povertyactionlab.org/evaluation/measuring-impact-microfinance-hyderabad-india (accessed October 15, 2013).

[4] Londono, Ana, Juan Mora, and Philip Verwimp. "Abandoning Coffee under the Threat of Violence and the Presence of Illicit Crops. Evidence from Colombia." *Households in Conflict Network.* 150 (2013).

[5] Moulton, Brent. "Random Group Effects and the Precision of Regression Estimates." *Journal of Econometrics* 32 (1986): 387-97.

[6] Rockmore, Mark. "The Cost of Fear: The Welfare Effects of the Risk of Violence in Northern Uganda." *Households in Conflict* Working Paper No. 109, 2011.

[7] United Nations Development Programme. *United Nations Millennium Development Goals* (2000) (accessed November 19, 2013).

Appendix A: Summary Statistics

TABLE 1 SUMMARY STATISTICS

:

Variable Description	Healthy (Less Than 15 Days of Work Lost to Illness)	Unhealthy (More Than 15 Days of Work Lost to Illness)
Participated in Microfinance in the Last Three Years	0.152 (0.359)	0.121 (0.326)
Insurance	0.566 (0.496)	0.507 (0.500)
Assistance From Government	0.616 (0.486)	0.609 (0.488)
Assistance From Family	0.108 (0.311)	0.110 (0.313)
Titled Homeowner	0.799 (0.401)	0.795 (0.403)
Low Wealth (Less Than 1700 Rupees)	0.435 (0.496)	0.464 (0.499)
Medium Wealth (Between 1700 and 19200 Rupees)	0.443 (0.497)	0.413 (0.492)
Married	0.607 (0.488)	0.635 (0.482)
Children Under the Age of Two	0.232 (0.422)	0.259 (0.438)
Highest Year of Education	9.674 (3.398)	9.585 (3.484)
Age	27.006 (9.775)	27.071 (10.198)
Number of Observations	2164	6869

Notes: Sample means are reported with the corresponding standard deviations listed below in parentheses. Data is from Bannerjee, A., Duflo, E., Glennerster, R., and Kinnan, C. "The Miracle of Microfinance? Evidence From a Randomized Evaluation." *Jameel Abdul Latif Poverty Action Lab,* (April 2013). Specifically, the data is derived from an endline survey conducted two years after the introduction of the microfinance institution, Spandana, into the sample area.

Figure 5: Table 1

Appendix B: Regression Results

TABLE 2: Regression Results
The Impact of Health On Microfinance Participation

Variable description	Model 1	Model 2	Model 3	Model 4	Model 5
Healthy (Less Than 15 Working Days Lost to Illness)	0.031*** (0.008)	0.030*** (0.008)	0.030*** (0.009)	0.029*** (0.009)	0.029* (0.016)
Insurance	---	0.020*** (0.007)	0.020*** (0.007)	0.022*** (0.007)	0.022 (0.014)
Receive Assistance from Government	---	0.022*** (0.007)	0.022*** (0.007)	0.021*** (0.007)	0.021* (0.011)
Receive Assistance from Family	---	---	0.006 (0.011)	0.007 (0.012)	0.007 (0.018)
Titled Homeowner	---	---	-0.003 (0.009)	0.000 (0.008)	0.000 (0.021)
Low Wealth (Less Than 1700 Rupees)	---	---	---	0.000 (0.012)	0.000 (0.019)
Medium Wealth (Between 1700 and 19200 Rupees)	---	---	---	0.002 (0.011)	0.003 (0.016)
Married	---	---	---	-0.005 (0.008)	-0.005 (0.012)
Children Under Age Two	---	---	---	-0.019** (0.008)	-0.019 (0.012)
Highest Year of Education	---	---	---	-0.006*** (0.001)	-0.006*** (0.002)
Age	---	---	---	-0.001*** (0.000)	-0.001*** (0.000)
Constant	0.117 (0.004)	0.105 (0.009)	0.099 (0.009)	0.190 (0.022)	0.190 (0.041)
Clustered Standard Error	NO	NO	NO	NO	YES
Regression R^2	0.001	0.004	0.004	0.008	0.008
Number of observations	7740	9033	9033	9027	9027

NOTES: Models 1-4 include coefficient estimates with heteroskedastic robust standard errors in parentheses. Model 5, however, includes clustered standard errors in parentheses. All regressions include a constant term.
*** Denotes Statistical Significance at the 1% Significance Level
** Denotes Statistical Significance at the 5% Significance Level
* Denotes Statistical Significance at the 10% Significance Level

Figure 6: Table 2

Notes

Notes