CONSUMPTION SMOOTHING: INSTITUTIONS, INCENTIVES AND ECONOMIC OUTCOMES

Evidence from Framed Field Experiments and Panel Data

AISHA NANYITI

Propositions

1. Financial institutions may not improve market outcomes of the poor if they are not accompanied by preliminary interventions to improve the bargaining position of the poor. (this thesis).
2. Higher and fairer compensation increase productivity of self-signalling workers. (this thesis).
3. Cholera outbreaks in Kampala cannot be stopped without fixing the housing and drainage issues in its slums.
4. Trigonometry is redundant for students of economics.
5. Food biotechnologists should face the fact that for some communities, food security is not independent of taste.
6. Most outcomes are attributed to history, so development policy could have better outcomes if policy makers study history.

Propositions belonging to the thesis entitled: Consumption Smoothing: Institutions, Incentives and Economic Outcomes. Evidence from Framed Field Experiments and Panel Data.

Aisha Nanyiti

Wageningen, 02 May 2019

Consumption Smoothing: Institutions, Incentives and Economic Outcomes

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Contents

Chapter 1

Introduction

1.1 Background

Whereas the structure of Sub-Saharan African economies has changed overtime, the agricultural sector remains the main source of livelihood. The agricultural sector employs the biggest share (65%) of labour force in Sub-Saharan Africa (Chauvin et al., 2012). Smallholding is a common livelihood, with farms operating on less than 2 acres constituting 80% of agricultural activity in Sub-Saharan Africa (Lowder et al., 2016). Much of the agricultural activity is rudimentary, with insufficient levels of mechanisation (Oya, 2010). Most farm households depend on family labour, and use poor varieties, tools and techniques. Institutions for irrigation are largely undeveloped, and farming activity mainly depends on weather conditions. The nature based production implies seasonal fluctuations in farm labour productivity and output. Incomes of farmers and workers therefore, may undergo seasonal fluctuations.

While seasonality of nature based production, propagates seasonal changes in prices; infrastructural deficiencies, poor storage and marketing practices, reinforce the price volatilities, and expose agricultural incomes to fluctuation. The deficiencies in physical infrastructure in terms of irrigation, roads and energy systems for instance do not support farm efficiency and involvement in stable marketing systems such as value chains or contract supplying (Poulton et al., 2006; Zeller, 2003). In addition, limited government support, plus management and financial constraints faced by agricultural cooperatives, limit collective action of farmers (Collier & Gunning, 1999; Poulton et al., 2006).

Besides the seasonal fluctuation of agricultural incomes, household incomes are also susceptible to shocks. While disasters such as floods, droughts and storms are covariate in nature, households suffer various idiosyncratic shocks including poor yields, injury, illness, and death of household members (Bloch et al., 2008; Gertler et al., 2009). Because farms mainly depend on family labour, incidences to family members directly affect household incomes.

Without smoothing, household consumption is susceptible to fluctuations (Besley, 1995; Kazianga & Udry, 2006; Kochar, 1999). Fluctuations in consumption are harmful to household welfare, for they imply insufficient consumption in some periods and threat of further reductions in consumption (Carter & Barrett, 2006; Holzmann & Jorgensen, 1999; Ligon & Schechter, 2003). Households use formal as well as informal institutions to smooth consumption. Consumption smoothing is a result of need for stable consumption across periods. Incentives are motivations for actions. Formal and informal insurance institutions offer different incentives to households, and therefore may imply different preferences and welfare outcomes. This thesis investigates incentives pertaining to formal and informal insurance institutions for consumption smoothing, their indirect, as well as aggregate level outcomes.

1.2 Insurance Institutions

Formal and informal institutions provide a framework through which households deal with income fluctuations and smooth consumption. Institutions are rules that govern behaviour, and operate either under formal public and private laws or through socially accepted informal norms and beliefs (North, 1994; Williamson, 2000). Households use institutions in ex-ante situation to prevent income fluctuations or in ex-post situation to cope with income fluctuations. Public measures to deal with volatile farm incomes may take the form of commodity price stabilisation schemes, crop insurance and credit cooperative schemes (Besley,

1995; Chetty & Looney, 2006; Morduch, 1994). Public schemes however, face constraints due to high operational costs which may limit their sustainability (Morduch, 1999a). Private strategies involve use of self-insurance and self-protection or available private formal and informal insurance institutions.

1.2.1 Self-insurance and Self-protection

Self-insurance refers to ex-post own means taken to reduce costs of income fluctuations (Courbage, 2001). Self-insurance measures include sale of assets, livestock or use of (crop) savings (Conning & Udry, 2007; Kazianga & Udry, 2006; Udry, 1995), and casual wage labour (Morduch, 1995). In ex-ante situations, individual measures to reduce probability of income fluctuations are referred to as self-protection. Self-protection therefore constitutes measures for income smoothing. Rural households may ensure smooth income through (farm) wage labour, by engaging in off-farm market activities or through crop and livestock diversification (Ellis, 1998; Islam & Maitra, 2012). Households may also ensure smoother incomes by engaging in cultivation of less risky crops, livestock or production technologies (Jalan & Ravallion, 1999). Such measures can be to the household's disadvantage as they may reduce (expected) profitability as households tend to engage in low return but less risky activities (Islam & Maitra, 2012; Morduch, 1994, 1995). In extreme cases households close to the poverty line with no alternatives may self-insure by reducing expenditure for example by taking children from school (Carter & Barrett, 2006; Chetty & Looney, 2006). Such adverse self-insurance measures may further sink households in poverty (Chetty & Looney, 2006; Jalan & Ravallion, 1999).

1.2.2 Self-protection through the Labour Market

The rural labour market plays a crucial role in consumption smoothing (Rose, 2001; Udry, 1994). Besides use of casual wage labour to cope with income fluctuations, rural agents use the labour market for self-protection. As mentioned above, seasonality in demand for agricultural labour in Sub-Saharan Africa implies that incomes of farm workers are prone to fluctuations on the casual labour market. Workers with diminishing marginal utility in consumption may seek to avert income fluctuations by engaging in tied labour (Bardhan, 1983; Eswaran & Kotwal, 1985; Mukherjee & Ray, 1995). While tied workers enjoy constant wages all year, a smoothing premium imply wage rates lower than average casual labour rates. Caselli (1997) shows that gains in financial market efficiency advantage workers. Interacting remote labour tying markets with savings institutions provides an alternative smoothing instrument to risk averse worker. Can access to a savings institution improve tied labour wages?

1.2.3 Formal Insurance

When available, formal insurance markets provide households an opportunity to privately buy coverage against volatile farm incomes. Formal insurance products usually fix coverage levels ex-ante or provide prior information on the terms of coverage. Covered individuals are expected to undertake more risk eventually (Belhaj & Deroïan, 2012). Rural areas in Sub-Saharan Africa, however, face limited access to formal insurance (Ambrus et al., 2014; Banerjee & Duflo, 2007, 2010; Dercon, 2006). Formal insurance markets are affected by information asymmetries namely, adverse selection and moral hazard problems. The tendency of demanding insurance mostly by high risk agents (adverse selection) and under-supplying self-protection by insured agents (moral hazard) implies high transaction costs to providers (Arnott & Stiglitz, 1991; Chiappori et al., 2012; Townsend, 1995). The high transaction costs

imply high market prices of insurance products and/or partial insurance coverage. More recently, formal insurance products usually provided by public institutions (or sometimes through markets), have been introduced in some parts of Sub-Saharan Africa (Barnett et al., 2008; Dercon et al., 2014; Giné & Yang, 2009). However, uptake of these products is low (Dercon & Christiaensen, 2011; Eling et al., 2014; Giné & Yang, 2009).

1.2.4 Informal Insurance

Rural households in Sub-Saharan Africa rely on informal institutions to smooth consumption (Genicot & Ray, 2003; Morduch, 1995). Without first-best formal insurance products, rural households depend on second-best informal insurance mechanisms (Morduch, 1994). Informal insurance instruments include inter-household in-kind gifts or cash transfers and borrowing from friends and family. Informal risk sharing occurs within local organisations like village rotating savings and credit associations, burial societies and labour sharing groups (De Weerdt & Dercon, 2006) or within kinship and social networks (Di Falco & Bulte, 2013; La Ferrara, 2010). Risk sharing transfers are usually determined ex-post. Depending on the type of arrangement however, transfers or terms of transfers may sometimes be known ex-ante. Informal risk sharing is based on the principle of reciprocity, and is customarily self-regulating, as the underlying informal contract is difficult to enforce by court of laws (Genicot & Ray, 2003). With full commitment, informal risk sharing is efficient (Belhaj & Deroïan, 2012; Eswaran & Kotwal, 1989; Kocherlakota, 1996). Limited commitment however, constrains coverage from informal risk sharing due to incentives for contract incompleteness on one side (Chandrasekhar et al., 2011; Genicot & Ray, 2003). Altruism reduces limited commitment and

facilitates higher welfare levels for the risk sharing partners (Aida & Sawada, 2016; Bourlès & Rouchier, 2012; Foster & Rosenzweig, 2001). A vital aspect of informal insurance is that little information asymmetries regarding outcomes exist within a risk sharing network (Arnott & Stiglitz, 1991; Dercon, 2002). Informal insurance however, suffers limitations to handling covariate shocks.

Agents also smooth consumption by borrowing form their kinship or social network: informal loans (or quasi credit) (Fafchamps, 1999). Informal loans offer combination of insurance and credit features (Besley, 1995). These loans are usually at very low or zero interest rates, with flexible pay back periods and positive probability for renegotiation of terms (Fafchamps, 1999; Fafchamps & Lund, 2003). Besides enabling risk sharing agents to circumvent limited commitment problems (Ligon et al., 2000), informal loans especially from kinship networks finance large expenditures that would otherwise be difficult to fund from the market without collateral (Kinnan & Townsend, 2012). While informal loans may overcome capacity (coverage) limits of social assistance, they are prone to enforcement constraints of credit markets in general (Fafchamps & Lund, 2003; Ligon et al., 2002).

Informal risk sharing has also been associated with social immobility (Besley, 1995; Morduch, 1999a) and negative effects on labour supply (Baland et al., 2016). Moreover, there are punishments for non-social behaviour within a risk sharing network, such as isolation and social stigma (Besley, 1995; La Ferrara, 2010; Ligon et al., 2002). The distortionary effect may even be larger, as sharing obligations divert savings, thus reducing overall ability of agents to undertake other investments that may be of higher return (Berner et al., 2012; Di Falco & Bulte, 2011; Grimm et al., 2016). To get around the moral obligation to share, agents may

transfer smaller amounts, insufficient for the need, rendering informal insurance imperfect (Baland et al., 2011; Lenel, 2015; Robinson, 2012).

Buying formal insurance may be a reliable solution to reducing incompleteness and increase coverage per agent (Morduch, 1994, 1995). Moreover, by undermining non-cooperative behaviour punishments, formal insurance provides relief from sharing obligations- sometimes interpreted as crowding out of informal insurance (Lin et al., 2014). Moral hazard is however, an important constraint to both formal and informal insurance (Di Falco & Bulte, 2013; Hölmstrom, 1979; Johnson, 1977). Incentive compatible coverage levels are therefore not complete (Kocherlakota, 1996). With provider's full commitment, a partial formal insurance product ensures a certain degree of coverage to the agent. As mentioned above, a certain degree of coverage supports risk taking (Belhaj & Deroïan, 2012; Morduch, 1994, 1995). Moreover, possibilities of limited commitment or lack of capacity under informal insurance imply that coverage level may be more precisely ascertained through formal insurance (see also Lin et al., 2014; Morduch, 1994, 1995). However, as earlier mentioned, uptake of formal insurance products in Sub-Saharan Africa is low. Lack of understanding of insurance products is one of the reasons explaining the low uptake (Ackah & Owusu, 2012; Cole et al., 2011). Rural households in Sub-Saharan Africa have vast experience with informal insurance, as a tool they regularly use to smooth consumption, and should easily understand all its incentive implications. Do rural households demonstrate clearer understanding of informal insurance than formal insurance?

1.2.5 Credit and Savings Institutions

Ultimately formal and informal insurance institutions influence economic development and the distribution of income. Informal institutions influence consumption and investment decisions of individuals, and their interaction with formal finance institutions (Casson et al., 2010; Savoia et al., 2010). Formal credit markets are as well affected by information asymmetries, mainly the adverse selection problem. The tendency of obtaining high risk debtors as clients (adverse selection) implies high costs and makes formal credit markets imperfect. Moreover, lack of collateral limit access of the poor to formal credit markets (Bardhan et al., 2000; Besley, 1995; Townsend, 1995).

Microfinance institutions gained popularity for their pro-poor approach (Eswaran & Kotwal, 1989; Morduch, 1999b; Udry, 1995). Products like small loans, micro-savings, and non-collateral requirements for loans through group and sequential lending, enable microfinance institutions to circumvent information asymmetries, and reach out to the poor (Batbekh & Blackburn, 2008; Hermes & Lensink, 2011). Compared to microcredit, micro-savings may have superior insurance features. Ex-ante savings with a microfinance institution functions as collateral and may be better than ex-post coping with credit that may not be easily accessible without assets (collateral) or good history of repayment (Banerjee & Newman, 1994; Barnett et al., 2008; Kazianga & Udry, 2006). Savings are however, affected by low rates of return (Besley, 1995; Eswaran & Kotwal, 1989).

Besides enabling the poor to smooth consumption in case of income shocks, microfinance facilitates the poor to engage in human capital or income generating investments. Human capital investments by the poor are vital for braking poverty traps and to attain higher income levels in the long run (Crimmins et al., 1984). Microcredit enables the poor to invest in

more productive activities, thereby improving their incomes (Armendáriz & Morduch, 2005; Ahlin & Jiang, 2008). Increase in incomes of the poor, implies narrowing of the income gap between them and the higher groups, as the poor catch up. Empirical work shows that microfinance has small positive effects on income equality (Hermes, 2014; Kai & Hamori, 2009; Tchouassi, 2011). Considerable heterogeneity however exists within the microfinance sector. Microfinance institutions differ in terms of their targeted clients, need for and size of the loans, as well as location, and the outcomes of their operations on income inequality may therefore be different. How do the different subgroups of microfinance institutions affect income inequality?

1.3 Effort Motivation

While workers may seek to smooth income through the labour market, on the demand side, motivating work effort is a key challenge for employers. Besides monetary (extrinsic) motives (Gneezy & Rustichini, 2000a, 2000b), intrinsic (altruism, reciprocity and guilt aversion) (Battigalli & Dufwenberg, 2007; Clark et al., 2010; Ellingsen et al., 2010; Falk et al., 1999), and image (social image and self-image) (Akerlof & Kranton, 2005; Benabou & Tirole, 2003) motivations are established as incentives for effort. Particularly self-image motives refer to ones concern for own perception of who they are (Bénabou & Tirole, 2006). Moral concerns for example other's payoffs and self-image motives are salient in African culture (Baguma & Furnham, 1993; Van Hoorn & Maseland, 2013). Behavioural theory shows that moral preferences often combine with self-interest to define behaviour of agents (Alger & Weibull, 2013). Moreover, in work settings, various motives intersect, to define effort outcomes. Understanding how extrinsic and intrinsic incentives interact with image motives in workplaces

is important for effort motivation. Experimental evidence for example, shows that agents reduce effort supply following unfair compensation (Fehr et al., 1997; Fehr et al., 1993). Further empirical evidence shows that extrinsic motives crowd out self-image motives (Ariely et al., 2009). However, positive self-image motivations are prone to decent extrinsic and intrinsic excuses for shirking (Epley & Gilovich, 2016). How do intrinsic incentives interact with self-image motives for effort?

1.4 Objectives

Incentives pertaining to insurance institutions influence coverage decisions and therefore welfare of agents. The aim of this thesis is to assess how interaction of formal insurance institutions with informal insurance institutions (or settings) affects incentives for consumption smoothing, and its associated economic outcomes. The overall objective of this thesis is to: identify incentive compatible solutions to smoothing consumption, examine the effect of intrinsic incentives on supply of effort, and analyse the aggregate level effects of microfinance institutions. Specifically this thesis assess (1) whether interacting savings institutions with rural labour markets improves incentives for labour tying; (2) how supply of self-image motivated effort can be more optimally elicited; (3) how insurance institutions can be aligned to elicit higher demand for formal insurance products; (4) how microfinance institutions affect income inequality. The individual chapters of this thesis address the following research questions:

1. Does workers' access to a saving institution increase wages for tied labour? (Chapter 2)
2. Do higher and fairer wages increase self-image motivated effort? (Chapter 3)
3. Is behaviour of rural households consistent with moral hazard incentives under formal insurance and informal insurance? (Chapter 4)

4. What is the effect of different subgroups of microfinance institutions on income inequality? (Chapter 5)

1.5 Methodology

The common constraint that researchers encounter when assessing impact of institutions on outcome variables is lack of a credible counterfactual. Consequentially contemporary economic research has embraced experimental techniques. The controlled environment enables the researcher to exogenously vary institutions, which facilitates causality inference (Charness & Kuhn, 2011; Croson & Gächter, 2010; Falk & Heckman, 2009). Practically, experimentalists use incentive compatible treatments and randomly assign subjects to treatments. A wide range of experiments are applied, namely: laboratory experiments, lab-in-field experiments, framed field experiments, and field experiments (randomised control trials). While laboratory experiments test theoretical predictions in a laboratory setting, most commonly with student as subjects (Abeler et al., 2011; Bellemare et al., 2008; Falk et al., 2008; Fehr et al., 1993), lab-in-field experiments are essentially the same, but replace students for target population as subjects (Binswanger, 1980; Bouma et al., 2008). To provide room for more context, framed field experiments associate theoretical expectations with real life scenarios, and use target population as subjects (Gneezy & List, 2006; Kube et al., 2012; Voors et al., 2012). Randomised control trials observe regular behaviour of subjects that are randomised to the treatment and control groups (Cecchi & Bulte, 2013; Duflo et al., 2013; Mobarak & Rosenzweig, 2012).

This thesis makes use of framed field experiments to elicit incentive compatible preferences. While reliable reference states are necessary for precise attribution of impact, real

institutional and population contexts are vital for correct representation of relevant unmeasurable. Throughout chapters 2, 3 and 4, framed field experiments are used to test game-theoretic model predictions. Chapter 2 applies a contextualised ultimatum game to mimic rural agricultural labour market incentives and outcomes, and chapter 3 makes use of the same to assess incentives for effort supply. Chapter 4 applies a contextualised risk game to test moral hazard incentives under formal and informal insurance, in a risky production task.

The experiments were conducted in Uganda. In terms of context, Uganda is one the countries with very low human development (Human Development Statistical Tables, 2014). According to the population and housing survey 2014, 81% of the population reside in rural areas, and agriculture is the main source livelihood. Agriculture employs 66% of the working population (UBOS, 2012), and majority of the farmers are engaged as smallholders (Quisumbing et al., 2011). The African cash crop revolution of 1920's instigated smallholder farming in Uganda as well, engaging in coffee and cotton growing, as well as food production on their smallholdings (Bryceson, 2002; Haas, 2017; Mafeje, 1973). Agricultural activity is largely dependent on weather conditions, with two cropping seasons following the rains, implying periods of high crop income and periods of relative scarcity within a year (Kijima et al., 2006). The rural labour market in Uganda is ancient, especially in the central region. Particularly in this region, cash crop revolution smallholder farmers are reported to hire cheap labour from immigrants from peripheral regions and across the border (Haas, 2017; Mafeje, 1973). The rural labour market gradually evolved due to changes in farm (crop) demands, expansion of rural non-farm sector and urbanisation (Bagamba, 2007). To date contracts are mostly informal (usually verbal even for some workers on large plantations), and farm labour wage rates are customarily low. A poverty report for instance, shows that individuals, who

entirely rely on casual or attached (permanent/tied) agricultural work, constituted a significant proportion of the poor in Uganda (MoFPED, 2002). Coverage of formal finance institutions is limited in rural areas. Rural households in Uganda mainly depend on informal institutions for their finance needs (Heathler, 2016).

This thesis also makes use of observational data. In chapter 5, panel data on developing countries is used to assess the effect of the different subgroups of microfinance institutions on income inequality.

1.6 Outline

The chapters of this thesis are organised as follows. Chapter 2 theoretically and empirically investigate the impact of access to tied contracts and a saving institution on rural labour market decisions and wages. We are particularly interested in assessing the impact of a savings technology on tied labour wages. We propose a rural labour market model characterised by inelastic supply of labour, diminishing marginal utility in consumption, and behindness aversion, and test its predictions with a framed field experiment. We find that access to saving institutions does not improve income of workers, as first moving landlords take advantage of the institutional innovations. In particular we find that access to tied contracts decreases wages for casual labour, and access to an alternative savings technology does not lead to increase in tied labour wages. We learn that even in the context of inelastic supply of labour, complementary institutional innovations may not benefit workers as second movers. Our findings suggest that to improve outcomes for workers, interventions should seek to elevate workers to first movers, and therefore supporting agricultural labour organisations may be fruitful.

Chapter 3 assesses theoretically and empirically, incentives for self-image motivated effort. Specifically we test whether higher and fairer wages accentuate self-image motivated effort, using a real effort task. We find that self-image motivated effort increases with wages and fairness of the wage. Our findings suggest that employers can more optimally elicit self-image motivated effort through more generous and fair compensations.

In chapter 4, we assess theoretically and empirically moral hazard incentives with formal insurance and informal insurance. We develop a model of risky effort and test whether household behaviour is consistent with moral hazard incentives under formal insurance and informal insurance. Doing this, we are specifically interested in ascertaining whether rural households demonstrate a better understanding of informal insurance than of formal insurance. As mentioned, unlike formal insurance, households in Sub-Saharan Africa use informal insurance more regularly, and should more easily understand it implications. If behaviour under formal insurance is inconsistent with moral hazard incentives, then supporting awareness programs to build knowledge of formal insurance products in rural Sub-Saharan Africa may be Pareto improving. We find behaviour to be inconsistent with moral hazard incentives under formal insurance but consistent with moral hazard incentives under informal insurance, and lack of experience with formal insurance products to instigate irrational behaviour. We learn that lack of understanding of formal insurance products precludes uptake. Our findings suggest that efforts to boost uptake should incorporate programmes to improve household understanding of formal insurance products.

Chapter 5 examines the effect of microfinance institutions on income inequality. Besides the aggregated indicator, I consider the effect of subgroups of microfinance institutions. I find that the nature of the microfinance institution matters for their outcomes.

Profit oriented microfinance institutions facilitate increase in incomes of their clients, thereby reducing the income gap between them and the higher groups, and microfinance institutions that are not profit oriented do not affect income inequality. My findings suggest that considering microfinance as an aggregate may be illusory and sequencing development interventions may be necessary for better outcomes.

Chapter 6 presents the general discussion of the results, in broader perspective considering interaction of insurance institutions, interventions and economic outcomes.

1.7 **Contribution**

This thesis mainly contributes to three strands of literature: (1) chapters 2 and 4 contribute to the literature on consumption smoothing, (2) chapter 3 contributes to the effort motivation literature, and (3) chapter 5 contributes to macro literature on effects of microfinance.

Chapter 2 contributes to the theoretical and empirical understanding of the impact of a savings (credit) institution on labour tying markets, considering rigidities on the supply side. Previous studies theoretically model the impact of labour tying and credit markets on rural labour market outcomes, for perfectly elastic supply of labour (Caselli, 1997; Eswaran & Kotwal, 1985; Mukherjee & Ray, 1995). Unlike earlier theory, this thesis considers inelastic labour supply. This thesis is also the first to empirically analyse the impact of credit markets on rural labour tying market outcomes.

Chapter 3 contributes to theoretical and empirical understanding of the impact of intrinsic incentives on self-image motivated effort. Effort motivation has received a lot of

attention (Akerlof, 1982; Clark et al., 2010; Falk & Fehr, 2003; Falk et al., 1999; Fehr et al., 1997; Gneezy & List, 2006). The notion of eliciting effort beyond extrinsic (monetary) incentives is however, not complete yet. While previous studies assess the interaction of extrinsic incentives with image motives (Bénabou & Tirole, 2006) and social image motives (Ariely et al., 2009), this thesis makes an empirical contribution to understanding how intrinsic incentives interact with self-image motives for effort. Rather than social image, chapter 3 focuses on how self-image motivations interact with monetary and intrinsic incentives in a workplace setting.

Chapter 4 makes the first contribution to theoretical and empirical comparison of moral hazard behaviour under formal and informal insurance. Previous studies separately model moral hazard under formal insurance (Hölmstrom, 1979; Johnson, 1977) and under informal insurance (Alger & Weibull, 2010; Arnott & Stiglitz, 1991).

Chapter 5 contributes to understanding the relationship between microfinance institutions and income inequality. Previous studies treat microfinance as an aggregate variable and use cross-sectional methods. In addition to the aggregate variable, this thesis uses panel techniques to examine the effect of subgroups of microfinance institutions on income inequality.

Chapter 2

Tied Labour, Savings and Rural Labour Market Wages: Evidence from a Framed Field Experiment

Abstract

How does the introduction of tied labour or a saving product affect labour market decisions and wages in rural agricultural labour markets? We develop a theoretical model of labour tying that incorporates diminishing marginal returns to consumption and inequality (behindness) aversion in the context of a rural agricultural labour market with seasonally fluctuating demand for labour, and test model predictions using a framed field experiment (modified ultimatum game) in rural Uganda. Our main findings are that (1) wages fluctuate with productivity, (2) access to tied contracts decreases wages for casual labour, and (3) access to a saving technology does not improve wages for tied labour. Consistent with model predictions and earlier theory, we empirically find that income for workers goes down (and income for landlords goes up) if an institutional innovation enables consumption smoothing by workers (tied contracts or a savings technology).

This chapter is based on:

Nanyiti, A., Pamuk, H., & Bulte, E. (2019). Tied Labour, Savings and Rural Labour Market wages: Evidence from a Framed Field Experiment. *Journal of African Economies*.

2.1 Introduction

Most rural households in developing countries rely on agriculture for their livelihoods. Seasonal demand for labour implies household incomes tend to be volatile, and in the absence of formal institutions to smooth consumption most households rely on self-insurance and informal insurance mechanisms (Morduch, 1994; 1999a; 1999b). A persistent institution to smooth income used by individuals with concave utility functions is labour tying (Bardhan, 1983; Eswaran & Kotwal, 1985; Morduch, 1999a; Mukherjee & Ray, 1995; Udry, 1994).

Tied workers enjoy a fixed wage all year, and landlords enjoy certainty regarding labour supply. In addition, landlords are able to reduce their total wage bill if workers are willing to pay a premium (in the form of a low average wage) to avoid income fluctuations (Bardhan, 1979, 1983; Eswaran &Kotwal, 1985; Mukherjee & Ray, 1995). The magnitude of this premium depends on alternative opportunities for income smoothing, such as the availability of saving technologies. Hence financial markets and rural labour market outcomes are linked. Specifically, gaining access to a saving technology makes casual labour contracts more attractive to workers, so that tied labour wages should increase to restore equilibrium on the rural labour market (Caselli, 1997; Banerjee & Newman, 1998).

In this chapter we present and test a seasonal labour market model with the following features: (i) inelastic supply of labour, (ii) seasonality in production, and (iii) diminishing marginal utility in consumption and "behindness aversion." Traditional models of labour tying are based on the Indian context, and start from the assumption of perfectly elastic supply of labour. This assumption becomes less realistic in an era of rapid urbanisation. Moreover, and unlike the case of traditional Indian agriculture, rural labour markets in some settings have long been characterised by labour scarcity. In parts of Africa, for example, population densities were

traditionally low. In such contexts, elites did not accumulate wealth by controlling land but by controlling labour (Binswanger & McIntire, 1987). This could take the extreme form of "owning labour" (e.g. slavery), but also of principal-agent relationships. The phrase "wealth in people" captures that wealthy individuals are able to command the labour of others (Guyer, 1995). Interestingly, the institution labour tying also occurs in this setting, albeit under different conditions than modelled in the existing literature.

In this chapter we analyse tied labour in a context that differs from the traditional Indian case. Rather than assuming perfectly elastic supply of labour we assume the polar opposite case of perfectly inelastic labour supply. This is captured in the model (and in the experiment) by a modified ultimatum game played between a landlord and workers. We analyse how the introduction of labour tying affects causal wages, and compare the levels of tied and casual wages offered by the landlord. We also analyse how a saving technology affects the labour market.

Even in the absence of competition for (scarce) labour we find that casual wages in the slack season are lower than casual wages in the peak season. This is caused by behindness aversion of workers, which invites disutility by the worker in case the landlord grabs too much of the surplus that is produced. We need behindness aversion, or time-varying opportunity cost of workers, to obtain cyclical patterns in casual wages. Consistent with earlier theory our model predicts that, in equilibrium, tied wages are lower than the average casual wage. This reflects that by offering "tied contracts" landlords enable workers to smooth consumption. As first movers in the game, landlords cream off the surplus that is created by the labour tying institution. Unlike conventional models of labour tying, however, we predict that access to a savings technology does not affect tied wages. Hence, we do not find that financial development empowers workers

who are consistently paid their (unchanging) reservation value. Our results also explain why casual and tied labour may co-exist within the same region (as in our study area) – in the presence of a saving technology both landlords and workers are indifferent between the two hiring modalities.

We test model predictions in an experimental labour market setting. We organized an experiment in Kiboga district of rural Uganda in which one (randomly selected) landlord interacts with two workers. We ran three treatments of the game: (i) a standard casual labour market, (ii) co-existing casual market and tied contracts, and (iii) the co-existing labour arrangements in the presence of a savings technology. Each treatment included multiple rounds ("years") of play with two seasons per year (with different productivity levels). As mentioned, each round in the experiment resembles an ultimatum game, and we assume the landowner is the first mover or proposer. Each round the landlord offers a casual wage (and possibly a tied wage, depending on the treatment), which is accepted or rejected by individual workers – determining economic outcomes for landlord and workers.

Our model correctly predicts fluctuations in casual wages across seasons as well as the impact of tied contracts and saving technology on casual wages. Our model also correctly predicts the level of tied wages relative to average casual wage, and the impact of saving technology on tied wages. Earnings for workers do not vary across treatments, and landlords are able to grab most of the rents of institutional innovations even in a context of imperfectly elastic supply of labour. We conjecture that changing the nature of the bargaining process, for example by turning workers into the first mover, will have more effect on worker welfare than investments in financial development. Outside the virtual reality of the lab this would mean that helping workers to organise into agricultural labour associations and enabling them to commit to

(collective) wage demands may help them more than providing workers with access to microfinance opportunities.

This chapter is organised as follows: in section 2.2 we sketch how the institution of tied labour is relevant to the context of Uganda. Section 2.3 briefly summarises the literature on rural labour markets, and presents a simple model of rural labour markets with inelastic supply of labour. Section 2.4 introduces the experiment and summarizes the data. Section 2.5 explains the identification strategy, section 2.6 presents the regression results, and section 2.7 presents the discussion and conclusions.

2.2 Labour tying in Uganda

As in many other parts of Sub-Saharan Africa, the land to labour ratio in rural Uganda is relatively high. Survey data show that in Central and South Western Uganda, respectively, 72 percent and 84 percent of the households own land. The average farm size is 4 acres, and most rural households engage as smallholder farmers (Bagamba, 2007).

Cash crop production has a long history in Uganda – dating as far back as the coffee and cotton boom in the 1920s. The decline in coffee and cotton prices after the 1970s caused a shift in focus of smallholder farmers to the production of annual crops, for example maize and sweet potatoes (Bagamba, 2007). This implied a change in labour demands, because these crops do not have constant labour demands throughout gestation. As a result of the seasonal nature of labour demand, casual labour is popular in Uganda and in the central Uganda in particular. Farmers hire casual labour to supplement family labour for specific tasks, and as in other countries (Geschiere, 1995; Kevane, 1994), casual wages fluctuate across the seasons (Dumas & Houdre,

2016). However, there are also workers who are employed on a permanent basis, receiving a fixed monthly wage to perform agricultural activities.

For the random sample of rural households who participated in our framed field experiment (see below), we collected information on labour hiring. According to our own data, some 37% of the households do not hire casual labour, and the remaining 63% does hire casual labour – typically between two and four workers. Moreover, 30% of the households in our sample hires tied labourers. The number of tied labourers varies, but the mode among households engaged in labour tying is to hire two workers. Per day of work during the labour peak, tied labourers receive lower wages than casual labourers: while casual labourers receive UGX 6000 per day, tied labourers receive UGX 120.000 for, on average, 24 days of work. Part of this pay difference reflects that casual workers are often paid "over-time" during the peak season, while tied labourers are not. Not surprisingly, we find that farm size matters for labour hiring. While farms that do not hire labour are on average some 2.6 acres, the average size of farms hiring more than one casual or tied labourers are, respectively, 4.0 and 5.6 acres.

The rural labour market in Uganda, as in many other African countries, is in a state of flux. Importantly, farmers do not face a perfectly elastic supply of labour. The expansion of the rural non-farm sector presents workers with alternatives that promise higher returns. The availability of non-farm opportunities and proximity to urban centres imply that agricultural labour may be scarce. Certainly in central Uganda, where we conduct our experiment, farmers experience shortages in the supply of labour (Bagamba, 2007). Rural-rural migration is very uncommon, and it is difficult for farmers to attract workers from elsewhere (IOM, 2015). Bottlenecks emerge for various reasons, including high (transport) costs.[1] While smallholder

[1] Individual migrant workers from rural districts often target large plantations for which migration costs are low, since accommodation is provided in plantation camps, MoFPED (2002).

farmers strapped for workers may sometimes arrange seasonal migration, this is not common for smaller farmers who find the cost of such arrangements prohibitive. Most farmers therefore depend on a pool of local workers, and try to call on known and trusted workers to perform specific tasks.

As will become clear from the conceptual framework below, one of the important functions of "labour tying" is consumption smoothing for workers. Consumption smoothing is important in contexts where demand for labour varies seasonally, and where households cannot access financial services to borrow. This latter condition is met in rural Uganda, where access of rural households to formal financial institutions is very limited. Heathler (2016) reports that formal financial institutions serve only 14% of the rural population in Uganda, and that rural households mainly depend on Village Savings and Lending Associations (VSLAs) and money lenders. But demand for cash strongly co-varies within rural communities, so borrowing opportunities are few when capital is needed most and interest costs charged by moneylenders may be prohibitive (Ntakyo, 2018).

2.3 Conceptual framework

A large theoretical literature exists on rural labour markets and the role of labour tying. Multiple motives for labour tying are proposed. For example, Bardhan (1983) rationalised tied labour by cost minimizing behaviour of the landlord, who faces high costs to ensure supply of labour in peak periods. Labour tying also enables (valuable) consumption smoothing by workers, who would otherwise face a volatile wage schedule – varying with the seasons. The benefits of this smoothing service may be captured by the landlord who can lower the tied wage to make the worker indifferent between accepting a (low but fixed) tied wage or a volatile wage earned on

the casual market (Basu, 2002; Mukherjee & Ray, 1995; Caselli, 1997). In addition, Eswaran and Kotwal (1986) focused on supervision costs and special tasks, arguing that by entrusting tied workers with crucial tasks landlords can reduce monitoring costs. Tied labourers are expected to shirk less because they stand to lose their privileged position if caught. Of course tied labourers also have incentives to invest in farm-specific knowledge or skills.[2]

The literature on labour tying is based on the context of rural India, characterized by a very skewed distribution of land and an abundant supply of labour. However, the land to labour ratio varies across space, and it is worthwhile to probe models starting from different premises. One alternative case is the one where labour supply is not perfectly elastic. As mentioned above, large parts of Africa are traditionally land abundant, and in the presence of urbanisation and commercial production, may face local scarcities of labour (Bryceson, 2002; de Haas, 2017; Duncan & Howell, 1992; Juif & Frankema, 2016; Mafeje, 1973; Ndalilah, 2012; Oya, 2010).

Our model extends the literature by proposing a rural labour market characterized by an inelastic supply of labour, and a setting where labourers do not compete for jobs or drive down wages. Surely this assumption is too simplistic to describe real rural labour markets in Uganda, or elsewhere in Africa, but it captures the underlying idea that local labour supply is restricted (labour is locally scarce), and that rural-rural migration in response to wage differentials is limited. To further simplify the analysis we assume spatial movement is limited, and also assume there is no competition between landlords for workers. Instead, we assume a series of ultimatum games, where the landlord proposes a wage that is accepted by the worker, or not. Upon

[2] If labour tying is a rational response to fluctuating demand for labour (in the context of a desire for smooth consumption patterns), then why is labour tying less prevalent today than in the past? The literature offers several suggestions. Mukherjee and Ray (1995) argue that peak period incentives for contract incompleteness on the supply side are responsible for the reduction in the incidence of tied labour. Bardhan (1979, 1983) points to advances in labour-saving technologies. Caselli (1997) proposes that alternative smoothing technologies (such as borrowing and saving) render labour tying less attractive for workers.

rejection, the landlord is unable to produce and earns nothing, and the worker also earns no income. In this setting, equilibrium wages will depend on whoever is able to exploit a first mover advantage, and propose the wage. The first mover should propose a wage that is on the other player's indifference curve. Landlords should offer (low) wages so that workers are indifferent between working and not-working.[3]

Production takes place in two periods: a peak season and a slack season. These periods together form one year. The year starts with a peak season, and a slack season follows after. During the peak period, the value marginal product of labour on the farm is "high." In contrast, labour is not very productive during the slack season. To obtain a fixed level of output from a unit of land, one unit of labour is required. In the peak (slack) season, combining one unit of land and labour produces $y_P > 0$ $(y_S > 0)$. Obviously $y_P > y_S$. We abstract from shirking, and assume perfect observability of effort across the seasons.

Landlords can employ tied or casual labourers which, in the absence of shirking, are perfect substitutes in production. When accepting the landlord's wage offer, tied workers are contracted for the entire year and receive the same wage across the seasons. In contrast, casual workers are (potentially) contracted per period, and receive a seasonal wage. Denote per season wages by w_i, where subscript $i \in (P, S, T)$, and P indicates peak, S indicates slack and T indicates tied. For the theoretical model we consider the case of one landlord interacting with a single worker. The landlord is endowed with one unit of land, and the worker is endowed with one unit of labour. Production does not require any complementary inputs or capital, but the

[3] Conversely, if workers were the first movers they would demand high wages that cream off the entire surplus and leave the landlord indifferent between producing and leaving the land fallow. We follow convention, and assume landlords are the first mover.

worker incurs a fixed cost (e) when supplying labour. We assume both the landlord and worker have period-separable utility functions, and perfect information about y_P, y_S and e.

We follow Fehr and Schmidt (1999) and characterise utility of the worker as dependent on own income and income of the landlord. We assume workers are behindness averse, i.e. are sensitive to negative payoff inequalities (Bartling et al., 2009; Bartling & von Siemens, 2004). Utility of the landlord depends on output levels (varying across rounds) and the workers' wage.

We assume the landlord has access to a (storage) technology, allowing him to save between peak and slack season and smooth his consumption. This technology could simply be access to a microfinance institution where landlords can borrow in the slack season to smooth consumption, or access to a bank account where harvest proceeds from the peak season can be safely stored (see Dupas & Robinson (2013) why informal savings at home tend to be difficult). Even if landlords have diminishing marginal returns to income, they can shift consumption between the seasons at zero cost until the marginal returns to income (consumption) are equated across the seasons. We therefore assume landlord's utility is linear in income. Workers do not have access to this technology in our basic treatment, and workers are assumed to display diminishing marginal returns to income. In case of a match, per period utility of the landlord is given by equation (2.1), and that of the worker is given by equation (2.2).

$$u^{LK}(y_i, w_i^K, \alpha) = (y_i - w_i^K)^{\gamma_l}, \text{ and} \tag{2.1}$$

$$u^{WK}(w_i^K, e, y_i, \alpha) = (w_i^K)^{\gamma_w} - e - \alpha(y_i - 2w_i^K). \tag{2.2}$$

We assume $\gamma_l = 1$, $\gamma_w = \frac{1}{2}$, $0 < \alpha \leq 1$. The exact value of γ_w is unimportant, as long as the value is smaller than one, so that there are diminishing marginal returns to income for the worker

(driving the desire to smooth income between seasons). Next, $K \in (C, CT, CTS)$ defines the three markets we will discuss below: casual market (C); casual market when the landlord can also offer tied contracts (CT); and finally a casual market with tied contracts and where workers can also save and carry their earning from one season to the next (CTS).

The first term on the right-hand side of (2.1) captures net income from using the land. The first term on the right-hand side of (2.2) captures wage income for the worker, the second is the utility cost from working, and the third term represents behindness aversion.

The landlord's problem is to maximise his utility subject to the worker's participation constraint. Optimal wages are defined by the workers reservation wage, or the wage that makes him indifferent between working and not working.

2.3.1 A casual labour market

Assume per period utility of the worker is given by equation (2.3).

$$u^{WC}\left(w_i^C, e, y_i, \alpha\right) = \left(w_i^C\right)^{\frac{1}{2}} - e - \alpha\left(y_i - 2w_i^C\right) \tag{2.3}$$

We normalise utility of the worker to zero if she does not work, which defines reservation utility for casual labour. Setting reservation utility $u^{WC}\left(\underline{w_i^C}, e, y_i, \alpha\right) = 0$ defines the worker's reservation wage $\underline{w_i^C}$ so that the worker supplies one unit of labour for wages $w_i^C \geq \underline{w_i^C}$. The optimal wage set by the landlord (w_i^{C*}) is given by $w_i^{C*} = \underline{w_i^C}$: the peak wage is $w_P^{C*} = \underline{w_P^C}$, and the slack wage is $w_S^{C*} = \underline{w_S^C}$. Since $w_i^{K*\prime}(y_i) > 0$ (proof in Appendix 2A), and $y_P > y_S$, it follows that $w_P^{C*} > w_S^{C*}$. The optimal wage varies across the seasons because of behindness aversion: since landlords earn more in the peak season, workers also demand a higher wage.

Prediction 1:

i. $0 < w_S^{C*} < w_P^{C*}$.

2.3.2 Introducing tied contracts

Conventionally, tied contracts enable workers to smooth consumption while their income fluctuates with the seasons. Yearly utility of a tied worker is given by equation (2.4):

$$u^{WCT}(w_T^{CT}, e, y_P, y_S, \alpha) = 2(w_T^{CT})^{\frac{1}{2}} - 2e - \alpha(y_P - 2w_T^{CT}) - \alpha(y_S - 2w_T^{CT}) \qquad (2.4)$$

where w_T^{CT} is the tied wage in the casual market when the landlord can offer tied contracts. Assume that workers on a tied wage contract compare their annual earnings with those of their landlord, so that for every season the tied worker's utility depends on how his tied wage compares to the landlord's average earnings:

$$u^{WCT}(w_T^{CT}, e, y_P, y_S, \alpha) = (w_T^{CT})^{\frac{1}{2}} - e - \alpha\left(\frac{1}{2}(y_P + y_S) - 2w_T^{CT}\right) \qquad (2.5)$$

Reservation utility of tied labourers is defined by $u^{WCT} = 0$, so that $u^{WCT}\left(\underline{w_T^{CT}}, e, y_P, y_S, \alpha\right) = 0$ defines the reservation wage, $\underline{w_T^{CT}}$. The optimal wage for tied labour (w_T^{CT*}) is simply $w_T^{CT*} = \underline{w_T^{CT}}$. Defining optimal wage as a function of landlord endowment, $w_i^{K*}(y_i)$, we show that $w_i^{K*\prime}(y_i) > 0$, and $w_i^{K*\prime\prime}(y_i) > 0$ (proof in Appendix 2A), $w_i^{K*}(y_i)$ is convex, so that $w_i^{CT*}\left(\frac{1}{2}(y_P + y_S)\right) = w_T^{CT*} < \frac{1}{2}w_S^{C*}(y_s) + \frac{1}{2}w_p^{C*}(y_p)$. In words, the tied wage is lower than the average casual wage in the casual market without labour tying; therefore the first-moving landlord faces reduced costs and earns a higher income. Observe that we need behindness aversion for this result, as this explains the existence of seasonal fluctuations in casual wages – without such fluctuations the motive for labour tying disappears.

Labour tying increases yearly income and welfare of the landlord in comparison to his yearly income and welfare in the casual market without tied contracts: $u^{LCT}(y_P, y_S, w_T^{CT*}, \alpha) > u^{LC}(y_P, w_P^{C*}, \alpha) + u^{LC}(y_S, w_S^{C*}, \alpha)$. Assume the landlord has the opportunity to offer the worker both casual and tied contracts, and offers w_T^{CT} and w_P^{CT} at the beginning of the peak season. He offers w_S^{CT} later, when the slack season starts. Denote by w_P^{CT*} the equilibrium wage offered to casual labour in the peak period when a tied contract is available. Then optimal strategy for the landlord is to offer $w_P^{CT*} < w_P^{C*}$, so that the worker earns negative utility in the casual market and voluntarily selects into the tied labour contract.[4]

Prediction 2:

i. $w_S^{C*} < w_T^{CT*} < w_P^{C*}$;

ii. $w_T^{CT*} < \frac{1}{2}\left(w_S^{C*} + w_p^{C*}\right)$;

iii. $w_P^{CT*} < w_P^{C*}$.

2.3.3 Introducing a saving technology for the worker

If casual workers are also able to access the saving technology, they can shift income from the peak to the slack season and increase their utility. Denote by s the amount saved by the worker in the peak period (and dis-saved in the slack period). The optimal amount to save (s^*) for casual workers is given by $s^* = \frac{1}{2}(w_P^{CTS} - w_S^{CTS})$ (see Appendix 2A for proof). This enables the casual worker to spend the same income each period, or $\frac{1}{2}(w_P^{CTS} + w_S^{CTS})$, yielding per-period utility:

[4] Observe that this result would disappear in case of competition for labour between landlords as this undermines their first mover advantage. Bertrand competition for scarce labour would bid wages up, until eventually landlords are brought back to their reservation utility level.

$$u^{WCTS}\left(w_i^{CTS}, e, y_i, \alpha, s^*\right) = \left(\frac{1}{2}\left(w_p^{CTS} + w_S^{CTS}\right)\right)^{\frac{1}{2}} - e - \alpha\left(\frac{1}{2}(y_P + y_S) - (w_P^{CTS} + w_S^{CTS})\right) \quad (2.6)$$

The ability to transfer income across periods increases the worker's utility of working in the peak season (earning a high casual wage). Since part of the peak income can now be costlessly transferred to the slack season, where the marginal utility of income is higher, the casual worker would obtain a positive utility level if casual market wages did not adjust (that is: a utility level that exceeds reservation utility). However, in equilibrium wages adjust, and saving workers are brought back to zero utility. A landlord seeking to maximize his earnings will offer wages such that the worker is indifferent between not-working and working, and indifferent between casual and tied labour.

This is formalised as follows. Denote by w_P^{CTS*}(w_S^{CTS*}) the equilibrium wage offered to casual labour in the peak (slack) period when the landlord can offer the tied contract and worker can save. Next w_T^{CTS*} denotes the equilibrium wage offered to tied labour when workers can save. A landlord sets yearly utility from tied labour and causal labour at zero. He offers $w_T^{CTS*} = w_T^{CT*}$, and w_P^{CTS*} and w_S^{CTS*} such that $(w_S^{CTS*} + w_P^{CTS*}) = 2w_T^{CTS*} < (w_S^{C*} + w_P^{C*})$. The yearly utility level of a saving casual worker is given in (2.7), and the utility of a tied worker is given by (2.8):

$$u^{WCTS}(w_i^{CTS*}, e, y_P, y_S, \alpha, s^*) = 2\left(\left(\frac{1}{2}(w_P^{CTS*} + w_S^{CTS*})\right)^{\frac{1}{2}} - e - \alpha\left(\frac{1}{2}(y_P + y_S) - (w_P^{CTS*} + w_S^{CTS*})\right)\right) = 0 \quad (2.7)$$

$$u^{WCTS}\left(w_T, e, y_p, y_S, \alpha\right) = 2\left((w_T^{CTS*})^{\frac{1}{2}} - e - \alpha\left(\frac{1}{2}(y_P + y_S) - 2w_T^{CTS*}\right)\right) = 0 \quad (2.8)$$

The landlord is also indifferent between tied labour (where he provides the smoothing service, at zero cost to himself) and casual labour (where the worker saves for herself). Observe that these outcomes are different from the ones in Caselli (1997), where the introduction of a saving technology forced the landlord to increase the tied wage in order to remain "competitive." In our case the landlord fully benefits from his first-mover advantage, which enables him to cream off all surplus from consumption smoothing that is created by either labour tying or saving. An important precondition for this is the assumption of perfect substitutability of casual and tied workers.[5]

Prediction 3:

i $w_T^{CTS*} = w_T^{CT*}$;

ii $w_P^{CTS*} = w_P^{CT*}$;

iii. $\frac{1}{2}(w_S^{CTS*} + w_P^{CTS*}) = w_T^{CTS*}$;

iv. $s^* = \frac{1}{2}(w_P^{CTS*} - w_S^{CTS*})$.

Figure 2.1 summarizes these outcomes for worker and landlord income. From the model we obtain the following testable hypotheses. For the labour market with casual contracts only, (i) the peak wage exceeds the slack wage. The introduction of tied contracts implies: (ii) the tied wage is between the casual wages, and lower than the average casual wage on a casual market without tied contracts; and (iii) the average peak wage decreases. Further introducing a savings

[5] Caselli (1997) and Eswaran and Kotwal (1985) suggest an efficiency wage explanation for labour tying: worker tasks in the slack and peak season are not the same. Slack season activities are crucial for farm performance but can be monitored only with a delay, creating scope for (casual) workers to shirk. To avoid shirking, landlords can offer tied (permanent) contracts. When workers move from tied to casual contracts (in response to access to credit) the landlords have an incentive to offer a higher permanent wage and attract them back to permanent work (reducing shirking). In our model and experiment, tasks in the slack and peak period are identical and tied and casual workers are perfect substitutes.

technology: (iv) leaves the tied wage unaffected; and (v) leaves casual wages unaffected compared to the context with only tied contracts (but again, lower than in the casual market without labour tying). When workers can save, labour costs for the landlord are the same on the tied and casual market.

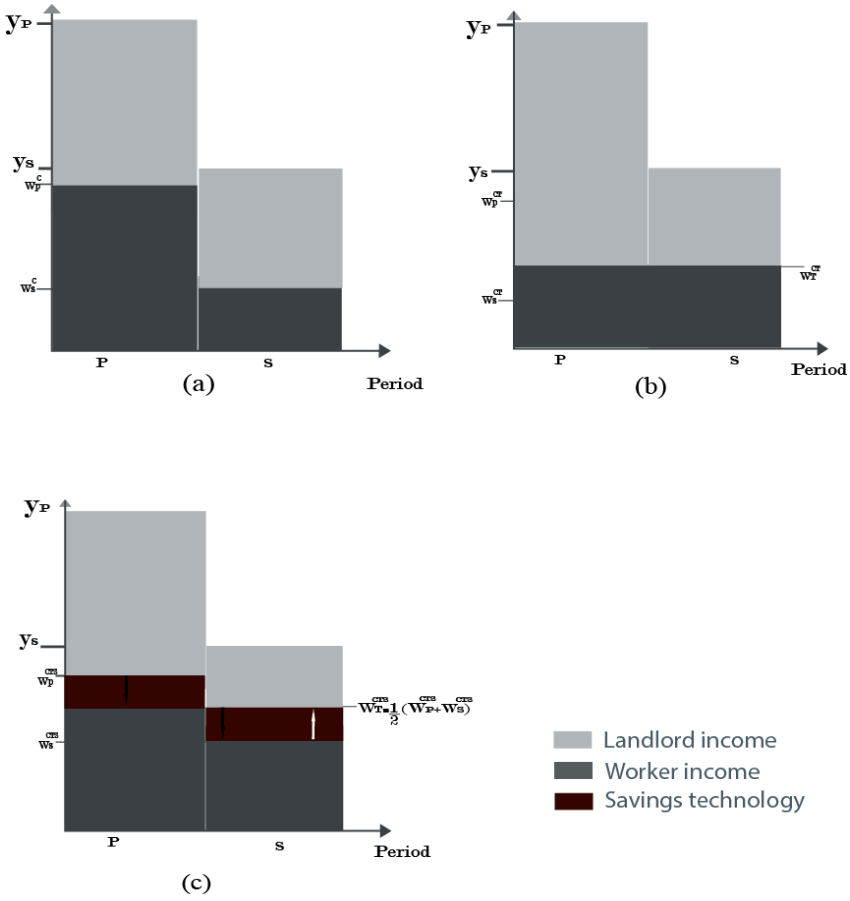

Figure 2.1: Panel (a) shows fluctuations in income of the landlord and worker in the casual market. Panel (b) shows incomes of landlord and worker in the casual market with tied contracts. The landlord obtains extra surplus from tied labour, and a tied worker obtains perfect smoothing of her income. Panel (c) shows income of landlord and worker in a casual market with tied contracts and saving technology for the worker. The landlord grabs extra surplus from the saving technology of the worker. A casual worker uses the saving technology to obtain perfect smoothing of her income.

2.4 Experiment and Data

We designed a framed field experiment that mimics key elements of rural labour markets in Africa. The game consisted of two types of players: "landlords" and "workers", who engage in a series of ultimatum wage offer games. Each treatment was played for 4 years (eight rounds), or four "peak seasons" and four "slack seasons." Each landlord was paired with two workers, who could work on two different plots of land. There is no competition between workers, so the design maps one-on-one on the single-worker theory discussed above. At the beginning of each round the landlord offered a wage to his workers, who could individually accept or reject the offer. There was also no direct communication between landlords and workers, and there was no scope for cooperation or coordination among workers – interaction took place via enumerators.[6] In case a worker rejected the offer, both parties earned nothing. Workers accepting the offer were given a simple task, but this did not affect their earnings.[7] The field experiment therefore is a modified ultimatum game.

Within a year, the peak season always occurs first. During peak seasons, the landlords received 20,000 shillings per worker for successful matches, and during slack seasons landlords received only 5,000 shillings per employed worker. [8] Landlords had access to an automatic (and perfect) savings technology, allocating earnings equally to the two seasons within each year. Hence, upon acceptance of both wage offers, landlord's seasonal income is 20,000 minus peak

[6] Enumerators talked to the landlords and then informed each worker individually about the landlord's offers and then provided feedback to the landlord about the total number of workers who had accepted and rejected.

[7] Accepting workers were given 500 grams of mixed yellow and maroon beans to sort based on colour (for two minutes), but their productivity in this task did not affect their own earnings or those of the landlord.

[8] At the time of experiment, USD 1 exchanged for 3600 Uganda shillings.

wage plus 5,000 minus slack wage, divided by two. This saving technology guarantees that landlords can costlessly shift income (consumption) between the seasons, enabling them to take advantage of income smoothing opportunities for the workers. Worker's income per round was given by the wage minus a utility cost associated with working. Across all rounds and seasons we assume this cost equals 1,000 shillings. Enumerators recorded incomes for landlords and workers, and individually informed all players about their income after each round. Payoff functions were public information, so workers knew how much the landlord stood to gain from a "match." After each treatment, one season was randomly chosen for payment (independently, for each respondent separately). This design provides risk averse workers with an incentive to "smooth" their earnings and avoid realizations with zero or low earnings. Randomly choosing one round for pay-out makes the game resemble the economic problem of interest (i.e., the importance of diminishing marginal utility from income and the role of savings).

Reflecting the theoretical model above, we organised three experimental treatments.

Casual market: This treatment simulated the casual labour market and allowed only one-period (one-season) contracts. Before each peak and slack season the landlord extended wage offers, which workers accepted or rejected.

Tied contracts: In this treatment, landlords offered seasonal wages as well as a "tied contract" covering both seasons (same wage across seasons). Before the peak season, the landlord made a peak offer and a tied wage offer. Workers accepted one offer, or rejected both. Casual or unemployed workers received another offer before the slack season.

Savings technology: This treatment resembles the former, but also allows workers to carry earnings from one season to the next (within the same period). Workers accepting the peak

wage were asked at the beginning of the period how much they intended to shift to the slack season—if anything.

We randomly varied the order in which we played these treatments at the village level, and have no reason to believe that differences in experimental play we observe between treatments may be caused by learning of the respondents or by experiences in earlier treatments.

We conducted the experiment in ten randomly selected villages in Kiboga district, Central Uganda in March 2017. Kiboga is largely a rural district, with 77% of the population living in rural villages (MoWE, 2010). Agriculture is the major economic activity, and the main crops in the region are maize, beans, bananas, sweat potatoes, cassava, groundnuts, onions, cabbage and tomatoes. In each village we randomly selected eighteen household heads to participate in the experiment. After explaining the protocol (see Appendix 2B), we randomly assigned participants into six groups of three people each, and randomly picked one group member to play as landlord. We engaged each group separately in all three treatments. As mentioned, each treatment was played for eight rounds but per treatment only one season from one year was picked for actual payment for workers (for landlords one season-worker combination was picked). So payments for workers were based on one draw from 8 outcomes, and payments for landlords were based on one draw from 8 outcomes (2 workers and 4 years).

In total, 180 respondents participated in 10 sessions of the experiment: 120 workers and 60 landlords. In each session 18 randomly selected village members participated. While players knew who were the other participants in their session, play of the game was anonymous in the sense that respondents were randomly matched to the groups, and at the decision stage, workers were never informed of other workers' choices. Matchings remained fixed throughout the session, and respondents consistently played the same role (landlord or worker). The fact that the

same worker and landlord interacted repeatedly implies there is some scope for signalling (as in real life), but landlords offered only one wage to the two workers and could not distinguish between the workers by offering individual wages based on individual "signals." Several examples were discussed after the protocol was explained, and we played one trial round before commencing the game. The experiment is summarized in a Figure in Appendix 2C.

After the experiment we held a short exit survey to collect data on social-economic characteristics of the participants. In Table 2.1 we summarize these data, which demonstrate that the sample was balanced across the subsamples of workers and landlords. Sixty percent of the participants practice farming as their main occupation, 50 percent of the participants are women. Most participants attended primary school and are members of a VSLA. Hiring and selling causal labour was common to most respondents, and majority of subjects were also familiar with the concept labour tying. We did not ask qualitative questions about the motives of our respondents for their choices in the experiment.

Table 2.1: Social-economic characteristics of participants

	Landlords (N=60)		**Workers (N=120)**		**P(1=2)**
Variable	**Mean (1)**	**SD**	**Mean (2)**	**SD**	
Farm size (acres)	3.72	3.69	3.23	6.26	0.58
Farm output (million shillings)	1.10	1.28	1.02	1.68	0.75
Tied workers employed	2	6	2	7	0.97
Casual workers employed	2	3	3	5	0.66
Age	41.4	15	39.5	14	0.42
Female	0.48	0.50	0.48	0.50	1
Major occupation-farming	0.67	0.48	0.67	0.47	1
Primary education	0.93	0.25	0.94	0.24	0.83
VSLAs members	0.68	0.47	0.68	0.47	1

2.5 Identification

We test key hypotheses by estimating a series of multivariate Ordinary Least Squares (OLS) models. In all the models, we use heteroscedasticity robust standard errors clustered at landlord level. The main dependent variable is wage offers by the landlord (peak, slack, or tied). Each year, landlords offer each type of wage (peak, slack and tied) to the workers; therefore the models are at year level. We control year fixed effects in our models. We first focus on behaviour in the casual market, and estimate model (2.9) for only casual market treatment observations:

$$w_{lkt} = \alpha_0 + \theta_1 Peak_k + \varepsilon_{lkt}, \quad (2.9)$$

where w_{lkt} is the wage offered by landlord l in market k and year t and, α_0 is the constant (or average wage offer in the slack period), $Peak_k$ is a dummy with value one during the peak season, and ε_{lkt} is the error term. Coefficient θ_1 picks up the difference between average peak wage offer and the average slack wage offer, which we expect to be positive because of behindness aversion, shown in prediction *1i*: $\theta_1 > 0$.

Next, we turn to the observations from tied contracts treatment and estimate (2.10):

$$w_{lkt} = \alpha_0 + \varphi_1 Peak_k + \varphi_2 Tied_k + \varepsilon_{lkt} \quad (2.10)$$

$Tied_k$ is a dummy with value one for tied wage offers. Coefficient φ_2 estimates the difference between the average tied wage offer and average slack wage offer (which we expect to be positive from prediction *2i*: $\varphi_2 > 0$). Our model also predicts (in prediction *2i*) that the average tied wage offer is lower than the average peak wage offer, or that $\varphi_1 - \varphi_2 > 0$. The model

prediction (prediction *2ii*) with respect to labour tying is that the tied wage is below the (average) casual wage for the markets without tied contracts, or that $\varphi_2 < \frac{\widehat{\theta}_1}{2}$.

Next, we introduce the saving technology, pool the data from all treatments, and estimate model (2.11) for slack, peak, and tied wage offers separately:

$$w_{lkt}^f = \alpha_1^f + \beta_1^f Tiedmkt_k + \beta_2^f Savingsmkt_k + \varepsilon_{lkt} \quad (2.11)$$

where f:{P,S,T} respectively denotes peak, slack and tied wage offer. For this model, α_1^f is the average peak or slack (or tied) wage offer in the casual (tied) market, $Tiedmkt_k$ is a dummy with value one for tied contracts treatment, and $Savingsmkt_k$ is a dummy with value one for savings technology treatment. Coefficient β_1^f captures the effect on wage offers due to the presence of tied contracts. Coefficient β_2^f picks up the effect on wage offers due to the introduction of a saving technology. Based on the model we expect that peak wage decreases when the landlord can offer tied contract (prediction *2iii*), or that $\beta_1^P < 0$. We next test whether the introduction of a saving technology affects tied wage offers (prediction *3i*), or that $\beta_2^T = 0$. We then test whether introduction on savings technology does not change peak wage offer (prediction 3*ii*), or that $\beta_2^P = \beta_1^P$.

Our model predicts that when workers can save, the tied wage equals the average casual wage (prediction *3iii*). To test this, we estimate (10) for only savings technology treatment observations and test $\varphi_2 = \frac{\varphi_1}{2}$.

Finally, we are interested in savings behaviour in the experiment, and estimate model (2.12) based on savings technology treatment to test prediction *3iv* from our model:

$$optsav - sav_{wt} = S_0 + S_1 X_w + \varepsilon_{wt} \quad (2.12)$$

where $optsav - sav_{wt}$ is the difference between optimal savings (full income smoothing) and actual savings for worker w in year t, X_w is vector of control variables, and ε_{wt} is the error term. As controls we include education and survey-based (i.e. hypothetical) measures of time – and risk preferences. If on average workers optimally smooth consumption, then $S_0 = 0$.

2.6 Results

Figure 2.2 shows an overview of the variation in average wage offers, acceptance rates and landlord earnings across the three labour markets, enabling us to verify most model predictions. The top-left panel shows that the average peak wage offer is higher than the average slack wage offer on the casual labour market. But the sharing rule varies across the seasons: in peak seasons, the average wage offer is almost 27.5% of the surplus and in slack seasons the average wage offer is more than 40% of the surplus. Observe that the average tied offer is between the average peak and slack offers, and consistent with model predictions it is below the average casual market wage offer. When workers gain access to the savings technology, as predicted, the average peak wage offer, average slack wage offer are not changed. As predicted, average tied wage offers are not affected by the saving technology.

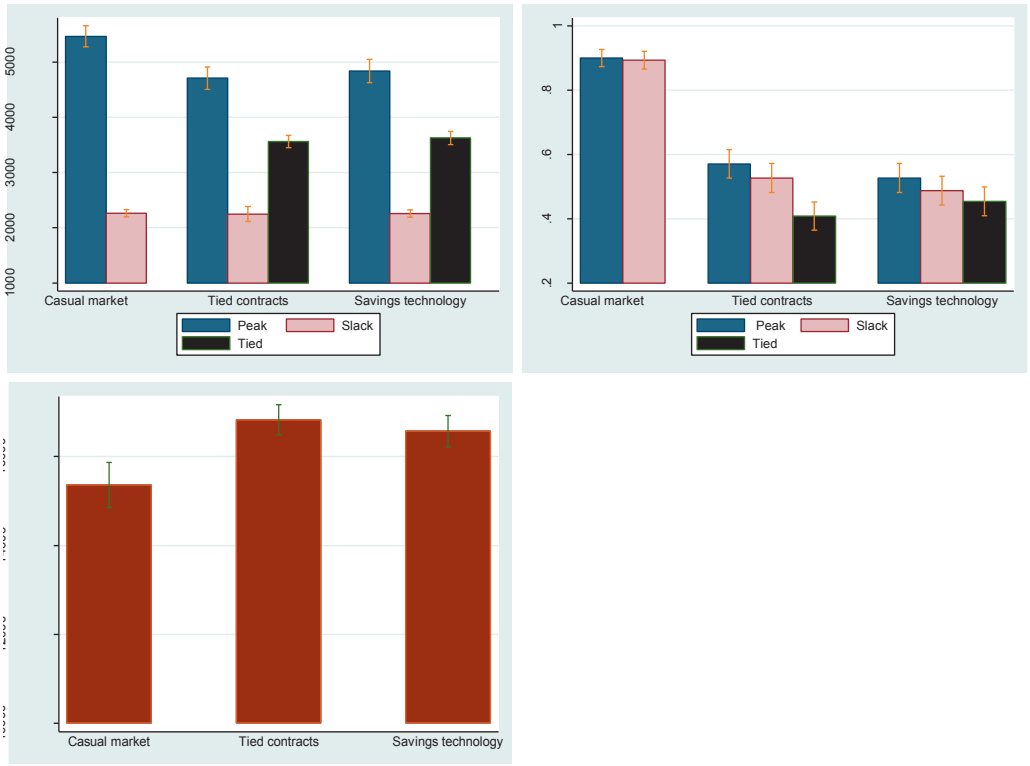

Figure 2.2: Variation across markets by treatments; average wage offers (top-left), average wage offer acceptance rates (top-right), and average landlord earnings (bottom).

The top-right panel summarizes acceptance rates. Almost 90% of the wage offers in the casual market are accepted by workers, suggesting the great majority of offers is evaluated as sufficiently fair. As predicted, introducing tied labour reduces acceptance rates in the casual market. However, acceptance rates are not reduced to zero – indeed, top-right panel reveals that even after introducing tied contracts the majority of the landlords and workers rely on the casual market for contracting. The introduction of the saving technology, however, does not appear to make the casual market more attractive.

The bottom panel plots average earnings for landlords. Observe that tied contracts make the landlord better off, and that the landlord is indifferent between a casual market with tied contracts and a labour market where workers can save.

We next explore these issues in a regression framework. Table 2.2 gives estimation results for models (2.9) and (2.10). In this Table, and in Tables 2.3 and 2.4 below, we pool behaviour of the respondents across the four years (or eight seasons). Distinguishing between "early" and "late years" does not meaningfully alter any of the results, indicating no learning effect on our results (for details see Appendix 2E).

Table 2.2: Estimates of average wage offers

	Average wage offer					
	(1)	(2)	(3)	(4)	(5)	(6)
Peak wage offer	3,201.46***	3,201.46***	2,460.62***	2,460.62***	2,581.25***	2,581.25***
	(159.45)	(170.92)	(174.15)	(182.20)	(166.01)	(173.69)
Tied wage offer			1,313.75***	1,313.75***	1,369.58***	1,369.58***
			(112.33)	(117.52)	(91.49)	(95.72)
Slack wage offer	2,265.00***	2,541.04***	2,246.67***	2,671.53***	2,256.67***	2,962.78***
	(57.60)	(123.67)	(84.51)	(86.91)	(56.23)	(90.70)
N	480	480	720	720	720	720
R-squared	0.671	0.835	0.410	0.638	0.464	0.684
Landlord FE	NO	YES	NO	YES	NO	YES
Year FE	NO	YES	NO	YES	NO	YES
Prediction 1i: $\theta_1 > 0$	[0.00]	[0.00]	-	-	-	-
Prediction 2i: $\varphi_2 > 0$	-	-	[0.00]	[0.00]		
Prediction 2i: $\varphi_1 - \varphi_2 > 0$	-	-	[0.00]	[0.00]	-	-
Prediction 2ii: $\varphi_2 < \frac{\hat{\theta}_1}{2}$	-	-	[0.00]	[0.13]	-	-
Prediction 3iii $\varphi_2 = \frac{\varphi_1}{2}$	-	-	-	-	[0.48]	[0.50]

Robust standard errors in parentheses. Standard errors clustered at landlord level. $***p < 0.01$.. p-values in brackets.

Consistent with model predictions, results in column 1 show that landlords offer casual labourers 3,200 shillings (USD90 cents) more in peak rounds than in slack rounds. The average casual wage offered in the slack rounds equalled 2,270 shillings (USD 60 cents), which increased

to 5,460 shillings (USD 1.5) in the peak season. This result is robust to landlord and year fixed effects (column 2). The income volatility in the casual market can be attenuated by a tied wage contract. Estimation results in column (3) show that tied wages are higher than average slack period wages, but lower than the average peak wage offer and also lower than the average casual wage offer. Specifically, the tied wage offer equalled 3,560 shillings (USD 1) and the average casual offer was 3,870 shillings (USD 1.1). Hence, landlords earn extra rents by offering tied contracts to workers to smooth their incomes.

Table 2.3: Impact of markets on average wage offers

	Average wage offer					
	(1)	(2)	(3)	(4)	(5)	(6)
	Slack	Slack	Peak	Peak	Tied	Tied
Tied Contracts	-18.33	-18.33	-759.17***	-759.17***		
	(84.09)	(87.98)	(158.94)	(166.29)		
Savings technology	-8.33	-8.33	-628.54***	-628.54***	65.83	65.83
	(55.55)	(58.12)	(176.88)	(185.06)	(72.83)	(78.07)
Casual market	2,265.00***	2,203.89***	5,466.46***	6,106.46***	3,560.42***	4,664.58***
	(57.62)	(58.88)	(173.52)	(113.39)	(98.37)	(56.22)
N	720	720	720	720	480	480
R-squared	0.000	0.307	0.043	0.622	0.001	0.626
Landlord FE	NO	YES	NO	YES	NO	YES
Year FE	NO	YES	NO	YES	NO	YES
Prediction 2iii: $\beta_1^P < 0$	-	-	[0.00]	[0.00]	-	-
Prediction 3i: $\beta_1^T = 0$	-	-	-	-	[0.37]	[0.40]
Prediction 3ii: $\beta_2^P = \beta_1^P$	-	-	[0.37]	[0.39]	-	-

Robust standard errors in parentheses. Standard errors clustered at landlord level. ***p < 0.01.. p-values in brackets.

Table 2.3 summarizes estimation results for model (2.11). Estimation results in column (3) show that the average peak offer is lower in the presence of a tied labour market and stays the same when workers gain access to a savings technology. This result is robust to including landlord and year fixed effects. These results imply landlords exploit the income smoothing opportunities of the worker. As expected, and reported in column (5), tied wages do not respond

to the introduction of the saving technology. This result is also robust to landlord and year fixed effects.

We next analyse savings behaviour. Table 2.4 gives estimation results for model (2.12).

Table 2.4: Savings Behaviour

	Dependent variable: Optimal savings (-) actual savings
Constant, $\hat{S}_0$	43.35
	(157.10)
Hypothetical Low discount rate	395.10 **
	(180.41)
Hypothetical Risk averseness	121.13
	(173.16)
Post-primary education	-54.97
	(177.31)
N	472
R-squared	0.035
Prediction 3iv: $S_0 = 0$	[0.78]

Robust standard errors in parentheses. Standard errors clustered at landlord level. **p < 0.05. p-values in brackets.

The difference between optimal savings and actual savings is not statistically different from zero, suggesting that workers on average save the optimal amount. A significant share of the workers (53%) self-selected into casual labour, and used the savings technology to obtain smoothing of their earnings.

2.7 Discussion and Conclusions

We examined the interaction between labour tying and a saving technology as mechanisms to smooth consumption for rural workers when incomes fluctuate over the seasons. Unlike earlier work we consider the case of inelastic supply of labour, and allow for inequality aversion of workers. Previous work, based on the context of the Indian countryside, is based on

the assumption of perfectly elastic supply of labour.[9] The polar opposite case of the one presented in these models would be a model where landlords compete for labourers. Our model seeks to reflect the East African context, so we consider an intermediate case where neither labourers intensively compete for jobs, nor landlords for workers. In keeping with reality, we also assume that landlords are the first movers in the game where wages are set.

Consistent with earlier theory we demonstrate that the introduction of labour tying may enable the landlord to secure a larger share of the economic rents. Behindness aversion will limit the extent to which the landlord will seek to exploit the worker by offering a wage that is very low. While it is an open question to what extent behindness aversion "matters" in the field as it does in lab-style settings, we propose that some sensitivity to income inequality will always be present. We next introduce a saving technology for the worker in order to enable her to carry income from the peak to the slack season (or from seasons with high wages to seasons with low wages), which should be welfare improving. To restore equilibrium, and make workers again indifferent between the casual and tied contract, the landlord can increase the tied wage offer or reduce the casual market wages. The latter option is obviously preferable for the landlord as it increases his own income.

We obtain a number of testable predictions from the theoretical model, which we week to test using a framed field experiment in rural Uganda. Consistent with the hypothesis of behindness aversion we find that (i) casual wages vary across the seasons. We also find support for the predictions that (ii) the tied wage offer extended by landlords is between the slack and

[9] The assumption of inelastic supply of labour is not crucial for our results. Similar results would eventuate when labour supply was elastic, provided that all potential workers have the same utility function and are equally behindness averse. In case of heterogeneity in behindness aversion across workers, however, the situation would be very different. Landlords could then seek out the subset of workers who are least behindness averse, and offer them the lowest wages. Seasonal wage differences for casual labour would diminish or potentially disappear, and the purpose of tied labour (to smooth consumption) would evaporate as well.

peak wage offers on the casual labour market, and average casual market wages exceed average tied wage. Our results are also consistent with the prediction that, (iii) landlords reduce casual wage in the peak period, to benefit from tied contracts as compensation for the consumption smoothing service he provides to the worker. When workers can save, consistent with predictions, we find that relative to the casual market without tied contacts and savings technology, landlords (iv) reduce casual wages and maintain workers at their reservation utility level. In equilibrium, (v) landlords are indifferent between tied and casual contracts (when workers can save), and prefer both of these outcomes to outcomes on the simplest casual market where consumption smoothing cannot occur.

Overall, the experiment suggests that labour tying may be a persistent agrarian institution, even in the face of ongoing urbanisation and decreasing surplus labour in the countryside. When landlords are first movers, they either benefit from labour tying (when workers cannot save) or they are not worse off (when workers can save). In equilibrium, workers earn the same reservation level of utility. This suggests interventions to improve outcomes for workers should not focus on introducing complementary institutional innovations, such as new contracts or access to microfinance. Instead, changing the nature of the game – so that workers are no longer responders or second-movers in an ultimatum game – may be a more fruitful approach.

Appendix 2A: Proofs

Landlord's per period utility:

$u^{LK}(y_i, w_i^K) = (y_i - w_i^K)^{\gamma_l}$

Since the landlord is risk neutral and has access to a saving technology, we assume $\gamma_l = 1$

$u^{LK}(y_i, w_i^K) = y_i - w_i^K$

Landlord's income is decreasing in w_i^K. Since supply of workers is perfectly inelastic, worker's participation constraint is binding in equilibrium.

Worker's per period utility:

$u^{WK}(w_i^K, e, y_i, \alpha) = (w_i^K)^{\gamma_w} - e - \alpha([y_i - w_i^K] - w_i^K)$

$u^{WK}(w_i^K, e, y_i, \alpha) = (w_i^K)^{\gamma_w} - e - \alpha(y_i - 2w_i^K)$

For $\gamma_w = \frac{1}{2}$,

$u^{WK}(w_i^K, e, y_i, \alpha) = (w_i^K)^{\frac{1}{2}} - e - \alpha(y_i - 2w_i^K)$.

Casual market:

Worker's participation constraint:

$u^{WC}(w_i^C, e, y_i, \alpha) = (w_i^C)^{\frac{1}{2}} - e - \alpha(y_i - 2w_i^C) \geq 0$

For reservation wage $\underline{w_i^C}$

$u^{WC}\left(\underline{w_i^C}, , e, y_i, \alpha\right) = \left(\underline{w_i^C}, \right)^{\frac{1}{2}} - e - \alpha\left(y_i - \underline{2w_i^C}\right) = 0$

Since the worker's participation constraint is binding, optimal wage $w_i^{C*} = \underline{w_i^C}$, $w_P^{C*} = \underline{w_P^C}$ and $w_S^{C*} = \underline{w_S^C}$, and

$u^{WK}(w_i^{K*}, e, y_i, \alpha) = (w_i^{K*})^{\frac{1}{2}} - e - \alpha(y_i - 2w_i^{K*}) = 0$ (2.A.1)

To prove that $w_P^{C*} > w_S^{C*}$, we investigate how w_i^{K*}changes due to a change in y_i by taking the first derivative of function $w_i^{K*}(y_i)$ with respect to y_i,: $w_i^{K*\prime}(y_i) = \frac{dw_i^{K*}}{dy_i} > 0$.

Taking the total differential of the implicit function (2.A.1), we get

$$\frac{1}{2} w_i^{K*-\frac{1}{2}} \frac{dw_i^{K*}}{dy_i} - \alpha + 2\alpha \frac{dw_i^{K*}}{dy_i} = 0,$$

$$\frac{dw_i^{K*}}{dy_i} = \frac{2\alpha w_i^{K*\frac{1}{2}}}{1 + 4\alpha w_i^{K*\frac{1}{2}}}. \quad (2.A.2)$$

Given $\alpha > 0$, for positive optimal wage offers $w_i^{K*} > 0$, $\frac{dw_i^{K*}}{dy_i} = w_i^{K*\prime}(y_i) > 0$; since $y_P > y_S$ then $w_P^{C*} > w_S^{C*}$.

Tied contracts:

To show how the tied labour wage compares to casual wages, we prove $w_i^{K*}(y_i)$ is a strictly convex function for $w_i^{K*} > 0$ by showing that $w_i^{K*}(y_i)$ has a continuous second derivative and non-negative $w_i^{K*\prime\prime}(y_i) > 0$ everywhere. To reach $w_i^{K*\prime\prime}(y_i) > 0$, we take the derivative of (2.A.2) with respect to y_i,

$$\frac{d^2 w_i^{K*}}{dy_i{}^2} = \frac{\left(1 + 4\alpha w_i^{K*\frac{1}{2}}\right)\alpha w_i^{*-\frac{1}{2}}\frac{dw_i^{K*}}{dy_i} - 2\alpha w_i^{K*\frac{1}{2}}\left(2\alpha w_i^{K*-\frac{1}{2}}\right)\frac{dw_i^{K*}}{dy_i}}{\left(1 + 4\alpha w_i^{K*\frac{1}{2}}\right)^2}$$

$$\frac{d^2 w_i^{K*}}{dy_i{}^2} = \frac{2\alpha^2}{\left(1 + 4\alpha w_i^{K*\frac{1}{2}}\right)^3}$$

Given $\alpha > 0$, for $w_i^{K*} > 0$, $\frac{d^2 w_i^{K*}}{dy_i{}^2} = w_i^{K*\prime\prime}(y_i)$ is continuous and always positive, $w_i^{K*\prime\prime}(y_i) > 0$. Therefore, $w_i{}^{K*}(y_i)$ is strictly convex and the convexity of $w_i^{K^*}(y_i)$ implies $w_T{}^{CT*}(\frac{1}{2}y_p + \frac{1}{2}y_s) < \frac{1}{2}w_P^{C*}(y_p) + \frac{1}{2}w_S^{C*}(y_s)$.

Savings technology:

Peak wage offered is $w_P{}^{CTS}$ and slack wage offered is w_S^{CTS}.
Let the worker save such that her utility is given by (2.A.3).
$u^{WCTS}(x, y) = (x)^{\gamma_w} + (y)^{\gamma_w}$ (2.A.3)
where $x + y \leq w_P^{CTS} + w_S^{CTS}$
The worker's problem is to maximise her utility in 2.A.3 subject to constraint $x + y = w_P^{CTS} + w_S^{CTS}$.
Let $w_P^{CTS} + w_S^{CTS} = a$; then $x + y = a$, and $y = a - x$.
Therefore the corresponding Lagrangian function:

$$L = (x)^{\gamma_w} + \big((a - x)\big)^{\gamma_w} + \mu(x + a - x - a)$$

$$\frac{dL}{dx} = \gamma_w(x)^{\gamma_w - 1} - \gamma_w\big((a - x)\big)^{\gamma_w - 1} = 0$$

$$x = a - x$$

$$2x = a$$

$x = \frac{1}{2}a = \frac{1}{2}(w_P^{CTS} + w_S^{CTS})$, $y = \frac{1}{2}a = \frac{1}{2}(w_P^{CTS} + w_S^{CTS})$.
But $x = w_P^{CTS} - s$, $\rightarrow s = w_P^{CTS} - x$,

so $s = w_P^{CTS} - \frac{1}{2}(w_P^{CTS} + w_S^{CTS})$,
and $s = \frac{1}{2}(w_P^{CTS} - w_S^{CTS})$.
Also $y = w_S^{CTS} + s$, $y = w_S^{CTS} + \frac{1}{2}(w_P^{CTS} - w_S^{CTS})$,
so $y = \frac{1}{2}(w_P^{CTS} + w_S^{CTS})$.
Optimal savings $s^* = \frac{1}{2}(w_P^{CTS} - w_S^{CTS})$, and worker's income each period is $\frac{1}{2}(w_P^{CTS} + w_S^{CTS})$.

Worker's yearly utility with savings is then:

$$u^{WCTS}\left(w_i^{CTS}, e, y_P, y_S, \alpha, s^*\right) = \left(\frac{1}{2}(w_P^{CTS} + w_S^{CTS})\right)^{\frac{1}{2}} - e - \alpha\left(y_P - 2\left(\frac{1}{2}(w_P^{CTS} + w_S^{CTS})\right)\right) + \left(\frac{1}{2}(w_P^{CTS} + w_S^{CTS})\right)^{\frac{1}{2}} - e - \alpha\left(y_S - 2\left(\frac{1}{2}(w_P^{CTS} + w_S^{CTS})\right)\right)$$

$$u^{WCS}\left(w_i^{CTS}, e, y_P, y_S, \alpha, s^*\right) = 2\left(\left(\frac{1}{2}(w_P^{CTS} + w_S^{CTS})\right)^{\frac{1}{2}} - e - \alpha\left(\left(\frac{1}{2}(y_P + y_S)\right) - (w_P^{CTS} + w_S^{CTS})\right)\right) = 0$$

Yearly utility of a tied worker is given by:

$$u^{WCTS}\left(w_T^{CTS}, e, y_p, y_S, \alpha\right) = (w_T^{CTS})^{\frac{1}{2}} - e - \alpha(y_P - 2w_T^{CTS}) + (w_T^{CTS})^{\frac{1}{2}} - e - \alpha(y_S - 2w_T^{CTS}) = 0$$

$$u^{WCTS}\left(w_T^{CTS}, e, y_p, y_S, \alpha\right) = 2\left((w_T^{CTS})^{\frac{1}{2}} - e - \alpha\left(\left(\frac{1}{2}(y_P + y_S)\right) - 2w_T^{CTS}\right)\right) = 0$$

Therefore,

$$u^{WCS}\left(w_i^{CTS*}, e, y_P, y_S, \alpha, s^*\right) = u^{WCTS}\left(w_T^{CTS*}, e, y_p, y_S, \alpha\right) = 0$$

$$2\left(\left(\frac{1}{2}(w_P^{CTS*}+w_S^{CTS*})\right)^{\frac{1}{2}}-e-\alpha\left(\left(\frac{1}{2}(y_P+y_S)\right)-(w_P^{CTS*}+w_S^{CTS*})\right)\right)$$

$$=2\left((w_T^{CTS*})^{\frac{1}{2}}-e-\alpha\left(\left(\frac{1}{2}(y_P+y_S)\right)-2w_T^{CTS*}\right)\right)=0$$

$$\left(\frac{1}{2}(w_P^{CTS*}+w_S^{CTS*})\right)^{\frac{1}{2}}+\alpha(w_P^{CTS*}+w_S^{CTS*})=(w_T^{CTS*})^{\frac{1}{2}}+\alpha 2w_T^{CTS*}=0$$

if $\left(\frac{1}{2}(w_P^{CTS*}+w_S^{CTS*})\right)^{\frac{1}{2}}=(w_T^{CTS*})^{\frac{1}{2}}$, then $\alpha(w_P^{CTS*}+w_S^{CTS*})=\alpha 2w_T^{CTS*}$, and

$$(w_S^{CTS*}+w_P^{CTS*})=2w_T^{CTS*}$$

Appendix 2B: Experiment Protocol[10]

Welcome to this research experiment.
Today we are going to play games imitating incomes of farmers and workers.
In every year, farmers have good seasons (peak), and low seasons (slack).
Farmers also need workers. The productivity of workers depends on the season. Workers productivity is high in peak seasons and low in slack seasons.
Farmers can hire tied (permanent) workers or casual workers.
Casual workers are hired and paid for each season separately. This means that income can be different, depending on the seasons.
Tied workers are hired for the entire year and get the same wage each season.
Today we are going to play a game about hiring labour in peak periods and slack periods.
We will play this game for many seasons or rounds. We are going to play three versions of the game. In all the versions we will play 8 seasons. One season will be picked at random from each version for payment. You will be paid based on how much you earned in that season.
Do you have any questions so far?
Status quo:
In all the games we are going to play, we will have a landlord and workers.

The landlord offers tasks to workers, and offers a wage. The workers decide individually whether they accept or reject the offer.

There are 4 years and 2 seasons within each year: peak and slack.

What happens when workers accept the wage offer of the landlord?

Each peak season, the landlord will receive 20,000/= per worker who accepted the wage offer. For each slack season, the landlord will receive 5,000/= per worker who accepted the offer. But of course he should pay a wage to the worker.

If the worker accepts the offer, he will receive the wage. But he also incurs a cost of 1000/= for say lunch or transport each season while working for the landlord.

The landlord's earnings per worker for each peak season is? 20,000 minus the worker's wage.

The landlord's earnings per worker for each slack season is? 5000 minus the worker's wage.

The worker's earnings for each season is? Worker's wage – 1000,

Remember workers decide individually about accepting the offer or not, and not as a group. Communication between participants is not allowed.

If the worker rejects the landlord's offer:

Both the worker and landlord earn 0/= for that season.

[10] This protocol was given to participants verbally in local language.

We let the lottery decide who are going to play as landlords and who will be their workers.

For the workers who accept the landlords offer, they will be given mixed yellow and maroon beans to sort according to colour for two minutes (same for the peak and slack seasons), and afterwards enumerators will weigh the sorted beans together at ounce and grams sorted will be recorded.

You now have two minutes to deliberate on the rules of the game, and if any questions arise, I answer them.

Any questions?

We are going to proceed with the games, but in groups.

We have a total of eighteen participants here, we are going to randomly form six groups, each of three people. I will randomly pick one landlord to play with 2 workers for each group.

As mentioned, we will play three versions of the game. For each version, you will play for 8 seasons, 4 for the peak and 4 for the slack. One season or round will be picked at random from the version for actual payment to you. For workers, it can be peak or slack season. For landlords, one year corresponding to one of the workers will be picked at random. Landlord earnings will then be given by a half of total year income of the landlord, corresponding to the randomly chosen worker and year. Landlord earnings therefore do not depend on the season, but rather on his earnings in that year.

This implies the landlord's picks from 8 years (4 years and two workers), and workers pick from 8 seasons.

Workers determine the landlord earnings as well. When a worker rejects the wage offer, the landlord cannot employ the worker and cannot earn money from that worker. So if a worker rejects the wage offer, that landlord earns nothing in that season. If in the lottery a year where a worker rejected all wage offers is picked, the landlord earns nothing. Therefore landlords, you need to be very calculative.

Workers also stand a chance of earning 0/= in a version, if they reject wage offers in some seasons, and if one of these seasons is picked for payment.

At the end of each version you will be asked to make a draw to determine the season/year you will be paid for that version at the end of the experiment.
Enumerators will be making calculations and recording your earnings for each version.
You will be informed about your earnings for each version, if you wish you may write it down.
Please make sure you understand the rules of the game, before you make any decisions.

Direct communication between landlord and workers is not allowed.

Enumerators will talk to the landlord and relay to workers individually each season. Enumerators then will give feedback to landlords regarding the number of workers who accepted and rejected wage offers each season.
Enumerators will be reminding you of the status quo information at the beginning of each version.
At the beginning of each version, one trial round will be carried out.
Version 1: Seasons game (Casual market)
Welcome to this version.

We are going to play for 4 peak and 4 slack season. Eight seasons or rounds in total.

The game is organised in pairs of seasons; one peak season and one slack season together make up one hypothetical year.

The landlord will make wage offers for all eight different seasons. The enumerator will share the season offer with the workers. The workers decide to accept or reject. The enumerator then informs the landlord about how many workers have accepted the offer.

Your season earnings will then be computed accordingly.

Workers who accepted the landlords offer will be given two minutes to perform the landlord's task.
Version 2: Tied game (Tied contracts)
Welcome to this version.

We are going to play again for 4 peak and 4 slack seasons. Eight seasons or rounds in total.

The game is again organised in pairs of seasons; one peak season and one slack season together are one hypothetical year.

In this version, the landlord will offer a wage for the season, as before. But in addition he now makes an offer for the two seasons together: the same wage for peak and slack season. This is called the tied wage: it is a contract for two seasons rather than one. Workers can accept either the peak wage offer or the wage offer for the pair of seasons. Or they can reject both offers.

Through the enumerators, workers will inform the landlord if they accept any of the offers or reject both.

For workers who accept the wage for a pair of seasons, they will get the same wage in both the peak and slack season. They have to take no more decisions that year. For workers who accept the peak wage offer and those who reject both wage offers, another wage offer will be made by the landlord at the beginning of the slack period.

Your season earnings will then be computed accordingly.

Workers who accepted the landlords offer will be given time to perform the landlord's task.
Version 3: Savings game (Savings technology)

Welcome to this version.

We are again going to play for 4 peak and 4 slack seasons. Eight seasons or rounds in total.

The game is organised in pairs of seasons; one peak season and one slack season together make up one hypothetical year.

In this version, landlord will again offer per season wage offers. They also offer a tied wage, or one contract for the whole year (two seasons). Workers can again accept either the peak wage offer or the tied wage offer for the pair of seasons. Or they can reject both.

Through the enumerators, workers will inform the landlord weather they accept any of the offers or reject both.

Workers who accept the tied wage for a pair of seasons will receive the same wage in both the peak and slack season. Workers who accept the peak wage offer and those who reject both wage offers will receive another wage offer for the slack season.

One thing is different from the previous version. Workers who accept per season (peak) wage will be allowed to move money and transfer it between the seasons. That is, they can move some of their peak wage earnings to their slack season. Transferred money will be added to earnings for the slack season.

Season or round earnings will then be computed accordingly.

Workers who accepted the landlords offer will be timed to perform the landlord's task.

At the end of the eight seasons, you will make a draw to determine your earnings for this version. For workers you will choose one season from the eight, and for the landlord you will choose one year from 8 years.

We thank you for your time.

Appendix 2C: The Experiment

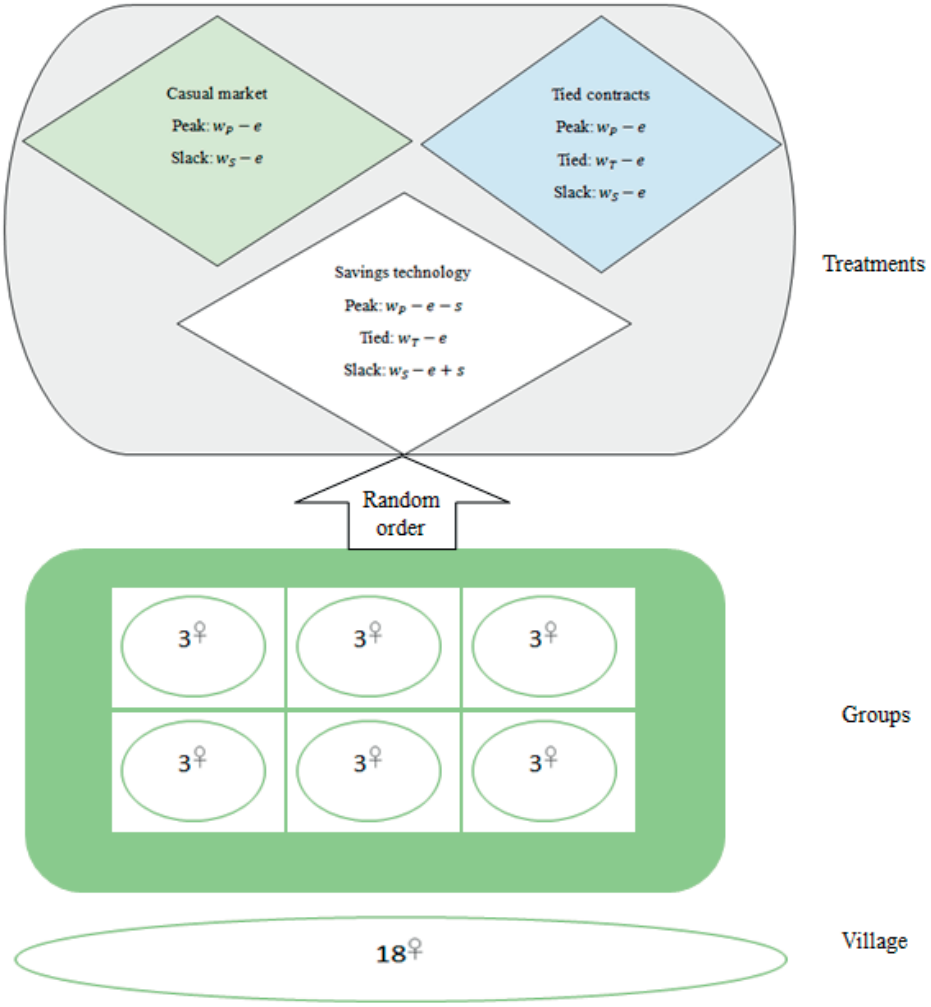

Figure 4C-1: Experiment groups and calculation of worker's earnings per treatment. The 18 randomly selected participants from the village were randomly grouped into 6 groups. Each group consisted of 1 randomly selected Landlord and 2 workers. Each group separately and simultaneously engaged in all treatments according to the random order corresponding to the particular village.

Appendix 2D: Variable definitions

Farm size: Total size of participant's household farm in acres.
Farm output: Average worth of the participant's household farm output per cropping season in million Uganda shillings.
Tied workers employed: Number of tied workers employed on the participant's household farm.
Casual workers employed: Number of casual workers employed on the participant's household farm.
Age: Age of participant in years.
Female: A dummy variable taking 1 if the participant is female and 0 otherwise.
Major occupation-farming: A dummy variable taking 1 if participant's major occupation is farming, and 0 otherwise.
Primary education: A dummy variable taking 1 if participant's education attainment is primary level and above, and 0 otherwise.
Post-primary education: A dummy variable taking 1 if participant's education attainment is ordinary level and above, and 0 otherwise.
VSLA members: A dummy variable taking 1 if participant is a member of a VSLA, and 0 otherwise.
Peak wage offer: Amount of Uganda shillings offered by the landlord in the peak period.
Tied wage offer: Amount of money Uganda shillings offered by the landlord, same in the peak period, and in the slack period.
Slack wage offer: Amount of Uganda shillings offered by the landlord in the slack period.
Tied contracts: A dummy variable taking 1 for the treatment (market) when the landlord offers tied contracts and casual contracts, and workers cannot save, and 0 otherwise.
Savings technology: A dummy variable taking 1 for the treatment (market) when the landlord offers tied contracts and casual contracts, and workers can save, and 0 otherwise.
Casual market: A dummy variable taking 1 for the treatment (market) when the landlord offers only casual contracts, and no tied contracts and workers cannot save, and 0 otherwise.
Hypothetical low discount rate: A dummy variable taking 1 for a participant with low discount rate, and 0 otherwise.
Hypothetical risk averseness: A dummy variable taking 1 for a risk averse participant, and 0 otherwise.
Landlord dummies: Are dummy variables taking 1 for a particular landlord and 0 otherwise.
Year dummies: Are dummy variables taking 1 for a particular hypothetical year, and 0 otherwise.

Appendix 2E: Learning Effect

Table 2E 1: Estimates of average wage offers, early and late years

-

	Average wage offer					
	Year 1 & 2			Year 3 & 4		
	(1)	(2)	(3)	(4)	(5)	(6)
Peak wage offer	3,001.67***	2,421.25***	2,526.67***	3,401.25***	2,500.00***	2,635.83***
	(147.35)	(154.07)	(187.74)	(188.15)	(220.38)	(173.64)
Tied wage offer		1,332.92***	1,345.83***		1,294.58***	1,393.33***
		(99.66)	(106.22)		(169.10)	(97.93)
Slack wage offer	2,257.50***	2,172.50***	2,262.50***	2,272.50***	2,320.83***	2,250.83***
	(66.23)	(70.10)	(64.15)	(57.37)	(137.17)	(58.26)
Observations	240	360	360	240	360	360
R-squared	0.688	0.471	0.429	0.666	0.367	0.501
Prediction 1i: $\theta_1 > 0$	[0.00]	-	-	[0.00]	-	-
Prediction 2i: $\varphi_2 > 0$	-	[0.00]	-	-	[0.00]	-
Prediction 2i:$\varphi_1 - \varphi_2 > 0$	-	[0.00]	-	-	[0.00]	-
Prediction 2ii: $\varphi_2 < \frac{\hat{\theta}_1}{2}$	-	[0.01]	-	-	[0.00]	-
Prediction 3iii: $\varphi_2 = \frac{\varphi_1}{2}$	-	-	[0.53]	-	-	[0.52]

Robust standard errors in parentheses. Standard errors clustered at landlord level. ***p < 0.01.. p values in brackets.

Table 2E-2: Impact of markets on average wage offers, early and late years

	Average wage offer					
	Year 1 & 2			Year 3 & 4		
	(1)	(2)	(3)	(4)	(5)	(6)
	Slack	Peak	Tied	Slack	Peak	Tied
Tied Contracts	-85.00	-665.42***		48.33	-852.92***	
	(63.02)	(156.62)		(145.04)	(194.53)	
Savings technology	5.00	-470.00**	102.92	-21.67	-787.08***	28.75
	(74.59)	(193.10)	(78.58)	(53.29)	(195.24)	(94.74)
Casual market	2,257.50***	5,259.17***	3,505.42***	2,272.50***	5,673.75***	3,615.42***
	(66.28)	(156.36)	(98.34)	(57.41)	(207.10)	(107.73)
Observations	360	360	240	360	360	240
R-squared	0.005	0.032	0.003	0.001	0.055	0.000
Prediction 2iii:$\beta_1^P < 0$	-	[0.00]	-	-	[0.00]	-
Prediction 3i: $\beta_1^T = 0$	-	-	[0.33]	-	-	[0.63]
Prediction 3ii:$\beta_2^P = \beta_1^P$	-	[0.20]	-	-	[0.76]	-

Robust standard errors in parentheses. Standard errors clustered at landlord level. ***p < 0.01. **p < 0.05. p-values in brackets.

Table 2E-3: Savings Behaviour, early and late years

	Dependent variable: Optimal savings (-) actual savings	
	Year 1 & 2	Year 3 & 4
	(1)	(2)
Constant, $\hat{S}_0$	-9.66	96.36
	(168.23)	(175.25)
Hypothetical Low discount rate	507.99**	282.22
	(191.88)	(205.87)
Hypothetical Risk averseness	26.65	215.61
	(201.84)	(175.48)
Post-primary education	15.85	-125.80
	(195.55)	(207.57)
N	236	236
R-squared	0.049	0.031
Prediction 3iv: $S_0 = 0$	[0.95]	[0.58]

Robust standard errors in parentheses. Standard errors clustered at landlord level. **$p < 0.05$. p-values in brackets.

Chapter 3

Self-Image Motives and the Supply of Work Effort: Experimental Evidence from Uganda

Abstract

While the theory of self-signalling proposes that subjects engage in (costly) behaviour to invest in (or preserve) a cherished self-image, the theory of motivated reasoning suggests they only need "the thinnest of veils" to justify selfish behaviour and shed such behavioural imperatives. We set out to test self-signalling and motivated reasoning in a real effort experiment in peri-urban Uganda. During one stage of this experiment subjects may supply effort in a tedious (repeated) task without obvious extrinsic and intrinsic payoffs. Patterns in the effort data are consistent with theoretical predictions of a self-image model: subjects provide costly effort even in the absence of conventional payoffs, and work harder if they were treated more generously and "fairly" during earlier stages of the experiment. This behaviour persists across experimental rounds.

This chapter is based on:
Nanyiti, A., Pamuk, H., & Bulte, E. (2019). Self-Image and the Supply of Work Effort: Experimental Evidence from Uganda. Paper being considered for publication.

3.1 Introduction

The supply of effort by workers is a classical research topic in economics, and the implications of asymmetric information and incomplete contracting (moral hazard and adverse selection) in labour markets have been studied in detail by generations of economists. Traditionally, economists emphasize the importance of extrinsic motives, or (the expectation of future) monetary payoffs. The basic model rests on the assumption that workers prefer leisure over working, and are prone to shirk in a context of imperfect information about their performance. One of the key challenges for firms is to provide appropriate (extrinsic) incentives to motivate workers to supply effort. However, many economists nowadays agree that the basic model of effort provision is too simple to explain variation in effort levels observed in labour markets.

Richer models of effort provision include intrinsic motives to work and social image concerns of workers (and possibly peer pressure). Intrinsic motives for the supply of effort include preferences for the payoffs of others, arising because of altruism, a desire for reciprocity, or guilt aversion. The relevant literature includes, but is not limited to, Akerlof (1982); Battigalli et al. (2013); Battigalli and Dufwenberg (2007); Charness and Dufwenberg (2006); Charness and Gneezy (2008); Dufwenberg et al. (2011); Fehr and Schmidt (1999); Lundquist et al. (2009), Mellström and Johannesson (2008), and Pepper et al. (2015). Social image motivations refer to others' perceptions, and include reputation effects or gains in social approval. These different types of motives may interact, and produce complex behaviour patterns. For example, monetary incentives may backfire and undermine intrinsic or image motives for prosocial behaviour (e.g., Gneezy & Rustichini 2000a,b; Fehr & Falk 2002, Gneezy et al. 2011), because they shift the decision frame of economic actors (Deci 1971, Heyman & Ariely 2004), or dilute the signalling

value of prosocial actions — "is the person acting pro-socially trying to do good or to do well?" (Benabou & Tirole 2006; Ariely et al. 2009). In a related analysis, Falk and Kosfeld (2006) study the interaction between a principal and agent where the principal can implement a minimum performance requirement.

More recently, Benabou and Tirole (2006, 2011, 2016) have proposed a complementary behavioural theory that readily extends to the workplace. According to their theory of self-signalling, economic agents care about "who they are" and form beliefs about their own type or identity. Assuming past states are imperfectly accessible and that actions are more readily recalled (or documented) than the underlying motives, people may refer to their own past actions to learn about their deep preferences and social identity. If certain identities or self-images are more desirable than others – most people prefer to think of themselves as trustworthy, hard-working or generous individuals – then people may signal behaviours associated with these types to themselves, in order to create or protect positive self-images (Bénabou & Tirole, 2006; Ellingsen & Johannesson, 2008). Since acting lazily in a workplace environment violates the self-image of being diligent and industrious, shirking makes it more difficult to uphold the cherished belief that one is, really, a hard-working individual. Self-signaling by avoiding undesirable behavior is therefore one way to reduce cognitive dissonance and its discomforts.

Of course there are alternative approaches to deal with cognitive dissonance. Epley and Gilovich (2016) describe how "motivated reasoning" reduces tensions between identity-based behavioural rules and actual behaviour, and can be used to rationalize undesirable behaviour. To maintain a sense of coherence between one's actions and a valued self-image, agents may display information-averting behaviour, or exploit uncertainties and ambiguities in the decision context to create "moral wiggle room" (e.g., Gino et al., 2016). Acting egoistically may be

reconciled with a positive self-image ("I am a moral person") if the other person – the one adversely affected by the egoistic act – actually *deserved* to be treated badly. For example, acting lazily may be justified if the employer pays wages that are indecently low, or unfair.

We are the first to use an experimental approach to study self-signalling and motivated reasoning in a setting mimicking the workplace – a context in which beliefs about identity are important. We use a two-stage framed field real-effort experiment in rural Uganda. In the first stage of our experiment a principal (employer) and agent (worker) interact in the context of an ultimatum game. The principal offers a share of his endowment as a wage transfer to the agent, and the agent accepts or rejects this offer. If she rejects the offer both subjects earn nothing in that experimental round. If she accepts the offer the endowment is split as agreed. In the second stage of the experiment, the agent is invited to sort beans in a tedious 4-minutes real effort task. Importantly, payoffs of *neither* the principal *nor* the agent vary with the quantity of beans sorted – eliminating traditional extrinsic and intrinsic motives to supply effort. The design also does not enable the agent to send signals to the principal as the principal does not observe individual output levels. However, it does not eliminate the possibility to send signals to future selves, including the following: "I am not a free rider or slacker who happily accepts transfers without doing anything in return."

We use the theory of motivated reasoning to probe whether the level of effort, or the propensity to engage in costly self-signalling, varies with the wage offer of the principal. Specifically, the ultimatum stage of the experiment introduces variation in both the *level* of the agent's payment as well as variation in the "*gap*" between her earnings and those of the principal. Agents seeking to preserve a positive self-image as a hard-working and trustworthy person may be willing to supply effort even in the absence of any monetary payoff to anybody.

But the theory of motivated reasoning predicts that agents only need the "thinnest of veils" to find an excuse for shedding such costly identity-based actions – and start shirking (Benabou & Tirole, 2016; Epley & Gilovich, 2016; Gino et al., 2016). If this hypothesis holds, variation in the earnings structure implies variation in the degree to which it is costly to display behaviour that violates one's positive self-image. Or rather, variation in the degree to which it is costly to avoid behaviour that confirms one's positive self-image.

Our main results are as follows. First, consistent with self-image considerations we find that agents voluntarily supply positive effort levels even in the absence of conventional motives (i.e., with an earnings structure based on lump sum transfers). Second, the salience of self-image interacts varies with the decision context and our empirical results are consistent with motivated reasoning – agents supply less effort when working in a context that morally "justifies" lazy behaviour. This occurs when the principal is less generous or when the division of surplus is less equitable. Both higher and fairer wages accentuate worker effort, consistent with our predictions about the salience of self-image concerns. Importantly, we also find that self-signalling persists across rounds of experimental play (effort levels do not dwindle towards zero), and we verify there is no "reverse link" between effort and future earnings or wage offers in the experiment – lagged effort by the agent in round t does not predict the principal's offer in round t+1. We also explain variation in the intensity of self-signalling, and find that gender and age matter: young men are especially prone to such behaviour.

This chapter is organized as follows. In section 3.2 we discuss the relevant literature, and introduce some notation to highlight the main ideas behind the empirical analysis. In section 3.3 we present our experimental set-up, and summarize our data. Section 3.4 outlines our

identification strategy, and section 3.5 presents our empirical results. The discussion and conclusions ensue in section 3.6.

3.2 Conceptual Framework

A large literature on effort supply has highlighted the importance of extrinsic motives such as wages and bonuses (e.g., Gneezy & Rustichini, 2000a,b; Bellemare & Shearer, 2009) and intrinsic motives (e.g., Clark et al. 2010; Falk & Fehr, 2003; Falk et al. 1999). Theory by Akerlof (1982) showed that workers' effort may exceed minimum performance levels in exchange for higher wages. This is supported by experimental evidence, showing that behaviour of employers and workers can take the form of gift exchange – high wages in return for high effort levels (Fehr et al., 1993 and Fehr et al. 1997) – even if the persistence of the gift exchange effect over time has been debated (e.g., Gneezy & List 2006; Kube et al. 2012). The interaction between extrinsic and intrinsic motives, and especially the "crowding out effect" of the former on the latter, has been studied in some detail – monetary incentives may undermine incentives for voluntary donations or work (e.g., Benabou & Tirole 2003, Mellström & Johannesson 2008, Ariely et al. 2009).

Other factors also explain behavior of professionals on the work floor. Akerlof and Kranton (2005) show that the self-image of workers, and their ideals about how jobs should be done, can serve as an incentive in the work place. To motivate our work, we follow Bénabou and Tirole (2006, 2011, 2016), who model beliefs as assets. People care about their identity and infer their values and preferences from past behaviour. The formation of beliefs about one's identity depends on "demand" and "supply" side considerations. "Demand" for a moral identity may follow from affective or consumptive benefits (Brunnermeier & Parker 2005) or from functional (instrumental) benefits (Battaglini et al., 2005). The "supply side" is characterized by imperfect

memory of past motivations. Since past behaviour is typically better recorded and more accessible than past motives, people tend to judge themselves by their own actions. This results in identity investments, where behaviour today affects the formation of beliefs about one's morality tomorrow. Rich theoretical analysis demonstrates that behavioural models based on identity investments and beliefs as assets explain a range of behaviours that are difficult to reconcile with more conventional economic models (Benabou & Tirole 2011).

The theory of self-signalling also speaks to behaviour in the workplace if people value certain work-related identities more than others. This is arguably the case, as evidence suggests many workers care about moral motives and provide effort out of a sense of duty. For example, Minkler (2004) presents survey evidence suggesting that moral motivations may be more widespread among US workers than any other motive for working hard.

To illustrate our main idea, consider a simple principal-agent model. We have in mind an agricultural context with multiple years and two production seasons per year: a peak season (*H*) with high potential payoffs and a slack season (*L*) with low potential payoffs. When successfully matched with an agent (worker), at the end of the season the principal (landlord or employer) earns a gross season-specific payoff q_i, where $i=H,L$ and where $q_H>q_L$. To secure a match, the principal offers part of this endowment, w, to the worker. If the agent accepts the offer the principal's net monetary payoff are $q_i–w$. In case the agent refuses the offer both parties earn nothing. Next, assume the agent has to decide how much effort to allocate to an arbitrary follow-up task. Importantly, in our stylized model (and experiment below), *effort levels do not affect anybody's monetary earnings* – these payoffs depend only on how the fixed, season-specific endowment is shared (see below).

We start by assuming a rather general utility function for both the principal and agent that includes, in addition to own monetary payoffs, measures of altruism and behindness aversion. Per season utility functions capturing intrinsic and extrinsic motives of principal *p* and agent *a* are given by:

$$u^p(q_i, w, \alpha, \beta) = q_i - w + \alpha_p w - \beta_p(2w - q_i - c_0) \quad \text{and} \qquad (3.1)$$

$$u^a(q_i, w, e, \alpha, \delta) = w + \alpha_a(q_i - w) - \beta_a(q_i - 2w + c_0) - c_0 - c(e), \qquad (3.2)$$

where $j \in (p, a)$, α_j is the weight associated with payoffs of the partner (altruism), β_j is a scaling parameter converting inequality in earnings into a measure of utility, c_0 is a fixed cost of match-making for the agent (e.g. capturing commuting cost), e denotes work effort, and $c(e)$ captures the costs associated with supplying effort (with $c'(e) > 0$, and $c''(e) > 0$). In the original Fehr and Schmidt (1999) model the specification is $u^p(x) = x_p - \beta_p max\{x_a - x_p, 0\} - \delta_p max\{x_p - x_a, 0\}; a \neq p$. Hence $x_p = q_i - w$ and $x_a = w - c_0$. To make the exposition easier we assume $q_i - w > w - c_0$ which is in line with experimental data – please see details below. We also assume that agents do not suffer utility loss from advantageous inequality which implies that $\delta_p = 0$. In the absence of any benefits associated with the provision of effort – for neither principal nor agent – (3.2) predicts that a utility-maximizing agent ends up at a corner solution: the optimal amount of effort equals zero, e^*=0.

Next, consider an augmented utility function for the agent that includes a desire for a positive self-image. Specifically, assume that worker *i* believes the proper (or moral) response for a hard-working individual receiving transfer *w* is to supply effort, for example because withholding effort is associated with the behaviour of a slacker or free rider. This behavioural response should not be interpreted as reciprocity, because positive effort levels do not make the principal better off. Fehr and Falk (2002) write that a reciprocal agent values the material payoffs

of the principal, motivating either friendly or retaliatory behaviour. Reciprocal behaviour typically depends both on consequences (outcomes) as well as intentions of the other player – see Falk and Fischbacher (2006) for a theory of reciprocity. The purpose of working is to alleviate the tension between actual behaviour and an image-based behavioural imperative.

We follow Benabou and Tirole's (2011) self-esteem model and augment the agent's utility function to enable self-signalling. Assume agents can send a signal about their own type by respecting the norm stipulating that effort should be supplied in response to receiving payment. We will augment the agent's utility function to include self-image benefits $V_k(I)$.

$$u_k^a(q_i, w, e, \alpha, \delta) = w + \alpha_a(q_i - w) - \beta_a(q_i - 2w + c_0) - c_0 - c_k(e) + V_k(I) \quad (3.3)$$

where k denotes agent type. Assume there are two "types" of individuals in society – hard-working ones, or "the cherished type," with associated image-based utility v_h, and cost of effort c_h and lazy workers with associated image-based utility v_l and cost of effort c_l. Naturally we assume that $v_h > v_l$, and also that effort is less costly for hardworking agents than for lazy agents (such that $c_h(e) < c_l(e)$ with $c_h'(e) < c_l'(e)$ and $c_h''(e) < c_l''(e)$). Define the population share of hard-working individuals by ρ. At the start of a period, during a "momentary insight into his true nature," an individual receives a signal about her type. At the end of the period, agents can remember this signal with probability φ (and they forget with probability (1-φ)). If an agent forgot her type, she refers back to her own behaviour and tries to infer her type from past choices with respect to effort, *e*.

End of period expected utility associated with the agent's self-image is defined as follows:

$$V_k(\hat{I}) = \varphi v_k + [1 - \varphi][\hat{\rho}(e)v_h + [1 - \hat{\rho}(e)]v_l] \quad (3.4)$$

where $\hat{\rho}(e)$ is the probability that the agent has formed the belief to be of the hardworking type. The specification in (3.4) assumes that lagged effort serves as a signal of being hardworking, $\hat{\rho}'(e) > 0$. Supplying low levels of effort (or no effort at all) may inform the agent that she is of the lazy type. Motivated reasoning, however, implies the salience of respecting behavioural norms varies with details of the payment received: "bad wages" create moral wiggle room justifying lazy behaviour. Specifically, we assume salience of the norm is a function of (i) the level of the wage (or the size of the transfer), and (ii) the perceived fairness of the wage (based on how a surplus is divided between the principal and agent – refer to Hennig-Schmidt et al., 2010). The extent to which agents feel more morally-bound to behave in accordance with the imperative is increasing in the wage level (w) as well as in the share of the total endowment offered to them (w/q). The assumption that an increasing share offered to the agent is "fairer" only makes sense if this share is less than half of the endowment, because in case the agent receives more than 50% of the endowment a further increase in the proposed wage will make the proposed allocation less fair. This condition is typically satisfied in our data – see below. We assume the salience of the norm in a particular context affects whether or not behaviour in that context provides a reliable "signal" of one's type. Specifically, if the norm is not salient, agents may discount any signal of being a lazy individual.

We define $S = S(w, q)$ as an indicator function, taking the value of either zero or one. In case S=1, the signal must be considered informative.

$$S(w, q_i) := \begin{cases} 1, & w \geq \epsilon_w \; or \; \dfrac{w}{q_i - w} \geq \epsilon_q \\ 0, & w < \epsilon_w \; and \; \dfrac{w}{q_i - w} < \epsilon_q \end{cases}$$

where ϵ_w and ϵ_q are threshold levels for wage and fairness, independently distributed between agents, respectively assigned from cumulative distribution functions $G(w)$ and $G(q)$, and publicly observable as well as verifiable.

The case *S*=1 indicates the signal is informative, or that the offered wage *w* was "sufficiently high" ($w > \epsilon_w$) or the proposed split of the endowment was "sufficiently fair" ($\frac{w}{q_i - w} > \epsilon_q$). Conversely, the case *S*=0 indicates outcomes where the signal is uninformative, creating moral wiggle room for the agent. Hence we can define the probability of receiving a signal that is informative, $\Pr(S = 1)$, as a function of wage and endowment, $\sigma(w, q_i) = \Pr(w \geq \epsilon_w \cup \frac{w}{q_i - w} \geq \epsilon_q)$, such that (i) $\sigma_w(w, q_i) > 0$ and (ii) $\sigma(w, q_H) < \sigma(w, q_L)$ (for given wage *w* and $q_H > q_L$).

We can now rewrite (3.4) as:

$$V_k(\hat{I}) = \varphi v_k + [1 - \varphi]\big[[1 - \sigma(w, q_i)][\rho v_h + (1 - \rho)v_l] + \sigma(w, q_i)[\hat{\rho}(e)v_h + [1 - \hat{\rho}(e)]v_l]\big]$$

where we assume that, in case of an uninformative signal (with probability $1 - \sigma(w, q_i)$), the agent simply uses the population share ρ to estimate her probability of being of the hard-working type. Observe that identity-based payoffs as modelled above introduce the possibility for agents to work hard for informational purposes – to create a signal of one's type and increase the probability of enjoying v_h.

Because the employer has a first-mover advantage, she offers the reservation wage to the agent in equilibrium. Normalize to zero the agent's utility in case no match eventuates, so that the expected reservation utility of agent $k=\{h,l\}$ with $c_k(e)$ satisfies:

$$u_k^a(q_i, w, e) = w + \alpha_a(q_i - w) - \beta_a(q_i - 2w + c_0) - c_0 - c_k(e) + \varphi v_k +$$
$$[1 - \varphi]\big[[1 - \sigma(w, q_i)][\rho v_h + (1 - \rho)v_l] + \sigma(w, q_i)[\hat{\rho}(e)v_h + [1 - \hat{\rho}(e)]v_l]\big] \geq 0. \qquad (3.5)$$

The equilibrium wage (w^*) is given by $w^* = \underline{w}(\alpha_a, \beta_a, c_0, \varphi, e, v_h, v_l, q_i)$ where $\underline{w}$ is the reservation wage: $u_a(q_i, \underline{w}, e) = 0$. Given w^* and q_i, the agent chooses the optimum effort level e_i^* satisfying the following first order condition:

$$c_k'(e^*) = (1-\varphi)\sigma(w^*, q_i)\hat{\rho}'(e^*)(v_h - v_l), \qquad (3.6)$$

where we assume a positive equilibrium effort level exists, $e^* > 0$. Through comparative statistics we now obtain the following testable predictions:

1. $\frac{de^*}{dw^*} = \frac{(1-\varphi)\sigma_w(w^*,q_i)\hat{\rho}'(e)(v_h-v_l)}{c_k''(e)} > 0$: in the absence of monetary payoffs to effort, and for a given endowment level q_i, agents supply more effort if they receive a higher wage w_i;
2. $\frac{de^*}{dq_i^*} = \frac{[\sigma(w^*,q_H)-\sigma(w^*,q_L)](1-\varphi)\hat{\rho}'(e)(v_h-v_l)}{c_k''(e^*)} < 0$: given $\sigma(w^*, q_H) < \sigma(w^*, q_L)$, the level of effort supplied by self-image preserving agents goes down if the wage offer is more unfair (i.e. given wage offer w, agents supply less effort if the total endowment q_i is larger).

We designed and implemented an experiment to test these predictions.

3.3 Experiment and data

We use data from a two-stage framed field experiment organized at ten randomly selected villages in Mityana district, Central Uganda in May 2014. For several reasons Uganda is a relevant place to study self-image in the workplace. The belief in hard work and intrinsic appreciation of work, the so called protestant work ethic (PWE), is deeply embedded in Ugandan culture (van Hoorn & Maseland, 2013; Shirokanova, 2015). In terms of PWE, Ugandan university students score higher than British university students (Baguma & Furnham, 1993), and case study evidence suggests that especially men gain (self) respect from being a hard worker that provides for the family (Siu et al., 2012).

The district we conducted the study is largely rural, with agriculture as the main economic activity. Households in the study area typically engage in crop cultivation on their own landholdings, or on small plots they rent in. While farm activity is mainly sustained by family labour, many household members also engage in off-farm activities (e.g. casual labour) to earn additional income. Much of the output produced on the farm is for own consumption, with surpluses sold mainly on local markets. Social groups like burial societies, women groups, and vending groups are common in the district. A potential drawback of our design is that many of our subjects knew each other, so that investing in a positive social-image may be as important as investing in a positive self-image. We explain below how we try to attenuate this concern.

In each village we randomly selected eighteen people to participate in the experiment. Per village we conducted three experimental sessions. After explaining the experimental protocol (see appendix 3A), we randomly grouped participants into three groups of six persons. One randomly selected member per group was subsequently assigned the role of principal (landlord) and the other five members were agents (workers). These roles were fixed throughout the experiment. In total, therefore, 30 principals and 145 workers participated in the experiment. The experiment took four "years" with two alternating agricultural "seasons" per year, or 8 seasons (experimental rounds): four peak seasons with high endowments and four slack seasons with low endowments. All subjects were informed about the number of rounds, and were told that the experiment was a one-time event (i.e. that the experimenter would not return to their village for additional experiments).

Depending on the season principals could earn a high or low endowment: $(q_i) \in (q_h, q_l)$ for every successful match. The maximum number of matches per round was five per group as there were five agents per principal (the minimum number of matches was obviously zero). In

the first stage, the principal offered one fixed "wage" to his five agents: $w^* \in [0, q_i]$. Each agent in the group individually accepted or rejected the (common) wage offer. A match ensued in case an agent accepted the wage offer and the experimental earnings for the agent equaled the accepted wage minus a fixed cost: $w–c_0$. The experimental earnings of the principal were given by $(q_i–w)$. Payoff functions were public knowledge for all participants.

In the second stage of an experimental round the agent was invited to engage in a real effort task: upon accepting the wage offer, the agent received 500 grams of mixed yellow and maroon beans and was invited to sort these beans based on colour for a period of four minutes. Agents were reminded that neither their payoffs nor those of the principal were affected by the amount of effort supplied or the quantity of beans sorted. While all agents participating in the session were present in the same room, they enjoyed considerable privacy as they were spread out to attenuate competitive dynamics. The principal was also present in the same room, but did not face the agents. After the sorting stage enumerators weighed the beans and recorded the number of grams sorted. Weighing of sorted beans was always done in front of the agent. The principal was never informed about the amount sorted by individual agents, nor were the other agents – attenuating concerns about social imaging. After weighing, enumerators collected sorted and unsorted beans from all agents and then carried all beans to the principal and asked the principal to mix the beans again and make new packs of 500 grams for the next season. After each round, enumerators informed the principal about the number of agents that accepted the wage offer. There was no direct communication between principals and agents, or between agents: all communication was via the enumerator.

The earnings structure of the experiment was designed to eliminate the scope for reciprocal behaviour. Moreover, individual workers could not signal their appreciation for

generous offers to their principal by "working hard" as the principals only received beans from "their workers" altogether. While they had some sense of how much the workers had sorted, principals did not receive detailed feedback about amounts sorted, and typically did not care about that either. The scope for reciprocity towards the experimental team was also quite limited: since sorted beans were mixed again at the end of each round, in the presence of the workers, workers knew they were not producing anything that was inherently valued by the experimenter. Of course, as in other lab-style experiments, it is also possible that the agent's behaviour is affected by scrutiny (e.g. Levitt & List, 2007). However, we believe there is little reason to expect that effort motivated by the experimenter's scrutiny will vary with wages as predicted by the theoretical model.

Payments were made immediately after the experiment. At the end of the experiment, we paid players for one randomly picked round: agents randomly drew one out of eight rounds, and principals drew one outcome for payment out of their 40 experimental outcomes (eight rounds times five workers per round). In one of the villages we had five workers less and in one other village one worker missed one high round and two low rounds. We used the following parameters to specify the payoff functions: $(q_h, q_l) = (\text{UGX } 20{,}000,\ \text{UGX } 5{,}000)$ and $c_0 = \text{UGX } 1{,}000$. USD 1 exchanged for UGX 2,600 at the time of experiment. Experimental payments were consistent with the daily equivalent of farm work, on average around 5000 and 6000 UGX. Since stakes in the peak season were four times higher than in the slack season, a fair or inequality-averse principal should increase the wage offer to agents in the peak season. Subjects were reminded of the size of the endowment at the start of every round. To make sure that subjects fully understood the instructions we played two trial rounds of the experiment. The experiment is summarized in a Figure in Appendix 3B.

Table 3.1: Social-economic characteristics of participants

	Principals (N=30)		Agents (N=145)		P(1=2)
Variable	Mean (1)	SD	Mean (2)	SD	
Total land area (acres)	2.62	2.72	3.78	5.18	0.24
Farm size (acres)	2.25	1.74	2.51	2.05	0.52
Farm output (million shillings)	1.01	0.98	1.11	1.17	0.67
Casual workers employed	2	1.41	2	1.70	0.60
Age	38.1	11.67	40.9	14.1	0.32
Female	0.43	0.50	0.40	0.49	0.68
Major occupation-farming	0.50	0.51	0.56	0.50	0.56
Primary education	0.97	0.18	0.92	0.28	0.35
Post-primary education	0.27	0.44	0.38	0.49	0.24

We recorded wage offers and effort (grams sorted) across rounds, and organized a short exit survey with questions about social-economic and demographic characteristics. Table 3.1 summarizes key principal and agent characteristics and provides a balance test to verify whether random assignment "worked". Half of our subjects mainly derive their income from farming, and 40 percent of our subjects are women. Most subjects finished primary school and own a small area of land. The balance check indicates there are no significant differences between the two experimental groups in terms of observables. On average, agents sorted 219 (218) grams in the slack (peak) season, and the average wage offer was UGX 2200 (5200), respectively. On average, therefore, the endowment is distributed much more fairly in the slack season than in the peak season. In the low season workers on average secured 44% of the endowment, but in the peak season the mean offer was only 26%. There was considerable variation in wage offers: the standard deviation was UGX 401 (1633) in the slack (peak) season. Acceptance rates were very

high across the seasons: 92% for the slack seasons, and 95% for the peak seasons (statistically identical: p=0.54).

3.4 Identification

3.4.1 Self-image motivated effort and wage

We probe the relationship between wage offers, fairness and effort, and estimate the following model:

$$Effort_{jir} = \beta_0 + \beta_1 w_{ir} + \beta_2 q_h + \varepsilon_{jir} \quad (3.7)$$

where $Effort_{jir}$ is the number of grams of sorted beans for worker j, given endowment i and round r. Effort equals zero in case the worker does not accept the wage offered in that round, but may also equal zero for agents accepting the offer and subsequently refusing to do work that does not yield tangible benefits. Next, w_{ir} is the wage offer in 1000 Uganda shillings in round r, q_h is a dummy indicating "peak season rounds" with high endowments, and ε_{jir} is the error term. The estimated coefficients β_1 and β_2 measure the effect of wages and endowments on effort.

We predict that for agents wishing to invest in creating or maintaining a positive self-image, high wages increase effort: $\beta_1 > 0$. In addition, the distribution of the endowment may be important. Our simple model predicts that, to maintain a positive self-image, agents will supply more effort if they feel a given endowment is more fairly (equally) shared. To test this hypothesis we consider coefficient β_2. For a given wage w a greater endowment q makes the allocation less equal (for $w< q/2$, as was nearly always the case in the experiment). Any positive effect of wages on effort is attenuated by self-image motives in high endowment period as, *ceteris paribus*, the wage offer is seen as less equal. All else equal, higher earnings for the principal are more likely to facilitate motivated reasoning by the agent – letting her "off the

hook" and justifying lazy behaviour. We also explore alternative measures of fairness, below, including one that is consistent with the theoretical model: $w/(q-w)$.

To check the robustness and stability of our estimates, we vary the specification of model (3.7) and use different estimators. We estimate simple Tobit model models for censored data outcome variables without controls, and check the robustness of the results by estimating OLS models. To control for learning effects we add year fixed effects to the specification. To control for unobserved village characteristics we also add village fixed effects.

As an additional robustness check, we test our hypothesis focusing on the subsample of workers accepting the wage offer. We estimate a Heckman selection model based on (3.7) and the following selection equation:

$$Accept_{jir} = \alpha_0 + \alpha_1 w_{ir} + \alpha_2 q_h + \alpha_3' I_l + \varepsilon_{jir} \qquad (3.8)$$

where $Accept_{jir}$ is a dummy variable taking the value 1 if the worker accepts the wage offer, (0 otherwise) and I_l is a vector of exogenous instruments (subscript l indicates the principal). As instruments we use principal characteristics which may affect acceptance of the wage offer: a wealth dummy (taking value 1 if the principal has a farm larger than 2.5 acres, employs more than 1 casual worker, and has farm output exceeding UGX 1 million per season)[11] and a gender dummy. We conjecture these variables are correlated with acceptance but not with worker effort, as effort does not affect payoffs and principals do not know how much effort the worker provided. We estimate the model using Maximum Likelihood estimation, and control for learning and village fixed effects by adding year and village dummies.[12]

[11] These threshold values are based on the sample means.

[12] Our coefficient estimates are not different when we use the alternative method to estimate the model; two-step estimation. However standard errors are larger as the two-step estimation approach is less efficient.

3.4.2 Heterogeneity and time persistence of self-image motivated effort

How are self-image motives distributed in the population? Is self-image equally salient and important for all agents, or do some agents respond more strongly to high wages to protect their self-image? In the absence of theory or prior empirical evidence to guide our specifications, we view this part of the analysis as exploratory. We estimate model (3.7) for different subsamples of agents, distinguishing between social groups based on gender, age, education, and risk aversion (obtained via a hypothetical exit survey question). We next compare the coefficients of interest, β_1 and β_2 for these subsamples.

We are also interested in the persistence of the self-image motive over rounds of experimental play. Earlier work has cast doubts on the persistence of gift exchange behaviour over time, so it seems natural to ask whether self-image concerns lose salience after several rounds of experimental play. To address this issue we separately estimate (3.7) for "early years" (i.e. the first four seasons) and "late years" (the final four seasons) in the experiment and compare estimated coefficients to assess whether the effects of wages and fairness on effort wane over time.

3.4.3 Reciprocity, reverse causality, and competition

One concern challenging our approach to identifying self-image motives is that agents may use their effort to "signal something" to the principal in an effort to manipulate future wages. For example, by working harder they may invest in the (group) reputation of being trustworthy and hardworking, and therefore deserving of decent treatment (or high wage offers) in subsequent rounds. That is: effort by agents may invite reciprocal behaviour by the principal.

However, as mentioned, the scope for such signalling is extremely limited. There is also no signalling to other agents, as agents are only informed about their own output – not that of

others. It is unclear why the principal should care about effort supplied by his agents as this does not affect his payoffs. He also does not learn anything about individual effort, and only obtains a rough measure of aggregate effort (when mixing the bags for the next round) because he never receives an exact measurement of how many grams were sorted. Finally, the principal has to extend the same wage offer to his five agents, so agents seeking to signal have an incentive to free ride on the effort of other agents – any benefits from reputational investment will be shared with others. Nevertheless, to test whether effort affects future wage offers we estimate the following model:

$$w_{rt} = \delta_0 + \delta_1 Totaleffort_{r-1,t} + \delta_2 Totaleffort_{r-2,t} + \delta_2 q_h + \varepsilon_{rt}, \qquad (3.9)$$

where $Totaleffort_{ir-1}$ and $Totaleffort_{ir-2}$ capture lagged effort, or the total number of grams sorted by the five workers in the previous two rounds. We test whether $\delta_1 \neq 0$ and $\delta_2 \neq 0$ to assess whether there exists a reciprocal relationship between effort and wages.

Finally, we consider whether agents try to signal to each other or are engaged in competitive processes – supplying more effort if their peers work harder. To this end we will include a measure of aggregate quantity of beans sorted by co-workers as an additional control. Observe it is not obvious why interaction between agents would be mediated by the wage level.

3.5 Results

Table 3.2 summarizes our main results. Using various model specifications we ask whether wages and fairness explain variation in work effort. The first thing to observe is that the constant in the first model is different from zero. Our agents supply effort in the absence of material payoffs to themselves or their partner. Indeed, casual observations during the sorting stage of the experiment suggested that many agents worked hard to sort beans, occasionally at

considerable discomfort to themselves. To assess whether the supply of effort is driven by self-image considerations we consider whether model predictions are supported by our data.

First, and consistent with our predictions, we consistently find that agents supply more effort when receiving a higher wage in the first stage of that round. The magnitude of this wage effect is robust across specifications: an increase in the wage by UGX 1000 translates into 10 grams of extra beans sorted. The average wage offer (across peak and slack seasons) amounted to UGX 3,700, so the average effect of wages on effort equals 37 grams, or some 17% of the average quantity sorted. Workers sort 1.7% percent (3.7 grams) more after a 10 percent increase in wage offers. This result robustly emerges across all specifications; for models based on OLS and Tobit estimators, and for models including or excluding year and village fixed effects.

Table 3.2: Wages, fairness and effort

	Effort			
	(1)	(2)	(3)	(4)
Wage offer (UGX 1000)	10.751***	10.060***	8.816***	6.484***
	(2.80)	(2.65)	(2.61)	(2.02)
High endowment	-31.594***	-30.272***	-26.624***	-19.689***
	(9.71)	(9.11)	(9.04)	(7.47)
Constant	192.787***	196.484***	178.861***	161.219***
	(9.24)	(8.67)	(10.45)	(8.71)
Observations	1,157	1,157	1,157	1,157
(Pseudo) R-squared	0.002	0.022	0.044	0.150
Method	Tobit	OLS	OLS	OLS
Year FE	NO	NO	YES	YES
Village FE	NO	NO	NO	YES
Prediction 1: $\beta_1 = 0$	[0.00]	[0.00]	[0.00]	[0.00]
Prediction 2: $\beta_2 = 0$	[0.00]	[0.00]	[0.00]	[0.01]

Robust standard errors, clustered at group and year level in parentheses. *** $p < 0.01$, p-values in brackets. Wage offer is amount in shillings offered by the principal each round, and high endowment is a dummy for high season rounds.

Table 3.2 also reveals that, controlling for the wage that is offered to them, agents work less hard in "peak seasons" when the principal earns more. The wage offer was, on average,

much "fairer" in the slack season (44%, or UGX 2,200 out of an endowment of UGX 5,000) than in the "peak season" (26%, or UGX 5,200 out of an endowment of UGX 20,000). This is consistent with the idea that unfair compensation schemes erode the necessity to invest in self-image concerns, as proposed by the theory of motivated reasoning. Agents appear to search for an excuse to act in their own self-interest and avoid costly actions to maintain a positive self-image – "If the other guy acts badly, so can I…"

We probe the robustness of these results by using two alternative proxies of "fair wage offers." The variable *Fair1* is defined as the ratio of the proposed wage offer divided by earnings for the principal [or *wage*/(*endowment* – *wage*)]. Higher values of *Fair1* are associated with more equal distributions (this is true for realizations of variable *Fair1* in the range [0,1], which is the typical outcome – very few wage offers exceed half the endowment). The variable *Fair2* is a dummy referring to wage offers exceeding 40% of the endowment. Note that, unlike our high season dummy, these fairness proxies may introduce multicollinearity problems as they incorporate the wage offer, which also enters as a separate variable. However, qualitatively we find the same regression results as before: the wage level is positively correlated with effort, and the same is true for wages that are fairer or more equal. Regression results are reported in Appendix 3D.

Next, we test the robustness of our findings for the sub-sample of workers accepting the wage offer. Our Heckman selection model jointly estimates the effects of wage offers on acceptance and effort choice. Table 3.3 reports the estimation results. At the bottom of the Table, we report the *p*-value for the likelihood-ratio test for $\rho = 0$, comparing the joint likelihood of an independent model for the decision to accept the wage offer and a regression model on effort against the Heckman model likelihood, and λ which shows the selection effect. Since the *p*-value

is smaller than 0.01, our use of the Heckman model is justified, and the positive estimate for λ indicates that workers accepting the wage offer are more likely to exert high effort.

Column (1) of Table 3.3 reports the estimates for the selection equation. Workers receiving higher and fairer wage offers are more likely to accept the offer. The estimate for the wealth instrument is negative and statistically significant, implying that workers are less likely to accept wage offers from wealthy principals (perhaps suggesting inequality aversion, or envy). The gender of the principal does not matter for acceptance. The estimates in column (2) of the Table indicate that estimates based on the sample of accepting workers are consistent with our earlier findings: effort levels increase in the level and fairness of wage offers.

Table 3.3: Wages, fairness and effort (Heckman-selection-model)

	Accept wage offer	**Effort**
	(1)	(2)
Wage offer (UGX 1000)	0.182***	4.152**
	(0.06)	(1.78)
High endowment	-0.219	-18.345***
	(0.17)	(6.02)
Wealthy principal	-0.459***	
	(0.20)	
Male principal	0.076	
	(0.14)	
Constant	0.403	189.664***
	(0.22)	(6.49)
Observations	1,157	1,157
Year FE	YES	YES
Village FE	YES	YES
λ		46.097
ρ = 0		[0.00]
Prediction 1: $\beta_1 = 0$		[0.00]
Prediction 2: $\beta_2 = 0$		[0.01]

Robust standard errors, clustered at group and year level in parentheses. *** $p < 0.01$,** $p < 0.05$. p-values in brackets. Wage offer is amount in shillings offered by the principal each round, high endowment is a dummy for high season rounds, wealthy principal is dummy for wealthier principals, and male principal is a dummy for male principals.

Are self-image concerns equally relevant across all social groups? To answer this question we divided the population into subsamples and repeated the analysis. Coefficients of interest (those associated with the wage level and the endowment) are reported in Panel A of Table 3.4. Model estimates are based on an OLS specification that controls for "peak seasons," year and village fixed effects. Do higher wages invite a stronger behavioural response in some agents than in others? The regression results in the first column indeed support such a conjecture. Especially agents that are male, young or poorly educated respond strongly to wages. While we have no strong theoretical priors why self-image concerns are more salient for these social groups, we do observe that subjects with these characteristics are more likely to earn a livelihood by selling their labour on local labour markets as "casual workers," so that identity-based norms about proper working ethics may be especially relevant for them. The second column shows that young, poorly educated men are also the individuals who respond most strongly to the fairness of the proposed allocation.

Table 3.4: Heterogeneity and time persistence of the self-image motive

	Wage offer (UGX 1000)	High endowment
Panel A: Worker characteristics		
Female	-1.308	4.353
	(2.26)	(9.21)
Male	12.857***	-38.258***
	(2.36)	(8.60)
Young	7.346***	-26.765**
	(2.72)	(10.51)
Old	3.818	-8.384
	(2.88)	(9.96)
Post-primary	3.050	-5.142
	(3.08)	(9.62)
Primary and below	8.563***	-29.920***
	(2.46)	(9.35)
Risk averse	5.864***	-11.637
	(2.62)	(8.77)
Non risk averse	7.414***	-29.674***
	(2.78)	(10.69)
Panel B: Late vs. Early rounds		
Early rounds	10.229**	-29.200**
	(4.22)	(14.17)
Late rounds	7.846**	-24.852**
	(3.27)	(11.30)

Dependent variable in all models is effort. Robust standard errors, clustered at group and year level in parentheses. ***p<0.01, **p<0.05 . We control for year and village fixed effects in panel A and for year fixed effects in panel B.

Panel B of Table 3.4 presents regression results for the early and late periods separately to probe the persistence of self-image considerations. Our point estimates of the wage effect are nearly the same for the first four seasons as for the final four seasons (β=10.229 and β=7.846 respectively); agents increase their effort in response to higher wage offers during the entire experiment. It would be worthwhile to explore whether similar findings are obtained over longer time frames within a real "field setting." If so, self-signalling may prove to be more persistent than signaling to others in the context of gift exchange.

Table 3.5: Effort and wages: checking for reverse causality

	Wage offer		
	(1)	(2)	(3)
Sum of grams sorted (L.1)	0.367	0.385	0.615
	(0.54)	(0.54)	(0.62)
Sum of grams sorted (L.2)	0.145	0.088	0.269
	(0.50)	(0.54)	(0.50)
High endowment	3,092.042***	3,092.776***	3,105.523***
	(272.62)	(274.61)	(285.00)
Constant	1,721.063**	1,688.176**	980.727
	(707.34)	(698.36)	(846.78)
N	180	180	180
R-squared	0.619	0.620	0.688
Year FE	NO	YES	YES
Village FE	NO	NO	YES

Robust standard errors, clustered at group level, in parentheses. *** $p < 0.01$, ** $p < 0.05$.

Table 3.6: Effort, wages, and other subjects' effort

	Effort		
	(1)	(2)	(3)
Wage offer (UGX 1000)	6.941***	6.375***	4.891***
	(1.61)	(1.63)	(1.61)
High endowment	-20.879***	-19.235***	-14.890**
	(8.93)	(9.37)	(9.01)
Amount sorted by other group members	0.104***	0.097***	-0.057***
	(0.02)	(0.02)	(0.02)
Constant	115.090***	109.629***	124.610***
	(17.04)	(16.93)	(16.15)
Observations	1,157	1,157	1,157
R-squared	0.106	0.114	0.164
Method	OLS	OLS	OLS
Year FE	NO	YES	YES
Village FE	NO	NO	YES

Robust standard errors, clustered at group and year level, in parentheses. *** $p < 0.01$.

We next check whether our experiment suffers from reciprocity and reverse causality – agents working harder to induce the principal to extend more generous offers in the future. Regression results summarized in Table 3.5 reveal this is not the case. Across all specifications

we find that wage offers are not significantly correlated with our measures of lagged aggregate effort.

We also do not find that our results disappear when we control for the effort of other agents (Table 3.6). While agents worked separately and isolated from each other, bean sorting took place in the same space so it is possible that they observed each other's behaviour. If so, they may send signals to each other through the supply of effort (e.g. to invest in a social image) or engage in competitive dynamics. To capture this potential concern we add the aggregate quantity of beans sorted by fellow agents working for the same principal as an additional control variable. Observe that the specification of this model is slightly problematic because our own theory predicts that wage levels and aggregate quantities are not independent explanatory variables – the risk of multicollinearity looms large. With this caveat in mind, it is comforting to note that all earlier results go through. Even though there is a positive correlation between aggregate and own effort – consistent with some interaction between agents, results still show a positive effect of wages on own effort and a negative effect of unfair distributions.

3.6 Discussion and Conclusions

In recent years, a series of theoretical studies have shown that prosocial behaviour may, to some extent, be explained by a desire of subjects to create or maintain a positive self-image. Specifically, if subjects prefer to think of themselves as trustworthy or altruistic individuals it is "costly" to display behaviour that suggests otherwise as it implies a risk that future selves will reject positive self-images. Anticipating that future selves will refer back to past actions to infer something about one's deep preferences and beliefs, the current self has an incentive to behave in accordance with the desirable identity – respecting behavioural norms that follow naturally from such an identity. Acting egoistically today may hamper the production of credible beliefs about

one's superior morality later. However, an important caveat is provided by the theory of motivated reasoning. While people prefer to think of themselves as beings with the highest moral standards, they may be tempted to search for excuses to justify egoistic acts – carefully selecting and interpreting bits and pieces of evidence from their environment that suit this purpose.

In this chapter we introduce the theory of self-signalling to an experimental workplace. Rather than focusing on prosocial behaviour such as charity donations or voluntary provision of public goods we zoom in on the supply of effort in a work-place type of environment. The desirable self-image or identity that we try to capture is associated with being hard-working and industrious – as opposed to being indolent and lazy. We invoke motivated reasoning to explain why wage levels and fairness may affect the supply of effort that is necessary to uphold a positive image of one-self in the workplace. By choosing a certain effort level subjects can signal to their future selves that they are of the hardworking type. Our approach is consistent with survey-based evidence that suggests that moral motivations for hard working are prevalent among samples of workers.

To isolate the effect of self-image and self-signalling on effort we try to eliminate other factors affecting effort supply. The most prominent factors are extrinsic motives (experimental earnings, respect in the community) and intrinsic motives such as altruism or guilt aversion. We therefore construct a two-stage experiment where the effort level of our agents does not affect anybody's payoffs. After the experiment's first stage (an ultimatum game) in which experimental earnings are fully determined, the agent in the ultimatum game is invited to engage in a measurable but pointless activity. Since individual effort during this task is not revealed to other experimental subjects, effort supply cannot be used for signalling in a conventional sense (i.e. signalling to others). Likewise, we believe it is unlikely that our results are driven by scrutiny by

the experimenter – there is little reason to believe that the effects of scrutiny vary with wage levels or the fairness of proposed allocation as predicted by the theory of self-signalling.

We collected experimental data in Uganda, among a group of subjects with a history of working and for whom work-related self-identity is presumably more salient than for the usual subject pool of western students. We believe this is especially true for the subsample of casual labourers. Our empirical findings are consistent with predictions based on theories of self-signalling and motivated reasoning. Specifically, we find a persistent and positive relationship between wage levels and effort. We also find that workers supply less effort when the proposed allocation of wages is less fair – providing them with an excuse to take it easy. Additional analysis reveals that especially male subjects that are young or poorly educated display this sort of behaviour – exactly the same social group most dependent on casual wage labour to earn a livelihood. Interestingly, we also find that the association between wages and effort is persistent and does not fade out over time (not even after 8 rounds of bean sorting – a tedious job). The association cannot be explained by reverse causality – more effort does not invite higher wages – and does not disappear when we control for co-worker effort. While it is possible that our respondents were confused about the sorting task (why sort if there are no payoffs for anybody?), it is not clear how such confusion could explain the patterns in the data we observe.

The finding that self-signalling affects labour productivity may contain important lessons for employers – affecting both hiring policies (i.e. targeting individuals more prone to invest in a positive self-image) as well as the design of incentive regimes (fine-tuning earning structures to induce people to supply more effort). This is left for future research, as is research on how organizational structures (working in groups or individually, company monitoring structure) interact with self-signalling. We end the chapter by observing that self-signalling might

speak to a much broader set of issues that are potentially of interest to economists – inside and outside the workplace. Imperfect accessibility of past states implies people are to some extent able to produce their own beliefs about who they are. Both the value generated during the production process (the signalling) as well as the value of these beliefs themselves deserve more attention from empirical researchers.

Appendix 3A: Experiment Protocol[13]

Welcome to this research experiment.

Today, the game we are going to play imitates the decisions and incomes of farmers and workers.
Farmers have good seasons (peak seasons), and they have bad seasons (slack seasons).

In this game we are going to play 8 rounds or seasons: 4 peak seasons and 4 slack seasons.
We have two types of players in the game, landlords and workers. The luck of the draw decides what type you will be: a worker or a landlord. For every landlord there are five workers.

Landlords can employ their workers. For each round, landlords will offer a wage to their workers. Workers individually decide whether they accept or reject the offer.

To determine payments from game, one out of 8 rounds will randomly be picked.

For each peak round, landlords earn worth 20,000/= per worker who accepts the offer.
For each slack round, landlords earn worth 5,000/= per worker who accepts the offer.
Workers have to pay a cost of 1000/= for "lunch or transport" each round, but only if they accept the wage offer.

This means that the landlord's net earnings per worker for each peak round is 20,000 minus the worker's wage, if the worker accepts.
The landlord's net earnings per worker for each slack round is 5000 minus the worker's wage, again if the worker accepts.

The worker's earnings for each round, if she accepts the offer, is equal to the wage minus 1000.
When a worker refuses a wage offer, for that round, the worker earns 0/= and the landlord earns 0/= for that worker who rejects the wage offer.

Workers who accept the wage offer will be given two small polythene bags and a pack of 500 grams of mixed yellow and maroon beans. Workers is going to sort and put the sorted beans according to colour for a period of four minutes into the polythene bags. After wards, enumerators will weigh the sorted beans together and the number of grams sorted will be recorded. The amount sorted does not affect the earnings of the worker, or of the landlord. Workers who reject the offer are not given beans to sort. After the sorting task, the enumerator will collect the sorted and unsorted beans from all workers and then carry all of them at ounce to the landlord. The landlord will be asked to mix the beans again for the next round of the game.

The game is organised in pairs of rounds; one peak season and one slack season together make up one hypothetical year. Because we play for 8 rounds, we will have 4 hypothetical years in total. The peak season will always be played first. So the order of the seasons is as follows: peak-slack, peak-slack, and so on.

[13] This protocol was given to participants verbally, in local language.

Direct communication between landlord and workers is not allowed during the game. Enumerators will talk to the landlord and relay to workers individually each round. Enumerators will then inform the landlord about the number of workers who accepted and rejected the wage offer. Workers will not be informed about the number of workers who accepted and rejected the wage offer.

At the beginning of each round, enumerators will be reminding you of the season corresponding to the round.

Important for the game is to keep in mind the factors that affect the payoffs in the game.

- Keep track of the season you are playing.
- Remember workers decide individually not as a group about accepting the offer, or not.

You now have two minutes to think about the rules of the game, and if any questions arise, I answer them.

Any questions?

To make sure you have understood the game, we are now going to play two trial rounds.

We are now going to proceed with the game in groups.

We have a total of eighteen participants here, and we are going to randomly form three groups, each of six people, one landlord playing with 5 different workers. Each of you will make a random draw to decide whether you will play as the landlord or a worker. The composition of the group will stay the same during the 8 rounds, and we will not change types: the same group member will be the landlord across all rounds.

We also have three enumerators here, and each of them will handle one group only for all the 8 rounds.

As mentioned, a random draw will decide your payments. For earnings, landlords will make one random draw from 40 outcomes (remember there are 8 rounds times 5 workers). To determine worker earnings, each worker will make one random draw from 8 rounds. For each group, workers will make their draw first, followed by the landlord.

The payments draw can be a peak or a slack season. For the landlord, the season you draw can correspond to any of the workers, including those who rejected wage offers in some seasons. This means there is a chance of earning 0/= from the game. Workers too stand a chance of earning 0/=, if they reject wage offers in some rounds.

This game is a one-time opportunity: we are not going to come to your village, and invite you in the future to play the same game again!

While in your group, before the start of the games, Enumerators will ask you to read or will read you through an informed consent form, and afterwards ask you to sign it. This is important for it

shows you are participating in this experiment voluntarily, and that you aware that the information gathered will be analysed anonymously together with other information and treated confidentially, and used only for academic and research purposes. After the games, you will also engage in a short interview to enable us gather additional social and economic information.

We thank you for your time.

Appendix 3B: The Experiment

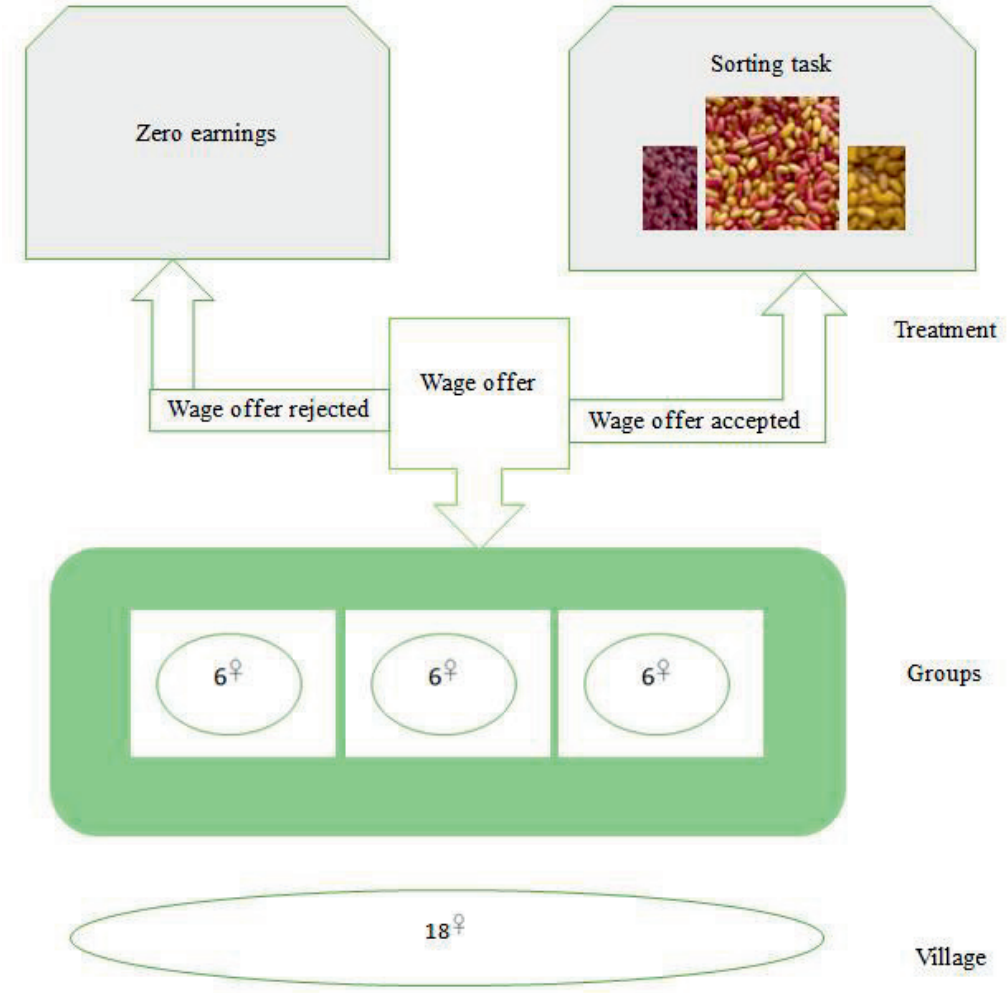

Figure 3B-1: Experiment groups and engagement in the effort task. The 18 randomly selected participants from the village were randomly grouped into 3 groups. Each group consisted of 1 randomly selected principal and 5 agents. Each group separately and simultaneously engaged in the experiment treatment. Agents who accepted the principal's wage offer were compensated the wage offered and engaged in the effort task. Agents who rejected the principal's wage offer earned zero and did not engage in the effort task.

Appendix 3C: Variable Definitions

Land ownership: Total amount of land owned by the participant's household in acres.
Farm size: Total size of participant's household farm in acres.
Farm output: Average worth of the participant's household farm output per cropping season in million shillings.
Casual workers employed: Number of casual workers employed on the participant's household farm.
Age: Age of participant in years.
Female: A dummy variable taking 1 if the participant is female and 0 otherwise.
Young: A dummy variable taking 1 if the participant is below 39 years of age and 0 otherwise.
Major occupation-farming: A dummy variable taking 1 if participant's major occupation is farming, and 0 otherwise.
Primary education: A dummy variable taking 1 if participant's education attainment is primary level and above, and 0 otherwise.
Post-primary education: A dummy variable taking 1 if participant's education attainment is ordinary level and above, and 0 otherwise.
Wage offer: Amount of money in thousand Uganda shilling offered by the principal each round.
High endowment: A dummy variable taking 1 for peak rounds, and 0 otherwise.
Wealthy principal: A dummy variable taking 1 for principles with above average indicators of wealth, and 0 otherwise.
Male principal: A dummy variable taking 1 if the principal is male and 0 otherwise.
Fair 1: Share of wage offer to the earnings of the principal each round.
Fair2: A dummy variable taking 1 for wage offers above 40 percent of the endowment each round, and 0 otherwise.
Risk averse: A dummy variable taking 1 for a risk averse (hypothetical) participant, and 0 for otherwise.
Early rounds: A dummy variable taking 1 if hypothetical year (round) is less than 3 (5), and 0 otherwise.
Year dummies: Are dummy variables taking 1 for a particular hypothetical year and 0 otherwise.
Village dummies: Are dummy variables taking 1 for a particular village and 0 otherwise.

Appendix 3D: Robustness Analysis

Table 3D-1: Robustness analysis 1 based on alternative fairness proxy

	Effort			
	(1)	(2)	(3)	(4)
Wage offer (UGX 1000)	5.757***	5.262***	4.590***	3.352***
	(1.63)	(1.54)	(1.51)	(1.27)
Fair 1	31.416***	29.905***	26.100***	19.699***
	(8.86)	(8.44)	(8.34)	(6.67)
Constant	176.330***	180.886***	165.587***	151.528***
	(13.23)	(12.52)	(13.32)	(9.94)
Observations	1,157	1,157	1,157	1,157
(Pseudo) R-squared	0.002	0.023	0.045	0.151
Method	Tobit	OLS	OLS	OLS
Year FE	NO	NO	YES	YES
Village FE	NO	NO	NO	YES
Prediction 1: $\beta_1 = 0$	[0.00]	[0.00]	[0.00]	[0.01]
Prediction 2: $\beta_2 = 0$	[0.00]	[0.00]	[0.00]	[0.00]

Robust standard errors, clustered at group and year level in parentheses. *** $p < 0.01$. p-values in brackets. Wage offer is amount in shillings offered by the principal each round, high endowment is a dummy for high season rounds, and fair 1 is the ratio of the wage offer to the earnings of the principal.

Table 3D-2: Robustness analysis 2 based on alternative fairness proxy

	Effort			
	(1)	(2)	(3)	(4)
Wage offer (UGX 1000)	7.731***	7.188***	6.217***	4.289***
	(2.05)	(1.95)	(1.97)	(1.53)
Fair2	25.527***	24.614***	20.984***	13.663**
	(7.59)	(7.24)	(7.43)	(5.83)
Constant	175.584***	179.839***	165.550***	152.817***
	(12.78)	(12.15)	(13.38)	(9.65)
Observations	1,157	1,157	1,157	1,157
(Pseudo) R-squared	0.001	0.025	0.046	0.150
Method	Tobit	OLS	OLS	OLS
Year FE	NO	NO	YES	YES
Village FE	NO	NO	NO	YES
Prediction 1: $\beta_1 = 0$	[0.00]	[0.00]	[0.00]	[0.01]
Prediction 2: $\beta_2 = 0$	[0.00]	[0.00]	[0.01]	[0.02]

Robust standard errors, clustered at group and year, in parentheses. *** $p < 0.01$,** $p < 0.05$. p-values in brackets. Wage offer is amount in shillings offered by the principal each round, high endowment is a dummy for high season rounds, and fair 2 is a dummy for wage offers above 40% of the endowment.

Chapter 4

Moral Hazard Incentives under Formal Insurance and Informal Insurance:

Evidence from a Framed Field Experiment

Abstract

In this chapter we explore moral hazard incentives associated with formal and informal insurance. We develop a theoretical model of risky effort that incorporates formal insurance and informal risk sharing, and use a framed field experiment in rural Uganda to test model predictions. Consistent with the theory, we find evidence of moral hazard under informal insurance. We however do not find evidence for moral hazard under formal insurance in our experiment. We propose lack of familiarity with formal insurance products may cause irrational behaviour. Our findings are consistent with findings from earlier studies which suggest that lack of familiarity impedes the development of formal insurance markets.

This chapter is based on:
Nanyiti, A. & Pamuk, H. (2019). Moral Hazard Incentives under Formal Insurance and Informal Insurance: Evidence from a Framed Field Experiment. Working Paper.

4.1 Introduction

Variability in weather conditions is a major source of risk for smallholder farmers in poor regions of the world. Smallholder farmers as well suffer household specific shocks, such as crop failure and illnesses of family members, which translate into lower returns to capital and time. These may cause shortfalls in household income and consumption (De Weerdt & Dercon, 2006; Karlan et al., 2014; Morduch, 1999a).

To mitigate shortfalls in income and in efforts and smooth consumption, many rural households rely on informal insurance institutions. This includes in-kind or cash transfers from households in good states to those in bad states, for example among kin members and socially-close households (Arnott & Stiglitz, 1991; Morduch, 1999a). However, informal insurance institutions usually provide imperfect coverage (De Weerdt & Dercon, 2006), and may impede own productive investments (Grimm et al., 2016).

Formal insurance products may be used by rural households to mitigate shortfalls in income. Index insurance is based on verifiable data, for instance a weather (rain) index, reducing incentive problems and transaction costs (Dercon et al., 2014). Indemnity insurance takes the form of individual crop indemnity designed for smallholder households. Incentive problems and transaction costs are important constraints in this case. Formal insurance products have more recently been promoted in poor rural regions of the world. Recent studies find a positive impact of the uptake of formal insurance products on farm investment and income (Karlan et al., 2014; Vargas & Viceisza, 2012). However, the uptake of formal insurance products in rural areas of Africa is low (Ackah & Owusu, 2012; Eling et al., 2014). This may be due to different reasons, including information asymmetries, prohibitive transaction costs,

lack of trust, or lack of knowledge about the insurance product (Ackah & Owusu, 2012; Cai & Song, 2017; Cole et al., 2011; Giné & Yang, 2009).

While households in poor communities use informal insurance institutions regularly, and often demonstrate a clear understanding of it, the same is not true for formal insurance products. Many households are not familiar with these products (Dercon et al., 2011; Giesbert, 2012), and may not understand their implications. Survey evidence among African farmers shows that lack of knowledge limits the uptake of formal insurance products (Ackah & Owusu, 2012; Dercon et al., 2011; Giesbert, 2012). Reviews by Erev and Haruvy (2013) and Eling et al (2014) stress the relevance of awareness to uptake of formal insurance products.

In a context of asymmetric information about behaviour, economic theory predicts that moral hazard should affect agricultural decisions. Specifically, we expect insured farmers to underinvest in self-protection – both in terms of effort (time) and capital.

In this chapter, we study moral hazard associated with formal insurance and informal insurance. We develop a stylized theoretical model, showing how effort of fully informed farmers should be affected by the introduction of formal and informal insurance. We compare effort supply in autarky (without any insurance coverage) with effort supply under formal and informal insurance. Comparative statistics predict that, ceteris paribus, effort should be highest in autarky, followed by informal insurance, and lowest under formal insurance. We use a framed field experiment conducted in rural Uganda to test predictions of the model. The experiment involves a real effort task, as well as good and bad states of the world. We analyse effort supply to mitigate risk (or moral hazard) under different treatment conditions.

Subjects playing the real effort game are randomly assigned to one of two groups: the formal insurance group and the informal insurance group. In both treatments, returns to effort are volatile, varying with the (exogenous) state of the world – good or bad.

Formal insurance group members engage in the risky effort task each round with the prospect of coverage from an insurance product. They pay a fixed insurance premium, and receive a transfer when they experience a bad state. There are three sub-treatments for the formal insurance experiment. In the first one, the formal insurance (premium) transfer is determined by the experimenter, is fixed and of public knowledge. In the second one, each group member voluntarily chooses a formal insurance (coverage) transfer plan. In the last arm, each member plays the control treatment (autarky condition).

Each informal insurance group member is paired with another informal insurance group member and engages in the risky effort task, with the prospect of receiving transfers from the partner – depending on states of the world. Transfers are sent from members with good states to partners in bad states. There are three sub-treatments. First, the transfer amount is fixed by the experimenter and is of public knowledge. Second, each group member voluntarily chooses how much to transfer to their partner. In the third arm each member plays the control treatment (autarky condition).

Experimental results show that with informal insurance, effort is lower than under autarky. This is consistent with model predictions. Contrary to model predictions however, effort with formal insurance is not statistically different from effort under autarky. These findings suggest households fail to take full advantage of insurance products. Unlike informal insurance, the "workings" of formal insurance appears not to be clear to many households who

lack experience with such products[14]. We document that subjects learn about formal insurance throughout the game, choosing higher coverage levels after experiencing low earnings due to bad states of production.

This chapter is organised as follows: section 4.2 presents related literature and a stylized model; section 4.3 describes experiment; section 4.4 gives the data description; section 4.5 gives the identification; section 4.6 presents the results; section 4.7 gives discussion and conclusions.

4.2 Conceptual framework

Principal-agent relations with outcomes contingent on unobservable action, invite moral hazard. Moral hazard is the tendency of insured individuals to under-supply self-protection, by reducing effort, time or capital investment (Hölmstrom, 1979; Mirrlees, 1999; Pauly, 1968). Moral hazard threatens efficiency (Hölmstrom, 1979; Johnson, 1977), influencing insurance costs from the perspective of the insurance company. To mitigate moral hazard incentives, insurance companies offer partial insurance coverage (Arnott & Stiglitz, 1991; Ligon & Thistle, 2008; Ray, 2011).

In this chapter, insurance coverage provided by registered companies is considered formal insurance (see also Lin et al., 2014). Each period, insured individuals pay an upfront premium, and receive a payment (benefit) in periods when they suffer a bad state of production. Insured individuals are reluctant to supply effort to increase the probability of a good state of production, because they are insured from losses in the bad state. Informal insurance institutions include cash transfers or in-kind assistance for misfortune or opportunity, exchanged amongst members within a risk sharing network (Charness & Genicot,

[14] Lack of trust for the insurer is not important for our results. Players were aware that their benefits will for sure be paid since insurer (experimenter) was always present at the venue.

2009; Coate & Ravallion, 1993; Ligon et al., 2002; Platteau, 1997). Informal institutions are not enforced by law, and benefits are typically based on prospects in terms of reciprocity in the future. Individuals with informal insurance receive coverage by sharing output with their risk-sharing partner. Transfers generally flow from individuals in good states to members in bad states. In addition to the standard moral hazard effect mentioned above, individuals also experience a disincentive to supply effort because they are expected to share with less-fortunate partners (eroding profits of good states). Alger and Weibull (2010) and Belhaj and Deroïan (2012) model such incentives, and find that when effort is unobservable, individuals exert low effort and make lower risk sharing transfers. But stronger levels of altruism facilitate more equitable risk sharing, and higher welfare outcomes.

Our model builds on existing literature by comparing moral hazard incentives under formal and informal insurance. We follow Alger and Weibull's (2010) characterization of optimal choices for risk averse agents.

We have in mind an agricultural context for two risk averse economic agents i &$j \in (1,2)$ $j \neq i$ producing an agricultural good for multiple years with volatile returns to their effort. Each agent chooses an effort level (x) that determines the returns to output. Suppose there are 2 states of the nature. A good state where output is high, Y^H, and a bad state where output is low (Y^L). Probability for high output, p, is increasing in agent's effort, $p = f(x)$ where $f: R_+ \rightarrow [0,1]$ and $f(0) = 0$, $f'(x) > 0$, $f''(x) < 0$, and $p \in [0,1]$, $p \rightarrow 1\ as\ x \rightarrow +\infty$. Per year expected utility for an agent is given by:

$$EU = p(x)u(Y^H) + (1 - p(x))u(Y^L) - v(x) \qquad (4.1)$$

where $u(Y)$ is the utility from consuming Y, $u' > 0$, $u'' < 0$, and, $v(x)$, is the cost of effort (disutility from effort), $v'(x) > 0$, and $v''(x) > 0$. We can simplify the model such that agents

can instead choose a probability for high output $p \in [0,1]$. Expected utility under autarky, without any insurance coverage, is given by:

$$EU = pu(Y^H) + (1-p)u(Y^L) - \omega(p) \quad (4.2)$$

where $\omega(p)$ is the cost of effort to reach probability p: $\omega(p) = v\left(f^{-1}(p)\right)$, $\omega'(p) > 0$, $\omega''(p) > 0$. Optimal probability p^A under autarky without any insurance coverage, and thereby optimal effort $x^A = f^{-1}(p^A)$ is determined by the first order condition that maximizes expected utility under autarky (4.2):

$$u(Y^H) - u(Y^L) = \omega'(p^A). \quad (4.3)$$

4.2.1 *Compulsory formal insurance*

Now suppose that purchasing formal insurance coverage is compulsory, and that the insurance premium and coverage are fixed. Each agent pays premium (C)[15] to the insurance company, which pays each agent benefit (B)[16] when an agent receives Y^L in a bad state of the nature, and $B > C > 0$. We assume the insurance company cannot observe effort, and agents are sure that the insurance company will not renege.

Augmenting premium and benefit of the compulsory formal insurance to (4.2), we rewrite (4.2). Now the expected utility under compulsory formal insurance is given by:

$$EU = pu(Y^H - C) + (1-p)u(Y^L + B - C) - \omega(p) \quad (4.4)$$

Optimal probability to receive high output under compulsory formal insurance, p^F, and optimal effort $x^F = f^{-1}(p^F)$ is determined by the first order condition maximizing (4.4):

[15] We consider actuarially fair insurance, $C = (1 - p(x))B$, Chiappori et al. (2012), Dahlby (1981),and Jehle & Reny (2000).

[16] In line with real insurance contexts, we consider partial insurance coverage, $Y^H - Y^L > B$.

$$u(Y^H - C) - u(Y^L + B - C) = \omega'(p^F) \quad (4.5)$$

Does the agent supply more effort under autarky or partial formal insurance? To answer this we compare p^A and p^F. It is evident that the marginal benefit from effort under formal insurance is smaller than the marginal benefit under autarky, $u(Y^H - C) - u(Y^L + B - C) \leq u(Y^H) - u(Y^L)$. We define this as moral hazard I: the disincentive to supply effort because agents are insured from losses in bad states. Due to moral hazard I (MHI^F), agents supply less effort under formal insurance than under autarky. So we reach to our first prediction:

Prediction 1: $x^A > x^F > 0$.

4.2.2 *Voluntary formal insurance*

Now consider the case when agents have to choose an insurance plan from a menu of coverage and premium pairs including the choice of no insurance $(B \geq 0, C \geq 0)$. Given $Y^H - Y^L \geq B$, and their choice for B and C, the agents' optimal probability under voluntary formal insurance, p^{VF}, and optimal effort $x^{VF} = f^{-1}(p^{VF})$ is again determined by (4.5), which is the first order condition maximizing (4.4). Does voluntary formal insurance decrease the supply of effort as well? Choice of actuarially fair formal insurance coverage changes the prediction for effort under compulsory insurance only slightly. When agents do not want insurance, they behave as under autarky (and there is no moral hazard I). So when B=0, $x^{VF} = x^A$. When agents are fully insured, $Y^H - Y^L = B$, then they should not work $x^{VF} = 0$ due to moral hazard I in the context of full insurance. For other values of B there is moral hazard I and agents supply effort less than autarky $x^{VF} < x^A$, because marginal benefit for extra effort is lower with insurance. Unless agents do not buy insurance, access to voluntary formal insurance decreases effort (for proof see Appendix 4A).

Prediction 2: $x^A > x^{VF} \geq 0$.

4.2.3 *Compulsory informal insurance*

Now consider the two selfish agents, i and j, who form an informal insurance network through sharing output with full commitment. Their informal insurance contract requires that agents i and j transfer a portion of their production to the other in case they are in a good state and the other is in a "bad state". There are four possible states of nature: (i) both agents i and j receive high output (Y^H, Y^H); (ii) agent i receives high output and agent j receives low output (Y^H, Y^L); (iii) agent i receives low output and agent j receives high output (Y^L, Y^H); (iv) or both agent i and j receive low output (Y^L, Y^L). At the end of each year the agent with high output makes a transfer, $0 \leq \tau \leq Y^H$ to the agent with Y^L. We assume that the agent with low output does not make transfers to the other, and that agents do not make transfers to each other in states when they both obtain equally high or low output. As a result informal transfers occur only in the states of natures described in (ii) and (iii).

Denote by $p_i \in [0,1]$ the probability for high output chosen by the agent i and by $p_j \in [0,1]$ the probability for high output chosen by the agent j. We focus on a case where decisions p_i and p_j are independent. The expected utility for agents i under informal insurance coverage is given by:

$$EU_i = p_i p_j u(Y_i^H) + p_i(1-p_j)u(Y_i^H - \tau_{ij}) + p_j(1-p_i)u(Y_i^L + \tau_{ji}) + (1-p_i)(1-p_j)u(Y_i^L) - \omega(p_i) \quad (4.6)$$

For compulsory informal insurance, the amount of transfer $\tau_{ij} = \tau_{ji} > 0$ is fixed. Denote by p_i^I, the optimal probability for high output chosen by the agent i, and by p_j^I, the optimal probability for high output chosen by the agent j. Optimal probability to receive high

output under compulsory informal insurance, p^I, and optimal effort $x^I = f^{-1}(p^I)$ is determined by the first order condition maximizing (4.6):

$$p_j\left(u(Y_i^H) - u\left(Y_i^L + \tau_{ji}\right)\right) + \left(1 - p_j\right)\left(u\left(Y_i^H - \tau_{ij}\right) - u(Y_i^L)\right) = \omega'(p_i^I) \qquad (4.7)$$

How does compulsory informal insurance effect the supply of effort in comparison to autarky? To answer this we re-write (4.7) as follows:

$$u(Y_i^H) - u(Y_i^L) - g\left(p_j, \tau_{ij}, \tau_{ji}, Y_i^H, Y_i^L\right) = \omega'(p_i^I) \qquad (4.8)$$

where $g\left(p_j, \tau_{ij}, \tau_{ji}, Y_i^H, Y_i^L\right) = p_j\left(u\left(Y_i^L + \tau_{ji}\right) - u(Y_i^L)\right) + \left(1 - p_j\right)\left(u(Y_i^H) - u\left(Y_i^H - \tau_{ij}\right)\right)$ represents moral hazard; the disincentive to supply effort under informal insurance (see Appendix 4A for derivation). $g\left(p_j, \tau_{ij}, \tau_{ji}, Y_i^H, Y_i^L\right)$ contains two types of moral hazard. The first term is, moral hazard I; the marginal loss from supplying effort when insurance from agent j is available to the agent i. The second term is moral hazard II; the marginal loss from sharing with agent j, when agent i receives high output and agent j receives low output. Both moral hazard I (MHI^I) and moral hazard II ($MHII^I$) dis-incentivize agent i to supply effort in an informal insurance network. Since $g\left(p_j, \tau_{ij}, \tau_{ji}, Y_i^H, Y_i^L\right) > 0$, our second prediction is as follows:

***Prediction 3*:** $x^A > x^I > 0$.

Is supply of effort by agent i higher under compulsory formal insurance or compulsory informal insurance, when nominal benefits and cost are same, $C = (B - C) = \tau_{ij}$?[17] To answer this, we re-formulate (4.7) and express it as:

[17] Depending on probability of loss p.

$$u\left(Y_i^H - \tau_{ij}\right) - u\left(Y_i^L + \tau_{ji}\right) + h\left(p_j, \tau_{ij}, \tau_{ji} Y_i^H, Y_i^L\right) = \omega'(p_i^I) \qquad (4.9)$$

where $h\left(p_j, \tau_{ij}, \tau_{ji} Y_i^H, Y_i^L\right) = \left(1 - p_j\right)\left(u\left(Y_i^L + \tau_{ji}\right) - u(Y_i^L)\right) + p_j\left(u(Y_i^H) - u\left(Y_i^H - \tau_{ij}\right)\right)$ (see Appendix 4A for derivation). The term $u\left(Y_i^H - \tau_{ij}\right) - u\left(Y_i^L + \tau_{ji}\right)$ captures the marginal benefit of supplying effort under formal insurance, $u(Y_i^H - C) - u(Y_i^L + B - C)$ from (4.5). Equation (4.9) is then $\omega'(p^I) = \omega'(p_i^F) + h\left(p_j, \tau_{ij}, \tau_{ji} Y_i^H, Y_i^L\right)$. To understand whether under informal insurance agents supply more effort, we focus on $h\left(p_j, \tau_{ij}, \tau_{ji} Y_i^H, Y_i^L\right)$. First consider the case when both agent i and j receive low output Y^L, and neither of them benefits from informal insurance. In this case $h\left(p_j, \tau_{ij}, \tau_{ji} Y_i^H, Y_i^L\right) > 0$, therefore the marginal benefit of supplying effort is higher under compulsory informal insurance than under compulsory formal insurance. Second consider the case that both agents receive Y^H and neither of the agents has to transfer τ to the other agent. In this case too $h\left(p_j, \tau_{ij}, \tau_{ji} Y_i^H, Y_i^L\right) > 0$, indicating that marginal benefit of supplying more effort is higher under compulsory informal insurance than under compulsory formal insurance. In cases when one of agents receives high output and the other receives low output, again $h\left(p_j, \tau_{ij}, \tau_{ji} Y_i^H, Y_i^L\right) > 0$. Since all cases stimulate effort, our fourth prediction is:

Prediction 4: $x^F < x^I$.

Prediction 4, implies that $\text{MHI}^F > \text{MHI}^I + \text{MHII}^I$ and $\text{MHI}^F > \text{MHI}^I$ since $\text{MHII}^I = \left(1 - p_j\right)\left(u(Y_i^H) - u\left(Y_i^H - \tau_{ij}\right)\right) > 0$. Because $\text{MHI}^I = p_j\left(u\left(Y_i^L + \tau_{ji}\right) - u\left(Y_i^L\right)\right) > 0$, depends on a $1 - p_j > 0$, that agent j does not effect τ_{ji} in case of Y_j^L, we suppose that $\text{MHI}^F > \text{MHI}^I$ since the insurance company will for sure pay transfer $B - C = \tau_{ji}$ in case of Y_i^L.

4.2.4 *Voluntary informal insurance*

Finally, we consider a case when agents i and j not only choose their probabilities for high output, but also how much they will transfer to each other before they exert effort. In this case agents i and j have to form beliefs about their partner's transfer choice, and probability for high output choice, and then decides on his or her transfer choice and choice of probability for high output. In equilibrium, agent i anticipates τ_{ji} in case of (Y^L, Y^H), and agent j anticipates τ_{ij} in case of (Y^H, Y^L). Optimal effort level x^{VI} for the agent i under voluntary informal insurance is derived from equation (4.8). If agent i forms a belief $b_i(p_j = 0)$, because of moral hazard II, optimal choice of transfers is $\tau_{ij} = 0$, and $x^{VI} = x^A$. If agent i forms a belief $b_i(p_j = 1)$, because of agent j's moral hazard II, $\tau_{ji} = 0$, and $x^{VI} = x^A$. If agent i forms a belief $b_i(0 < p_j < 1)$, because of moral hazard II, optimal choice of transfers is $\tau_{ij} = 0$, and $x^{VI} = x^A$. Optimal transfers are $\tau_{ij} = \tau_{ji} = 0$,[18] and agents supply effort equal to autarky level.

Prediction 5: $x^A = x^{VI}$.

From model predictions, we obtain five testable hypotheses. (1) effort with compulsory formal insurance is lower than effort in autarky; (2) effort with voluntary formal insurance is lower than effort in autarky; (3) effort with compulsory informal insurance is lower than effort in autarky; (4) effort with compulsory formal insurance is lower than effort with compulsory informal insurance; (5) effort with voluntary informal insurance is the same as effort in autarky.

[18] The zero transfer prediction is divergent to reality in African context where informal insurance is very commonly used. Real informal insurance contexts consist of altruistic agents who interact continuously and sometimes have reciprocal motives, compared to selfish agents that we model.

4.3 Experiment and Data

We designed an experiment to test these predictions. The experiment was conducted in the Uganda district of Nakaseke in March 2014. The district is largely rural, with 82% of the population living in villages (MoWE, 2010). The main economic activity in the district is agriculture, comprising livestock production including cattle, goats, sheep, and poultry, and cultivation of crops including coffee, maize, rice, beans, and plantain. Most people engage in social-economic groups within their villages, and at common places like markets. In addition to friends and family, these groups form the main source of safety net in case of shocks in income. People hardly use formal insurance schemes. We randomly selected 20 villages from the district, and from each village we randomly selected 14 household heads to participate in the experiment. After explaining the experiment protocol (see Appendix 4.B) to all participants together, we randomly assigned them into two groups: 6 people to the formal insurance group, and 8 people to the informal insurance group. In total 120 participants were assigned to the formal insurance group, and 160 participants were assigned to the informal insurance.[19]

At the beginning of the experiment all participants were informed that they were going to play a risky production game for 15 rounds. Participants were assigned the role of agricultural producers, and were informed that they would be invited to engage a real effort task involving the sorting of beans at the beginning of each round. The probability of a good state, p, with high output Y^H is increasing in the amount of beans sorted. Subjects earned Y^H=10000 shillings when drawing a blue ball, and Y^L=2,000 shillings when drawing a red ball.

Each round, subjects were given a container of 4000 grams of proportionally mixed yellow and maroon beans. Subjects had 3 minutes to sort beans according to colour. When

[19] In one villages,one participant in the informal insurance group did not play the autarky treatment.

three minutes were over, enumerators weighed the sorted beans for that round. Subjects earned 1 blue ball per 10 grams of sorted beans, replacing red balls from a bag containing 32 red balls (initially). Enumerators then asked subjects to draw a ball from the bag, to determine their output for the round. For instance when a subject sorted 160 grams of beans, then the bag contained 16 blue balls and 16 red balls, so that the subject's chance to earn 10000 Shillings was 16/32=0.5 for that round.

4.3.1 Treatments

Each subject played this game under three treatments that each lasted for 5 rounds of bean sorting and lottery participation. The nature of the treatments varied, depending on assignment to either the formal or informal insurance group. Subjects assigned to the formal insurance group played the game under conditions of (i) autarky, (ii) compulsory formal insurance, and (iii) voluntary formal insurance treatments. Subjects assigned to the informal insurance group played the game under conditions of (i) autarky, (ii) compulsory informal insurance, and (iii) voluntary informal insurance treatments. The experiment is summarized in a Figure in Appendix 4C. Details of the treatments are as follows.

Autarky (Control treatment): Subjects engaged in the production task without any form of insurance. Each subject either earned per period $Y^H = 10000$ when picking a blue ball or $Y^L = 2000$ when picking a red ball.

Compulsory formal insurance: Subjects had to buy formal insurance coverage from the experimenter, costing a premium,C, of 3000 shillings each round and paying a benefit, B, of 6000 shillings at the rounds (when the subject drew a red ball). So the insurance was partial and covered 75% of the loss (75%=6000/8000) and the insurance packages offered were actuarially fair based on average probability of loss at village level ($p = 0.5$), calculated during test

experiments. Subjects earned $Y^H - C = 7000$ when they picked a blue ball, and earned $Y^L + B - C = 5000$ when they picked a red ball.

Voluntary formal insurance: This treatment was similar to the previous treatment, but subjects chose their insurance coverage from a menu of insurance products with premium and coverages as summarized in column 1 of Table 4.1. At the beginning of each round, subjects privately informed the enumerator the level of coverage (and associated premium) they wanted to buy.

Compulsory informal insurance: At the beginning of the treatment each subject was randomly paired with another subject within their experimental group, and this pair was kept fixed throughout the treatment. When a pair's earnings differed (Y^H, Y^L) or (Y^L, Y^H) , the subject who drew a blue ball (and earned Y^H=10000) had to transfer τ=3000 shillings to the partner drawing a red ball (and earned Y^L=2000). After sharing, final earnings per period are $(Y^H - \tau = 7000,\ Y^L + \tau = 5000)$ or $(Y^L + \tau = 5000,\ Y^H - \tau = 7000)$. Subjects did not share if they had the same earnings: (Y^H, Y^H) or (Y^L, Y^L).

Voluntary informal insurance: At the beginning of the treatment, each subject was randomly paired with another subject from the group, and this pair was kept fixed for the 5 rounds. Subjects however, decided on the amount of money they would like to transfer to their peer in case of unequal earnings. At the beginning of each round, subjects privately informed the enumerator about the size of their transfer by using a list of transfer choices summarized in column 2 of Table 4.1.

Table 4.1: Choice sets

Transfers/Coverage	Voluntary formal insurance (1)		Voluntary informal insurance (2)	
	Coverage (%)	Premium (UGX)	Transfer (%)	Amount to transfer to partner (UGX)
Full	100	4000	50	4000
High	75	3000	37.5	3000
Average	50	2000	25	2000
Low	25	1000	12.5	1000
Zero	0	0	0	0

4.3.2 Order of Treatments

We visited 20 villages, and played all treatments in all villages: autarky, compulsory formal and informal insurance, and voluntary formal and informal insurance. Table 4.2 summarizes the final distribution of orders by the treatments. There are six possible orders for three treatments; and as a consequence of random ordering, some orders were played more frequently than others. As shown in Table 4.2, autarky treatment was played first in 10 villages, second in 4 villages and third in 6 villages. The compulsory formal and informal insurance treatments were played first in 4 villages, second in 10 villages and third in 6 villages. The voluntary formal and informal insurance treatments were played first in 6 villages, second in 6 villages and third in 8 villages.

We control for the order of play of treatments in our econometric analysis. Each subject played a total of 15 rounds. We use a series running from 1 to 15 to indicate the rank at which a round was played. For instance if the order of play for a village was voluntary (in)formal insurance first, followed by compulsory (in)formal insurance and lastly autarky treatment, then rounds for voluntary (in)formal insurance would take ranks from 1-5, followed by compulsory (in)formal insurance with ranks 6-10 and lastly autarky treatment with rank 11-15.

Table 4.2: Order of play of treatments

Order	Autarky	Compulsory (in)formal insurance (1)	Voluntary (in)formal insurance (2)
First	10	4	6
Second	4	10	6
Third	6	6	8

4.3.3 Payments

At the end of each round, enumerators computed subjects' earnings depending on the colour of the ball picked and insurance payments or transfers. Enumerators informed subjects individually about their earnings for that round. Out of five rounds for each treatment, one round was randomly picked per participant for actual payment. After the experiment, enumerators paid each subject the sum of the earnings from the three selected rounds: one from the autarky treatment, one from compulsory (in)formal insurance, and one from the voluntary (in)formal insurance.

4.3.4 Exit Survey

We recorded earnings, transfers, choices for insurance, and effort (grams sorted) across rounds, and organized a short exit survey with questions about social-economic and demographic characteristics after the experiment.[20] The exit survey also included hypothetical risk aversion and time preference games. Table 4.3 summarizes key subject characteristics, and provides a balance test. Random assignment of participants to the formal and informal insurance group "worked." Most subjects have a small area of land, are married, middle aged, and finished primary school. A good number of participants belong to VSLAs, and very few have formal insurance coverage. Because of the small sample size it is perhaps not surprising

[20] In one village one participant for the formal insurance group did not participate in the exit survey.

that we also have a lack of balance for some variables: farming as major occupation, household head status, low discounting rate, and borrowing from VSLA. To mitigate confounding effects due to lack of balance we control for subject fixed effects in our estimations.

Table 4.3: Social-economic characteristics of participants

	Formal Insurance (N=120)		Informal Insurance (N=160)		P(1=2)
Variable	**Mean (1)**	**SD**	**Mean (2)**	**SD**	
Farm size (acres)	3.23	3.83	3.07	3.77	0.72
Farm output (million shillings)	0.86	1.10	0.73	0.94	0.25
Number of assets	4	1.91	4	1.90	0.45
Age	41.3	15.29	42.5	13.56	0.48
Household size (people)	8	3.87	8	4.10	0.84
Female	0.40	0.49	0.41	0.49	0.92
Married	0.65	0.48	0.70	0.46	0.38
Household head	0.69	0.46	0.79	0.41	0.05
Major occupation-farming	0.75	0.43	0.63	0.49	0.03
Hire labour	0.41	0.49	0.37	0.48	0.47
Primary education	0.88	0.33	0.89	0.32	0.75
Post-primary education	0.28	0.45	0.24	0.43	0.46
Member of VSLA	0.39	0.49	0.48	0.50	0.12
Risk averse (hypothetical)	0.56	0.50	0.49	0.50	0.21
low discount rate (hypothetical)	0.36	0.48	0.22	0.42	0.01
Coping mechanisms					
Gifts from family and friends	0.16	0.37	0.16	0.37	0.93
Borrow from family	0.05	0.22	0.1	0.30	0.12
Borrow from friends	0.19	0.40	0.26	0.44	0.17
Borrow from VSLA	0.13	0.33	0.23	0.42	0.03
Formal insurance coverage	0.00	0.00	0.01	0.08	0.39

4.4 Identification

4.4.1 *Formal and informal insurance and effort*

Using data from the experiment we estimate the following model to test predictions 1-5:

$$E_{ij} = \beta_1 + \beta_2 Compulsory\ formal_{ij} + \beta_3 Voluntary\_formal_{ij} + \beta_4 Compulsory\_informal_{ij} + \beta_5 Voluntary\_informal_{ij} + \mu' R_j + \gamma' X_i + \varepsilon_{ij}, \quad (4.10)$$

where E_{ij} is the amount of sorted beans by subject i, in round j (in grams), $Compulsory\ formal$, $Voluntary\ formal$, $Compulsory\ informal$, $Voluntary\ informal$, are binary variables indicating the relevant treatment arm (taking value of 0 otherwise). Autarky is the omitted category in regression model (4.10). R_j is a vector including dummies for the rank at which each round was played, controlling for order of play of treatments, X_i is a vector for subject dummies, controlling for unobserved subject fixed effects, and ε_{ij} is the error term. Coefficient β_2 estimates the difference between effort under compulsory formal insurance and effort in autarky. Due to moral hazard I (prediction *1*), we expect $\beta_2 < 0$. Coefficient β_3 measures the difference between effort under voluntary formal insurance and effort in autarky. Depending on the level of coverage bought, we expect (prediction *2*) $\beta_3 < 0$. Coefficient β_4 estimates the difference between effort under compulsory informal insurance and effort in autarky. Due to moral hazard I and moral hazard II (prediction *3*), $\beta_4 < 0$. Our model also predicts (prediction *4*) that effort under compulsory formal insurance is lower than effort under compulsory informal insurance, therefore $\beta_2 - \beta_4 < 0$. Coefficient β_5 measures the difference between effort under voluntary informal insurance and effort in autarky. We expect (prediction *5*) average transfers to be zero and $\beta_5 = 0$.

4.4.2 Heterogeneity and learning effect

We also explore whether moral hazard incentives under insurance coverage are different for subgroups of subjects with different characteristics. To do this we estimate the above regression model separately for males and females, young and old subjects, and primary and post-primary educated subjects. We also explore whether experience with VSLAs and the level of risk aversion (hypothetical) matter. We compare results across subsamples to the full sample results. We also zoom in on the scope for learning, and re-estimate the model for the first two rounds and the last three rounds separately.

4.4.3 Experience with formal insurance

A recent study by Cai and Song (2017) finds that experiencing "bad outcomes" promotes the adoption of weather insurance. We seek to test the hypothesis that subjects learn about the value of insurance after suffering a bad outcome, and estimate model (4.11):

$$c_{ij}^{k} = \delta_0 + \delta_1 B_{ij-1} + \delta_2 E_{ij} + \mu' R_j + \gamma' X_i + \varepsilon_{ij} \quad (4.11)$$

where c_{ij}^{k} is the kth coverage chosen by subject i, in round j. B_{ij-1} is ball picked by subject i, in round $j-1$. E_{ij} is grams of sorted beans for subject i, in round j. R_j is a vector including dummies for the rank at which the each round was played , X_i is a vector of subject dummies, and ε_{ij} is the error term. Coefficients δ_1 and δ_2 measure the effect of bad outcomes and past effort on coverage choice, respectively.

We estimate (4.10) and (4.11) using OLS. We use heteroscedasticity robust standard errors clustered at the subject level to control for the fact that the choices of an individual across rounds are not independent observations. First we estimate a parsimonious version of

our model with only treatment dummies and round dummies. In our preferred specification we also add subject fixed effects to control for unobserved subject characteristics.

4.5 Results

Our main results are given in Table 4.4. Column (1) is the parsimonious specification, and column (2) is the preferred specification.

Table 4.4: Effect of insurance on effort

	Effort	
	(1)	(2)
Compulsory formal insurance	7.80**	1.00
	(3.27)	(2.41)
Voluntary formal insurance	5.96	-0.84
	(3.74)	(2.84)
Compulsory informal insurance	-8.50***	-3.18*
	(2.80)	(1.90)
Voluntary informal insurance	-11.42***	-6.09***
	(2.78)	(1.92)
Autarky	154.65***	172.49***
	(2.87)	(2.38)
N	4,195	4,195
R-squared	0.087	0.770
Order FE	YES	YES
Subject FE	NO	YES
Prediction 1: $\beta_2 < 0$	[0.99]	[0.66]
Prediction 2: $\beta_3 < 0$	[0.94]	[0.38]
Prediction 3: $\beta_4 < 0$	[0.00]	[0.05]
Prediction 4: $\beta_2 - \beta_4 < 0$	[0.10]	[0.92]
Prediction 5: $\beta_5 = 0$	[0.00]	[0.00]

Robust standard errors, clustered at subject level, in parentheses. *** $p < 0.01$,** $p < 0.05$, * $p < 0.10$. p-values in brackets.

First, observe that the constant in column (1) shows that subjects sorted around 150 grams in the autarky. As a result they earned around 15 balls on average, providing them with 50% probability of earning "high output." Agents supply a considerable amount of effort when there is no insurance.

Now we turn to our model predictions. Predictions *1* and *2* state that access to formal insurance invites moral hazard, causing subjects to decrease their effort. Our experimental results however do not support these predictions. We find that formal insurance does not affect effort. Since the estimated coefficients for compulsory formal and voluntary formal insurance are not statistically smaller than zero, we conclude that formal insurance did not invite moral hazard.

Next consider the results for informal insurance, with which our respondents are much more familiar. The model predicts that average effort should be lower than under autarky (prediction *3*), and exceed effort with compulsory formal insurance (prediction *4*). While our results are consistent with prediction *3*, they do not support prediction *4*. Respondents reduce their effort and sort 3 grams less in the compulsory informal insurance regime compared to autarky. This reduction corresponds to a 0.1 standard deviation change. There is also a significant difference between compulsory formal and compulsory informal insurance. This suggests, somewhat counterintuitively, that subjects in our sample took advantage of their informal insurance networks, but not of the formal insurance.

Finally, our results for voluntary informal insurance are not in line with model prediction *5*. We predicted that subjects would not make transfers to their partners and would not expect any transfers in return – a return to autarky. But contrary to model predictions, 89% of the respondents choose positive transfer amounts: on average, subjects transferred about 1500 shillings to their partner. This average transfer amount is smaller than the compulsory informal insurance transfer of 3000 shillings.

We find that in the voluntary informal insurance treatment, respondents sort fewer beans. This means transfer and effort choices are consistent. Subjects reduced effort by 6 grams

(compared to autarky), which is consistent with moral hazard I and moral hazard II. Hence, while subjects chose to make positive transfers, they sorted fewer beans and attenuated the possibility that they actually had to provide the transfer. Results in Table 4.4 also show that effort across the two informal insurance schemes are different ($p = 0.1$). This suggests the two types of moral hazard may be additive.

When comparing the formal and informal insurance treatments, an important factor is the fact that villagers were matched with co-villagers ("peers") in the informal insurance treatments. This could invite altruism (Alger & Weibull, 2010; Belhaj & Deroïan, 2012), and image motivations (Benabou & Tirole, 2011). However, and contrary to expectations, we find that subjects supply less labour with informal insurance. In contrast, altruism and image concerns should have invited additional effort (so as not to free ride on transfers from peers, and to increase the probability of being able to help a peer). We conclude that insofar as altruism and image concerns are relevant, they are dominated by something else.

Perhaps the difference between the formal and informal insurance treatments is the extent to which subjects are familiar with the main concept, and understand its workings. Previous studies on insurance take-up in developing countries show that often economic agents from developing countries are not familiar with insurance products, and do not fully understand the benefits of insurance (Ackah & Owusu, 2012; Eling et al., 2014; Giesbert, 2012). Only agents with high cognitive capacities take advantage of formal insurance instrument (Swami et al., 2012).

We next explore whether we find patterns in our data suggesting that subjects fail to understand the implications and behavioural imperatives of the uptake of formal insurance. We focus on formal insurance coverage choices from the voluntary formal insurance treatment. Moreover for 87% of the rounds, subjects bought positive coverage level, and on average (bought average coverage) paid 2000 shillings in premium. We first regress effort on dummies for four different insurance coverage levels (full, high, average, low) in Table 4.5. Prediction *2* states that supply of effort should decrease with the coverage level. After controlling for treatment order and subject characteristics, coverage level is not statistically different from zero. Hence, coverage does not reduce the supply of effort. There is therefore evidence that our subjects did not understand insurance product well and behaved irrationally.

Table 4.5: Effect of coverage level on effort

	Effort	
Coverage level	(1)	(2)
Full	-48.92***	-11.11
	(14.27)	(10.02)
High	-41.62***	-6.85
	(14.67)	(8.61)
Average	-42.96***	-8.20
	(16.16)	(9.19)
Low	-34.97**	-8.76
	(17.05)	(9.63)
Autarky (Zero)	196.35***	150.22***
	(13.38)	(9.87)
N	600	600
R-squared	0.143	0.843
Order FE	YES	YES
Subject FE	NO	YES

Robust standard errors, clustered at subject level, in parentheses. *** $p < 0.01$,** $p < 0.05$.

Next we probe whether some subgroups understood the advantages of formal insurance better. We do not have a measure of cognitive ability, but did collect data on education

backgrounds, experience with financial products, and a range of other variables. We re-estimate model (4.10) for different subgroups separately, and report results in Panel A of Table 4.6. Subgroup estimates are similar to the ones reported earlier, so we find no evidence of particular subgroups behaving "more rationally" than others.

Table 4.6: Effect of insurance on effort: Subgroups and learning effect

	Compulsory formal insurance	Voluntary formal insurance	Compulsory informal insurance	Voluntary informal insurance
Panel A: Subject characteristics				
Female	4.12	4.53	-6.67**	-8.59***
	(4.10)	(4.52)	(3.07)	(2.93)
Male	-0.56	-3.58	0.75	-2.17
	(2.95)	(3.56)	(2.27)	(2.37)
Young	1.52	-1.36	-0.36	-3.26
	(3.43)	(4.19)	(2.64)	(2.66)
Old	0.17	-0.47	-5.73**	-9.57***
	(3.43)	(3.66)	(2.72)	(2.64)
Post-primary	6.70	0.11	3.06	0.45
	(4.69)	(6.85)	(2.53)	(3.22)
Primary and below	-1.27	-1.25	-5.13**	-8.26***
	(2.74)	(2.87)	(2.39)	(2.29)
Member of VSLA	3.56	6.37	-1.99	-4.44
	(4.88)	(4.81)	(3.05)	(2.87)
Non VSLA members	-0.40	-4.10	-4.07*	-7.36***
	(2.48)	(3.36)	(2.35)	(2.64)
Risk averse	0.96	-3.79	-1.81	-5.61**
	(2.91)	(3.60)	(2.78)	(2.56)
Non risk averse	1.02	2.85	-4.52*	-6.73**
	(4.18)	(4.64)	(2.53)	(2.80)
Panel B: Learning effect				
Round 1&2	0.60	-1.18	-3.30	-5.84***
	(2.61)	(3.27)	(2.05)	(2.14)
Round 3,4 &5	1.59	-0.33	-2.99	-6.46**
	(3.41)	(3.75)	(2.70)	(2.72)

Dependent variable is effort. We coefficients corresponding to the formal and informal insurance treatments. Robust standard errors, clustered at subject level, in parentheses. *** $p < 0.01$,** $p < 0.05$, * $p < 0.10$. We control for order of play of treatments and subject fixed effects in all specifications.

Finally, we consider learning. Our subjects were not familiar with formal insurance before the experiment but may learn about it during the game. To test for learning, we explore whether moral hazard develops within the game: do formally insured subjects supply less effort at later stages of the game? We estimate model (4.10) again, but now introduce a binary variable taking the value of one for rounds three, four and five (and zero for rounds one and two). Results are provided in panel B of Table 4.6, and do not support predictions 1 and 2 either. We also probe the role of learning, by regressing coverage choices on a variable indicating whether the subject experienced "bad outcomes" in preceding rounds of the game. Results are given in Table 4.7, and are consistent with the hypothesis that subjects learn after experiencing a bad outcome. When subjects experienced a bad outcome, their likelihood of buying higher coverage levels increased. This result is robust to Ordered Probit estimation (for details, see Appendix 4E).

Table 4.7: Effect of Bad outcome on coverage

	Coverage level	
	(1)	(2)
Bad outcome (L.1)	0.27**	0.18**
	(0.12)	(0.08)
Effort	-0.01***	-0.002
	(0.00)	(0.00)
Constant	4.09***	4.16***
	(0.35)	(0.30)
N	600	600
R-squared	0.081	0.797
Order FE	YES	YES
Subject FE	NO	YES

Robust standard errors, clustered at subject level, in parentheses. *** $p < 0.01$,** $p < 0.05$.

4.6 Discussion and Conclusions

In absence of formal insurance institutions, households rely on informal insurance institutions to avert adverse fluctuations in consumption. Due to risk of concurrent bad states, reliance on informal insurance may have negative effects on overall insurance coverage. However uptake of formal insurance products is low. Lack of familiarity with formal insurance product has been reported as one of the impediments for uptake. Without proper understanding, households may fail to take up insurance products, and let alone fully exploit them. Understanding of incentives pertaining to formal insurance products is pertinent not only to uptake, but also to overall insurance coverage. Moral hazard incentives attenuate investment in self-protection. In this chapter we examined moral hazard incentives associated with formal and informal insurance institutions. Unlike earlier studies, we compare effort incentives pertaining to formal insurance to effort incentives pertaining to informal insurance. Our model abstracts from a production context with uncertain returns to effort, and shows that formal insurance is associated with moral hazard I (disincentive for effort because households are insured from losses in bad states) and informal insurance is associated with both moral hazard I and moral hazard II (disincentive for effort because households do not want to share their high output in good states). Our model predicts that individuals work harder in autarky, and effort is higher with informal than with formal insurance.

We tested our theoretical predictions using a framed field experiment in a rural Uganda district. Our model correctly predicts behaviour with informal insurance relative to autarky. Consistent with model prediction, our empirical results show that relative to autarky, individuals reduce effort when they are part of compulsory informal insurance networks. We

also find that with access to voluntary informal insurance, individuals instead reduce effort to avert transfer obligations.

We do not find evidence for moral hazard incentives with formal insurance. Contrary to the model prediction, empirical results show that agents did not reduce effort when they have access to formal insurance, relative to autarky. Our empirical results therefore suggest that access to formal insurance did not trigger moral hazard incentives.

The results suggest that people had difficulty grasping the idea of formal insurance – paying a premium every period to attenuate downside risk when the state of nature is "bad". Their behaviour is clearly at odds with theoretical predictions. The deficiency of moral hazard incentives could not be explained by cognitive ability but by learning from experience, in particular bad shocks. However, people seem to understand informal insurance better, and their behaviour is consistent with moral hazard incentives. Many people in rural Africa rely on informal sharing networks to smooth consumption; so it is something they know and understand well. Our findings suggest that familiarity with insurance products is relevant for uptake. Supporting uptake of formal insurance products in poor and remote regions may necessitate awareness programmes to increase understanding of these products.

Appendix 4A: Proofs

Formal insurance:

The expected utility of the agent under compulsory formal insurance is given by:

$EU = pu(Y^H - C) + (1-p)u(Y^L + B - C) - \omega(p^F)$, and

$u(Y^H - C) - u(Y^L + B - C) = \omega'(p^F)$ (4.A.1)

Taking total differential from equation (4.A.1), we obtain

$\frac{dp^F}{dC} = \frac{u'(Y^L+B-C)-u'(Y^H-C)}{\omega''(p^F)}$, for $Y^H - Y^L > B$, $\frac{\partial p^F}{\partial C} > 0$, and for $Y^H - Y^L = B$, $\frac{\partial p^F}{\partial C} = 0$.

Informal insurance:

The expected utility for agents i under informal insurance coverage is given by:

$EU_i = p_i p_j u(Y_i^H) + p_i(1-p_j)u(Y_i^H - \tau_{ij}) + p_j(1-p_i)u(Y_i^L + \tau_{ji}) + (1-p_i)(1-p_j)u(Y_i^L) - \omega(p_i^I)$, and

$p_j\left(u(Y_i^H) - u(Y_i^L + \tau_{ji})\right) + (1-p_j)\left(u(Y_i^H - \tau_{ij}) - u(Y_i^L)\right) = \omega'(p_i^I)$ (4.A.2)

Rewriting 4.A.2 by adding $(1-p_j)u(Y_i^H)$ and subtracting $(1-p_j)u(Y_i^H)$ on the left hand side, we obtain:

$$u(Y_i^H) - u(Y_i^L) + \left((1-p_j)\left(u(Y_i^H - \tau_{ij}) - u(Y_i^H)\right) - p_j\left(u(Y_i^L + \tau_{ji}) - u(Y_i^L)\right)\right) = \omega'(p_i^I)$$

Let $g(p_j, \tau_{ij}, Y_i^H, Y_i^L,) = (1-p_j)\left(u(Y_i^H - \tau_{ij}) - u(Y_i^H)\right) - p_j\left(u(Y_i^L + \tau_{ji}) - u(Y_i^L)\right)$, then

$u(Y_i^H) - u(Y_i^L) + g(p_j, \tau_{ij}, \tau_{ji}, Y_i^H, Y_i^L) = \omega'(p_i^I)$.

Since $g(p_j, \tau_{ij}, \tau_{ji}, Y_i^H, Y_i^L) < 0$, $\omega'(p^A) > \omega'(p^I)$, and $x^A > x^I$.

We can also rewrite 4.A.2 by adding $(1-p_j)u(Y_i^L+\tau_{ji})$ and subtracting $(1-p_j)u(Y_i^L+\tau_{ji})$ on the left hand side, and obtain:

$$u(Y_i^H-\tau_{ij})-u(Y_i^L+\tau_{ji})+\Big((1-p_j)\big(u(Y_i^L+\tau_{ji})-u(Y_i^L)\big)-p_j\big(u(Y_i^H-\tau_{ij})-u(Y_i^H)\big)\Big)=\omega'(p_i^I)$$

Let $h(p_j,\tau_{ij},\tau_{ji},Y_i^H,Y_i^L)=(1-p_j)\big(u(Y_i^L+\tau_{ji})-u(Y_i^L)\big)-p_j\big(u(Y_i^H-\tau_{ij})-u(Y_i^H)\big)$, then $u(Y_i^H-\tau_{ij})-u(Y_i^L+\tau_{ji})+h(p_j,\tau_{ij},\tau_{ji},Y_i^H,Y_i^L)=\omega'(p_i^I)$.

For $\tau_{ij}=\tau_{ji}=C$; $\omega'(p^F)+h(p_j,\tau_{ij},\tau_{ji},Y_i^H,Y_i^L)=\omega'(p_i^I)$.

Since $h(p_j,\tau_{ij},\tau_{ji},Y_i^H,Y_i^L)>0$, $\omega'(p^F)<\omega'(p^I)$, and $x^F<x^I$.

Appendix 4B: Experiment Protocol[21]

Welcome to this research experiment.
Today we are going to engage you in a series of games. The games imitate fluctuating incomes of agriculture.
Farmers exert high or low effort, and sometimes get high output (earn high incomes) and sometimes they get low output (earn low incomes). So incomes of farmers fluctuate and they often take measures to cope or avert the fluctuations.
We are going to play many rounds of games.
We are going to play three versions of the game. In all the versions we will play 5 rounds. One round will be picked at random from each version for payment. That forms the three chances for earning money today.
Any questions so far?
Status quo:
In all the games we are going to play, you will be given mixed yellow and red beans to sort according to colour for three minutes, and after wards enumerators will weigh the sorted beans together at ounce and grams sorted will be recorded. You will then earn blue balls according to grams sorted.

We have 2 bags, one containing 32 red balls, and another containing 32 blue balls. For each 10 grams of sorted beans, you earn one blue ball.

For example if you sort 200 grams you earn 20 blue balls, which you replace for 20 red balls, in the bag of 32 red balls.

We then after, we shall ask you close your eyes and draw one ball. A red ball drawn is worth 2000 and a blue ball drawn is worth 10,000 shillings[22].
In this game, we sort beans to increase the chances of drawing a blue ball (earning 10,000 shillings).
Communication between participants is not allowed.
Remember for each version, you will play for 5 rounds. One round will be picked at random from each version for payment. It can be a round where you earned 2000 or one where you earned 10000 shillings.
Enumerators will be calculating and recording your earnings and will let you know your earnings at the end of each round, should that round be picked at random for payment.
At the end of each version you will be asked to make a draw to determine the round you will be paid for, from that version at the end of the experiment. You will be informed about your earnings for that version, if you wish you can write it down.
It is important you understand the rules of the game, before we start the games.
Do you have any questions?
Enumerators will be reminding you of the status quo information at the beginning of each version.
We are going to proceed with the games, but in groups. I wish good luck beforehand.

[21] This protocol was given to participants verbally, in local language.

[22] At the time of the experiment, USD 1 exchanged for 2600 Uganda shillings.

We have a total of fourteen people here, we are going to randomly form two groups, one of six people (formal insurance group), and another of eight people (informal insurance group)[23].

While in your group, before the start of the games, Enumerators will ask you to read or will read you through an informed consent form, and afterwards ask you to sign it. This is important for it shows you are participating in this experiment voluntarily, and that you aware that the information gathered will be analysed anonymously together with other information and treated confidentially, and used only for academic and research purposes. After the games, you will also engage in a short interview to enable us gather additional social and economic information.

Formal insurance group

Version 1: Autarky game (Autarky)

Welcome to this version.

Each round, depending on the number of blue balls you earned from sorting beans, you will draw one ball from a bag containing 32 balls.

When you draw a red ball you earn 2000 shillings and when you draw a blue ball you earn 10,000 shillings.

We are going to play for 5 rounds, and at the end you will be asked to randomly pick one round to determine your earnings for this version.

Version 2: Insurance game (Compulsory formal insurance)

Welcome to this version.

Each round, depending on the number of blue balls you earned from sorting beans in that round, you draw one ball from a bag containing 32 balls.

In this version however you buy insurance.
The insurance cost a premium of 3000 shillings every round and pays a benefit of 6000 shillings in the rounds when subjects draw a red ball.
When you draw a red ball, the insurance company will compensate you 6000 shillings and after paying the premium you will earn 5000 shillings for that round. When you draw a blue ball, you do not receive compensation, but only pay the premium and you will earn 7000 shillings for that round.

We are going to play for 5 rounds, and at the end you will be asked to randomly pick one round to determine your earnings for this version.

Version 3: Choice insurance game (Voluntary formal insurance)

Welcome to this version.

Each round, depending on the number of blue balls you earned from sorting beans in that round, you draw one ball from a bag containing 32 balls.
In this version however you prior decide on the amount of premium (insurance coverage) to pay.

[23] Group names were not mentioned to participants.

You can buy 100% coverage (pay premium 4000 shillings and earn 6000 shilling with a blue or read ball) or 75% coverage (pay premium 3000 shillings and earn 7000 shillings with a blue ball or 5000 shillings with a red ball) or 50% coverage (pay premium 2000 shillings and earn 8000 shillings with blue ball and 4000 shillings with a red ball) or 25% coverage (pay premium 1000 shillings and earn 9000 shillings with a blue ball and 3000 shillings with a red ball) or 0% coverage (pay zero premium and earn 10000 shillings with blue ball or 2000 shillings with a red ball).
Depending on the amount of coverage you buy, when you draw a red ball, the insurance company will compensate you and you will pay premium as well. When you draw a blue ball, you do not receive compensation, but only pay the premium.

We are going to play for 5 rounds, and at the end you will be asked to randomly pick one round to determine your earnings for this version.

Informal insurance group

Version 1: Autarky game (Autarky)

Welcome to this version.

Each round, depending on the number of blue balls you earned from sorting beans in that round, you draw one ball from a bag containing 32 balls.

When you draw a red ball, you earn 2000 shillings and when you draw a blue ball, you earn 10,000 shillings.

We are going to play for 5 rounds, and at the end you will be asked to randomly pick one round to determine your earnings for this version.

Version 2: Sharing game (Compulsory informal insurance)

Welcome to this version.

Each round, depending on the number of blue balls you earned from sorting beans in that round, you draw one ball from a bag containing 32 balls.
In this version however we randomly assign you a partner.
When you draw a red ball and your partner drew a blue ball, your partner will give you 3000 shillings and you will earn 5000 shillings for that round and your partner will earn their remaining 7000 shillings for that round. When you draw a blue ball and your partner drew a red ball, you will give your partner 3000 shillings and you will earn your remaining 7000 shillings for that round and your partner will earn 5000 shillings for that round. When you and your partner both draw a red ball, you both earn 2000 shillings and when you and your partner both draw a blue ball, you both earn 10,000 shilling.

We are going to play for 5 rounds, and at the end you will be asked to randomly pick one round to determine your earnings for this version.

Version 3: Choice sharing game (Voluntary informal insurance)

Welcome to this version.

Each round, depending on the number of blue balls you earned from sorting beans in that round, you draw one ball from a bag containing 32 balls.

In this version however you prior decide on the amount of money you give to your randomly assigned partner, in case you draw a blue ball and your partner draws a red ball.
You can decide to give your partner 4000 shillings or 3000 shillings or 2000 shillings or 1000 shillings or zero.
When you draw a red ball and your partner drew a blue ball, your partner will give you the amount they a prior decided on and you will earn 2000 shillings plus that amount for that round and your partner will earn 10,000 shillings minus that amount for that round. When you draw a blue ball and your partner drew a red ball, you will give your partner the amount you prior decided on and you will earn 10,000 minus that amount for that round and your partner will earn 2000 shillings plus that amount for that round. When you and your partner both draw a red ball, you both earn 2000 shillings and when you and your partner both draw a blue ball, you both earn 10,000 shilling.

We are going to play for 5 rounds, and at the end you will be asked to randomly pick one round to determine your earnings for this version.

We thank you for your time.

Appendix 4C: The Experiment

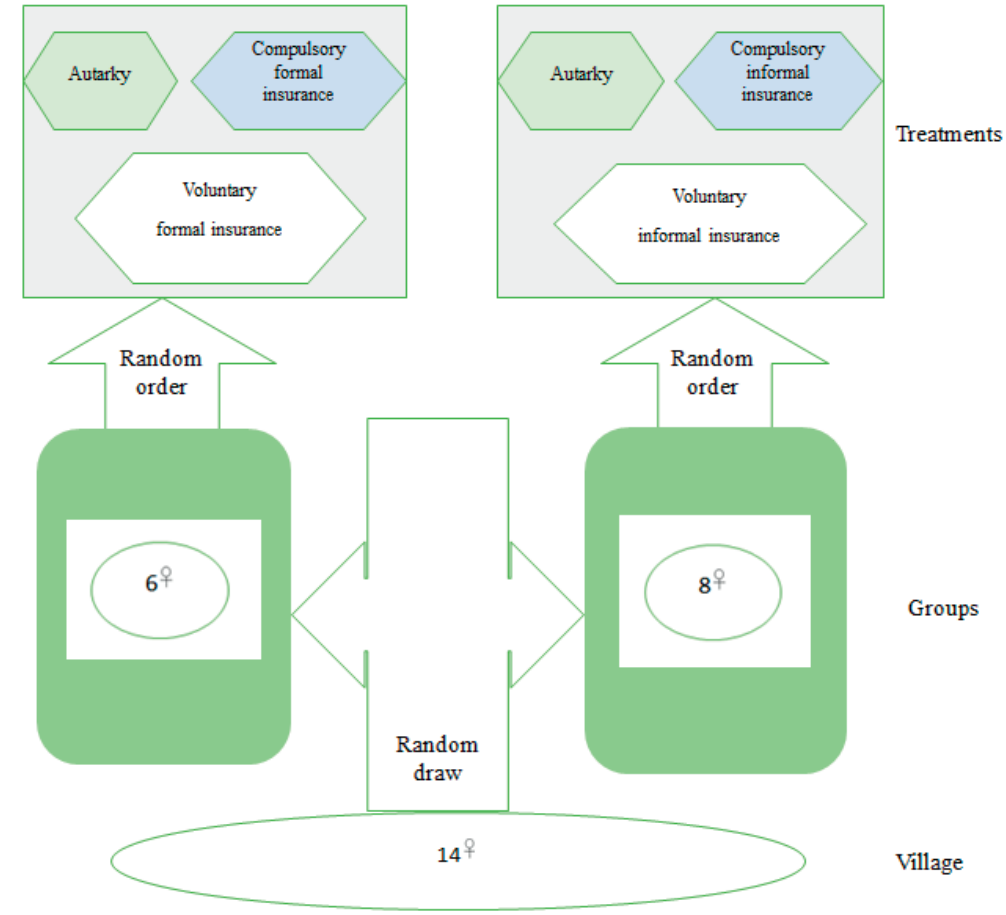

Figure 4C-1: Experiment groups and engagement in the treatments. The 14 randomly selected participants from the village were randomly grouped into 2 groups, the formal insurance group consisting of 6 participants, and the informal insurance group consisting of 8 participants. Each group separately and simultaneously engaged in the corresponding treatments according to the random order corresponding to the particular village.

Appendix 4D: Variable definitions

Farm size: Total size of participant's household farm in acres.
Farm output: Average worth of the participant's household farm output per cropping season in million shillings.
Number of assets: Total number of types of assets owned by the participant's household.
Age: Age of participant in years.
Household size: Total number of people in the participant's household.
Female: A dummy variable taking 1 if the participant is female and 0 otherwise.
Young: A dummy variable taking 1 if the participant is below 42 years of age and 0 otherwise.
Married: A dummy variable taking 1 if the participant is married and 0 otherwise.
Household head: A dummy variable taking 1 if the participant is the household head and 0 otherwise.
Major occupation-farming: A dummy variable taking 1 if participant's major occupation is farming, and 0 otherwise.
Employ hired labour: A dummy variable taking 1 if the participant's household employ non-family labour on the farm.
Primary education: A dummy variable taking 1 if participant's education attainment is primary level and above, and 0 otherwise.
Post-primary education: A dummy variable taking 1 if participant's education attainment is ordinary level and above, and 0 otherwise.
Member of VSLA: A dummy variable taking 1 if participant is a member of a VSLA, and 0 otherwise.
Risk averse: A dummy variable taking 1 for a risk averse (hypothetical) participant, and 0 for otherwise.
Low discount rate: A dummy variable taking 1 for a participant with low discount rate, and 0 otherwise.
Gifts from family and friends: A dummy variable taking 1 if a participant reported using gifts from family and friends for coping with shocks, and 0 otherwise.
Borrow from family: A dummy variable taking 1 if a participant reported borrowing from family to cope with shocks, and 0 otherwise.
Borrow from friends: A dummy variable taking 1 if a participant reported borrowing from friends to cope with shocks, and 0 otherwise.
Borrow from VSLA: A dummy variable taking 1 if a participant reported borrowing from VSLA to cope with shocks, and 0 otherwise.
Formal insurance coverage: A dummy variable taking 1 if a participant reported using formal insurance coverage to cope with shocks, and 0 otherwise.
Compulsory formal insurance: A dummy variable taking 1 for compulsory formal insurance treatment, and 0 otherwise.
Voluntary formal insurance: A dummy variable taking 1 for voluntary formal insurance treatment, and 0 otherwise.
Compulsory informal insurance: A dummy variable taking 1 for compulsory informal insurance treatment, and 0 otherwise.
Voluntary informal insurance: A dummy variable taking 1 for voluntary formal insurance treatment, and 0 otherwise.

Autarky: A dummy variable taking 1 for autarky condition without any form of insurance, and 0 otherwise.
Full: A dummy variable taking 1 if a participant bought 100 % formal insurance coverage and 0 otherwise.
High: A dummy variable taking 1 if a participant bought 75 % formal insurance coverage and 0 otherwise.
Average: A dummy variable taking 1 if a participant bought 50 % formal insurance coverage and 0 otherwise.
Low: A dummy variable taking 1 if a participant bought 25 % formal insurance coverage and 0 otherwise.
Order dummies: Are dummy variables taking 1 for a particular rank of round of play, and 0 otherwise.
Subject dummies: Are dummy variables taking 1 for a particular participant and 0 otherwise.
Round 1&2: A dummy variable taking 1 if the round of play is 1 or 2, and 0 otherwise.
Bad outcome: Are dummy variables taking 1 if a participant picked a red ball and 0 otherwise.
Effort: Amount in grams of beans sorted per round.

Appendix 4E: Robustness Analysis

Table 4E-1: Effect of Bad outcome on coverage; probit estimation

	Coverage level	
	(1)	(2)
Bad outcome (L.1)	0.22**	0.44***
	(0.10)	(0.14)
Effort	-0.005***	-0.004
	(0.00)	(0.00)
Constant cut (zero/autarky)	-1.88***	-4.12***
	(0.32)	(0.64)
Constant cut (low)	-1.25***	-2.68***
	(0.30)	(0.60)
Constant cut (average)	-0.51*	-1.00*
	(0.30)	(0.57)
Constant cut (high)	-0.01	0.35
	(0.31)	(0.59)
N	600	600
Pseudo R-squared	0.027	0.501

Robust standard errors, clustered at subject level, in parentheses. *** $p < 0.01$,** $p < 0.05$, * $p < 0.10$.

Chapter 5

Microfinance Institutions and Income Inequality:

A Panel Data Analysis

Abstract

Microfinance institutions may provide a pathway to increase incomes of the poor and reducing income inequality. While microfinance institutions differ in their modes of operation in terms of their profit orientation, charter type, and target market, evidence on the effect of this heterogeneity on economic outcomes is still scant. In this chapter, I use a dynamic panel model on data from 52 developing countries (1) to examine the effect of access to microfinance on income inequality, and (2) to explore whether the different subgroups of microfinance institutions have different impacts on income inequality. The main results are that operations of for-profit MFIs, MFIs organised as banks and MFIs targeting the less-poor, increase income inequality, while those of not-for-profit MFIs, MFIs organised as NGOs and MFIs targeting the bottom-poor, have no effect on income inequality.

This chapter is based on:
Nanyiti, A. (2019). Microfinance Institutions and Income Inequality: A panel Data Analysis. Working Paper.

5.1 Introduction

Microfinance gained a lot of popularity over the past two decades as a promising solution to poverty and income inequality. The microfinance movement aimed at extending small loans to finance capital requirements of the poor, and to enable them to engage in income generating and self-employment activities (Armendáriz & Morduch, 2005; Milana & Ashta, 2012). Nowadays, microfinance institutions (MFIs) provide a broad range of financial services, including microcredit, micro savings, insurance, training products and at times a combination of training and credit (Odell, 2010). The business models applied by MFIs have evolved over time. Originally, most MFIs aimed at reaching out to low-income groups with small loans. Although, most microfinance institutions still focus on the poor and financially-excluded households, there has been an increase in the number of commercial MFIs aiming for profits and targeting less-poor clients (Armendáriz & Szafarz, 2011; Cull et al. 2009; Yunus, 2011). To attain financial sustainability, these MFIs attempt to increase profitability, which often come at the expense of deeper outreach (D'Espallier et al. 2017; Kar, 2013; Mia & Lee, 2017; Louis & Baesens, 2013; Serrano-Cinca & Gutiérrez-Nieto, 2014).

Profit seeking behaviour by some MFIs implies that the mode of operation of MFIs varies within the microfinance industry. MFIs differ in terms of their profit orientation, their charter type, as well as their target market strategies. MFIs registered as profit institutions typically seek to reduce transaction costs, for instance by targeting relatively less-poor (less-risky) clients, or by focusing their operations in urban locations. Regarding charter type, MFIs are organised as banks, and MFIs are organised as NGOs. MFIs organised as NGOs may differ in their operations. For instance, they may locate their operations in remote areas, provide subsidised loans, train clients or make an effort to recruit poorer clients. Likewise MFIs vary

according to their target markets. MFIs targeting the high-end market may differ in their operation from MFIs targeting the low-end market, in terms of the social-economic characteristics of their clients, location choice, and processing time and size of loans. The variation in operations of MFIs matters for their outcomes. However, there exists no evidence that explains how variation in MFIs' operations influences outcome variables. This chapter contributes to filling this gap.

Financial institutions are a fundamental component of economic development paths. A pro-poor approach, like microfinance, is expected to influence development outcomes (Levine, 1997). Even though microfinance institutions primary target poverty, through outreach to lower income groups, they reduce financial exclusion of groups at the bottom of the distribution and this ultimately should have an effect on income inequality. The expectation is that access to credit enables poor households with limited or no savings to engage in income-generating activities, resulting in an increase in their incomes. This enables them to catch up with higher income groups (Mahjabeen, 2008). This outcome on inequality need not materialize if the poor mainly use loans for consumptive purposes that do not contribute to physical capital accumulation (Mosley & Hulme, 1998).

There is little empirical evidence on how access to microfinance is related with income inequality at the macro level. With the exception of Kai and Hamori (2009), Tchouassi (2011), and Hermes (2014), the literature focuses on theoretical work or empirical analyses at the micro level. Using cross-sectional country level data, Kai and Hamori (2009), Tchouassi (2011) and Hermes (2014) study the relationship between access to microfinance and income inequality, and generally find small positive effects on income equality. A potential concern with these

studies is that they treat microfinance as an aggregate variable. Yet, as mentioned above, there is considerable heterogeneity in the operations of the microfinance sector.

This chapter examines the effect of access to microfinance on income inequality, and explores whether different subgroups of MFIs impact differently on income inequality. For this purpose, I use a panel of 52 developing countries for the period between 2000 and 2011. I measure income inequality by GINI Index provided by Standardized World Income Inequality Database (SWIID), and access to microfinance is measured by MFI's gross loan portfolio provided by Microfinance Information eXchange (MIX) database. The subgroups of MFIs are determined basing on the classification of MFIs according to their profit orientation, charter type and target market, specified in MIX data. My main result is that profit oriented MFIs tend to increase income inequality, and MFIs that are not profit oriented have no effect on income inequality.

The rest of this chapter is organised as follows. Section 5.2 presents the theoretical foundation, section 5.3 describes the data, Section 5.4, describes the empirical model, section 5.5 presents the results, and section 5.6 presents the discussion and conclusion.

5.2 Theoretical Foundation

Microfinance emerged as an innovative instrument for increasing outreach to the poor to help them overcome the limitations (high transaction costs and lack of collateral) they face in accessing formal financial services. MFIs applied models that focused on small individual loans, group loans, or progressive lending to provide financial services to low-income individuals. Such financial services are expected to enable the poor to finance income generating projects, human capital development and consumption needs (Armendáriz & Morduch, 2005; Banerjee & Duflo 2010; Banerjee & Newman, 1993). By reaching out to

bottom income groups, MFIs induce savings or entrepreneurship, which should translate into higher incomes and asset holdings (Awaworyi, 2014; Buera et al., 2015; Li et al., 2011; Kaboski & Townsend, 2005, 2012). Microfinance also enables households to smooth consumption in case of negative income shocks (Ambrosius et al., 2013; Khandker, 2005; Berhane & Gardebroek, 2011; DeLoach & Lamanna, 2011; Gertler et al., 2009). This is important as it prevents untimely sale of assets such as land and livestock which are key factors in income generation (Berner et al. 2012; Kazianga & Udry, 2006; Mosley & Hulme, 1998).

Generally microfinance is considered as a strategy for empowering the poor. However, the ultimate outcome of borrowing on incomes of the poor depends on their ability to pay back the borrowed funds. Wright et al. (1999) and Hulme (2000) discuss the possibility of extra risk to some households in a sense that failure to repay loans may result into loss of assets (as some of the poor may need to sell their assets to repay borrowed funds). Similarly, Kabir Hassan (2002) reports seizing of assets and termination of relationship between the client and MFI (or between the client and fellow group members) in cases of repayment problems. Such situations reduce welfare of the borrower.[24]

Over time, actors in the microfinance industry recognised the need to promote financial sustainability of MFIs, and to reduce reliance on donor or government support. Many MFIs started to focus on the profitability of their operations, by commercialising their activities. In some instances, commercialisation involved the transformation of microfinance institutions from non-profit oriented to profit oriented, from non-government organisations (NGOs) or non-

[24] Defaulting does not only affect the borrowers, but also the MFIs. Mungure (2015) points out that some of the loans borrowed from MFIs are not paid back, resulting into accumulation of bad debts. As a result the financial sustainability of the MFIs is affected, which translates into reduced capacity to cater for their clients. Thus MFIs have devised some strategies to reduce on loan default including better screening of loan applicants, increased monitoring to ensure loan recovery and commercialising of their operations.

regulated to regulated institutions providing market-based financial services (Ledgerwood & White, 2006). To increase profits, MFIs put greater attention on reducing transaction costs as well as the probability of default. As a result, the clientele of MFIs is split into distinct groups, hereafter referred to as the less-poor and the bottom-poor. Compared to the less-poor, the bottom-poor have lower incomes (often less than half the income of their counterparts), and have fewer assets (Mosley, 2001). Depending on their shareholding ideology or funding strategy, MFIs may target either group of clients, pursue the intermediary group or possibly a combination of client groups.

Profit-oriented MFIs may target the less-poor group associated with a lower default rate (better credit worthiness- have some collateral), and provide bigger loans to this sub-group. In contrast, the small loans normally acquired by the bottom-poor are associated with high transaction costs due to the need for frequent monitoring of clients by loan officers to ensure recovery (Xu et al., 2016; Louis & Baesens, 2013). Pursuing a pro-poor mission, not-for-profit MFIs may also provide loans with flexible or longer grace periods (Field et al. 2013; Miamidian et al, 2005).

Differences in operations of MFIs may have implications for the effect of microfinance on the distribution of income. Theory by Banerjee and Newman (1993) and Matsuyama (2007, 2008), shows that outcomes of financial institutions depend on the initial income status of the clients. Bauchet et al. (2011) only find significant effects of microfinance on incomes for the sub-group of less-poor clients including wage earners and men. Moreover, different client groups have different abilities and needs for loans. The bottom-poor may obtain small loans for small business activities or consumption smoothing, which may not result into higher income status (Banerjee & Duflo, 2010). Such outcomes imply that the income gap between bottom-

poor and less-poor groups widens. The overall effect on income inequality also depends on how the incomes of bottom and less-poor evolve relative to the incomes of the non-poor members in society. Specifically; if income of the less-poor increases, they may catch up with richer society members (reducing inequality) and move away from the bottom-poor (increasing inequality). The net effect of increasing the income of the less-poor on inequality is therefore theoretically ambiguous, and ultimately an empirical matter.

Surprisingly, only few studies deal with the effect of microfinance on income inequality, and even less studies use cross-country data. Mahjabeen (2008) finds that provision of credit to poor entrepreneurs is positively associated with an increase in employment opportunities, and a reduction in income inequality within a country. Likewise, Copestake (2002) finds a positive association of access to credit with household income status, and Cuong et al. (2007) finds access to credit to positively impact on the level of household income and expenditure.

Kai and Hamori (2009), Tchouassi (2011) and Hermes (2014) study the impact of access to microfinance on income inequality using country level data. Kai and Hamori (2009) uses Microcredit Summit Campaign data on 61 developing countries, and the total number of MFIs and number of borrowers in a country to measure microfinance intensity, and find that microfinance is associated with a reduction in income inequality. Likewise, Tchouassi (2011) uses the number of borrowers in a country to measure microfinance intensity, and data on 11 Central African countries. This study finds income inequality to be negatively correlated with access to microfinance. Hermes (2014) uses data on 70 developing countries, and the share of number of active borrowers to total population and the share of gross loan portfolio to GDP to measure the intensity of microfinance activities. He finds microfinance to reduce income

inequality by a small magnitude. The main conclusion from these studies is that microfinance has small positive effects on income equality. This chapter builds on Kai and Hamori (2009), Tchouassi (2011) and Hermes (2014). The main difference between this chapter and these studies is that I consider subgroups of MFIs rather than treating MFIs as an aggregate variable.

5.3 Data

Data on income inequality are taken from the SWIID[25] dataset. This dataset estimates the gini index (GINI) using official income statistics. The gini index measures the degree to which the distribution of income (or consumption expenditures) deviates from a perfectly equal distribution. The index ranges from 0 to 100 and the lower this ratio, the more equitable the income distribution. SWIID considers observations based on the entire population of the country. Data is taken from scholarly projects, key cross-national databases, and national statistics agencies (Solt, 2016). SWIID checks the comparability of the data based on consistency with the Luxembourg Income Study (LIS), which is sometimes recognised as the gold standard.

Data on access to microfinance is taken from the MIX[26] database. This database provides annual performance information on microfinance institutions (MFIs), their funders and networks. MIX is a non-profit organization and through its website MIX provides access to financial and social performance information for a wide range of MFIs around the world. Data is voluntarily submitted by the MFIs according to the microfinance industry reporting standards. MIX checks the data for reliability and then annualizes it to fiscal and calendar years. MIX data has been used by several studies, including Ahlin et al. (2011), Cull et al. (2011), Imai et al. (2012), Hermes

[25] http://fsolt.org/swiid/

[26] www.mixmarket.org

(2014), Lopatta and Tchikov (2016), Maksudova (2010), and Wagner and Winkler (2013). The voluntary reporting by MFIs to MIX poses a concern. As pointed out by Cull et al. (2011) and Imai et al. (2012), it is possible that newer MFIs may not be in position to voluntarily report to MIX, causing a selection problem. The selection problem may also be influenced by motives underlying voluntary reporting. For instance MFIs seeking external financing may voluntarily report to MIX (Ahlin et al., 2011; Maksudova, 2010). To check the extent of the selection bias in MIX data, Ahlin et al. (2011) and Imai et al. (2012) estimated various econometric models with different subsamples based on different criteria for example, the extent of validity of data submitted and find similar and consistent results across subsamples. Moreover, for my analysis, I only consider MFIs that have at least three diamonds, on the MIX quality and reliability rating system of five diamond ranks. Higher diamond ranks are associated with higher disclosure of data and reporting.

I use the classification of MFIs according to their profit orientation, charter type and target market provided in the MIX data, to divide the total sample into different subgroups. Specifically, I include for-profit MFIs, MFIs organised as banks and MFIs that target high-end borrowers to proxy for profit-oriented MFIs serving the less-poor, and include not-for-profit MFIs, MFIs organised as NGOs, and MFIs targeting broad-end borrowers and low-end borrowers to proxy for MFIs that are not profit oriented reaching out to the bottom poor. More details about these categories are given in Appendix 5A. To measure access to microfinance, I follow Hermes (2014), and use the share of MFI's gross loan portfolio to nominal GDP, and the share of number of active borrowers to total population. Similar indicators are used in finance to measure access to and use of banking services (Beck et al. 2007; Beck et al. 2009; Clarke et al., 2006; Honohan, 2008; Mookerjee & Kalipioni, 2010).

Selection of covariates is based on the existing literature (Hermes, 2014; Kai & Hamori, 2009). I include the log of real GDP per capita (in US dollars for 2010 prices), trade openness (measured by the log of the ratio of sum of imports and exports to GDP), inflation rate, share of rural population to total population and government spending as a share of GDP. Data for covariates are taken from the World Development Indicators (WDI) dataset reported by the World Bank.[27] Table 5.1 gives summary statistics of variables used in the analysis, and Appendix 5B gives the pairwise correlation coefficients.

[27] www.data.worldbank.org/data-catalog/world-development-indicators

Table 5.1: Descriptive Statistics

	Variable	Obs	Mean	SD	Min	Max
Dependent Variable	GINI	395	32.244	7.879	11.886	54.535
Access to microfinance Gross loan portfolio	All MFIs	395	8.82e+07	4.41e+08	12640	5.26e+09
	Profit	395	7.35e+07	3.90e+08	12640	4.70e+09
	Not for profit	395	1.44e+07	5.42e+07	10697	6.12e+08
	Bank	395	2.35e+07	7.91e+07	51703	7.45e+08
	NGOs	395	1.09e+07	5.04e+07	10697	5.79e+08
	High-end	395	5395831	2.69e+07	47158	2.15e+08
	Broad-end	395	2.40e+07	8.55e+07	44470	1.01e+09
	Low-end	395	4.83e+07	3.78e+08	47	5.01e+09
Number of active borrowers	All MFIs	395	375902.5	2647658	2	3.18e+07
	Profit	395	301411.4	2305694	2	2.81e+07
	Not for profit	395	73245.11	354447	192	3542947
	Bank	395	19037.05	77612.26	201	821047
	NGOs	395	66321.11	336225.2	107	3423808
	High-end	395	2215.648	12475.38	192	175234
	Broad-end	395	41045.25	241729.1	201	4269276
	Low-end	395	329948.4	2491681	36	3.14e+07
Covariates	Real GDP	395	14168.39	20002	271.022	144246.4
	Trade	395	85.477	35.164	21.67383	209.891
	Inflation	395	7.454	9.116	-3.653	108.897
	Rural Population	395	57.969	18.849	13.953	91.318
	Government spending	395	16.795	12.977	3.460	111.038
Standardising indicators for access to microfinance	GDP	395	5.99e+10	2.01e+11	4.53e+08	1.84e+12
	Population	395	4.73e+07	1.84e+08	262202	1.25e+09

5.4 Empirical Model

In this section, I develop the estimation strategy. To examine the effect of access to microfinance on income inequality and to explore whether the subgroups of MFIs impact differently on income inequality, I estimate the empirical model below.

$$gini_{it} = \alpha_i + \mu gini_{it-1} + \gamma lnMFI_{it} + \beta_j X_{it} + \delta_t + \varepsilon_{it} \quad 5.1$$

Where $gini_{it}$ is the gini coefficient for country i in year t, α_i represents country specific effects. I include the lag of the dependent variable to control for autoregressive tendency. In some estimations $lnMFI_{it}$ proxies the aggregated indicator of access to microfinance, and in other estimations it proxies disaggregated indicators based on the different subgroups of MFIs (according to profit orientation of MFIs, charter type of MFIs and target market of MFIs). In all estimations $lnMFI_{it}$ represents the log of the category of MFIs' share of gross loan portfolio to nominal GDP for country i in year t. X_{it} is a vector of covariates for county i in year t, δ_t is time fixed effects, and ε_{it} is the error term. Not all subgroups of MFIs are active in all countries. In order not to lose these observations, I add to each observation, the minimum non-zero value of the category of MFIs's share of gross loan portfolio (to GDP) before taking logs (see Cameron & Trivedi, 2005 for similar imputations).

The challenge of estimating autoregressive specifications is that the lagged dependent variable is correlated with the error term, and pooled OLS is inconsistent. The OLS-fixed effects estimator transforms the data to remove fixed effects, but the transformed lagged dependent variable is still correlated with the error term (Anderson & Hsiao; 1982; Nickell, 1981). While I start from the premise that microfinance enables low-income individuals to engage in productive activities, contributing to their income, a potential reverse relation may prevail as well. MFIs are not randomly established, and particular MFI subgroups for instance, not-for-profit MFIs, MFIs organized as NGOs or those that target the low-end market, may reach out to locations with less-equitable income distributions. Locations with more equitable income distributions may be more appealing to profit-oriented MFIs, MFIs organized as banks and MFIs that target the high-end market.

A straightforward way of dealing with endogeneity problem is using the instrumental variable (IV) estimator. However, valid instruments that are suitable for panel analysis are difficult to find (Bound et al. 1995). Previous cross sectional studies use country of origin of the existing legal system and absolute value of the country's capital city latitude (Hermes, 2014), and cost of enforcing a contract and lag of a weighted five year average of gross loan portfolio (Imai et al, 2012). While country of origin of the existing legal system, might provoke concerns regarding the possibility of ongoing trade or development relations, the above mentioned instruments, may be problematic for panel analysis.

Instead, System Generalised Method of Moments (system GMM) is applicable. Transforming the model by taking differences or forward orthogonal deviations, eliminates fixed effects and higher order lags of regressors are valid instruments for the lagged regressor (Arellano & Bond, 1991; Arellano & Bover, 1995). To increase on moment conditions and improve efficiency, the system GMM (Bludell and Bond, 1998) uses first differences of instruments as additional instruments, since they are not correlated with fixed effects. It constructs a system of equations; the original one and the transformed equation, and first differences are valid instruments for the model in levels and levels are valid instruments for the model in first differences. The system GMM is implemented as single-equation estimation problem, since an identical linear-functional relationship applies both to the transformed and untransformed variables (Roodman, 2006). However, the properties of system GMM estimator are weakened by limited time periods. To account for this, I estimate model (5.1) using system GMM, and apply the Windmeiger (2005) small-sample correction for two-step standard errors. I then test the hypothesis $\gamma > 0$.

As a robustness check, I re-estimate model (5.1), but instead use the share of number of active borrowers to total population as a proxy for access to microfinance. Weber (2013) demonstrates that the volume of MFIs' total gross loan portfolios is predominantly owned by Chinese MFIs, followed by MFIs from Latin America and the Caribbean. East Asia contributes about 55% of the MFIs' total gross loan portfolios, 24.3% is contributed by Latin America and the Caribbean. This means that using only gross loan portfolios to indicate for access to microfinance may imply that results are driven by the proportion of the gross loan portfolios from East Asia.

5.5 Results

In this section, I present the empirical results. I report pooled OLS results in columns (1) and (2) of all tables as baseline results, and report system GMM results in columns (3) and column (4) of all tables as the main results. Columns (1) and (3) reports results for the share of gross loan portfolio to GDP as the indicator for access to microfinance, and columns (2) and (4) report results for the share of number of active borrowers to total population as a robustness check. Although the main aim of the chapter is to explore the effect of subgroups of MFIs on income inequality, I first focus on the aggregate indicator of microfinance access.

Table 5.2: Effect of All MFIs on Income Inequality

	GINI			
	(1)	(2)	(3)	(4)
GINI (lagged)	0.906***	0.903***	0.673***	1.464***
	(0.02)	(0.02)	(0.22)	(0.32)
All MFIs	0.092***	0.103***	0.140	0.348
	(0.03)	(0.03)	(0.08)	(0.28)
Real GDP	-0.064	-0.065	-0.248	-0.070
	(0.11)	(0.11)	(0.28)	(2.68)
Trade	0.238	0.189	0.521	-1.009
	(0.40)	(0.39)	(1.13)	(1.62)
Inflation	0.006	0.006	0.004	-0.011
	(0.01)	(0.01)	(0.01)	(0.04)
Rural population	0.003	0.005	0.016	0.006
	(0.01)	(0.01)	(0.03)	(0.05)
Government spending	0.009	0.010	0.006	0.036
	(0.01)	(0.01)	(0.02)	(0.08)
Constant	3.144	3.398*	10.804	-7.190
	(1.96)	(1.97)	(8.69)	(26.37)
Method	OLS	OLS	System GMM	System GMM
Number of Obs	395	395	395	395
R-squared	0.866	0.867		
Number of Countries			52	52
Number of Instruments			43	44
Arellano-Bond AR(2)			[0.477]	[0.135]
Hansen			[0.351]	[0.309]

Robust standard errors in parentheses. *** p<0.01, * p<0.1, p-values in brackets.

Table 5.2 reports results for the effect of the aggregated indicator of access to microfinance. Results in column (1) and (2) show a negative effect of the aggregated indicator of access to microfinance on income equality. However this effect disappears when endogeneity is taken into account. Results in column (3) and (4) show that MFIs in aggregate do not have an effect on income inequality. One possible explanation for this surprising result is that aggregating MFIs does not capture the heterogeneity of MFIs in terms of differences in their operations and effects. Different subgroups of MFIs may have opposing effects on the income distribution, which may be obscured when MFIs are lumped together (Miamidian et al, 2005; Field et al. 2013). The effects of the subgroups of MFIs may average out in the

aggregate. To test for the effect of heterogeneity of MFIs on income inequality, I consider the disaggregate indicators of access to microfinance along lines of profit orientation of MFIs, the MFI's charter type and the MFI's target market. First I consider the effect of profit orientation of MFIs on income inequality. The indicator of access to microfinance is split according to MFIs registered as for-profit and MFIs registered as not-for-profit.

Table 5.3: Profit orientation of MFIs and Income Inequality

	GINI			
	(1)	(2)	(3)	(4)
GINI (lagged)	0.912***	0.907***	0.551***	0.582***
	(0.03)	(0.03)	(0.18)	(0.19)
For-profit MFIs	0.083**	0.081*	0.727*	0.802*
	(0.04)	(0.04)	(0.42)	(0.42)
Not-for-profit MFIs	0.003	0.047	-0.248	-0.109
	(0.05)	(0.05)	(0.40)	(0.34)
Real GDP	-0.112	-0.105	-0.624	-0.587
	(0.11)	(0.11)	(0.47)	(0.41)
Trade	0.274	0.226	1.722	1.308
	(0.41)	(0.41)	(1.77)	(2.04)
Inflation	0.007	0.007	0.013	0.011
	(0.01)	(0.01)	(0.03)	(0.03)
Rural population	0.004	0.006	0.035	0.053
	(0.01)	(0.01)	(0.06)	(0.05)
Government spending	0.007	0.008	0.029	0.010
	(0.01)	(0.01)	(0.04)	(0.05)
Constant	3.379*	3.860*	16.996	18.090
	(1.95)	(1.96)	(11.12)	(12.14)
Method	OLS	OLS	System GMM	System GMM
Number of Obs	395	395	395	395
R-squared	0.866	0.867		
Number of Countries			52	52
Number of Instruments			41	41
Arellano-Bond AR(2)			[0.848]	[0.785]
Hansen			[0.377]	[0.297]

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1, p-values in brackets.

Table 5.3 reports results for the effect of profit orientation of MFIs and income inequality. Results in column (1) and (2) are similar to results in column (3) and (4). These results suggest that profit-oriented MFIs have a negative effect on income equality.

Specifically, a one-percent increase in access to microfinance by the less-poor is associated with a 0.727 (0.802) percentage-point increase in income inequality. The possible explanation for this finding is that profit-oriented MFIs offer bigger loans to their clients, which enables them to make bigger business enterprises, hire more labour or increase the stock of assets, resulting into improvement in their income status (Banerjee & Duflo, 2010; Matsuyama, 2011; Mosley & Rock, 2004). If the income status of individuals at the bottom of the income distribution remains the same, an increase in income of the less-poor clients of for-profit MFIs implies that the income gap between bottom and less-poor widens. Moreover, results indicate, though positive, but insignificant effect of the not-for-profit MFIs on income equality. This is possibly due to the smaller loan sizes which may not have a significant impact on clients' business activities and incomes. It may also be the case because these clients mainly use microcredit for consumptive purposes.

Next I explore the effect of charter type on income inequality. The indicator of access to microfinance is split according to MFIs organised as banks and MFIs organised as NGOs.

Table 5.4: Charter type of MFIs and Income Inequality

	GINI			
	(1)	(2)	(3)	(4)
GINI (lagged)	0.913***	0.915***	0.828***	0.708***
	(0.03)	(0.03)	(0.14)	(0.19)
MFIs organized as Banks	0.096*	0.142*	0.531*	1.520*
	(0.05)	(0.08)	(0.29)	(0.89)
MFIs organized as NGOs	0.017	0.064	-0.023	-0.133
	(0.01)	(0.05)	(0.10)	(0.41)
Real GDP	-0.092	-0.122	-0.478	-0.920
	(0.11)	(0.12)	(0.44)	(0.65)
Trade	0.308	0.177	1.049	1.282
	(0.40)	(0.40)	(1.02)	(1.72)
Inflation	0.010	0.012	0.001	0.024
	(0.01)	(0.01)	(0.02)	(0.04)
Rural population	0.007	0.006	0.039	0.063
	(0.01)	(0.01)	(0.03)	(0.06)
Government spending	0.006	0.008	-0.004	0.003
	(0.01)	(0.01)	(0.02)	(0.05)
Constant	3.051*	4.508**	9.664	20.458
	(1.79)	(1.95)	(8.47)	(16.72)
Method	OLS	OLS	System GMM	System GMM
Number of Obs	395	395	395	395
R-squared	0.867	0.866		
Number of Countries			52	52
Number of Instruments			50	33
Arellano-Bond AR(2)			[0.262]	[0.434]
Hansen			[0.411]	[0.154]

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1, p-values in brackets.

Table 5.4 reports results for the effect of charter type of MFIs on income inequality. Results in column (1) and (2) are similar to results in column (3) and (4). These results again suggest that MFIs organised as banks have a negative effect on income equality, while MFIs organised as NGOs do not have an effect on income inequality. These results are consistent with the ones above because compared to MFIs organised as NGOs, MFIs organised as banks normally target the less-poor clients (Miamidian et al, 2013). MFIs organised as banks enable the less-poor clients to invest and improve their incomes, thereby contributing to increased inequality as the income status of the bottom groups does not change.

Lastly I investigate the effect of target market of MFIs on income inequality. The indicator of access to microfinance is split according to MFIs that target the high-end market, the broad-end market, or the low-end market.

Table 5.5: Target Market of MFIs and Income Inequality

	GINI			
	(1)	(2)	(3)	(4)
GINI (lagged)	0.913***	0.917***	0.980***	0.755***
	(0.02)	(0.02)	(0.09)	(0.18)
MFIs targeting High-end	0.132**	0.158**	0.070*	0.530*
	(0.06)	(0.07)	(0.04)	(0.30)
MFIs targeting Broad-end	-0.054	-0.106	0.024	-0.053
	(0.05)	(0.07)	(0.08)	(0.27)
MFIs targeting Low-end	0.156***	0.197***	-0.042	0.406
	(0.05)	(0.05)	(0.17)	(0.25)
Real GDP	-0.065	-0.075	-0.077	-0.255
	(0.11)	(0.11)	(0.22)	(0.40)
Trade	-0.054	-0.184	0.032	-0.482
	(0.41)	(0.40)	(0.93)	(1.29)
Inflation	0.010	0.011	0.003	0.028
	(0.01)	(0.01)	(0.02)	(0.02)
Rural population	-0.004	-0.005	0.006	0.008
	(0.01)	(0.01)	(0.01)	(0.04)
Government spending	0.009	0.010	-0.001	0.023
	(0.01)	(0.01)	(0.02)	(0.02)
Constant	6.708***	7.211***	1.465	21.275*
	(2.34)	(2.26)	(6.54)	(11.91)
Method	OLS	OLS	System GMM	System GMM
Number of Obs	395	395	395	395
R-squared	0.869	0.871		
Number of Countries			52	52
Number of Instruments			40	33
Arellano-Bond AR(2)			[0.126]	[0.264]
Hansen			[0.281]	[0.329]

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1, p-values in brackets.

Table 5.5 reports results for the effect of target market of MFIs on income inequality. Results in column (1) and (2) are generally similar to results in column (3) and (4), except for MFIs that target the low-end market which show a negative effect on income equality for the pooled OLS results. However this effect disappears when endogeneity is taken into account.

Results in column (3) and column (4) suggest that MFIs targeting the high-end market promote income inequality, and MFIs targeting broad-end and low-end market do not have an effect on income inequality. These results are consistent with results above, and together they suggest that MFIs that offer bigger loans or target less-poor clients contribute to increasing their clients' incomes and to widening the income gap between them and the bottom groups.

5.7 Discussion and Conclusions

Microfinance is considered a pro-poor tool to enable low income groups engage in income generating activities or self-employment. The relationship between microfinance and income inequality is thus of relevance to economic literature. Previous studies Kai and Hamori (2009), Tchouassi (2011) and Hermes (2014) consider MFIs as an aggregate variable. However, heterogeneity of MFIs in terms of their operations may imply differences in economic outcomes. In this chapter I examine the effect of access to microfinance for subgroups of MFIs according to their profit orientation, charter type, and target market. This chapter makes an empirical contribution to the microfinance literature by examining how the different subgroups of MFIs affect income inequality. I find for-profit MFIs, MFIs organized as banks and MFIs that target the less-poor to have a negative effect on income equality, and the not-for-profit MFIs, MFIs organized as NGOs and MFIs that target the bottom-poor, not affect income inequality. These findings suggest microfinance does not contribute to enhancing the income status of the bottom-poor and anti-poverty policies for this category may need to explore empowerment alternatives like asset grant programmes (Buera et al., 2015; Dorfleitner et al., 2017). For the less-poor, my results show that microfinance help to improve their income status, thereby increasing the income gap between them and the bottom-poor.

Appendix 5A: List of variables and source of data

	Variable	Description	Source
Dependent Variable	GINI	Standard gini coefficient estimates based on official income statistics	SWIID (2012).
Access to microfinance	Gross loan portfolio	Mean value calculated on the basis of total gross loan portfolio between two consecutive periods	MIX (2012).
	Number of active borrowers	Total number of active borrowers	MIX (2012).
Subgroups of MFIs	Profit status	MFIs registered as profit institutions, and MFIs registered as not-for profit institutions.	MIX (2012).
	Charter type	MFIs organized as banks and MFIs organized as NGOs.	MIX (2012).
	Target market	Mix categorises MFIs according to share of average loan balance per borrower to GNI per capita. MFIs targeting broad-end borrowers have share of average loan balance per borrower to GNI per capita falling between 20 to 149 percent, MFIs targeting high-end borrowers have average loan balance per borrower to GNI per capita falling between 150 to 250 percent, and MFIs targeting low-end borrowers have average loan balance per borrower to GNI per capita of less than 20 percent (average loan size is < USD 150)	MIX (2012).
Covariates	Real GDP	Real gross domestic product per capita in 2010 prices	WDI (2012)
	Trade	Share of the sum of imports and exports to GDP (trade),	WDI (2012)
	Inflation	Change in consumer price index	WDI (2012)
	Rural population	Share of rural population to total population	WDI (2012)
	Government spending	Share of government final consumption expenditure to GDP	WDI (2012)
Standardising access to microfinance indicators	GDP	Nominal gross domestic product	WDI (2012)
	Population	Country's total population	WDI (2012)

Appendix 5B: Correlation Matrix

		1	2	3	4	5	6	7	8
GINI	1	1.00							
Gross loan portfolio (All MFIs)	2	0.07*	1.00						
Number of active borrowers (All MFIs)	3	0.09*	0.54*	1.00					
Real GDP	4	-0.10*	-0.05*	-0.01	1.00				
Trade	5	0.15*	0.01	0.04*	0.05*	1.00			
Inflation	6	0.01	-0.03*	-0.03*	-0.03*	-0.05*	1.00		
Rural population	7	0.13*	-0.01	0.04*	-0.03*	-0.15*	-0.10	1.00	
Government spending	8	0.03	0.03*	-0.00	0.09*	0.13*	-0.03*	-0.01	1.00

Pairwise correlation coefficients. * indicates statistical significance at 5% level.

Appendix 5C:List of Countries in the Sample

	Country	Years of Gini data		Country	Years of Gini data
1	Albania	9	27	Haiti	7
2	Algeria	6	28	Honduras	12
3	Angola	9	29	India	12
4	Armenia	12	30	Jamaica	6
5	Bahamas, The	5	31	Kenya	12
6	Barbados	11	32	Kyrgyz Republic	12
7	Belize	12	33	Lesotho	12
8	Bolivia	9	34	Madagascar	12
9	Botswana	8	35	Malawi	11
10	Brazil	6	36	Mauritania	8
11	Burkina Faso	12	37	Mauritius	8
12	Burundi	10	38	Mongolia	8
13	Cambodia	10	39	Montenegro	8
14	Cameroon	8	40	Mozambique	12
15	Colombia	4	41	Namibia	10
16	Cote d'Ivoire	12	42	Nicaragua	3
17	Djibouti	8	43	Niger	10
18	Dominican Republic	12	44	Nigeria	12
19	Ecuador	12	45	Paraguay	9
20	Egypt, Arab Rep.	12	46	Rwanda	6
21	El Salvador	9	47	Sri Lanka	7
22	Fiji	10	48	Tanzania	12
23	Gabon	12	49	Thailand	12
24	Gambia, The	12	50	Timor-Leste	11
25	Georgia	7	51	Togo	6
26	Guyana	12	52	Trinidad and Tobago	12

Chapter 6

Synthesis

6.1 Introduction

The contingency of agriculture, the dominant sector in Sub-Saharan Africa, to weather conditions submits household incomes to seasonal fluctuations. Volatile agricultural incomes imply households are at risk of insufficient consumption and poverty traps (Carter & Barrett, 2006; Ligon & Schechter, 2003; Townsend et al., 2004). Formal and informal insurance institutions for consumption smoothing imply different incentives to households, and their interaction has implications for household welfare. This thesis contributed to understanding of how the interaction between insurance institutions affects incentives for consumption smoothing and work effort, and to a better understanding of the aggregate level effects of insurance institutions.

This thesis fits the broad debate on institutions, incentives and development. Institutions matter for development (North, 1994; Acemoglu et al., 2014). Formal and informal institutions define incentives and decisions, and thereby influence the development process. Likewise formal and informal insurance institutions play a vital role in shielding consumption from income fluctuations. Reliance on formal institutions alone is rare, especially in Sub-Saharan Africa. Households often use a combination of informal and (in)formal institutions (Morduch, 1995). More recently, formal insurance products are promoted in rural regions of Sub-Saharan Africa; areas that predominantly rely on informal insurance institutions (Karlan et al., 2014).

The following section presents an overview of the key lessons learnt across the core chapters of this thesis, areas for future research, and policy implications.

6.2 Key lessons

6.2.1 Cooperation

To avert volatility in consumption, workers with concave utility functions may opt for tied labour arrangements, with wages lower than the average casual wage due to a smoothing premium. Interaction of financial markets with rural labour markets may attenuate the premium. Access to credit markets may result into improvement in the welfare of tied workers. For instance, a savings institution makes casual labour more attractive and should therefore lead to increase in tied labour wages (Caselli, 1997). From chapter 2 we learn that complementary saving institutions may not improve incomes of workers as second movers. We suppose that intervention to benefit workers, should consider elevating their bargaining position to first movers. Proposers can avert the supposed benefits of financial development to responders, to their own benefit. Symmetrically, workers as proposers (first movers) can exploit the benefits of financial development. Worker organisations improve the bargaining power of workers (Rubery, 1978). In rural settings, labour cooperatives in the form of local worker groups, constitute empowerment of workers (Gilligan, 2002; Kevane, 1994). Village worker groups may contribute to enhancing the bargaining position of workers. Supporting worker group formation facilitates higher share of rents that go to labour, and therefore enhance the worker's ability to exploit the benefits of savings institutions.

In addition, supporting worker groups and the subsequent use of savings institutions, implies tightening of rural casual labour market. While some of the rural poor are landless, the bulk of them are small farmers, with farm incomes barely enough to sustain consumption (Lanjouw & Lanjouw, 2001). A vibrant casual labour market is vital for this segment of the rural population. Individuals select into own smallholding and use rural casual labour market to

smooth consumption. Tightening of the rural casual labour market implies higher returns to labour and higher household incomes.

The benefits from use of savings institutions depend on the level of savings. Saving levels are however, reportedly low for Sub-Saharan Africa (Cronjé & Roux, 2010). Apart from low per capita incomes and time-inconsistent consumption (present bias), the low saving levels are also an institutional issue (Aryeetey & Udry, 2000). While social customs like holding physical assets for example land or real estate may reduce returns to savings, social assistance obligations reduce actual savings. Individuals invest in non-financial assets or engage in negative saving, so as to get around sharing obligations (Baland et al., 2011). Formal financial and insurance institutions alter the incentives and offer alternatives to distortionary claims of the social network (Dupas & Robinson, 2013). However, limited uptake (access) of formal financial and insurance products undermines risk pooling and restricts the welfare benefits. Uptake can be supported by subsidising cooperation (savings or insurance schemes) or by providing information on benefits.

6.2.2 Information

Information is empowering (Van der Burg & Prinz, 2006). Agents exploit available information to make consumption and production decisions (Hirshleifer, 1973). Information regarding market wages for instance facilitates first moving worker's bargaining. Besides, information on benefits, may increase use of savings, credit and insurance institutions, and contribute to reduction in average transaction costs. An economic good, information is costly. Therefore, providing free information is subsidising decision making. Moreover, information positions agents in better position to exploit incentives (Lewis & Sappington, 1997). Supporting information dissemination is therefore affirmative (Harrison et al., 2006;

Konstadakopulos, 2005; Sturges & Chimseu, 1996). Community information centres and/or extension workers contribute to building information of rural agents, thereby aiding bargaining, market involvement and improving productivity (Dittrich & Städter, 2015; Sturges & Chimseu, 1996).

As employers, rural agents attempt to motivate effort. Chapter 3 contributes to the ongoing debate on interaction of extrinsic, intrinsic and image motives. Moreover monetary incentives have been shown to crowd out image motivations, for example motives for donations or charity works (Ariely et al., 2009; Benabou & Tirole, 2003; Mellström & Johannesson, 2008). Unlike the case of social goods, for workplace settings in chapter 3, we learn that monetary and intrinsic motives crowd in self-image motivated effort. Agents increase supply of self-image motivated effort following higher and fairer compensations. In addition, we learn that this sort of behaviour is more salient among young and uneducated men. This is particularly the category that depends on the rural labour market for income (MoFPED, 2002). This finding implies that by targeting this category of workers, farmers could gain in productivity. Besides, farmers can provide additional information to workers so as to elicit greater effort. Information regarding income of the agent's comparison group, payment history or agent's level in the payment hierarchy, aids workers comparisons and influences work effort (Clark et al., 2010; Clark & Oswald, 1996).

Information is as well important to potential users of insurance products. In chapter 4, we learn that lack of knowledge constrains uptake of formal insurance. Because formal public and private instruments are largely unavailable for a safety net, most households in Sub-Saharan Africa rely on informal insurance mechanisms to shield consumption from income fluctuations. Promoting formal insurance products in remote areas, presents an opportunity for

the interaction of formal insurance with informal insurance. Accordingly, the debate on the impact of the interaction of formal and informal insurance institutions is significant, with some studies arguing that formal insurance crowds out informal insurance (Attanasio & Rıos-Rull, 2000; Lin et al., 2014) and other studies disputing this insight (Chandrasekhar et al., 2011; Dercon et al., 2014). With this debate far from conclusive, insights on incentive structures of these insurance institutions contribute to a better understanding of these insurance institutions.

Apart from being incomplete (Townsend, 1995), as already mentioned, claims of informal insurance networks, distort the entrepreneurship path (Berner et al., 2012). Formal insurance coverage has been found to improve risk taking by agents (Belhaj & Deroïan, 2012; Cai et al., 2009). Moreover, Mobarak and Rosenzweig (2012) find risk taking to improve, even for agents belonging to an informal insurance network. While access to formal insurance may evade sharing obligations, it is associated with strong moral hazard (see Chapter 4). Partial coverage eases moral hazard incentives (Arnott & Stiglitz, 1991; Ligon & Thistle, 2008; Lin et al., 2014). Moreover, prior choice of coverage level, aids precise ascertainment of incentive compatible formal insurance coverage to households.

Uptake of formal insurance products however, is low (Ackah & Owusu, 2012; Eling et al., 2014), and the debate on why uptake is low is ongoing. Lack of understanding of formal insurance products is cited as one of the causes for low uptake (Cai & Song, 2017; Chapter 4). Information builds knowledge (Nelson, 1970). Agent's knowledge matters for uptake of formal insurance products (Thornton et al., 2010; Zimmer et al., 2009; Karlan et al., 2014). Likewise, knowledge on benefits improves savings behaviour (self-insurance) (Sayinzoga et al., 2016). In real (insurance) situations where experience may amount to a welfare loss, providing information is an alternative. Informative programmes on benefits (for example expected

incomes based on past conditions or hypothetical production failures) contribute to building knowledge of agents.

6.2.3 Growth

In chapter 2, we suppose supporting of local working groups as a way of empowering workers to benefit from financial development (or credit market interventions in rural labour markets). High levels of poverty (subsistence or unemployment), however, undermines the power of worker organisations (Rubery, 1978). A broader approach to empowering workers points to aspirations for economic growth. Pro-poor growth entails rise in opportunities and incomes of the poor (Ravallion & Chen, 2003). High average incomes imply high reservation wages in the (rural) labour market, and therefore higher wages to workers. High incomes are also essential for higher level of savings, and higher investments in human capital which are associated with better performance of microfinance institutions (Ahlin et al., 2011).

Chapter 5 contributes to the lasting debate on the effects of microfinance on poverty. Results are mixed, with some studies finding positive relationships (Berhane & Gardebroek, 2011; Imai et al., 2012; Kaboski & Townsend, 2012; Khandker, 2005), and other studies finding contrasting results (Banerjee et al., 2015; Kaboski & Townsend, 2011,2012). We learn from chapter 5 that the relationship between microfinance institutions and income inequality depend on the nature of microfinance institutions. Particularly profit oriented MFIs facilitate increase in incomes of their clients (usually the less-poor) thereby reducing the income gap between them and the higher income group. In contrast MFIs that are not profit oriented reach out to the bottom-poor with small loans enough only for small businesses activities or consumption smoothing that do not significantly improve their income status or contribute to narrowing the income gap between them and higher groups. This finding suggests that

microfinance alone is not enough to enhance the income status of the bottom-poor. Anti-poverty policies may need a compressive pro-poor growth approach to raise the income position of the bottom-poor to levels comparable to the less-poor, such that accessing microfinance can contribute to attaining higher income levels. Such growth approaches may entail increase in preliminary interventions like assets (plus or skill) grant programmes, to increase returns to the bottom-poor, to better position them to exploit the benefits of economic growth.

6.3 Areas for Future Research

This thesis contributed to: finding ways for improving incentives pertaining to insurance institutions and effort motivation, and understanding the aggregate level effects of microfinance institutions. There is however, ample space for future research. As responders in wage negotiations, workers are at a disadvantage, and accept low wages. We suggest first mover advantage to workers. Future empirical work is necessary to ascertain the impact of first mover advantage to workers, on rural labour market outcomes. For precision and analysis of casual effects, as in this thesis, such studies should take experimental approaches. Real labour market bargaining features numerous incentives at stake that make analysis of the impact of say a work group intervention using observational data somehow problematic. In addition, in line with practice (Dovi, 2008), the alternative savings product we provided in chapter 2 paid zero interest. The finding that complementary saving institutions do not improve incomes of workers as second movers, should not be taken for the probably repellent interest rate provided, but rather on the responder position of workers in the bargaining game. Moreover, savings do not generally rise with interest rates (Ogaki et al., 1996), and interest rate is not a significant barrier to savings (Dupas & Robinson, 2013). However, positive interest rates may prompt different behavioural response from workers as first movers. Testing the impact of interest

would however, require longer time frames, more probable with a field experiment, or lab followed by a field experiment. Complementary to this thesis, future research should assess the impact of financial markets on labour outcomes, by taking the borrowing rather than the saving element used in this thesis. Workers may perceive credit differently from saving (Karlan et al., 2014). However, first moving landlords can in the same way erode benefits from credit to their advantage. It would be extra informative if results from such a study conform to our findings.

Because at workplaces effort motivations are intersected with each other, and contract information for comparison of emoluments is in some cases not accessible, approaches for fine-tuning actual compensation regimes needs further attention from future research. Future research should consider the impact of incentivised work groups, retreats, sponsored trips, and extra information on worker productivity and generosity of compensations on effort. For such studies, field experiments provide a better fit and as well promise precise isolation. Furthermore, inequality aversion to one's disadvantage has been shown to be increasing at a decreasing rate (Bellemare et al., 2008). We show in chapter 3 that work effort positively responds to fairness of the wage offer, but the evolution of this response is not established. It is intriguing whether effort responses to perceived fairness of the wage, shrink after a relative maximum. Future empirical work should consider evolution of self-image motivated effort to fairness of wages. For such a study, having several endowments (in chapter 3, we used two endowments) is necessary to aid responder comparison. Results from such a study, would provide more information to employers regarding appropriate levels of incentive regimes. Likewise, the artefact of our framed field experiment could be an issue. Critics can suppose that a laboratory experiment with complete strangers (as agents) could be more appropriate.

Although such a study may provide complementary results to our findings, it however, disregards context in terms of proximity in rural agricultural labour markets.

Complementary to this thesis, future research should provide empirical evidence on the impact of interventions taken to improve understanding of formal insurance products. For validity concerns, such studies should be survey based or opt for field experiments. Future research could alternatively examine the impact of public decrees that make formal insurance products compulsory for farmers. While farmers use their knowledge in making a purchase decision, the price of the formal insurance product is as well relevant to their choice to avert risk. Farmers may not buy formal insurance products if they consider themselves good risk. Cost of insurance and uptake are antagonistic. Incentives in terms of low cost of insurance products increase uptake, and high uptake is necessary for bringing down the cost of insurance. Compulsory purchase of insurance offsets adverse selection, and results into low cost of insurance products (Johnson, 1977). A field experiment may be used to test whether rules compelling farmers to have insurance for any formal dealings with for example government (credit or equipment) agencies can be used to reinforce uptake and lower cost of formal insurance products in Sub-Saharan Africa.

Lastly, future research with more data points could further examine the impact of microfinance institutions on income inequality.

6.4 Policy Implications

This thesis set out to: identify ways for improving incentives for consumption smoothing, and effort motivation, and understanding the aggregate level effect of microfinance institutions. We learn that cooperation, information and growth matter for economic outcomes. Collective bargaining and market information may aid worker's negotiations for

better compensation. Information regarding extra generosity of compensation regimes is relevant for eliciting greater work effort. Informational programmes regarding the benefits of formal financial and insurance products may improve uptake. Pro-poor growth (empowerment) interventions may help to better position the bottom-poor to exploit the benefits of financial and economic development.

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General Arrangements and Consent for the Experiments

Participants in the experiments consisted of randomly selected household heads (a female or male household head or an adult member) in rural villages in central Uganda. Villages for the experiment were randomly selected during the pre-field visits to the district administration. Participants were randomly selected during mobilization visits to the village chairperson of the selected villages, a week prior to the experiment day. Chairpersons were asked to inform the randomly selected household members of the invitation to participate in a research experiment, where they stand chance of earning an equivalent of a day's work. Participants were promised (and were provided) subsistence (a snack, water and soda) at the venue (church, or school or public hall). On the eve of the experiment day, research team followed up with a reminder visit or a call.

At the venue, experiment protocol was explained, and participants were asked to consent to the experiment. Each participant read (or was read through) the informed consent form asserting that accepting to participate in the experiment was at own will, and if the participant wished so, he/she could leave at any point during the duration of the experiment. The consent form also emphasised that information gathered was to be; analysed anonymously together with information from other villages, treated confidentially and only used for research purposes. Participants, who voluntary accepted, were asked to sign the consent form and proceeded with the experiment. After the experiments, participants were engaged in short exit surveys to collect social-economic information, and hypothetical risk and time preference data, were thanked for participating, were paid their earnings from the experiment, and set off.

Summary

This thesis aims at identifying ways for relaxing incentive compatible constraints for consumption smoothing and effort motivation, and a better understanding of the effect of microfinance institutions on income inequality. A large proportion of Sub-Saharan Africa's population depends on the agricultural sector for its livelihood. The contingency of this dominant agricultural sector on weather conditions implies that household incomes are prone to seasonal fluctuations. In addition, household incomes are susceptible to idiosyncratic shocks like crop failure and surprises to family labour. Without smoothing, income volatility implies fluctuations in household consumption. Fluctuations in consumption are detrimental to welfare, for they reinforce poverty. While households use formal and informal institutions to smooth consumption, incentives pertaining to these institutions, determine preference and welfare outcomes.

In Chapter 1, I present an overview of household incomes in Sub-Saharan Africa, describing the major sources of volatility. I then describe the insurance institutions used by households to shield consumption from income fluctuations. Using current literature I sketch the incentive pledgees, pitfalls, and interactions of insurance institutions. I then outline the research objective and questions, and describe the methodologies used in the entire thesis.

Chapter 2 studies incentives for smoothing through the rural labour market. We assess the impact of a savings institution on wages for labour tying. We theoretically model labour tying, incorporating diminishing marginal utility in consumption and behindness aversion in a framework of seasonal fluctuations in demand for labour, and test model predictions using a framed field experiment in Uganda. We find that access to a savings institution does not lead to increase in wages for tied workers. We postulate that complementary institutional innovations

may not improve outcomes for second moving workers, and elevation to first moving position could be more affirmative.

Chapter 3 considers the demand side of the labour market, and assess how employers can more optimally motivate work effort. We present a theoretical model of self-image motivation for effort and test model predictions in a framed field experiment in Uganda. We find self-image motivated effort to increase with wages and fairness of the wages.

Chapter 4 examines moral hazard incentives under formal insurance and informal insurance. We develop a theoretical model of risk sharing in the context of output fluctuations contingent on effort. We use a framed field experiment in rural Uganda to test whether agents articulate incentives under informal insurance better than formal insurance. We find household behaviour to be consistent with moral hazard incentives under informal insurance, but not with formal insurance. We learn that lack of experience with formal insurance products instigate irrational behaviour. We suggest interventions to incorporate aspects for improving agent's knowledge about the formal insurance products in order to increase uptake.

Chapter 5 considers the aggregate level effects of microfinance institutions. I analyse the effect of microfinance institutions on income inequality using panel data for developing countries. In addition to the aggregate variable, I analyse the effect of subgroups of microfinance institutions on income inequality. While I find microfinance institutions in aggregate, and microfinance institutions that are not profit oriented to have no effect on income inequality, I find profit oriented microfinance institutions to have a positive effect on income inequality.

In Chapter 6, I provide the synthesis; highlight areas for future research and policy implications of this thesis.

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Publications

Nanyiti, A., Pamuk, H., & Bulte, E. (2019). Tied Labour, Savings and Rural Labour Market Wages: Evidence from a Framed Field Experiment. *Journal of African Economies*, 1-20, ejz004, https://doi.org/10.1093/jae/ejz004.

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Completed Training and Supervision Plan

Activity	Department/Institute	Year	ECTS*
A) Project related competences			
Advanced Micro Economics (UEC51806)	Wageningen University	2013	6
Advanced Econometrics (YSS 34306)	Wageningen University	2013	6
Rural Economic Analysis (AEP 31306)	Wageningen University	2013	6
Parametric Efficiency and Productivity Analysis	WASS	2013	3
Dynamic Efficiency and Productivity Analysis	WASS	2013	3
Experiments in Development Economics: Methods and Applications	University of Groningen	2015	2
B) General research related competences			
WASS Intoduction course	WASS	2013	1
PhD Research Proposal writing	Wageningen University	2013	6
Information Literacy for Researchers	Wageningen Graduate School	2013	0.6
Techniques for Writting and Presenting a Scientific Paper	Wageningen Graduate School	2013	1.2
C) Career related competences/personal development			
'Tied Labour, Savings and Rural Labour Market Wages: Evidence from a Framed Field Experiment'	CSAE, University of Oxford	2018	1
'Moral Hazard Incentives under Formal Insurance and Informal Insurance: Evidence from a Framed Field Experiment'	CSAE, University of Oxford	2019	1
Total			**36.8**

* 1 ECT is equivalent to 28 hours of study load.

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