Land Rights and Women's Empowerment in Rural Peru: Insights from Item Response Theory

by

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Abstract

Women's land rights are increasingly advocated as an empowerment tool to spur development outcomes. However, empirical evidence of this relationship is limited. In this study we use data from peasant communities in rural Peru to explore the effect of the intra-household allocation of inherited land on women's empowerment. Empowerment is modeled as a latent variable measured by different influence indicators using a Generalized Structural Equation approach. We draw on Item Response Theory (IRT) to estimate difficulty and discrimination parameters which can inform policymakers about the impact of empowerment policies on women's types of influences within their households. The empirical approach is consistent with empowerment's latent and multidimensional nature and pays attention to endogeneity issues often present in other empirical studies. We find that although women's land rights increase empowerment, the intra-household allocation of land determines the magnitude of this impact.

Preface

This thesis is an original work by María José Montenegro Guerra. The research project, of which this thesis is a part, received research ethics approval from the University of Alberta Research Ethics Board, Project Name "Carbon emission and gender implications of employment in the Upper Mantaro Watershed, Peru", No. Pro00049912, November 5th, 2014.

Dedication

To all the women who were part of my study.

Acknowledgments

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Section 1: Introduction

Women in developing countries, compared to men, participate less in the labour market, earn lower wages, own less resources and exert less influence over household economic decisions (e.g., World Bank 2012).[1] A growing body of literature has shown that women's empowerment[2], besides being an end in itself, can offset many of these disadvantages, and as a consequence, also generate a host of development outcomes (e.g., Smith and Haddad 1999; Schultz 2002; Sabroni, Quisumbing, and Ahmed 2013). As an example of the latter, the empowerment of mothers has been shown to increase the human capital of children (Duflo 2003), especially daughters, with salutary effects on future household income. The magnitude of the empowerment-effect on yields is estimated to be large enough to lead a fall in the number of food insecure people in the world by over 150 million (FAO 2011). Consequently, governments and non-profit organizations continue to expend considerable amounts of resources and time on women's empowerment initiatives in developing countries (Harper et al. 2014; Gates 2014).

Recent reviews of the literature, however, reveal that there exists remarkably little policy relevant information on the factors that drive women's empowerment (Malhotra, Schuler, and Boender 2002; Allendorf 2007; Trommlerová, Klasen, and Leßmann 2015). Much of the voluminous literature on women's empowerment in developing countries focuses on important conceptual definitions, with empirical components that rely largely on case studies and qualitative analysis (O'neil, Domingo, and Valters 2014). The relatively thin empirical literature on the

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[1] In most low or middle income countries, females also have a higher mortality rate than men (World Bank 2012). Although, given the same care as males, females tend to have better survival rates than males at every age. (Sen 1990).
[2] Following the literature, empowerment throughout this study is measured by women's *influence or "say"* over household economic decisions (e.g., Basu 2006)

drivers of empowerment has been criticized for having failed to come up with an appropriate measure of the multi-dimensional nature of empowerment (e.g., Samman and Santos 2009). While empowerment is a multi-dimensional construct (e.g., Mason 1993; Kabeer 1999; Kishor 2000; Estudillo, Quisumbing, and Otsuka 2001), standard econometric modelling frameworks, such as regression analysis and limited dependent variable models, accommodate only unidimensional outcomes. This inconsistency has forced empirical empowerment studies to limit their outcome measures to a single dimension of empowerment (e.g., influence or decision-making authority over asset sales), or use an aggregated empowerment score, like the Women's Empowerment in Agriculture Index (WEAI) developed to track the impacts of the US Government's Feed the Future Initiative (Alkire et al. 2013), that is based on an arbitrary set of weights. Quantitative analyses of the drivers of empowerment have also been criticized by Trommlerová, Klasen, and Leßmann (2015), Samman and Santos (2009) and others, on methodological grounds, such as the inconsistent use of linear estimators in nonlinear specifications and for not addressing the endogeneity of key determinants. [3]

The gap in the literature is particularly noticeable in the wake of recent development policies which stress land rights as an instrument for empowering women and spurring development in poor economies. In fact, the recent UN Sustainable Development Goals refer to women's land rights under Goal 1 (No poverty), Goal 2 (Zero hunger) and Goal 5 (Gender equality) (UN 2015). It is often claimed that women constitute, on average, 43% of the agricultural force in developing countries and produce between 60% to 80% of the food (United Nations Economic Commission for Africa 1972; Momsen 1991; Gupta 2009). However, the distribution

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[3] e.g., Garikipati 2008; Malhotra and Mather 1997; Hindin 2000; Jejeebhoy and Sathar 2001; Jejeebhoy 2000; Roy and Niranjan 2004; Gupta and Yesudian 2006; Allendorf 2007; Allendorf 2012; Lokshin and Ravallion 2005.

of land remains highly biased against women. Based on the limited available data, it is estimated that less than a quarter of landholders in developing countries are women.[4] Women also remain dependent on men for gaining access to land, regardless of their own rights (Deere and Leon 2003; Rao 2005). In places such as rural Peru, communal ownership of land, governed by customary laws, norms and practices regarding inheritance and ownership, dictate women's de facto and de jure rights[5] (Budlender and Alma 2011). In such economies, women farmers are believed to have less control than men over services such as credit, inputs and livestock transfers and sales due to fragile or non-existent land rights (FAO 2011).

However, while the effect of women's empowerment in spurring growth and development is the subject of a fast growing body of research (Hoddinott and Haddad 1995; Duflo 2003), the effect of women's land rights on women's empowerment is a "rarely studied" issue in empirical development economics (Allendorf 2007, p.11). The effect of land rights on women's empowerment is complex, and likely to depend on the social context including how property rights are managed and enforced in the community, as well as on the land rights of other members of the woman's household, specifically her spouse.

1.1   Overall Goal and Thesis Objectives

The overall goal of this thesis is, therefore, to fill the gap in the literature by *a) developing a new econometric framework for studying the determinants of women's empowerment and b) using the framework to study the effect of women's land rights on their empowerment.* In contrast to the rest of the literature, our approach treats women's empowerment as a continuous latent

[4] Authors' calculation from the (FAO 2010)
[5] While rural Andean communities have their own tenure systems and rules, women's rights in practice can deviate from this rules

variable that is unobserved; we observe, instead, a set of influence indicators that represent a woman's authority over a range of different household economic decisions. Therefore, unlike previous studies, our approach allows us to model the multidimensional nature of empowerment (measured by the influence indicators) and simultaneously estimate the effect of a covariate on latent empowerment. It also allows us to calculate the effect of a change in latent empowerment on each influence indicator.

To meet our overall goal, we have two specific objectives. First, using a set of primary data that we collected from rural Peru in 2014, we examine how land rights and their intra-family distribution affect women's empowerment. We compare the magnitude of the effect of land rights held by women and male members of their households with the effect of other more commonly recognized determinants of empowerment, such as education. Due to endogeneity issues of using ownership of land and the nature of our study area, we define land rights as inheritance of usufruct rights.

Second, we examine how empowerment, conditional on land rights and other determinants, is linked to women's influence over different household economic decisions (e.g., control over credit or distribution of income from livestock). In this context, for each influence category, we estimate a *"threshold"* and a *"sensitivity"* parameter. These two parameters summarize how a policy change that alters women's empowerment may be expected to alter different types of women's influence, each of which may be uniquely associated with a specific development outcome. For instance, it is plausible that while land rights have a positive effect on women's empowerment, they may have different effects on different types of empowerment as measured by the influence indicators. An increase in empowerment may increase women's influence over credit decisions (which is helpful in leveraging better investment outcomes) or alternatively

empowerment may increase women's influence over agricultural and livestock decisions (which is helpful for achieving land use change objectives of policymakers rather than investment outcomes). The threshold and sensitivity of an influence indicate how much empowerment is required to turn on a particular influence and, conditional on the threshold point, the sensitivity of the influence to a change in empowerment. Ideally, policymakers would prefer to target women's influences with lower thresholds and a higher sensitivity to achieve development outcomes.

Our econometric approach for meeting our two specific objectives is based on item response theory (IRT) which we operationalize using a generalized structural equation model (GSEM) (Skrondal and Rabe-hesketh 2007). Both GSEM and IRT have been applied widely in the psychometrics literature (Rasch 1960; Thurstone 1927; Lawley 1943) and is now is the subject of a small but growing literature in in economics led by scholars' recognition of its immense potential in the applied economic world (most notably see Das and Zajonc 2010). IRT has been applied widely in the psychometrics literature (Rasch 1960; Thurstone 1927; Lawley 1943) but its use has been limited in economics despite scholars' recognition of its potential in the applied economic world (Skrondal and Rabe-hesketh 2007). Since our observable influence indicators are a set of discrete ordered variables which we link to a latent construct of empowerment and subsequently to a set of covariates including land rights, the appropriate framework is Graded Response Model, a type of IRT that is appropriate for categorical items (Samejima 1997).

Specifically, our econometric model has two components. The first "structural" component of our model allows us to estimate how changes in land rights and other determinants affect women's empowerment. The estimates from this component help address objective 1 by identifying if land rights are an effective policy lever that can be pulled to catalyze women's empowerment as a development tool. The second "measurement" component relates the multiple

influence indicators to their underlying level of empowerment. The measurement component of our model allows us to estimate how a change in empowerment shifts different types of influence a woman has over household economic decisions. Thus, the estimates from this part of the model allow us to address objective 2 and identify the types of women's influence that can be leveraged by empowering women through land rights and other determinants.

We empirically test the role of land rights in empowering women using data from six different highland peasant communities in Peru. We construct a set of discrete ordered indicators of the level of a woman's influence over the household economic decisions (e.g., influence over credit application and spending or influence over how to spend income from livestock production). Our approach contrasts with the bulk of the empirical literature on women's intra-household decision-making power which typically employs an indicator summarizing women's decisions about one single dimension of empowerment that is easily observable, such as food consumption (Patel et al. 2007), or an aggregated index of empowerment (e.g., Parveen and Leonhäuser 2004).

1.2   Contributions to the Literature

Our study makes several novel contributions to the women's empowerment literature. First, we contribute to the literature on the issue of land rights and women's empowerment. Despite the intense policy attention in recent years given to the issue of using land rights as a means for empowering women in developing countries, there are hardly any studies that validate this claim empirically (Allendorf 2007). Allendorf's (2007) study of this issue in Nepal is a notable exception. However, unlike Allendorf, we use separate information on land inheritance of men, women or both. By using inheritance data for land rights, rather than direct information on land holdings, we avoid methodological problems related to endogeneity of the land rights variables that have plagued other studies such as Allendorf's (2007). Our study also explores the intra-family

allocation of land rights and their impact on women's empowerment. Although the importance of intra-family allocation of access to resources is well recognized (Von Braun and Webb 1989; Due and Gladwin 1991; Haddad, Hoddinott, and Alderman 1997), it is rarely explored in the literature on land rights and women's empowerment due to data limitations (see Allendorf 2007). As far as we know, Wiig's (2011) study of land rights on women's empowerment in Peru is the only study that tests the effects of the intra-family allocation of land. However, Wiig's study measures empowerment using a public goods game making it hard to generalize the findings and impossible to draw conclusions about the effect of land rights on different dimensions of empowerment.

Second, we apply an econometric approach that is new to the analysis of women's empowerment and that allows us to overcome the problems faced by previous studies on this issue. As far as we know, only one study by Pitt et al. (2006) in the women's empowerment literature has used a multidimensional model of empowerment which, differently from our approach, is based on factor analysis. While we estimate the measurement and structural components of our model simultaneously using maximum likelihood, Pitt et al. (2006) use a two stage approach which is less efficient and with unknown coefficient estimator properties.

Third, a strong assumption in most empirical work using ordered choice models is that that the items elicited through a series of survey questions are received in a similar manner by respondents. Our primary analysis uses data on responses given by women on their influence over household decision making. In our context, we are particularly concerned if the answers by women to women's decision-making power questions would be different if the same questions were posed to men. This distortion can occur for instance if the questions have a subjective component and are open to interpretation differently by men and women (see Mohapatra and Simon, (forthcoming) for a detailed example). This phenomenon occurs when survey questions (viz., our influence

indicators) that measure a latent trait (empowerment) are received differently by different groups of people with the same value of the latent trait and is called differential item functioning (DIF). Although DIF arises naturally in ordered choice models it is usually ignored in economic studies due to methodological limitations of ordered logit and probit models (Greene and Hensher 2009). In our context, however, it is necessary to check for DIF since it can directly affect the assessment of the impact of land rights on women's empowerment. We address the DIF problem across men and women by estimating a larger IRT model that we use in our analysis with responses on women's influence collected from both men and women respondents. We introduce a gender (sex) variable into the measurement part of our model to look for evidence on DIF and evaluate if our results regarding our main hypothesis about land rights and women's empowerment still holds after accounting for the bias due to DIF.

Fourth, our study is also a timely analysis of peasant communities in rural Peru. Recent years have seen a growing concern among policymakers and activists about the stark gender inequalities that mark Peru's rural economic landscape. Gender gaps are most pronounced in rural communities where relative to boys, girls have less access to almost all kinds of productive resource including education, work opportunities, and nutrition (PNUD 2010; Kabeer 2011). The policy response has been focused primarily on increasing women's land rights to reduce these gaps. The most notable of these responses was a massive national program launched in the early 1990s, the Special Land Titling Program (PETT), which focused on distributing land titles to women during its second phase. Since the peasant communities manage their resources

collectively and have their own jurisdiction, however, such land reforms permeate into these communities in complex ways, and often meet with limited success[6].

1.3 Thesis Structure

Section 2 provides a background of women's land rights, as well as a literature review of the empirical studies of land rights and women's empowerment. The arguments for using land rights to induce empowerment are also discussed in this section. Section 3 describes the geographic characteristics, communal land tenure systems, and livelihoods of our study area. Our sampling methodology and data collection are described in Section 4. This includes a detailed description of the WEAI tool and how it was implemented in our study. Section 5 provides a literature review of the common methodological and measurement problems of the empirical studies of women's empowerment. Our variables and empirical model are described in Section 6. In particular, we introduce Item Response Theory, describe the structural and measurement components of our Generalized Structural Equation Model (GSEM) and explain how empowerment thresholds and sensitivities are estimated. The results of our structural component, as well as the empowerment thresholds and sensitivities, are reported in Section 7. The results of our alternative models are also reported in this section. In Section 8 we discuss our results and provide some policy implications of our study. Finally, in Section 9 we discuss our study's limitations and draw conclusions from the results of our study.

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[6] The PETT program was not implemented in formally recognized peasant communities where land is defined as communal property (Wiig 2013)

Section 2: Land Rights and Women's Empowerment

The objective of this section is to situate our study in the existing literature of women's land rights and empowerment. To do so, we first discuss land rights and how we define them in our study. We then review the empirical work that has analyzed this topic and highlight the methodological and econometric issues in the literature. Lastly, in the second part of this section we review the arguments that support the linkage between land rights and empowerment.

2.1   Definition of Land Rights

Land rights include a variety of legitimate claims to land and its benefits (Schlager and Ostrom 1992; Meinzen-Dick et al. 1997). Most policy attention and researchers focus on effective land rights or claims that are legally or socially recognized and enforced by a village-level or state-level institution (Agarwal 1994). Although ideally studies should consider different aspects of land rights, such as tenure security or control over land, most empirical studies define land rights as ownership of land due to data limitations (e.g., Allendorf 2007). In our study area it is more relevant to focus on usufruct rights since the peasant communities are the legal land-owning entities. Although traditionally there were no land markets, usufruct rights have been passed down the generations through inheritance. Thus, while land rights in the studies reviewed in this section are defined more broadly, we define land rights as the inheritance of usufruct rights to land.

2.2   Review of Empirical Studies

Some studies have examined the direct linkage between women's land rights and welfare outcomes. For example, Panda and Agarwal (2005) found that women in Kerala, India who own land are less likely to suffer from physical and psychological domestic violence. In a study in Honduras and Nicaragua, Katz and Chammorro (2003) also found a positive effect of land rights

on households' food expenditures and child education attainment. These studies often implicitly assume that significant coefficients of women's land ownership variables in income or other welfare outcomes are linked to the bargaining power of women, rather than testing for this linkage explicitly. For instance, Deere et al. (2004) found that women's land rights have a positive effect on off-farm income of dual-headed households in Peru. The authors attribute this effect to land right's positive impact on women's intra-household bargaining power. The impact of land rights on off-farm income, however, can also be attributed to other factors, such as relaxed credit constraints of the household that allow women to diversify their livelihoods.

On the other hand, studies that use women's empowerment (rather than a household welfare measure) as an outcome variable often include ownership of land in aggregated asset measures as a covariate. For instance, Deere and Twyman (2012) find that women's share of wealth increases the likelihood of symmetric joint decision-making regarding their decision to work and spending income in Ecuador. Similarly, Jejeebhoy's (2000) study of women's empowerment in India uses an index of control over economic resources which includes ownership and control over land and other valuables. This approach, however, makes it impossible to identify the individual impact of land rights.

In the absence of solid empirical evidence on the issue, some scholars are of the opinion that land ownership may not necessarily empower women (Kathewera-Banda et al. 2011). According to this view, claiming land rights as a determinant of women's empowerment without empirical evidence disregards the contribution of other factors, such as skills, age, and access to credit, that could have a greater impact on empowerment and thus be more efficient gender policy tools. Moreover, women's land rights may not be empowering if access and control are mediated

by men, if land tenure is insecure or if land is infertile (Kathewera-Banda et al. 2011; ActionAid 2013).

Although land rights continue to be pushed as a policy to empower women[7], few studies have attempted to provide evidence of the linkage between land rights and empowerment and challenge the views described above. A problem faced by researchers attempting to causally link land rights and women's empowerment is endogeneity. Often, due to data limitations studies use ownership of land as a proxy for land rights (e.g. Allendorf 2007). Using land ownership as a proxy for land rights is clearly problematic because empowered women are more likely to be able to purchase land since they may also have a higher income earning ability.

Ideally, natural experiments would allow researchers to properly identify the causal link between land rights and women's empowerment. However, it is difficult to track land reforms that have exogenously or randomly assigned land rights to women. Wiig's (2013) community level empirical analysis of the PETT program in Peru, to our knowledge, is the only study which uses a natural experimental approach. The study uses land titles before and after the PETT program as a proxy for land rights[8]. The distribution of land titles is argued to be uncorrelated with community characteristics, making the land rights variable exogenous. The analysis includes two community-level variables representing the proportion of plots inherited by men and women. The results show that men's inheritance has a negative impact on women's empowerment. The study also finds that joint titles increase women's decision-making, especially for decisions regarding agriculture and

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[7] In fact, the Sustainable Development Goal (SDG) 5.a states: "Undertake reforms to give women equal rights to economic resources, as well as access to ownership and control over land and other forms of property, financial services, inheritance and natural resources, in accordance with national laws." (UN 2015)
[8] Other studies have also used similar approaches to study the impact of joint land titling programs on outcomes such as soil conversation and land inheritance by gender (Ali, Deininger, and Goldstein 2014), women's labor supply (Field 2011), and labor allocation (Nakasone 2011).

land-related investment. Although this study does not suffer from endogeneity issues in the sense described above, its analysis of land inheritance is at the community level only. Thus, the impact of land inherited to men could be an indirect measure of the overall gender bias in each community, which could impact whether women's opinions are taken into account at the household level. Where natural experiments are not available, field experiments (e.g., public good games) have also been used to estimate empowerment and test the effects of land rights (e.g., Wiig 2011). However, these experiments are difficult to recreate and their conclusions cannot be easily generalized.

In the absence of experimental data some scholars argue that information on the amount of land inherited by the woman is an alternative proxy for women's land rights (Quisumbing and Maluccio 2003; Wiig, Bråten, and Fuentes 2011). The assumption is that acquisition of inherited assets does not depend on the bargaining power within the household and is exogenous to empowerment. However, since inheritance data are usually not available, most studies that analyze the direct impact of land rights on women's empowerment have used ownership of land as a proxy for women's land rights. The first is a study of five Asian countries by Mason (1998). The study ran OLS regressions where the dependent variable was a six item scale indicator measuring women's influence in household decisions. Mason's findings suggest that ownership of land increased domestic decision-making for women in India and Thailand. The second study is an empowerment study using the 2001 Nepal Demographic and Health Survey (NDHS) by Allendorf (2007). Two metrics of empowerment were used in this study: an ordinal variable measuring the number of decisions the woman participated in and a binary variable showing if the woman participated in most decisions or not. These indicators were analyzed in ordered probit and logit models respectively. Allendorf found a positive effect of ownership of land on women's influence over household decision-making that is comparable to the effect of other determinants such as

education. Although these studies suggest that increasing land rights is indeed a promising route to promote women's empowerment, they do not address the endogeneity issues of using ownership of land as a proxy for women's land rights.

2.3   Arguments for Women's Land Rights and Empowerment

Despite the limited empirical evidence, there are clear arguments for using women's land rights as a tool for empowering women. Several scholars argue that land ownership increases women's security and influence, thereby helping them to take control over household decisions (Agarwal 1997; Haddad, Hoddinott, and Alderman 1997). Manser and Brown (1980)explain this relationship using a bargaining model of intra-household resource allocation where marriage is treated as a cooperative game. In their model a woman's ownership of land, relative to her spouse, would improve her threat point and change the resulting Nash equilibrium in her favor. Thus, a woman with more capital, or in this case land, will have a higher threat point since her fallback position in case of a divorce will be stronger (Manser and Brown 1980).

In some situations, a divorce might not be a plausible threat because of the economic or social costs related to dissolving a marriage. In Lundberg and Pollak (1993) bargaining model each individual controls their own income and contributes to a collective good to maximize their own utility taking their partner's contribution as given. The result is a non-cooperative and inefficient equilibrium, or threat point, where the couple might still be better off than if they were divorced. The threat point is determined by each partner's contribution and, therefore, their income. In this context, as long as women control the land rents of their property, land rights can increase their income contribution influencing the equilibrium. This relationship has also been described as the norm of "perceived contribution response" (Sen 1990), where the man will be expected to decide more within the household if his income contribution is greater.

According to Agarwal (1994), women's threat point is not only determined by their ownership of assets and income contribution to the household. Agarwal (1994) argues that access to external support systems from outside the household, NGOs, or the state increase women's ability to survive outside the household increasing their bargaining power. Furthermore, Agarwal argues that due to social or cultural forces women might not have a "voice" in some aspects of life for which bargaining might not happen at all. Thus, contextual factors from outside the household—specifically social and traditions that shape land rights—can also be important mediators of the impact of women's land rights on empowerment.

A shortfall of the bargaining models is that they only predict the impact of land rights for women in dual-headed households. However, we can expect the same processes that increase women's bargaining power within their household to impact women's agency as they interact with other members in their households and in their communities. In fact, ethnographic evidence supports these claims. Agarwal (1994), for example, found that widows in Rajasthan, India received more respect and consideration in their communities when they owned land. Similarly, we can expect a single woman's situation within a community to improve if she owns land or other real-estate.

The various bargaining models underscore the importance of women's land rights in determining their power. It is important to note, however, that according to these models it is the land rights held by a woman, relative to male members in her household, which matters to her empowerment. However, the intra-family distribution of land rights and their impacts on women's empowerment have been neglected in the empirical literature reviewed above. To our knowledge, Allendorf (2007) is the only author that has tried to include the intra-household allocation of land rights in an empowerment model. Allendorf (2007) addressed the lack of data on intra-household

land allocation by assuming that landless women who work in any relative's land belong to the category of "lives in landed household" where land rights are held by other members within the woman's household. The other two categories in this study are "owns land herself" and "lives in landless household". The results suggest that women who own land themselves are more likely to be empowered than those women living in landed households. Even though this approach does not account for the effect of land rights held by husbands or other male members within the "lives in landed household" category, these results suggests that the intra-household allocation of land also plays a role in women's empowerment.

Thus, despite the focus on land rights as a policy tool to spur empowerment, the direct linkage between land rights and empowerment has rarely been tested empirically. The few exceptions have methodological issues and, hence, empirical evidence is still needed to support the rationale for land rights as a development tool. Our study addresses this gap by directly testing the effect of land rights on women's empowerment using land inheritance, an exogenous measure of land rights.

Section 3: Study Area

The objective of this section is to discuss how the area's climatic conditions and history of conflicts over land have shaped farmers' livelihoods in our study area. This section is organized in three parts. First, we provide background information of our study area's climatic and geographic characteristics. We then summarize the history of conflicts over land of peasant communities in rural Peru and the tenure rules in these communities. The third sub-section discusses the livelihood activities of farmers in our study area.

3.1   Climatic and Geographic Characteristics

Our study is based in the Upper Mantaro Watershed in the Peruvian High Andes. The Mantaro Watershed, located in the center of Peru, generates 35 percent of the country's electricity and provides food products for Peru's capital city Lima. With a population of 700,000 and its important agricultural activities, the Mantaro Watershed represents an important area for Peru's economy (CONAM 2005). Our data was collected from six different peasant communities located in this area. The Mantaro Valley has been divided into an upper, middle and lower regions based on their different climatic and biodiversity characteristics. The Upper Mantaro Watershed, typically made up of the Andean highlands, extends from Lake Junín to Ingahuasi and is located between 4100 and 3000 meters above sea level. The climate in the Upper Mantaro Watershed is characterized by a cold dry season from April to September with nightly temperatures ranging from 5 to 0^0C and daily temperatures ranging from 0 to 5^0C. The rainy season extends from October to March with daily temperatures that range between 10 and 20^0C. Given its altitude and extreme climatic conditions, this area is highly vulnerable to meteorological and geodynamic phenomena, such as droughts, frosts, torrential rains and landslides, which could be exacerbated by climate change (CONAM 2005).

Our study takes place in 6 different peasant communities around Lake Junín in the Upper Mantaro Watershed belonging to the provinces of Junín and Pasco. Figure 1 shows the study area and communities involved. Lake Junín is the second largest lake in Peru and it has been a protected area since 1974. It was also recognized as a Ramsar Wetland of Global Significance in 1997 (Ramsar Sites Information Service 1997) and as a Globally Important Bird Area in 2008 (Angulo Patrolongo 2009). Despite its recognition as an area of globally-important biodiversity, nearby mining operations and sewage from surrounding cities have polluted the lake threatening its

biodiversity. Since many peasants' communal lands fall within the buffer area of the lake, pollution and water levels also impact peasants whose livelihoods depend on these lands.

The area around the lake is characterized by the life zone páramo where grasslands and bofedales, carbon-rich Andean peatlands, domain the landscape. Although there are limited data on the carbon content of the soils in this area, a study suggests that the dry Peruvian Andes might represent 0.1% of the total carbon stored in soils in the world (CIP 2010). There is also evidence that croplands, especially potato cultivation, in the area are expanding due to rising temperatures (De Haan and Juárez 2010). The rate of conversion of natural rangelands has increased drastically with the recent boom of maca. Given the potential contribution of these land use dynamics to carbon emissions, the Government of Peru is interested in implementing a carbon storing environmental services program in this area (CIP 2010).

3.2   Peasant Communities in Rural Peru: A History of Conflicts Over Land

The majority of the agricultural production in Peru is controlled by *comunidades campesinas* or peasant communities. The communities are institutions with members that organize and manage their lands and assets following traditions and customs. Peasant communities have a long history of struggle over resources, especially land. In the twentieth century, *hacendados*[9] invaded communal lands forcing the communities to move to lower quality lands. After constitutional changes in 1933, the communities were able to be legally recognized as indigenous communities which provided them with social protection and the means to reclaim their land from the *hacendados* (Roberts and Samaniego 1978).

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[9] Landowners of haciendas, a large estate where tenants worked for a landlord in exchange of plots of land for themselves.

In the 1970's, land reforms created rural-cooperatives called *Sociedades Agrícolas de Interés Social (SAIS),* to control the lands expropriated from the *haciendas.*[10] Many communities opposed the SAIS because they wanted to manage and control the land themselves. All over Peru, peasant communities fought for their independence from the SAIS demanding to receive their lands back (Nuijten, Lorenzo, and Vries 2006). To this day, conflicts over land between the SAIS and some communities are still on-going. In Junín, the conflict between the SAIS Tupac Amaru and the community of Ondores over more than 20,000 hectares has lasted for several years (Nuijten and Lorenzo 2009). The constant, and often violent, fights over land have made community members very protective of their land.

In the 1980s Peru suffered under the terrorist regime of the Maoist movement *sendero luminoso* or Shining Path. Many peasant communities supported the ideals of the Shining Path as they wanted to eliminate the SAIS and return the land to the communities. However, the violent means of the group, which included the public assassination of political and community leaders, public trials, and attacks to the SAIS, instigated a strong fear among the people that is still present today in some rural communities of the Peruvian Andes (Nuijten, Lorenzo, and Vries 2006).

Finally, the new Constitution of 1993 and a new Land Law in 1995 allowed for the privatization of communal land creating large changes for the peasant communities. Large scale titling programs following these laws, including a national land titling program known as the *Programa Especial de Titulación de Tierras y Catastro Rural* (PETT) or Special Land Titling and Cadastre Project, have allowed community members to get titles for lands that are technically

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[10] *Comunidades campesinas* (peasant communities) became the official name for the indigenous communities after the land reform of 1970 (Nuijten, Lorenzo, and Vries 2006)

owned by the community (Nuijten, Lorenzo, and Vries, 2006).[11] Thus, although these changes increased farmers' tenure security, they also created conflicts and division within peasant communities.

3.2.1 Communal Land Tenure Systems

Nuijten, Lorenzo, and Vries (2006) provide a detailed description of property relations in one indigenous Andean community called Usibamba in the Department of Junín. The following is a summary of the general trends in peasant communities and their communal land tenure systems as described by Nuijten, Lorenzo, and Vries and as informed by our fieldwork.

Land allocation decisions, as well as most other decisions affecting the community, are made by the community's executive leaders who are elected every year. The highest authority, however, is the general assembly made up of all community members. Most decisions have to be presented and accepted by the general assembly before being enforced. In peasant communities land is allocated only to community members. Membership is usually granted to children of existing members only since most communities are wary of outside people. Members are expected to fulfill certain duties, such as attending community meetings and participating in communal work parties, in exchange for receiving communal land and other benefits of the community. They can also be asked to participate in community committees as leaders or members. Community members do not receive any sort of financial remuneration for these positions but face pressure to accept them if asked by the community.

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[11] The program required joint titling of unregistered plots of land for which it served as a "gender-equalizing reform" because sons tend to inherit more than daughters (Wiig 2013)
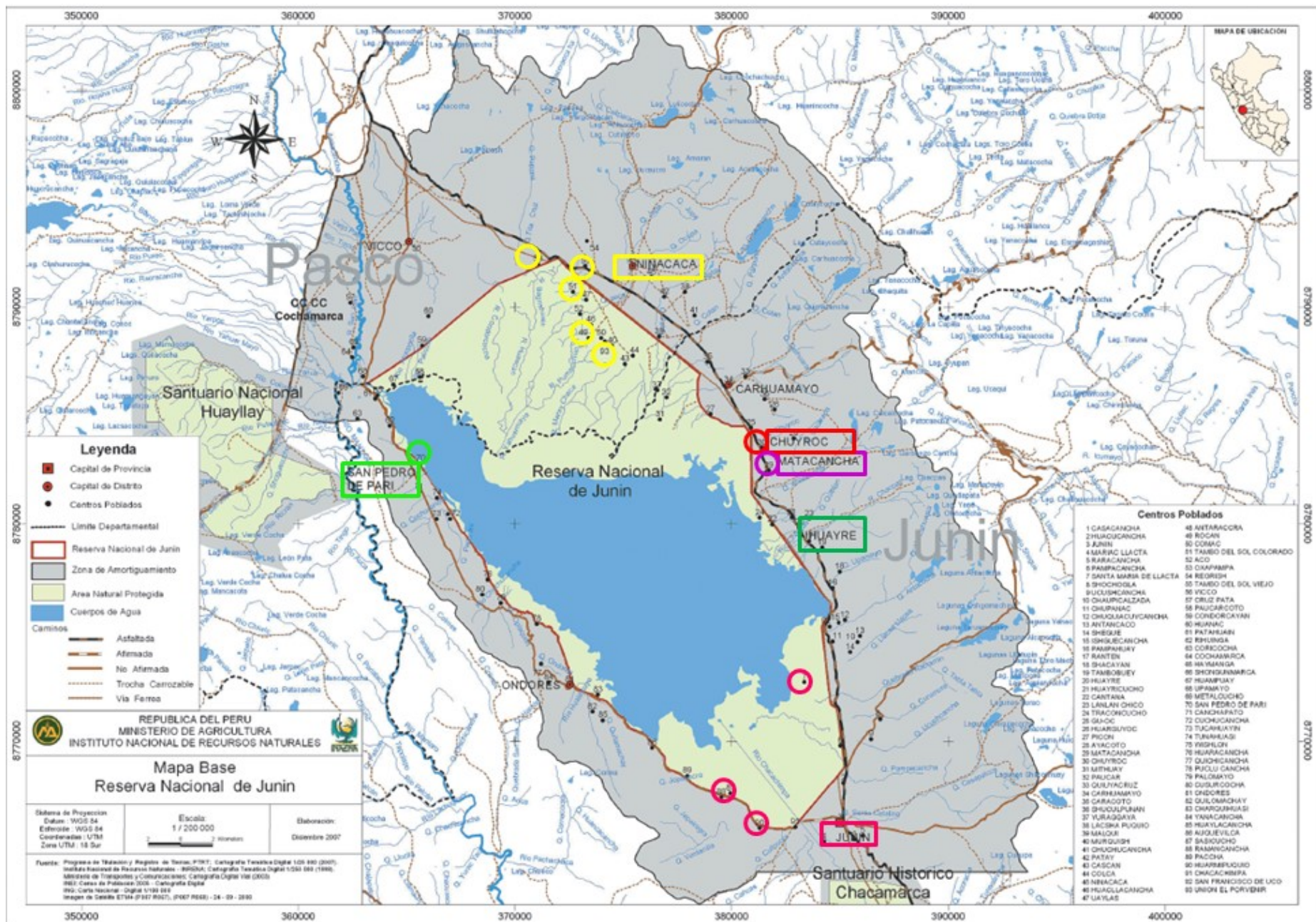
Figure 1. Map of the Lake Junín Area and the Communities Sampled in Our Study

Notes: Each color represents the villages of each of the six peasant communities sampled in our study

Source: Adapted from Benavides Ferreyros, Camino Ivanissevich, and Uganda Gómez (2008)

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The general trend is for communities to grant most members with shared access to the communal lands used for grazing livestock. Most communities have also allocated a smaller portion of their lands to provide members with access to one plot for potato cultivation for their own consumption. There are some elements of private property rights in certain types of communal land. Some families might enjoy usufruct rights of communal land or might have inherited ancestral lands originally allocated to the communities' founders. Although these lands are still legally owned by the community, users enjoy exclusive access to these lands and have a higher sense of tenure security. Inheritance of usufruct rights is usually only allowed in these types of land.

Table 1. Communal Norms Across the Peasant Communities in Our Sample

Community	Registration in favor of men	Members must be from whithin the community	Ancestral land	Maca allowed in ancestral	Maca allowed in communal	Any land can be sold, rented	Inheritance/ Spliting of Land?	Requisites to getting land
Pari	+	+	+	+	-	-	-	Apply
Junin	No, but only 1 partner can be registered	+	-	-	-	-	-	5 years of participation in community
Huayre	No, both partners can be registered	-	+	+	+	-	+	5 years of participation in community
Ninacaca	-	-	+	Yes, only for consumption	NA	Can be rented for livestock	+	No available communal land
Matacancha	Yes and can only registered if married	-	-	NA	+	Can be rented to family	-	Apply and be accepted by community members
Chuiroc	No, but only 1 partner can be registered	+	-	NA	Yes for consumption	-	Only house	Apply and be accepted by community members

Notes: "+" indicates "yes" and "-" indicates "no"

It is important to note that not all communities have lands with elements of private property which might limit the livelihood options in those communities. For instance, maca cultivation, a local crop, is mostly found in ancestral lands, even though in theory many communities have not

yet allowed this type of land use. Furthermore, farmers' de jure and de facto rights are often different. Although in theory some communities might not allow inheritance of land, in practice farmers might be able to pass down their usufruct rights to their children. The discrepancy between de jure and de facto rights makes it difficult to account for each community's tenure systems. Table 1 summarizes how communal rules for land use vary across the six communities of our study. The data reported in this table is not an aggregate of individual data collected through our study's surveys but was collected through interviews with community stakeholders. Although the table shows that inheritance of land is only allowed in two communities, the results of our household surveys indicate that inheritance of land occurs in all communities except for Matacancha.

3.3 Livelihood Activities

The peasant communities in our study area are mainly dependent on livestock production. The majority of the grazing livestock is sheep, but households perceived with having a higher socioeconomic status also raise cattle. Owners of cattle are engaged in dairy production which usually involves their own home production of cheese which is sold in nearby markets. Farmers are also involved in grazing alpaca and llamas, especially in the communities belonging to the province of Pasco. The main product of these animals is wool; however, their meat is also sold and consumed in this area of Peru. Agricultural activities are also important aspects of the livelihoods of these communities. However, potatoes and maca are the only crops that survive the harsh climatic conditions of this area. Potato cultivation for consumption is promoted by the communities through the allocation of plots of communal land for each household. The recent expansion of maca cultivation, on the other hand, has opened new opportunities for farmers who can either produce it or find temporary jobs processing or working in the maca fields.

Nearby mining activities as well as urban centers offer off-farm employment opportunities, especially for men, and represent an important force of permanent or temporary migration out of the communities. Women, however, are more restricted to farm activities where they have to endure harsh climatic conditions and take care of their domestic responsibilities. An increase in responsibilities of women within family farms and households as a result of migration of men has also been observed in other areas of Peru (Deere 1982). Many women farmers remain close to their traditions and continue to knit and spin clothing for their households or for additional income. Women occasionally receive opportunities for off-farm work under projects ran by the municipal governments to build or maintain public infrastructure. During our fieldwork, for example, public work in the main roads in the community of Huayre provided many women with temporary waged work.

Section 4: Primary Data Collection

This section is organized in two parts. First, we discuss our data collection process, surveys and the primary data we collected. The second part describes the Women's Empowerment in Agriculture Index (WEAI) in detail, how it was applied in our surveys, and the data we collected using this tool.

4.1   Data Collection Process

Data for this study was collected by the authors with support and input of the International Potato Center (CIP) staff members from October to December 2014. Local enumerators supported the interviewing process through which our data had to be collected due to the community members' mistrust in written documents. The interviews followed a consistent format where all

the data in our surveys was obtained through interviews with survey participants. The interviews were recorded and transcribed to our survey forms.

Our study area included six different peasant communities surrounding Lake Junín in the High Peruvian Andes. These communities were included in our sample after the General Assemblies of the communities approved our study. Most members in these communities are livestock farmers who spend most of their time in fields far away from their homes grazing livestock. Because of the nature of their livelihood activities, the only way of finding participants was to visit them at their homes either very early in the morning or late in the evening once they returned from the fields. To make our sample random we selected only every other house and attempted several times to reach only those households. To account for the land rights differences our questionnaire included questions related to land use, tenure, perceived security, and inheritance.

The data on demographics and assets were collected through household surveys administered to 233 households. To create an individual wealth index we included questions of households' ownership of different durable assets. Our data includes detailed information of the intra-household distribution of all assets, including livestock, land, and capital. Individual surveys were also administered to the main adults in each household to collect data on influence over household economic decisions. To reduce social desirability bias, a pair of enumerators separated the two main adults while they were completing the individual survey to ensure answers were not influenced by potential conflict between household members. In single-headed households only the main adult was interviewed. The individual survey consisted of detailed information regarding the individual's employment and the WEAI. Out of our 320 individual observations, 186 participants were women and 134 were men.

4.2   Women's Empowerment in Agriculture Index (WEAI)

We implemented the Women's Empowerment in Agriculture Index (WEAI) (Alkire et al. 2013) in our individual surveys to get a comprehensive measure of influence in decision-making and empowerment. The strength of the WEAI is that it measures empowerment and agency of both men and women in 5 different domains relevant in agricultural rural communities: (1) decisions about agricultural production, (2) access to and decision-making power about productive resources, (3) control of and use of income, (4) leadership in the community and (5) time allocation. empowerment in other domains (Alkire et al. 2013). In section 5.1 we discuss in detail how the WEAI is consistent with our definition of empowerment.

The WEIA has already been applied in various developing countries allowing for a robust comparison of empowerment across countries (Alkire et al. 2013). To make our survey more efficient and avoid overlaps between our household and individual surveys, we modified some questions in the WEIA. Figure 2 shows the domains and indicators collected in our modified survey.

In the first domain in our WEIA survey we asked participants about their influence in decisions regarding the distribution of benefits, transactions, and inheritance of land and other productive assets owned or used by their household unit. To measure control and use of income we asked respondents if they had borrowed money from various sources in the last 12 months, and their influence over applying for and distributing that loan. In terms of income, we asked participants if they have funds that are exclusively managed and owned by themselves, how much money they make relative to their partners, and if they receive any sort of pension. In the leadership domain participants were asked if they were members or leaders of various groups including agricultural associations, women's groups, or religious communities, and the extent to which they

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influence decisions made within these groups. The time allocation domain asked participants to describe the numbers of hours they allocate in all the activities they undertake in a normal day. Lastly, we asked individuals to rate their satisfaction with the time they have left for leisure and resting. Table 2 provides a more detailed description of each component of the WEAI we included in our survey and the assets included in each question.
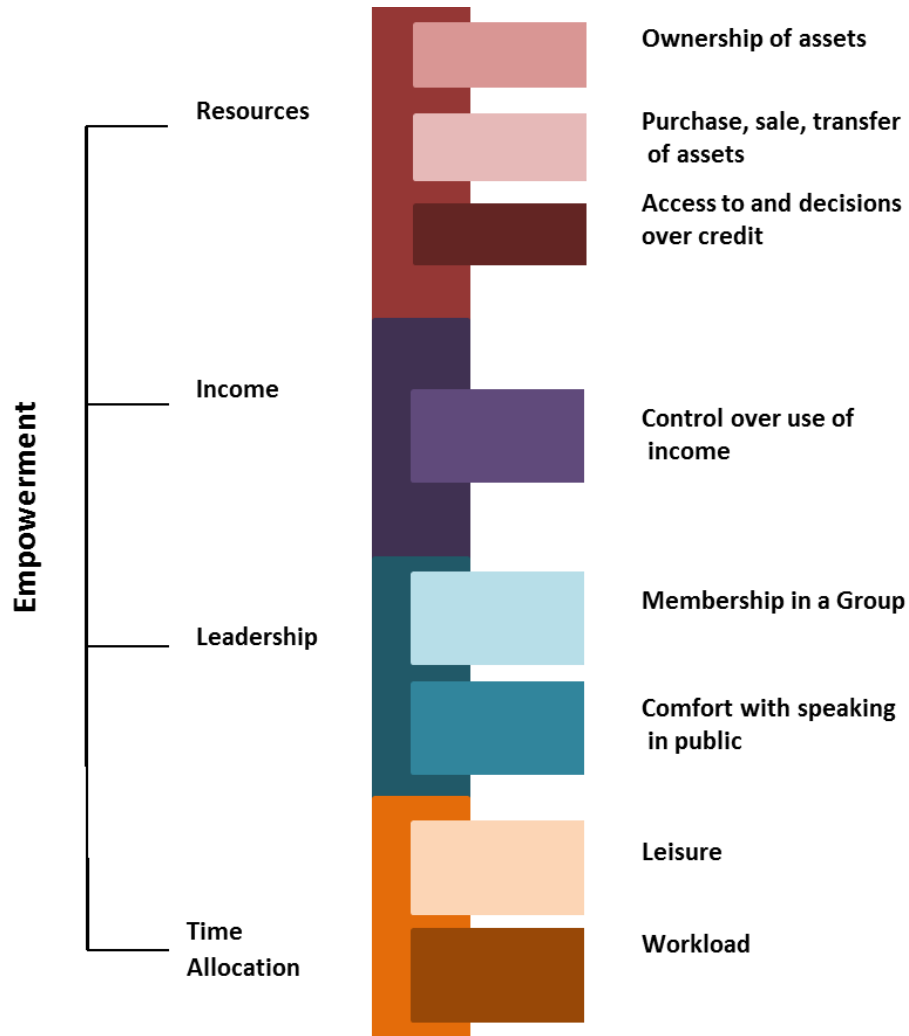
Figure 2. Women's Empowerment in Agriculture Index Domains and Indicators

Table 2. Explanation of Domains and Indicators from the WEAI in Our Questionnaire

Indicator	Explanation of variables
Category 1*	
Agricultural Land	Category 1 measures the individual's
Livestock	contributions to decisions over buying,
Commercial Crops	selling, or transferring different assets.
Rented Land	
Goods	
Transportation	
Category 2*	Category 2 measures the individual's
Bank	contributions to decisions over credit from
Friends or relatives	different sources
Category 3*	
Agricultural Land	Category 3 measures the individual's
Livestock	contributions to decisions over the
Commercial Crops	distribution of revenue from different
Rented Land	productive assets
Expenditures	
Category 4	
Group membership	1=belongs to a social group, 0=otherwise
Public Speaking	1=comfortable with public speaking, 0=othe
Category 5	
Hours worked (paid and unpaid)	Hours worked in paid and unpaid work task
Leisure Time	1=satisfied with leisure time, 0=otherwise
Category 6	
Cows	Number of livestock owned by the
Sheep	individual either individually or jointly with
Alpacas	other household members
Llamas	
Land	Number of plots that the individual receives

* Answers are scored in terms of who makes the decision (1) respondent (0.72) respondent and other hh members (0.5) other members from the household or outside the household, respondent and partner, or no access to asset (0.25) partner and other members (0) partner

Section 5: A Review of Empirical Models of Empowerment

The objective of this section is to highlight the challenges of conducting empirical studies on women's empowerment. First, we review the various definitions of empowerment across the literature. The second part of this section reviews the existing empirical studies and highlights their common measurement and methodological issues. To do so, we first discuss the challenges with measuring empowerment both indirectly using proxies and directly using outcomes or indicators of empowerment, particularly in light of the previous discussion about the conceptual definition of empowerment. We then separately review studies that treat empowerment as an observable variable and those that treat it as a latent construct. Finally, we discuss studies that address the endogeneity issues otherwise ignored in most empirical models of empowerment.

5.1 Definitions of Empowerment in Empirical Studies

According to (Alkire et al. 2013), the concept of empowerment is influenced by a person's experiences, beliefs, aspirations, context and culture. Thus, empowerment has been defined in various ways by different researchers. The following is a summary of the most commonly cited definitions of empowerment.

Empowerment is often defined in terms of women's agency or their ability to make strategic choices about their lives based on what they value (Malhotra and Schuler 2005; Sen 1989; Kabeer 1999). Kabeer (1999) is often cited for developing the concept of empowerment further into a process that involves three dimensions: resources, agency and outcomes. Resources refer to pre-conditions such as access to assets or human capital required for women to exercise their agency. These resources have been further divided into sources and settings of empowerment (Kishor 2000). Sources are the assets that improve women's sense of security and thus increase their bargaining power within their household. Settings of empowerment include women's past

and current environments which facilitate or hinder their ability to exercise their agency. Agency, the second dimension described by Kabeer (1999) involves the action taken which includes decision-making processes and negotiation. Lastly, the outcomes refer to the well-being outcomes achieved as a result of women exercising their agency. In terms of Kaaber's definition, empirical studies have focused more on analyzing the resources (such as access to assets or income) and outcomes of empowerment (such as child nutrition) often leaving agency aside (Alkire et al. 2013).

Other definitions have described empowerment as a more complex concept that depends on more than just individual choices of women. For instance, the Alsop, Bertelsen, and Holland (2006) definition of empowerment involves women's agency as well as their ability to exercise their agency to achieve a desired outcome. Following the Alsop, Bertelsen, and Holland (2006) definition, empowerment is also determined by the institutions that govern empowerment of women and whether they allow women to exercise their agency effectively. Similarly, other scholars have broadened their definition of empowerment to include how external factors and relationships enable women to exercise their agency. Narayan (2002) describes access to information, inclusion and participation, accountability and local organizational capacity as four main aspects of empowerment. Thus, Narayan's definition of empowerment includes people's connections with each other and their institutions rather than focusing on their ability to make individual choices.

Despite the different definitions of empowerment, researchers have reached a consensus on certain features of empowerment such as its multidimensional nature (Samman and Santos 2009). According to Samman and Santos (2009), empowerment can be exercised in different spheres, domains and levels. Spheres refer to the institutions that allow women to exercise their agency. Alsop, Bertelsen, and Holland (2006) refer to these spheres when stressing the importance

of institutions in their empowerment definition. Domains represent the different areas of life in which an individual can exercise empowerment such as allocating household expenditures, influencing production decisions, practicing a religion, or having freedom of movement. Malhotra, Schuler, and Boender (2002) for instance, suggest that empowerment should occur in the economic, socio-cultural, interpersonal, legal, political, and psychological domains. Lastly, levels of empowerment refer to how individuals can exercise agency at the community, household or country levels (Samman and Santos 2009). Research often pays attention to women's agency exercised at the household level also described as their intra-household bargaining power.

From the various definitions of empowerment, we can conclude that empowerment is a complex process that involves individuals and institutions at multiple levels. For this study we will follow the WEAI focus on women's agency and those aspects that relate to empowerment of women in agriculture exercised at both the household and community level (Alkire et al. 2013). Our measure of empowerment and empirical methodology are also consistent with the multidimensional nature of empowerment.

5.2   Measurement and Methodological Issues of Empirical Studies

One of the reasons for the lack of evidence of the drivers of empowerment is the challenges associated with measuring empowerment. According to Samman and Santos (2009), the majority of empirical studies measure empowerment indirectly using proxies such as land ownership, ownership of assets and education. This approach has been strongly criticized because these factors are commonly considered preconditions of empowerment rather than indicators of empowerment (Govindasamy and Malhotra 1996; Malhotra and Mather 1997; Malhotra, Schuler, and Boender 2002). Alkire (2008) uses asset holdings to exemplify how some of these issues may arise. First, asset holdings might not translate to empowerment in the same way for different individuals. Using

asset holdings can also ignore the effect of different pathways, such as inheriting assets vs buying them, through which empowerment is affected. Finally, when asset holdings are used, increases in empowerment from other sources will not be accounted for (Alkire 2008).

Only a few empirical studies of the drivers of empowerment attempt to measure empowerment directly (Samman and Santos 2009 provide an overview). Common measures in this literature include influence over household economic decisions, control and access to resources, and mobility which are commonly aggregated into indices (Jejeebhoy 2000). In other words, these studies treat empowerment as an observable variable. Common measures or indicators of empowerment in the literature are: economic, child related, and marriage related decision-making, mobility, power dynamics with husband, and access and control over assets (Jejeebhoy 2000). According to Samman and Santos' (2009) review of the literature, the majority of studies use simple dependant variables where the correlates of women's empowerment are analyzed using OLS or logit regressions. A common approach is to ask questions regarding one or more indicators and create a dichotomous variable that is equal to 1 if the woman is considered empowered for that indicator. For example, Hashemi, Schuler, and Riley (1996) ran several logit regressions on each of eight binary indicators of agency in a study of the effect of credit programs on empowerment in Bangladesh. Other studies have also compared the effect of empowerment determinants on different indicators in a similar way (e.g., Hindin 2000; Hashemi, Schuler, and Riley 1996; Malhotra and Mather 1997; Mason 1998).

Although various studies recognize the importance of measuring empowerment using different indicators, for empirical purposes most studies aggregate measures of different indicators into one index which is then used as the dependent variable in a multi-variate regression (e.g., Jejeebhoy and Sathat 2001; Schuler and Hashemi 1994; Wiig 2013). For example, Al Riyami,

Afifi, and Mabry (2004) create two different variables that sum up the number of binary indicators representing the decisions in which the woman had a say and the places the woman is allowed to visit. In her study of land rights in Nepal, Allendorf (2007) also used an aggregated measure of empowerment calculated by adding the number of decisions in which the woman participates and is considered empowered. Other studies create an additional dichotomous variable to indicate that a woman is empowered if she has adequate levels of a certain proportion of all the indicators in their dataset (e.g., Speizer, Whittle, and Carter 2005; Hindin 2000; Garikipati 2008). Hashemi, Schuler, and Riley (1996), for example, ran an additional regression in their analysis of credit programs in Bangladesh where the dependent variable is binary and equal to 1 when a woman is considered to be empowered in five or more of their eight indicators of agency.

Researchers agree that empowerment is a multidimensional construct with different domains that must be carefully considered (Isvan 1991; Kishor 1995; Beegle, Frankenber, and Thomas 2001; Hashemi, Schuler, and Riley 1996; Mason 1998; Malhotra and Mather 1997; Malhotra, Schuler, and Boender 2002). However, a review of the empirical literature on drivers of empowerment shows that studies commonly use rather simplistic measures of empowerment that often rely on aggregating information from different indicators into one dependent variable. This aggregation forces researchers to overlook the possibility that the determinants of empowerment may have different effects on different facts of empowerment. In fact, drawing from a study by Mason (1998) which provides evidence that the drivers of empowerment have different effects on different empowerment domains, we expect this possibility to be high. It has also been shown that empowerment in one dimension does not necessarily guarantee or enhance empowerment in any other dimension (Allendorf 2007; Mason 2005; Mason 1998). Thus, focusing only on one or a few dimensions could lead to conclusions that are not necessarily applicable to all dimensions of

empowerment. Finally, another weakness of this aggregation is that it often assumes that each indicator has the same contribution to women's empowerment. Even those studies that do not make this assumption rely on an arbitrary set of weights used to aggregate indicators into an empowerment variable (e.g., Ross et al. 2015).

While most studies use empirical approaches that treat empowerment as an observable variable, fewer studies apply an approach that acknowledges the latent nature of empowerment. Narayan (2005) describes agency as a latent phenomenon that can only be deduced through its actions or results. While most scholars agree with this view, the majority of the empirical work reviewed so far does not have an empirical approach that accounts for the latent nature of empowerment. To our knowledge, Allendorf (2012) and Pitt, Khandker, and Cartwright (2006) are currently the only two exemptions. In a study of family relationships and women's empowerment in India, Allendorf (2012) measures empowerment based on decision-making over expenditures on eight items and mobility to various different places. This study uses exploratory factor analysis to create one factor to measure agency which was then used in an OLS regression. In another study of participation in microfinance programs and women's empowerment in Bangladesh, Pitt, Khandker, and Cartwright (2006) apply a structural equation model (SEM) where their latent empowerment is measured with 72 indicators that measure women's empowerment in various domains including purchasing ability, access to resources, activism, household attitudes, and others. While most studies develop empowerment measures from observed indicators, these studies treat observable factors as indicators of a latent phenomenon. Thus, their approaches are more consistent with the widely-agreed notion that empowerment is an unobservable variable. By including various indicators, instead of aggregating them into one variable, these approaches are also more consistent with the notion of empowerment as a multi-dimensional construct.

A final issue in the existing literature is that the vast majority of studies ignore endogeneity issues (Trommlerová, Klasen, and Leßmann 2015; Samman and Santos 2009). To our knowledge there are only three studies that address endogeneity from reverse causality or unobserved heterogeneity by using two-stage least squares (2SLS) methods. Garikipati (2008) instruments the years of membership in a self-help group program in a study of the effect of a microcredit program on women's empowerment in rural India. However, while 2SLS IV is appropriate for linear models, the study applies it in a limited dependent variable context. The second case is a study of the determinants of women's empowerment in rural Bangladesh by (Anderson and Eswaran 2009). The authors correct the endogeneity bias from using women's work activities and earned income by using household-agricultural and health shocks as instruments for their first-stage estimation. Similarly, Trommlerová, Klasen, and Leßmann (2015) also use a 2SLS method to correct for potential endogeneity issues of education, literacy, economic activity and wealth. They found that all their estimates using OLS and logit regressions were still significant except for literacy, wealth and gender. Other studies have not accounted for endogeneity issues but have econometrically avoided endogeneity by using instrumental variables in their estimations (e.g., Imai et al. 2014).

We develop an empirical model that solves the issues discussed in this section. We use a Generalized Structural Equation Model (GSEM) that allows us to treat empowerment as a latent variable observed by several indicators belonging to different domains that are relevant to women's empowerment in agriculture. By using this approach, we are not forced to aggregate the indicators or impose arbitrary weights on each indicator to create an empowerment measure. We also rely on our detailed survey data and use inheritance of land instead of ownership of land in our analysis. Using inheritance is better than using ownership, although there might still be

endogeneity across generations. Nevertheless, our inheritance measure is more robust to endogeneity than other measures typically employed in the literature.

Section 6: Empirical Specification

The following section is divided into three parts. First, we discuss the determinants of empowerment that will be used in our empirical model. This includes a summary of other studies' findings of the drivers of empowerment included in our model. In subsection 7.2 we describe our empowerment latent variable and the influence indicators used in our measurement model. In subsection 7.3 we describe our econometric approach. This subsection describes Item Response Theory (IRT) and how it is applied to our analysis of women's empowerment. Section 7.4 describes our econometric model. Finally, we conclude the section by describing some of the challenges in assessing goodness of fit in GSEM models.

6.1   Determinants of Empowerment

Based on our field work and review of the literature (e.g., Samman and Santos 2009; Jejeebhoy 2000) we grouped the main determinants of women's empowerment into three categories: assets and wealth, household characteristics, and community involvement. Within the category of assets and wealth we pay special attention to the allocation of land rights within the household to address our first objective. In this section we first review each determinant included in our model and the expected signs. Then, we include a rationale for including each determinant drawn from previous existing studies.

6.1.1 Assets and Wealth

We expect that ownership and control over assets would have a positive impact on women's empowerment. According to Doss (2013), assets can increase women's bargaining power by increasing their options outside the household, providing income via rents or through their use in production activities, and increasing their sense of security. Interestingly, asset control has not been consistently found to be a strong predictor of empowerment especially when social norms, religion, or caste systems are important factors in the specific context being studied (Samman and Santos 2009). For instance, Allendorf (2007) found that in Nepal a woman's place in the family structure is a stronger source of empowerment than her control over assets. Lokshin and Ravallion's (2005) study in Russia also suggest that ownership of assets or wealth does not necessarily translate to self-perceived levels of empowerment.

Our sample includes peasant communities that are geographically close to each other and share very similar social norms, cultures, and religion. Thus, since these social factors are constant across communities, we expect differences in ownership of assets to have positive impacts on empowerment. Grazing cattle is perceived in the area as a sign of higher socioeconomic status possibly due to the potential for higher costs and earnings from dairy production. We expect that *ownership of cows*, included in our model as a binary variable showing whether the women's household owns cows, is associated with higher empowerment.

We also include individual *wealth* (wealth index) that accounts for different household and individual assets owned by the woman. Since it is likely that wealthier women have more access to land, it is necessary to separate these two effects to identify the actual effect of land rights on women's empowerment. Our wealth index, therefore, does not include land rights. A positive coefficient on individual wealth would suggest that women's ownership of assets and higher

socioeconomic status increase their empowerment. This relationship is expected in a context like rural Peru since women with less economic stress could have more flexibility to allocate their time in other activities outside their homes that could enhance their bargaining power.

6.1.2 Land Rights

To determine the effect of intra-household allocation of land rights on empowerment, we include three dummy variables in our first model: *woman inheritance*, *man inheritance*, and *joint inheritance*. These variables show whether the women's household has land inherited by the woman only, by the man only, or by both. The control variable not explicitly included in our model represents women who live in households where no land has been inherited. Land ownership has only been included in three studies where it has been found to have positive impacts on women's empowerment (Allendorf 2007; Wiig 2011; Mason 1998). Following the limited evidence, we expect that women living in households where they are the only ones who have inherited land will be more empowered than those living in landless households. As far as we know, only Wiig's (2011) study in rural Peru has tested the effect of living in households where only the man has inherited land. Following the bargaining literature discussed in Section 2.2, we expect this variable to be negatively associated with women's empowerment since the man is more likely to monopolize decision-making if he has a greater fallback position or income contribution. However, there is a possibility for this coefficient to be positive if women's access to land inherited by other members is empowering in itself. Finally, we expect the coefficient on land rights inherited by both members to be positive since access to land at the household level could provide women with greater opportunities.

6.1.3 Household Characteristics

The first set of household characteristic variables we include has to do with family structure. First, we include two dummy variables, *single woman* and *woman only*, indicating whether the woman is single or whether the woman used to be in a partnership that has now been dissolved due to a divorce, separation, or because she is a widow. The coefficients on these variables would show the impact of women's marital status relative to women living in a couple, whether they are in a marriage or a consensual union. In the context of the divorce-threat models of bargaining power, it is expected that marital status will play a role in women's decision-making power. Unmarried women, for example, might be more empowered given that they have the flexibility to continue with their education or work rather than having to engage in domestic chores. However, having been involved in a partnership in the past could also influence women's decision-making power. Marital status was included in Kamal and Zunaid's (2006) empowerment study in Bangladesh. The authors found that unmarried women are more likely to be empowered and the effect of marital status surpassed that of education. Even though Bangladesh is an extreme case where the average age at marriage is very low, we still expect marital status to determine empowerment in rural Peru.

We also include three variables of family structure. *Male adults* and *female adults* are variables indicating the number of other male and female adults (over the age of 15 years old) in the household. We expect the presence of other male adults to have a negative impact on women's empowerment since they could replace women's role in decision-making. The presence of female adults is expected to be positively associated with women's empowerment. Finally, we include *children* as a continuous variable of the number of children below the age of 15 years old present in the household. We expect the coefficient on this variable to be negative because as the number

of children increases the workload for women increases, and their time available to be involved in their household decreases.

Education is commonly included in empowerment models and has been found to be an important predictor of different domains of empowerment (K. Gupta and Yesudian 2006; Malhotra and Mather 1997; Hindin 2000). In some cases, the evidence shows that specific levels of education achieved, rather than a continuous measure of years of education, predicts empowerment. Speizer, Whittle, and Carter (2005) showed that having only primary education is associated with male-centered attitudes and beliefs in women in Honduras. Jejeebhoy (2000) and Jejeebhoy and Sathat (2001) also showed that all levels of education were important predictors in Tamil Nadu, India, while in Uttar Pradesh, India and Punjab, Pakistan only secondary education was a significant predictor of women's empowerment.

Intuitively, we would expect education to increase empowerment by providing women with self-confidence, awareness, and more opportunities. However, when it comes to household economic decisions, the education level of women relative to their spouse or other male decision-makers will determine women's influence within the household. Thus, we include the household level variable *education difference* which is the difference between the man and the woman's level of education. We would expect that as the education gap increases in favor of the man, the woman could become less confident to participate in household economic decisions or to challenge her partner. In contrast, if a woman is relatively more educated than her spouse, we would expect her to have a greater influence within the household. This relationship would work differently for women who are either single or widowed since they might be the only individuals involved in their household's decision-making. To account for this we estimate the education difference between the woman and the oldest man adult in the household who is assumed to take over the role of a

spouse as the primary decision-maker. In households where no other male figure is present we set the education gap equal to zero since we assume that there is no education advantage working against or in favor of these women.

Finally, we included the *member's age* as a determinant of empowerment. We expect older women to be more experienced and, thus, have more decision-making power. Many women in our sample, especially those living alone, are seniors and as such have been involved in the communities for various generations. We expect these women to be more respected among community members too.

6.1.4   Community Involvement

We include two dummy variables to account for community involvement: *public speaking* and *group membership.* Public speaking shows whether the woman feels comfortable speaking in community meetings and family disputes. Group membership shows whether the woman is part of any agricultural, social, women's, or religious group. We expect both of these variables to be positively associated with empowerment since greater participation in their community could allow women to be more confident in participating in decisions made at the household and community level.

Registration in the community is another factor that could determine women's empowerment. When new households are formed, most communities allow for only one member in the household to be registered in the community. Although the partner of the registered member still enjoys the benefits of belonging to the community, in case of a separation or divorce the registered member is more likely to keep assets, such as land, which are managed by the community. Thus, if a woman is registered she might be more confident in challenging her partner since her fallback position is strengthen by the community. However, women that are empowered

are more likely to challenge the commonly patriarchal systems of communities and demand to be registered instead of their male partners. Therefore, we did not include registration in the community as an explanatory variable of women's empowerment because it is endogeneously determined.

6.2   Indicators of Women's Influence over Household Economic Decisions

As mentioned earlier, we treat our empowerment variable as a latent variable that is measured using a set of influence indicators. We consider the influence of women over 13 separate household economic decisions. The 13 influence indicators are drawn from the WEAI questions related to women's influence in 3 broad categories: (1) purchase, sale, and transfer of assets and (2) access to and decisions over credit from the resources domain and (3) control over use of income from the income domain. Each influence indicator indicates the level of influence over an economic decision held by a woman relative to her partner (or in cases when they don't have a partner, other adult decision-makers within the household). Each influence indicator is a discrete ordered variable with five categories indicating whether the decision was made by (1) the man alone *(M)* (2) the man and another household member *(MO)* (3) the woman and the man jointly (or in other words an equal balance of bargaining power within the household) *(MW)* (4) the woman and another household member *(WO)* or (5) the woman alone *(W)*. Category 3 includes scenarios where decisions are made by other members in the household, by members outside the household, or where no decisions are made because there is no access to the specific asset. In these scenarios empowerment is assumed equal between partners. Figure 3 reports the distribution of observations in each category for one of our influence indicators—decision-making over buying, selling, or transferring agricultural land. For this indicator men are the sole decision-makers in 7 households, women are the sole decision-makers in 29 households and there is some type of joint

influence in 102 households. Figure 4 reports the distribution of observations for all influence indicators used in our analysis.
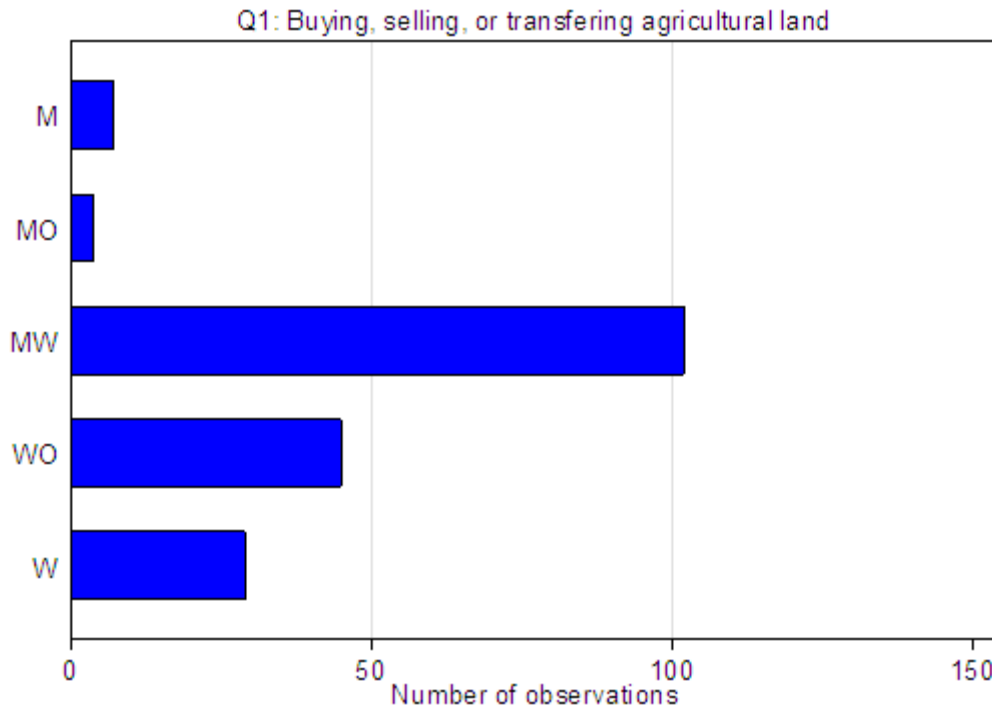
Figure 3. Distribution of Responses for the Influence over Decision-making over Buying, Selling, or Transferring Agricultural Land

6.3   Empirical Approach

6.3.1   Item Response Theory

At the crux of our empirical approach is Item Response Theory (ITR). In many disciplines, scholars are often interested in studying latent or unobservable characteristics. The latent traits can't be observed directly but can be measured using a set of items or questions. For example, a teacher interested in measuring statistical aptitude (the latent variable or trait) can administer a test with several questions (or items). IRT has been used in different applied disciplines such as psychometrics to develop links between observable measures of a latent trait and levels of the

Who is the main decision-maker in...

M=Man, MO=Man and others, MW=Man and woman, WO=Woman and others, W=Woman
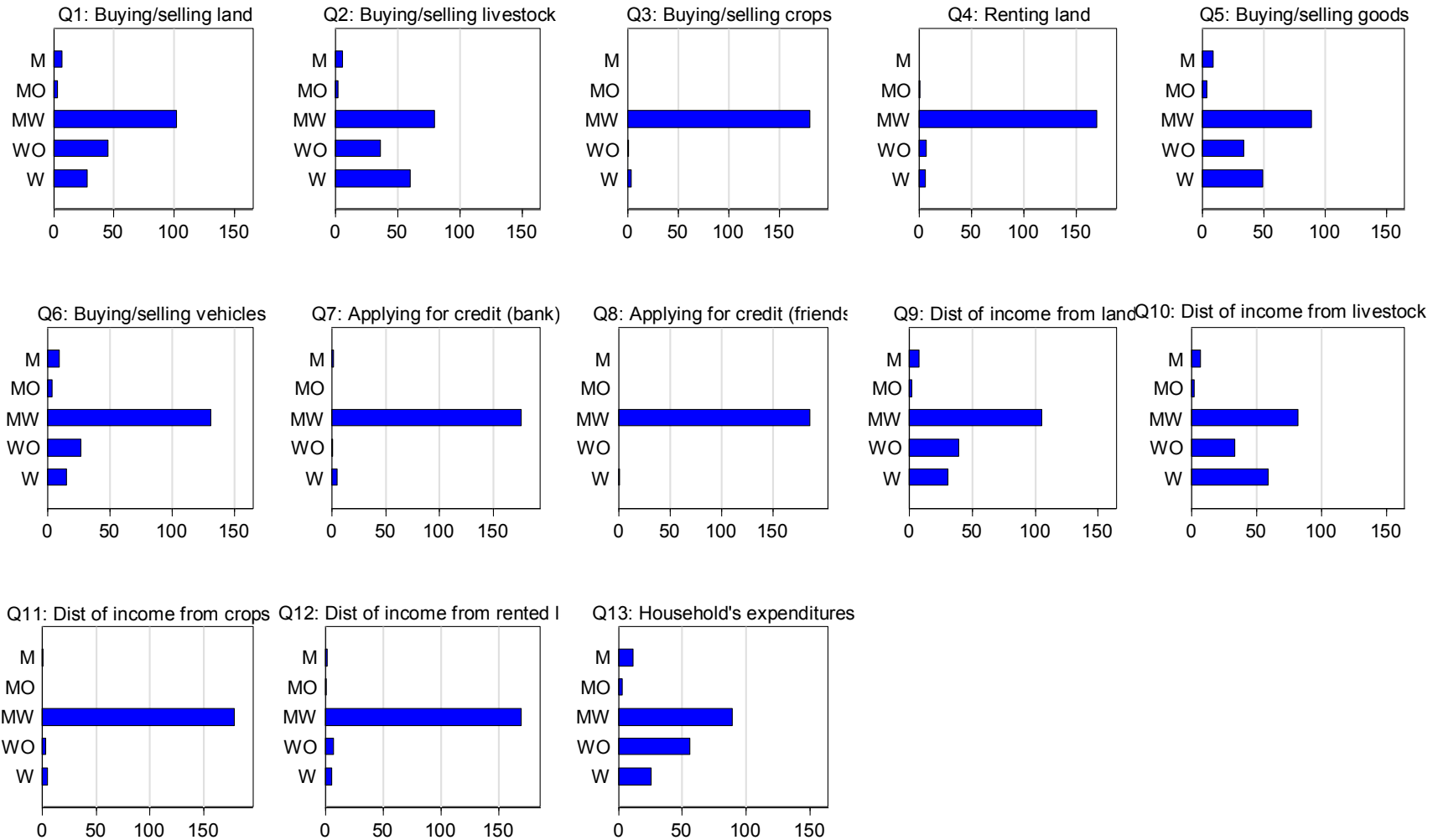
Figure 4. Distribution of Responses for the 13 Influence Indicators of Empowerment

latent trait (e.g., Embretson and Reise 2000; Hambleton and Swaminathan 1985; Hambleton, Swaminathan, and Rogers 1991). For instance, IRT is used in educational testing to link students' responses to different items (e.g., questions which require yes/no answers) to their latent ability. Computerized adaptive tests like the GRE and GMAT are based on IRT (Montgomery and Cutler 2013). Other applications of IRT include the estimation of ideological ideal points of political figures (e.g., Martin and Quinn 2002; Bailey and Maltzman 2008) as well as variations of democracy within countries (Treier and Jackman 2008). In the development literature, application of IRT is limited. Das and Zajonc's (2010) study is a notable exception that used IRT to compare the distribution of cognitive skills of 9th grade children from the Indian states of Orissa and Rajasthan with international benchmarks.

IRT can be understood with a simple example from the educational testing literature mentioned above. Standard testing methods report the grade of a student in one specific test and provide a measure of student performance on a test specific scale. Using the standard approach, the test scores of students of the same class offered on two equivalent campuses may not be comparable because they differ in two ways: a) *difficulty* - questions across 2 tests may have different levels of difficulty, and b) *discrimination* – questions may differ in their capacity to separate out high ability and low ability students. The higher the discrimination the better the item is at identifying respondents within a narrow range of ability. IRT provides an alternative to standard test scoring methods by identifying the two types of differences and providing a mathematical approach to remove the differences from the scores so all tests are on the same scale.

6.3.2 The Item Characteristic Curve

The Item Characteristic Curve (ICC) is the fundamental concept in IRT. Both the difficulty and discrimination parameters are estimated using the ICC, a function that links individuals' item response probabilities to the latent trait. Figure 5 shows a hypothetical ICC for the education testing example. The figure plots the probability of a correct response to a test question or item as a function of underlying ability or the latent trait. The difficulty represents the level of ability at which a respondent is likely to provide a correct answer for an item. That is, the difficulty is the minimum level of latent ability (x-axis) where the probability of a correct response crosses the 50% mark (y-axis). Similarly, the discrimination parameter is the slope of the ICC at the difficulty point (Figure 5).
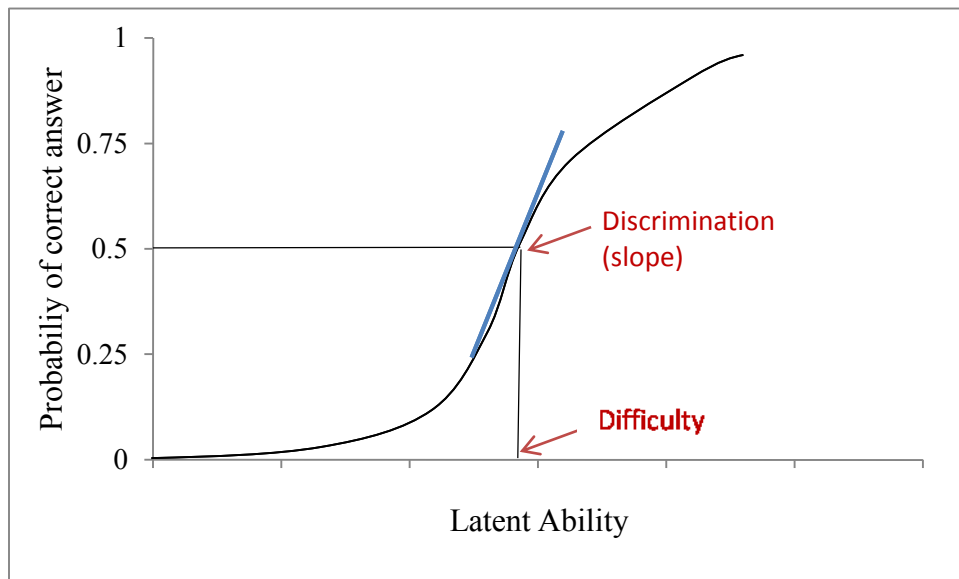
Figure 5. Difficulty and Discrimination Parameters in an Item Characteristic Curve (ICC)

A formal expression for the ICC is given in equation S1 which expresses the probability of success as a function of latent trait lambda (assumed to be $N{\sim}(0,1)$), discrimination s, and difficulty d usually with a logistic specification for F:

$$P(Q = 1|\lambda, d, s) = F(s(\lambda - d)) \qquad\qquad \text{Equation S1}$$

$$P(Q = 1|\lambda, d, s) = \frac{e^{s(\lambda-d)}}{1 + e^{s(\lambda-d)}}$$

Often, the ICC is expressed in slope intercept form (for ease of computation see (Zheng and Rabe-Hesketh 2007)):

$$P(Q = 1|\lambda, d, s) = F(s\lambda - sd)$$

$$P(Q = 1|\lambda, d, s) = F(\beta\lambda - \delta)$$

So that the discrimination and difficulty parameters are recovered in a second step such as:

$$s = \beta; d = \frac{\delta}{s}$$

6.3.3 Application of IRT to Women's Empowerment

We apply the IRT model described above for our analysis of women's empowerment. The items in our case are our 13 women's influence indicators and the latent variable we consider is women's empowerment. Unlike the standard model, our items are ordered discrete rather than binary variables. Due to the discrete nature of our items, we define our ICCs as the probability of a woman being in the highest category of decision-making (where women are the sole decision-makers) as a function of her underlying empowerment[12]. Thus, we are going to focus on the probability of a woman being the sole-decision maker vs the man being the sole-decision maker. Our approach is comparable to the Graded Response framework which is a type of IRT model that is appropriate for categorical items and is estimable using GSEM methods (Samejima 1997). Note,

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[12] In our model each item is described by a discrimination parameter and between category threshold parameters that represent each category's difficulty. Thus, each item will have one less difficulty parameter than the number of categories possible for that item. Each difficulty represents the latent trait level at which it is likely that an item's response is above the threshold.

however, that the probability of the woman being the sole-decision maker with respect to each of the four other categories could also be computed. However, for the sake of brevity and the focus of my stud on women's intra-household power, the most relevant categories are women and men as sole-decision makers.

Difficulty and discrimination in the educational test literature allow researchers to remove item's test-specific attributes thereby allowing tests to be put on a common scale so that students can be compared for example based on math tests across a cross section of countries. In our case, difficulty and discrimination provide us with novel policy information about each influence indicator. Specifically, they provide information on how different influences, each of which may be associated with a different development outcome, can be harnessed by empowering women. Figure 6 shows two hypothetical ICCs for two influence indicators with different difficulty values: Indicator 1 has a difficulty level that is located farther to the left of the latent variable axis. Thus, in the context of our study, the difficulty measures an *influence's threshold or the minimum level of empowerment required to turn on the influence*. In Figure 6, influence indicator 1 has a lower threshold than indicator 2, suggesting that less empowerment is required to turn on influence 1 relative to influence 2. That is, it is "easier" to turn on influence 1 through empowerment policies. Figure 7 shows hypothetical ICCs for two influence indicators with different discrimination values at their threshold or difficulty points. Influence 2 has a higher discrimination indicated by its steeper slope compared to influence 1. In the context of our study, the *discrimination parameter measures an influence's sensitivity or responsiveness to changes in empowerment*. In Figure 7, influence indicator 2 is more sensitive to policy interventions that increase empowerment than influence 1. It is plausible that a woman's influence over credit decisions may be highly sensitive to small changes in empowerment while her influence over livestock production may be less

responsive. This could be the case even if the influence over livestock sales has a lower threshold or is "easier" to turn on. Taken together, policy makers would benefit from targeting influence categories that have lower thresholds and are more responsive.
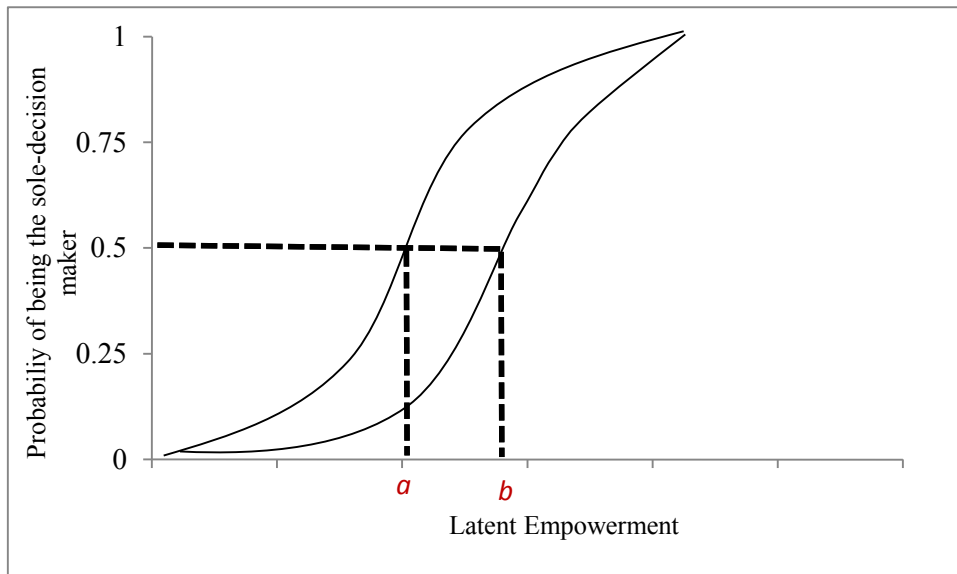
Figure 7. ICCs with Different Difficulties or Empowerment Thresholds
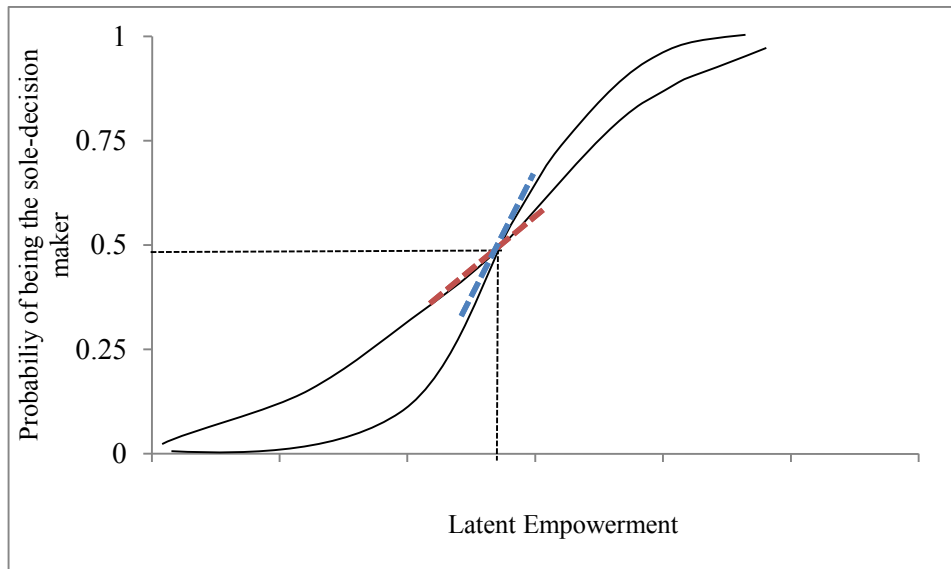
Figure 6. ICCs with Different Discriminations or Empowerment Sensitivities

6.4 Empirical Model

Our model involves two components, a measurement equation and a structural equation. For the first component, using IRT we specify latent empowerment as a continuous variable λ_j^* measured by 13 influence items or influence indicators, $i = 1, \dots, 13$ for each woman j. Given the discrete nature of the influence indicators, our measurement component is specified using ordered logits. The underlying continuous response Q_{ij}^* is estimated as a linear function of latent empowerment λ_j^*.

$$Q_{ij}^* = v_i + s_i \lambda_j^* + \varepsilon_j \qquad \text{(Equation 1)}$$

In Equation 1, v_i is a constant term, s_i is a factor loading associated with an influence indicator, and ε_j is assumed to be logistically distributed. Further, we assume that all items take on the ordered categories, $k = 0, \dots, 4$ (where $k = 4$ is woman as the sole decision-maker). As in standard ordered logit models, the observed outcome of each influence indicator Q_{ij} is related to the continuous response Q_{ij}^* via a threshold model (Equation 1.a).[13]

$$Q_{ij} = \begin{cases} 0 \text{ if } -\infty < Q_{ij}^* < k_{1i} \\ 1 \text{ if } k_{1i} < Q_{ij}^* < k_{2i} \\ 2 \text{ if } k_{2i} < Q_{ij}^* < k_{3i} \\ 3 \text{ if } k_{3i} < Q_{ij}^* < k_{4i} \\ 4 \text{ if } k_{4i} < Q_{ij}^* < \infty \end{cases} \qquad \text{(Equation 1.a)}$$

Therefore, the probability of a woman j belonging to an empowerment category k (e.g., sole decision-maker) with respect to indicator i (e.g., control over credit) is:

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[13] Each cut-point dividing two categories has a different characteristic curve which is used to determine the difficulty parameter for each category. Thus, each item will have one less difficulty parameter than the number of categories possible for that item. The difficulty represents the latent ability level at which a random drawn individual is likely to respond above the cut-point.

$$\Pr\left(Q_{ij} \geq k | a_i b_i \lambda_j^*\right) = \frac{\exp\{s_i(\lambda_j^* - d_{ik})\}}{1 + exp\{s_i(\lambda_j^* - d_{ik})\}}$$

Where s_i is discrimination parameter or empowerment sensitivity of influence indicator i

and $d_i = (b_1, b_2, \ldots, b_K)$ is the difficulty threshold for each category of indicator i.

We assume the outcome for all indicators must fall in one of the four categories of women's

influence. Thus, the probability of observing outcome k is:

$$\Pr\left(Q_{ij} = k | s_i d_i \lambda_j^*\right) = \Pr\left(Q_{ij} \geq k | s_i d_i \lambda_j^*\right) - \Pr\left(Q_{ij} \geq k + 1 | s_i d_i \lambda_j^*\right)$$

The model parameterizes the probability of observing outcome k using the slope intercept form

as:

$$\Pr\left(Q_{ij} \geq k | \delta_i B_i \lambda_j^*\right) = \frac{\exp\{\beta \lambda_j^* - \delta_{ik}\}}{1 + exp\{\beta \lambda_j^* - \delta_{ik}\}}$$

And, since the model is estimated in slope-intercept form, a second step is required where we

estimate the discrimination (or empowerment sensitivity) and difficulty (or empowerment

threshold) using:

$$s_i = \beta_i \text{ and } d_{ik} = \frac{\delta_{ik}}{\beta_i} \qquad \text{(Equation 3)}$$

The second component of our model is the structural component which relates our

empowerment latent variable, a continuous linear variable, λ^* to a set of observed determinants

(Equation 4). Our specification of observed determinants focuses on distribution factor variables

that affect the intra-household distribution of power and attributes of women or individual

characteristics which are expected to influence their empowerment. In Equation 4 X_j is a vector of

individual characteristics that includes the variables from the assets and wealth, household

characteristics, and community involvement categories which were described in detail in Section

6.1. Summarizing briefly the discussion in Section 6.1, land rights are represented by three dummy

variables, W_j, M_j, J_l, that represent woman, male, and joint inheritance respectively. The land rights and education difference variables measure the distribution factors that are expected to determine the distribution of power within women's households. The parameters to be estimated are α, γ, μ, and ν and ε_j is a non-systematic error that captures unmeasured determinants that vary across women. The coefficients on the land rights dummy variables represent the effect of each type of inheritance on women's latent empowerment, holding everything else constant.

$$\lambda^* = \alpha X_j + \gamma W_j + \mu M_j + \nu J_j + \varepsilon_j \qquad \text{(Equation 4)}$$

To better understand from a policy perspective what the empowerment thresholds and discriminations mean for peasant communities in rural Peru, we estimated the average level of empowerment in our sample. The mean empowerment level is predicted using the estimates of our GSEM model defined in equations 1 and 4. The predicted mean, estimated using Empirical Bayes, is the mean of the empirical posterior distribution using the estimated model parameters (see STATA manual 14 for more details on Empirical Bayes estimation).

Our specification has three potential issues. First, we are not accounting for community effects which could influence the impact of land rights on women's empowerment. Second, our basic model does not consider the amount of inherited land but only includes our land rights dummy variables. Although it would be ideal to have continuous data on land inheritance amounts, the data we collected on hectares of inherited land does not have enough variability in it.

Third, as mentioned earlier, a strong assumption in our model in the way the data was collected was that that the influence indicators which were elicited through a series of questions are perceived in a similar manner by both men and women. Specifically, we assumed that a question regarding a woman's influence over a household decision will be perceived and answered in exactly the same way. To account for differential item functioning (DIF), across men and

women, as a robustness check, we pool the data using only women's responses that we use for our analysis above, with a dataset where men answered the same questions. The pooled sample contains both couples as well as single-heads of households. We estimate the larger IRT model with the pooled sample and test for DIF by testing the statistical significance of the coefficient on a variable denoting the sex of the survey respondent. The sex dummy variable is restricted only to appear in the measurement portion of the model and, thereby, captures differential attitudes and interpretations of the questions by men and women who have the same value of the latent trait.

To address these issues, we ran four *additional models* to check for the robustness of the land right effects observed in our basic model. The first three additional models have different specifications of the explanatory variables of empowerment in Equation 4 and the fourth additional model accounts for DIF. The first additional model includes community dummy variables to take into account community effects. In the second additional model, we account for quantities of inheritance given our data (rather than using binary inheritance indicator). To do so we estimate the average amount of land in hectares that households inherited and created new land rights variables each of which has three categories: no inherited land, amount of inherited land below the average, and amount of inherited land above the average. Given the lumpiness of the inheritance variables this approach allows us to approximate the effect of larger and smaller inheritances without relying on the variability of the data. Our third additional model includes the new land rights variables plus the community dummy variables. Finally, our fourth additional model accounts for DIF. To do so, we pooled our women's sample with identical questions and other household data we had elicited by deploying a questionnaire for collecting a "men's sample". In fact, the larger pooled sample is more reliable in the sense that it yields greater degrees of freedom, however, we refrained from using it due to possible inconsistencies across gender in answering

the power questions. Our analysis in this model will allow us to do so by explicitly accounting for DIF in the model. We first transformed the men's responses so that they are scaled to measure women's empowerment on each of the influence indicators. In other words, if a man responded that he is the sole-decision maker of an influence, the corresponding score for that man's influence would be a 0 because the woman has no power over that influence. In order to test if there are differences between men's and women's responses, an additional measurement component is added to our basic model. This component relates the responses to each of our 13 influence indicators to the individual's sex through a sex dummy variable (1=woman).
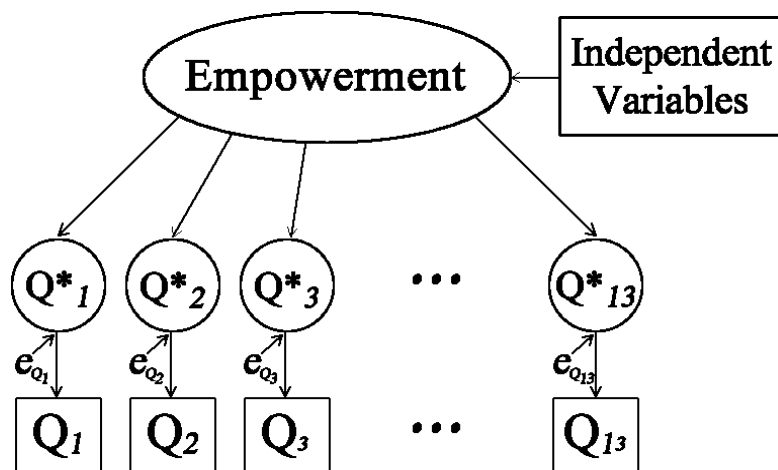
Figure 8. Summary Diagram of the Linkage of the Measurement and Structural Component in our GSM Model

Recent advances in the literature allow estimation of Structural Equation Models (SEMs) where the indicators are ordered using generalized structural equation modelling (GSEM). This model allows the simultaneous estimation of the structural (a linear regression of latent empowerment on a set of observed determinants) and measurement component (a series of ordered logits relating our set of women's influence indicators to latent empowerment). In our model, the two components are estimated simultaneously using maximum likelihood (Statacorp 2013). Figure 8 illustrates the linkage between the measurement and structural equations. In the pathway

diagram, arrows show causal relationships, circles represent latent variables, and rectangles represent observed variables.

6.5   Challenges Assessing Goodness of Fit in GSEM

Although there are some options available to determine goodness of fit of latent variable models, statistical tests for GSEM are not available in most software. Ideally, the chi-squared test should be used to decide whether a model should be accepted or rejected. In the chi-squared test the null hypothesis is an exact-fit of the covariance matrix from the model and the observed covariance matrix. A rejection of the null hypothesis could indicate several issues including model misspecification, low sample size to parameters estimated ratio, and causal heterogeneity (Antokanis 2013). Failing to reject the null hypothesis implies that the model's covariance matrix is consistent with the observed covariance matrix. However, even the chi-squared test presents challenges and should be carefully interpreted. For instance, an insignificant statistic does not strictly mean the model should be accepted but significant statistics could also be driven by large sample sizes (Kline 2011). Most software has not fully developed a GSEM feature yet and chi-squared tests are usually not available.

Other indexes such as the root mean squared of approximation (RMSEA) and the comparative fit index (CFI) are often suggested as alternatives to assess the fitness of GSEM models. However, these statistics are not robust and are also not available in most software for GSEM. The RMSEA is a measure of "badness" of fit of the model. When the RMSEA is significant and less than 0.05 the close-fit hypothesis can be accepted. On the other hand, the CFI compares how the model fit has improved in comparison to a baseline model where no parameters are freely estimated. A CFI below 0.95 suggests that there might be a flaw in the model's specification (Kline 2011). These tests are less powerful and should be used collectively to identify

flaws in a model (Kline 2011). Some scholars caution against assessing fitness with these tests claiming that it is not possible to know how misleading these estimates are (Antokanis 2013). Thus, experts claim that these measures fall short of the chi-squared test (McIntosh 2012; Antokanis 2013).

Because of the software limitations to assess goodness of fit, we employed a series of goodness of fit tests for thirteen regressions where each indicator is regressed on the explanatory variables of the structural equation. We assess the goodness-of-fit tests for these regressions to support our rationale for using each indicator in our measurement model.

Section 7: Results

7.1   Descriptive Statistics

Table 3 shows the descriptive statistics for the 232 households included in our data. The typical household in our sample has 4 members. Around 29 percent of the households have one or more children below the age of 12. At least one male, other than the women's husband, is present in 34 percent of the households and at least one other female adult is present in 38 percent of the households sampled, possibly because it is common for people to take care of their parents once they become seniors and absorb them into their households. In terms of marital status, 42 percent of the households are headed by a man or woman only, while 40 percent are headed by a married couple. The high proportion of households headed by one individual, who in most cases is a woman, can be partly explained by the lesser opportunities for women to migrate. It is also common for men to abandon their partners after migrating to urban centers for better work opportunities. On the other hand, 18 percent of the households are headed by a couple in a consensual union. Consensual unions are common in the area because they are recognized as a

partner for legal matters in the community and the costs of marriage can be high. The table also shows the representation of each community in our sample.

Table 3. Descriptive Statistics at the Household Level

Household Characteristics	N	Pecentage
Total observations	232	
Average number of members per	4	
Household Composition		
Kids (1 or more)	68	29
Male adults (1 or more)	80	34
Female adults (1 or more)	87	38
Household Headship		
Single-headed	97	42
Two-headed Married	94	40
Two-headed Consensual Union	42	18
Community		
Junin	63	27
Matacancha	5	2
Huayre	64	28
Ninacaca	70	30
Chuiroc	10	4
Chacpay	21	9

Table 4 reports the descriptive statistics of the individual characteristics of the participants of our individual survey by gender. In total we have 186 and 130 observations for women and men respectively. The descriptive statistics show some gender inequalities in respect to education and wealth. The average education level for men is 8.12 while the average education for women is 4.89. In other words, a typical woman did not complete primary school while a typical male completed the second grade of secondary school. The large education gap could result from

families forcing young girls to stay at home taking care of the domestic responsibilities or helping out with livestock operations. On average, the wealth index for men is 3.53 while for women it is 2.51. Higher access to education, relative to previous generations, in rural Peru allow young adults to access more opportunities in nearby urban centers creating a flow of young people out of rural areas. Thus, we see a high average age of 57 for both genders.

Table 4. Member Level Descriptive Statistics

Individual Characteristics	Mean (SD)	
	Women	Men
Demographics		
Education (1=1st primary, 15= University)	4.89 (4.06)	8.12 (3.69)
Age	57.51 (14.63)	57.46 (15.54)
Wealth (index)	2.51 (1.30)	3.53 (1.80)
	Percentage	
	Women	Men
Registered in the community	0.72	0.50
Marital Status		
Single	13.9	10.77
Divorced	0.53	0.77
Separated	8.56	1.54
Widowed	24.6	5.38
Married	36.36	55.38
Consensual Union	16.04	26.15
Total observations	186	130

A large proportion of women are registered in the community while only half of the men are registered. Registration in the community can be an important contributor of power within the household since it is common for communities to allocate land to households under the name of the registered member. Although it may seem from these numbers that women have more power and are more represented in the communities, a closer look at the marital status of our sample

suggests a different story. The percentage of women that are single, separated, or widowed in our sample is greater than that of men for each category. In particular, the proportion of widowed women is five times that of men. Since a high proportion of women are not in partnerships, it is expected for them to be the members registered in their communities.

Table 5. Definitions and Descriptive Statistics of the Variables in the Empowerment Structural Eauation

Variable	Women		Variable Description	Predicted
	Mean	Std. Dev.		Sign
Wealth	2.51	1.30	Index of individual wealth	+
Cow ownership	0.36	0.48	Dummy variable: 1 if household owns cows	+
Public Speaking	0.65	0.48	Dummy variable: 1 if woman feels comfortable speaking in public	+
Group Membership	0.21	0.41	Dummy variable: 1 if woman participates in a social or leadership group	+
Man inheritance	0.27	0.44	Dummy variable: 1 if only the man in the household inherited land	-
Woman inheritance	0.29	0.45	Dummy variable: 1 if only the woman in the household inherited land	+
Woman and man inheritance	0.02	0.15	Dummy variable: 1 if both the woman and the man inherited land	+
Adult males	0.47	0.73	Dummy variable: 1 if there are other male adults in the household	-
Adult females	0.54	0.74	Dummy variable: 1 if there are other female adults in the household	-
Kids	0.55	0.94	Dummy variable: 1 if there are any kids in the household (12 or less)	-
Woman only	0.34	0.47	Dummy variable: 1 if the woman is divorced, separated, or widowed	+
Single woman	0.14	0.35	Dummy variable: 1 if the woman is single	
Education difference	-1.83	3.65	Difference in education level between female and male adult in the household (if woman only==1, members' age was used)	+
Age	57.51	14.63	Member's age in years	+

The descriptive statistics of the women's empowerment drivers that are included in our structural model are reported in Table 5.[14] The mean wealth index is 2.51 with significant variation around the mean across observations. Only 36 percent of the women in our sample live in households that own cows and could potentially be perceived as belonging to a higher socio-economic class. The majority of women (65 percent) said that they feel comfortable speaking in

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[14] These statistics are estimated using the 186 women observations only

public but only a small proportion (21 percent) participates in social, religious, women's, or agricultural groups. Approximately half of the women's households have other male and female adults present. This could include parents, parents-in-law, or adult children. Around half of the households have children below the age of 12 years. 34 percent of the women in our sample are heads of their households on their own after being divorced, separated, or widowed. In contrast, only 14 percent of our sample is single or has not been in a marriage or consensual union before.

In terms of land, the descriptive statistics show some heterogeneity in distribution factors across the women's households. Only 58 percent of the women in our sample live in households where land has been inherited. While there are slightly more women living in households were inheritance has only been acquired through the woman, only 2 percent of households have inherited plots through both male and female adults.

Education was included as the difference between education of the main woman and man in each household. On average, women have less education than their partners; however, there is a large variance in the difference of education levels in our sample. The average age of women is 57.51 but there is also a big variation around the mean for this variable.

7.2   Structural Component Results

Table 6 reports the results of the structural component (Equation 4) of each of our four models. The coefficients of the empowerment structural equation represent the effect of each variable on the latent women's empowerment.

In our basic model (Model I) the coefficients on the *woman inheritance* and *joint inheritance* variables suggest that there is a significant relationship between women's land rights and women's empowerment. First, similar to Allendorf (2007) and Mason (1998) we find that women living in households where only women have inherited land are more likely to have greater

Table 6. Results of the Structural Components of Women's Empowerment as the Dependent Variable

Independent Variable	Coefficients (Standard Error)			
	Model I	Model II	Model III	Model IV
Wealth	0.15*	0.15*	0.15*	0.15*
	(0.08)	(0.08)	(0.08)	(0.08)
Ownership of cows	0.24	0.31	0.25	0.32
	(0.21)	(0.21)	(0.21)	(0.21)
Group Membership	0.28	0.30	0.30	0.32
	(0.22)	(0.23)	(0.22)	(0.23)
Public Speaking	0.03	0.05	0.05	0.02
	(0.26)	(0.26)	(0.27)	(0.26)
Woman inheritance	0.47*	0.31	0.40*	0.27
	(0.27)	(0.28)	(0.23)	(0.25)
Man inheritance	-0.34	-0.50*	-0.26	-0.41*
	(0.25)	(0.27)	(0.21)	(0.23)
Joint inheritance	1.4*	1.33*	0.76*	0.69*
	(0.73)	(0.73)	(0.40)	(0.40)
Male adults	0.37**	0.35**	0.37**	0.37**
	(0.15)	(0.15)	(0.15)	(0.15)
Female adults	-0.19	-0.21	-0.21	-0.22
	(0.15)	(0.15)	(0.15)	(0.15)
Children	0.12	0.07	0.14	0.08
	(0.12)	(0.12)	(0.13)	(0.13)
Woman Only	2.7***	2.75***	2.71***	2.77***
	(0.43)	(0.43)	(0.43)	(0.43)
Single Woman	2.13***	2.27***	2.23***	2.31***
	(0.42)	(0.44)	(0.43)	(0.44)
Education Difference*	0.04*	0.04	0.03	0.04
	(0.02)	(0.03)	(0.03)	(0.03)
Age	0.01	0.00	0.00	0.00
	(0.01)	(0.01)	(0.01)	(0.01)
Junin		-0.89**		-0.87**
		(0.40)		(0.41)
Matacancha		-1.35*		-1.35*
		(0.72)		(0.73)
Huayre		-0.60		-0.60
		(0.40)		(0.41)
Ninacaca		-0.48		-0.48
		0.38		(0.38)
Chuiroc		-0.37		-0.36
		0.58		(0.58)

Note: Stars indicate significance at the 10% (*), 5% (**), and 1%(***) levels

decision-making power. The finding is consistent with the theoretical arguments that claim that land rights improve the fallback position of women and support the rationale for enhancing land rights as a development tool. Even though it has been argued that having formal rights, such as inheriting land, does not mean women control the land (Doss 2013), our model suggests that inheriting land is sufficient for increasing women's intra-household power. The coefficients on the two other land rights variables provide additional information regarding the intra-family allocation of land rights and empowerment. While the coefficient on *man inheritance* is not significant, the coefficient on *joint inheritance* is significant and positive. Our model also suggests that this effect is greater than the effect of providing land rights to women only. Overall, these results provide strong evidence of, heretofore, unnoticed intra-family land allocation effects on women's empowerment.

As expected, the coefficient on our *wealth* index is significant and positive but women's *ownership of cows* is not significant. Despite comments of community members about cows being a sign of higher economic status, our model suggests that women's perceived status at the community level does not impact their decision-making within the household. In contrast, it makes sense for wealth to be significant and have a positive impact on empowering women since it provides women with more opportunities. For instance, if a woman has the ability to invest in her household's livestock she will probably have a greater influence over the management and revenue from the household's livestock operations.

According to our results, neither belonging to a social or leadership group (*group membership)* nor women's comfort in public speaking (*public speaking)* have significant effects on empowerment. These results suggest that empowerment at the household and community levels

could have different drivers. Alternatively, it is possible that other males in women's households were equally involved in community groups, for example, for which a woman, highly involved in her community would not gain any relevant skills relative to other decision-makers within her household. The results of the household structure variables provide interesting evidence of the allocation of power among family members. We expected *male adults* and *female adults* to have negative impacts on women's empowerment since additional adults in the households would normally reduce the woman's opportunities to participate in economic decisions. However, our results show that additional male adults have a positive impact on women's empowerment. It is common for older members to join their daughter's or son's families once they reach a certain age. The positive effect of additional males could be attributed to the presence of a woman's own family member who are males and who support her authority and power in the household. This variable also includes the presence of sons older than 15 years old who might not necessarily replace the woman's place as a decision-maker. In many cases, the new generations are more engaged with off-farm activities which could contribute to male sons not being a threat to women's influence in household decisions. Surprisingly, the effect of additional adult women in the household does not have a significant impact on empowerment. The effect of children in a household has been found to differ across empowerment studies; in our case, the effect is not significant.

The effect of *woman only*, which includes women that are divorced, separated, or widowed, is significant and greater than the effect of any other determinant. This result is expected because our measure of empowerment is the women's influence within the household relative to a partner or any other man. Thus, by not having a partner, women in this category will automatically appear as though they have more power. This dummy variable, along with the *single woman* variable, will purge out this upwards shift in empowerment. It is interesting to note that the effect of being single

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is smaller than the effect of having a household headed by a woman only. Our results suggest that the dynamic of power during a partnership, or the process involved in dissolving this partnership, can increase a woman's bargaining power even once the partnership is dissolved.

The difference in *education* levels is a statistically significant determinant of women's empowerment. In other words, an increase in the gap between the woman´s and the man´s education has a positive impact on women´s empowerment. The *age* coefficient is positive but does not have a significant effect.

In conclusion, we find that in our basic model the factors that determine the distribution of factors within the household –intra-household allocation of land and education differences-have significant effects in women's empowerment measured as their influence in household economic decisions. On the other hand, most women's attributes, such as community involvement and age, are not significant determinants of their empowerment which is measured in our model as their intra-household bargaining power. The women's wealth is the only variable that has a significant effect on women's empowerment.

The results of our additional models further support that the intra-family allocation of land rights matters for women's empowerment. When community effects are taken into account (Model II and Model IV) the results on the land rights variables change. First, unlike in our basic model, *woman inheritance* is not statistically significant and *man inheritance* is negative and significant. Most importantly, however, we see that in both models joint inheritance remains significant and has the greatest effect among the land rights variables. To test if the women's empowerment effect is driven by community norms, we ran an additional model where we interacted the *woman inheritance* variable with each of the community dummy variables. Since none of the interactions

was statistically significant, we can conclude that the empowerment effects we have uncovered are not community specific.

Our third additional model (Model IV) also supports the importance of woman and joint inheritance for women's decision-making authority. Since the land rights variables are categorical in this model, the land rights coefficients represent the additional effect of being in a greater category of inherited amount of land relative to not inheriting any land. The results suggest that the quantity of land inherited through the woman or jointly has a positive effect on women's empowerment. In other words, the effect of land inherited on women's empowerment is greater if a woman inherits more land than the average amount of land inherited by women or inherited jointly.

Table 7. Differential Item Functioning (DIF) (MODEL V): Measurement Component Results Showing the Effects of the Sex Dummy (1=woman) on the Influence Indicators

Influence Indicator	Model V	
	Coefficient	St. Error
Buying, selling or transfering		
agricultural land (q1)	2.862	(0.432)***
livestock (q2)	3.888	(0.622)***
commercial crops (q3)	-	-
rented land (q4)	2.535	(0.763)***
goods (q5)	2.694	(0.488)***
transportation vehicles (q6)	1.28	(0.346)***
Applying and using credit from		
bank (q7)	1.126	(0.564)**
relatives or friends (q8)	-	-
Distribution of income from		
agricultural land (q9)	2.704	(0.429)***
livestock (q10)	2.829	(0.524)***
commercial crops (q11)	2.575	(1.091)**
rented land (q12)	1.326	(0.541)**
Distribution of		
expenditures (q13)	2.275	(0.347)***

Note: Stars indicate significance at the 10% (*), 5% (**), and1%(***) levels

Table 8. Differential Item Functioning (DIF) (MODEL V): Results of Structural Component of Women's Empowerment as the Dependant Variable

Independent Variable	Coefficients
	(Standard Error)
	Model V
Wealth	**0.083**
	(-0.076)
Ownership of cows	**0.32**
	(-0.236)
Group Membership	**0.408**
	(-0.281)
Public Speaking	**0.486**
	(-0.27)
Woman inheritance	**1.047**
	(0.339)**
Man inheritance	**-0.818**
	(0.287)**
Joint inheritance	**1.862**
	(0.825)*
Male adults	**0.146**
	(-0.163)
Female adults	**-0.163**
	(-0.172)
Children	**0.1**
	(-0.138)
Woman Only	**1.498**
	(0.332)**
Single Woman	**0.608**
	(-0.363)
Education Difference*	**0.031**
	(-0.036)
Age	**0.017**
	(-0.009)
Junin	**-0.249**
	(-0.435)
Matacancha	**-0.283**
	(-0.885)
Huayre	**-0.376**
	(-0.436)
Ninacaca	**-0.278**
	(-0.426)
Chuiroc	**-0.232**
	(-0.626)

Note: Stars indicate significance at the 10% (*), 5% (**), and1%(***) levels

Table 7 reports the measurement component (Equation 1) results of the respondent's sex on 11 of our influence indicators. The influence over buying and selling commercial crops and the influence over credit from relatives could not be included in this model due to the lack of variability in their responses. The statistically significant coefficients on the sex dummy variable shows that DIF is indeed an issue in our data and that men and women have inherent differences to the empowerment questions regardless of the empowerment level in the household. This issue is found across all the influences included in the model. The positive sign on the DIF coefficient further tells us that the response to women having influence in household economic decisions is exaggerated when women answer the question rather than men. This could create significant bias in the land rights variable.

To determine if our results hold once DIF is accounted for we look at the structural part of our fifth model reported in Table 8. We find that our three land rights variables are statistically significant. The *woman inheritance* and *joint inheritance* remain positive, with joint inheritance having the greatest effect on empowerment. The *man inheritance* variable, on the other hand, is negative. Our results show that inherited land by the man only has a negative effect on women's empowerment. Thus, the findings from this model are qualitatively consistent with our previous results. In addition, a critical finding in the DIF model is striking evidence of a negative externality of men inheriting land on women's empowerment.

Overall, we provide some evidence that women's inheritance matters for women's empowerment but we have more robust evidence that joint inheritance matters more. Our additional models provide strong evidence of the intra-family land rights effects.

7.3 Measurement Component Results

The measurement equation (Equation 1) results from our basic model (Model I) were used to estimate our influence thresholds and sensitivities following the necessary transformations from Equation 3. The estimates reported in Figure 9 represent the predicted mean latent empowerment and the influence thresholds (or their difficulties) which indicate the level of latent empowerment required to make a woman the sole decision-maker in an influence relative to a base category[15]- influence over buying, selling or transferring agricultural land. The influence types are organized from lower to higher thresholds to ease the comparison between the influence indicators. Since the empowerment thresholds are a function of two random variables (see Equation 3) we can assume that the thresholds are statistically significant if both the discrimination factor and the threshold cut-point are significant. This is the case for all influences except for the influence over credit from relative or friends. Thus, this influence is excluded from our analysis.

First, we can see that the predicted mean latent empowerment is lower than any of the empowerment thresholds reported in Figure 9. Thus, on average, women are not empowered enough to be the sole-decision makers in any of the influences. The low mean predicted latent empowerment shows there is significant room for empowerment policies that could benefit the peasant communities in our study.

The results show that influence over transfer and revenue distribution of livestock have lower thresholds, that is they require low levels of empowerment relative to the other indicators. These results are optimistic provided that grazing livestock is the main livelihood activity of

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[15] All indicators had significant loading factors, except for influence over applying or using credit from relatives or friends. Thus, this indicator was excluded from our analysis.

women; if development programs empower women it is almost guaranteed that women will gain more influence over their most important activity. The influence with the next lowest threshold is the purchase and sale of goods for the household. Influence over agricultural land and influence over expenditures have similar thresholds and are also among the "easiest" influences to achieve for policy-makers. Since agricultural land is required for grazing livestock, increasing women's influence on these decisions allows women to be more autonomous in how they manage their livestock activities. Furthermore, knowing that changing women's influence over expenditures made in the household requires relatively low levels of empowerment is helpful for development programs that aim to increase household's well-being through the adoption of specific goods. For example, if a development policy seeks to address health concerns by increasing the adoption of improved stoves, empowering women could be a tool to achieve this goal as long as women have
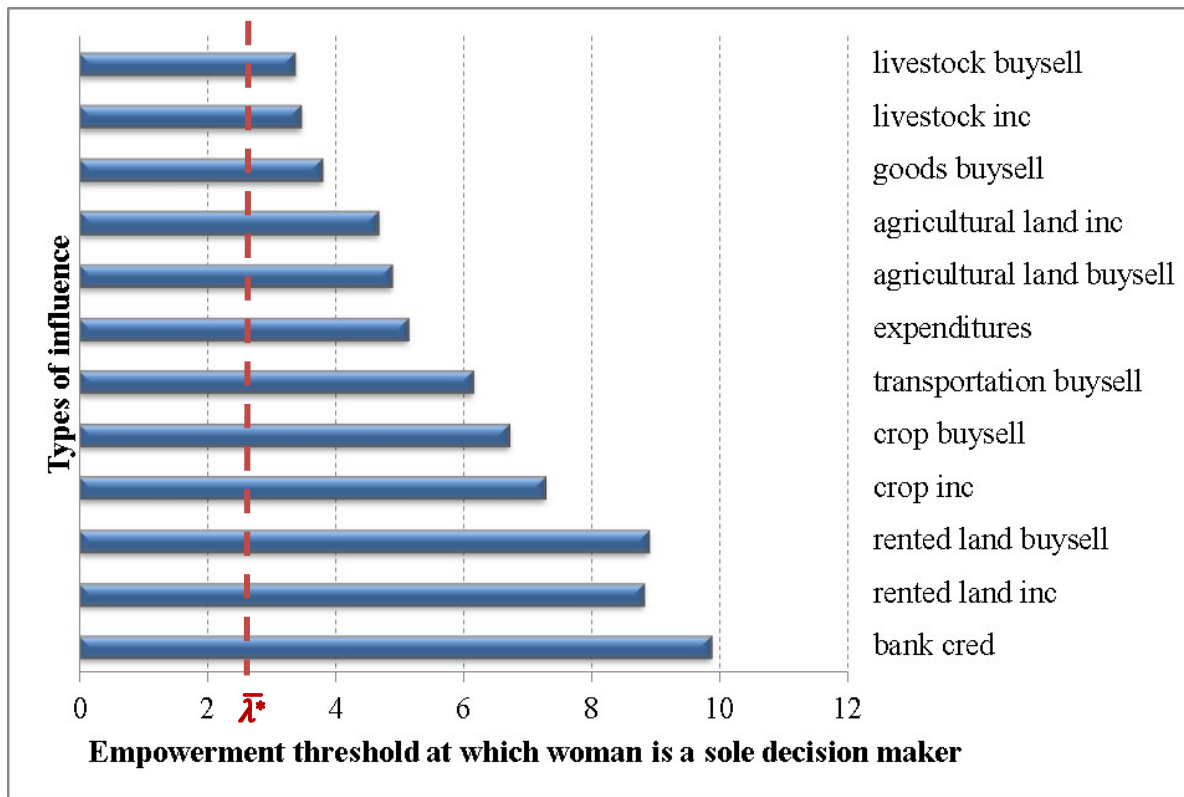
Figure 9. Empowerment Threshold of Each Indicator in the Measurement Component

different preferences regarding this technology. In fact, empowerment could be preferred over other policy tools since it would also unleash other positive impacts on women's and household's welfare.

The remaining influences have higher thresholds or are endorsed by women at rather higher levels of empowerment. These results provide insights regarding the plight of women in these peasant communities. First, high amounts of empowerment are required to turn on the influence over purchase or sale of vehicles in the household. Women's exclusion from these decisions could contribute to their lack of means of transportation to nearby towns and cities where alternative occupations are available. The exclusion of women from influences that could help them to diversify their livelihoods could further exacerbate their dependence on grazing livestock, placing them in a vulnerable position as resources such as land become scarcer or climatic conditions become harsher as a result of climate change.

The influence indicators of production and income distribution from commercial crops also have high thresholds and require high levels of empowerment to occur. These results suggest that it would require more resources to empower women to a point that facilitates their options to diversify their livelihoods or to a point where they can control the production of crops.

The influence indicators for applying to credit and managing credit from banks also have high thresholds. It is possible that women's exclusion from these decisions hinders their ability to access any credit. Thus, their possibilities of engaging into activities that require investments (e.g. small businesses) are slim. Finally, the other indicators with high thresholds are the influence over renting out land and influence over controlling the distribution of revenue from rented land. These results raise more concerns about women's wellbeing since renting out land is becoming an important source of income as a result of the scarcity of land.

Figure 10 shows the results of the empowerment sensitivities as estimated from our measurement model. These are the discrimination parameters which show, conditional on the threshold points, how sensitive is an influence to a small change in empowerment. In Figure 10 the types of influence are ordered from most sensitive to least sensitive to changes in empowerment. The discrimination parameters are the coefficients reported in STATA. All influences were significant except for the influence over credit from friends or relatives.
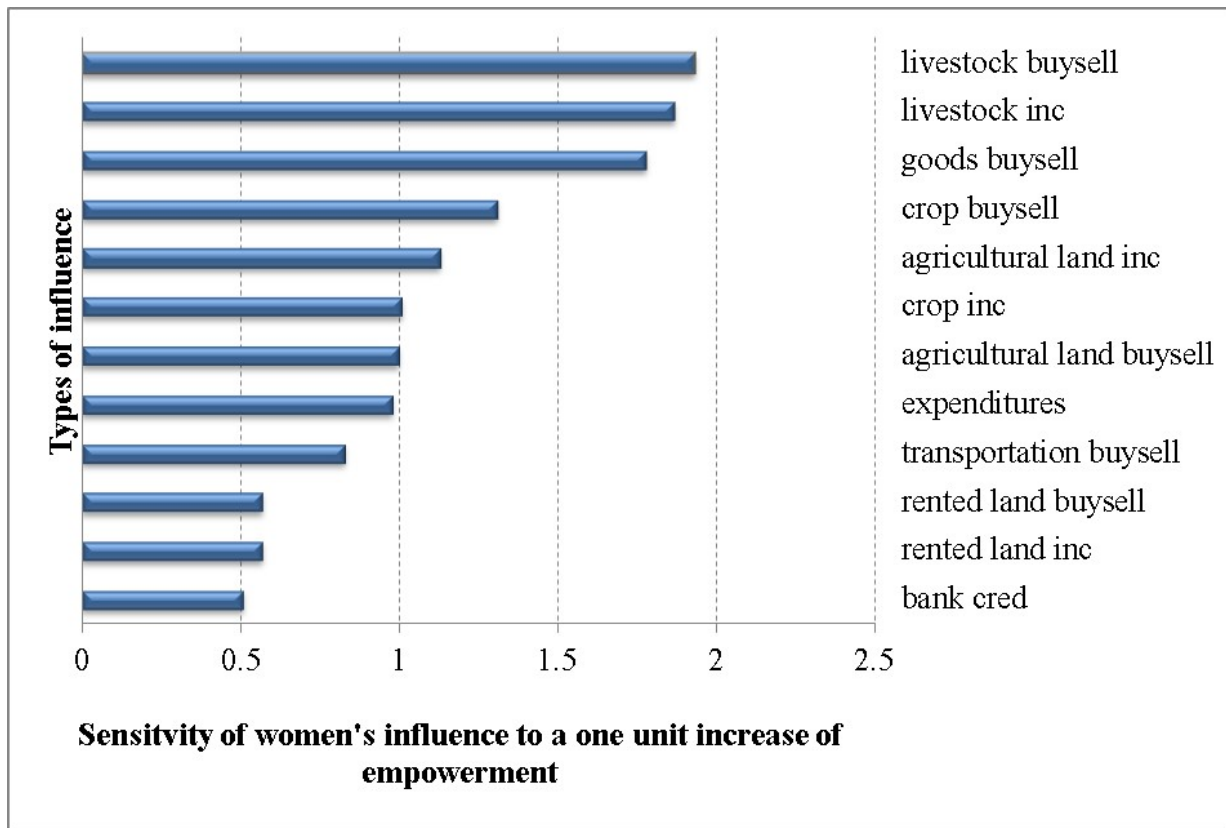
Figure 10. Empowerment Sensitivities of Each Indicator in the Measurement Component

First, we will focus on the influence indicators that are highly sensitive to changes in empowerment. For these influences, small changes in empowerment would result in large increases in the probability of women having sole decision-making power over an influence. The influences with the highest sensitivities are the influence over buying and selling livestock and the

influence over income from livestock. This again is optimistic from a policy perspective since policies that empower women would also have a large impact on the likelihood of women influencing the management of their primary livelihoods. The influence over buying and selling goods and commercial crops and the distribution of income from agricultural land are also highly sensitive. The influences on income distribution from commercial crops, buying and selling agricultural land, and expenditures are somewhat sensitive to changes in empowerment.

On the other hand, decisions over renting out land and credit from banks have the lowest empowerment sensitivities. In other words, small changes in empowerment would not induce large changes in the probability of women being sole-decision makers in those influences. These influences also have high thresholds and would therefore not be recommended as targets for development policies. Lastly, buying or selling transportation vehicles also has a low sensitivity to changes in empowerment.

Table 9. Indicators of Empowerment by Empowerment Threshold and Sensitivity Parameters

		Empowerment Threshold*	
		High	**Low**
Empowerment Sensitivity	**High> 1**	Distribution of income from commercial crops Buying or selling commercial crops	Distribution of income from agricultural land Buying or selling goods Distribution of income from livestock Buying or selling livestock
	Low <1	Buying or selling transportation Distribution of income from rented land Transferring of rented land Bank credit	Buying or selling agricultural land Expenditures

*Thresholds are considered high or low depending on whether they are higher or lower than the threshold for buying or selling agricultural land (the control indicator)

Table 9 provides a summary of where the indicators fall in terms of the two influence parameters. Some influences with high influence thresholds, such as transportation decisions and decisions around renting land, have low sensitivities to changes in empowerment. Thus, it would not be efficient for empowerment policies to target these indicators to achieve development outcomes. On the other hand, indicators with high thresholds and high sensitivities would be difficult (since they would require high levels of empowerment to occur) but effective if targeted by empowerment policies (since they are very responsive once the necessary level of empowerment is achieved). These indicators could be considered as policy targets depending of the context of the development project. The most attractive influence indicators for policy-makers are those with low empowerment thresholds and high sensitivities. In this case the most attractive indicators are: distribution of income from agricultural land, buying or selling goods, distribution of income from livestock and buying or selling livestock. A further exploration of how these parameters can be used to evaluate alternative policies is provided in Appendix A.

7.4   Goodness of Fit Tests

Table 10 reports the goodness of fit results for the thirteen ordered logit regressions where each indicator is modeled as a function of the explanatory variables in the structural equation. We can conclude from the chi-square tests for the regressions that the indicators can be directly explained by at least one determinant in our structural model. The only two indicators where the null hypothesis in the chi-squared test cannot be rejected are our two measures of commercial crops. These indicators could be problematic due to the low number of observations producing maca, the only commercial crop in the area, in our sample. Our conclusions about land rights still apply once these indicators are removed from the model.

Table 10. Goodness of Fit Statistics of the Ordered Logit Regressions of Each Indicator as a Function of the Independent Variables in Our Structural Component

Indicator	Chi-square	Prob>chi-squared
Buying, selling or transfering		
agricultural land (q1)***	117.48	0.0000
livestock (q2)***	123.21	0.0000
commercial crops (q3)	19.92	0.1328
rented land (q4)***	41.92	0.0001
goods (q5)***	189.76	0.0000
transportation vehicles (q6)***	101.2	0.0000
Applying and using credit from		
bank (q7)***	125.67	0.0000
relatives or friends (q8)***	158.23	0.0000
Distribution of income from		
agricultural land (q9)***	123.82	0.0000
livestock (q10)***	146.92	0.0000
commercial crops (q11)	14.26	0.4306
rented land (q12)***	44.42	0.0001
Distribution of		
expenditures (q13)***	215.83	0.0000

Section 8: Discussion and Policy Implications

Our first objective was to determine how the intra-household allocation of land rights affects women's empowerment in rural Peru. The results of our structural component suggest that, as predicted by the intra-household bargaining literature, there is a positive effect of women's land inheritance on women's empowerment. Following the literature, we would also expect that if a man has more land rights relative to his wife or conjugal partner, the woman would have a weaker fallback position and, therefore, less influence within the household. However, the results in our first four models show that the effect of man's inheritance is not statistically significant. This could be because the effect of the relative advantage of male's land rights could be cancelled by the

possibility of some of men's land falling into the women's possession, and thus improving her fallback position, if the partnership is dissolved. Wiig's (2011) findings from qualitative interviews indicate that women in peasant communities in rural Peru might benefit from men's or joint land rights after a separation or divorce for three reasons (1) land inheritance to a spouse is perceived to be an inheritance to the couple as a unit (2) land can be given as a compensation if the man is considered guilty for the partnership ending and (3) land might be given to the woman if she is the primary caregiver of any children. It is possible that effect of the possibility of acquiring men's land after a divorce or separation has a greater impact when there is joint inheritance, making the coefficient of joint inheritance the largest coefficient among our land rights variables. However, a closer examination of our fifth model's results suggests that DIF effects could explain the lack of significant results on the effect of men's land rights on women's empowerment. Our results support the use of land rights to empower women and show that policymakers need to consider the intra-household distribution of land rights to maximize the empowerment effect of development policies.

Our findings also provide new information that could be used by policymakers to increase women's empowerment in peasant communities in rural Peru. Women's land rights have been promoted throughout Peru both through policies, the most notable being the PETT program, and through research studies that link land rights to women's empowerment. However, the PETT program did not allocate land titles in peasant communities. Thus, the policy implications from the existing literature that shows a linkage between land titles and development outcomes, including women's empowerment, are not applicable to peasant communities. In contrast, promoting women's or joint land inheritance in peasant communities is a feasible alternative. Since male inheritance is strongly preferred in the Peruvian highlands (Wiig 2011), future empowerment

policies could promote women's and joint inheritance. It is possible that achieving this goal requires collaboration with peasant communities so that the institutions regarding inheritance of land rights are not biased against women. For instance, in some of the communities of our study women were pressured into registering as community members under their spouses' name. Some women feared that they would be more likely to lose their inherited land in case of a divorce if they were registered under their spouses' name. The possibility of their daughters' land being taken away could motivate parents to prefer transferring their land to their sons. Ensuring that the norms around transfers of land are not threatening women's land rights could promote the equal distribution of land rights across generations.[16]

Our second objective was to explore how women's empowerment is linked to the different types of influences in our model. We identify the influences that would be most attractive from a policy perspective in terms of the level of empowerment needed for women to be the sole decision-makers over an influence and the influence's sensitivities. Our analysis provides policy-makers with ex-ante information about the linkage between women's empowerment and a desired policy outcome. By identifying the threshold and sensitivity of the influences, policymakers could more easily choose between policy alternatives. In a sense if we think of different development outcomes Y1 (children's education/ nutrition) or alternatively Y2 (entrepreneurship), both functions of women's influences, then one can imagine that the two development outputs use different influences with different intensities. This is similar to the way that physical outputs use labor and capital with different intensities. Understanding the threshold and the sensitivity of each influence

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[16] Wiig (2011) argues that the equal distribution of land rights between daughters and sons is essential to ensure that the effects of the PETT program persist across generations

in this context can provide policymakers with critical information about what type of development outcomes can be attained from gender policies.

Section 9: Limitations and Conclusions

We examine the role of land rights and the intra-family distribution of land rights on women's empowerment in peasant communities in Peru. We use the Generalized Structural Equation Modelling (GSEM) to model women's empowerment as a latent variable measured by thirteen indicators and determined by observable variables common in the existing literature. Through this econometric method we address measurement issues present in the women's empowerment literature. Furthermore, our use of data on land inheritance allows us to solve some of the endogeneity problems found in previous land rights and empowerment studies and provide relevant policy implications for peasant communities in rural Peru.

9.1   Limitations and Future Research

Although our study addresses important shortcomings in the few studies of women's empowerment and land rights, future research could expand the measurement of land rights making it more comprehensive. A limitation of our study is that we could not collect data on tenure security because of the sensitivity of discussing land rights in our study area. However, tenure security is likely important since the peasant communities are the owning entities of the land. Additional and accurate data on each household's amount of land, with enough variability, would also improve the study allowing for quantity effects to be taken into account. Additional data on other rights would allow us to construct different proxies of land rights which could be used to compare our measure with other land rights measures.

Future studies and additional data could also include a stricter definition of intra-household bargaining power by only pooling couples' observations. Given the high rate of migration out of peasant communities, it was often challenging to find both adults in dual-headed households. Thus, our dataset does not contain enough couples' observations to run separate models on couples and single-headed households.

As mentioned earlier in this thesis, a limitation of GSEM is the lack of available goodness-of-fit tests in most econometrical software. Although we attempted to justify the validity of our model by running separate goodness-of-fit tests on the empowerment indicators, more appropriate tests would allow us to compare alternative models and improve the model's specifications. Future advances in the available software will be beneficial for future empirical studies using GSEM.

9.2   Conclusions

Despite these limitations, our results provide robust evidence to support the use of land rights to achieve development goals. We also show the importance of considering the intra-household allocation of land rights to increase the effectiveness of development policies. We find that the effect of land rights inherited only by women is significant and positive on women's empowerment. However, the effect of land inherited by both the man and the woman in a household is significant and greater than other determinants of empowerment such as education and ownership of assets. These results remain constant across four different specifications of our model, providing robust evidence of the importance of joint inheritance of land on women's empowerment. One of our additional models suggests that once DIF effects are taken into account, men's inheritance has a negative externality on women's empowerment.

We also provide an additional analysis of the indicators used in our model using Item Response Theory. Our results suggest that while high levels of empowerment are needed to

achieve women's influence over decisions regarding credit from banks and renting out land, these areas are the most responsive to changes in empowerment. Thus, our analysis suggests areas that policymakers can focus on to promote women's wellbeing in rural Peru. In addition, our GSEM methodology allows us to estimate the mean level of empowerment in our study area. Our results show that the mean level of empowerment is lower than all of the empowerment thresholds of our influence indicators. In other words, we show evidence that those influence which require high levels of empowerment, which happen to be the influences necessary for women to access other livelihood opportunities, are not achievable short-run targets for policy-makers. In contrast, given the mean level of empowerment, those influences related to livestock, which are also critical for women given their importance in their livelihoods, are areas where policies could focus on right away.

The policy attention and studies on land rights in Peru have so far only focused on the impacts of land titling primarily as a result of the PETT program. Wiig (2013) is the only study that analyzes the impact of joint land titles in rural communities in Peru. However, the findings of Wiig's study only apply to the impacts of land titling on unrecognized communities where land is not owned by the community and the PETT program was able to distribute land titles. Since Peru's focus on land rights has been limited to the PETT program, the potential for land rights policies in recognized communities has received little attention. Despite land in communities being legally owned by the community, our study provides evidence of how inheritance of user rights can still be used as a policy lever to induce empowerment and reach development outcomes.

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Appendix A

Section 1. An Exploratory Analysis of the Boom of Maca and Policy Implications of Empowerment Thresholds and Sensitivities

Right now there is an interesting phenomena unfolding in the Lake Junín area driven by the boom of maca. This event has both environmental consequences, as well as implications for women's livelihoods. While we don't have enough data to do an impact assessment study of the production of maca, which is also beyond the scope of this work, we will simply consider a hypothetical scenario. We will assume that the gender relations and specifically women's empowerment and the intra-household land effects stay the same. After providing a general set of conclusion regarding our results, this annex takes a specific approach. We will apply our results and draw conclusions and policy-implications from our work in the context of maca production. To do so, we first describe the policy issue introducing the boom of maca and its potential impacts on women's livelihoods. Then we draw implications of the influence metrics that we estimated in the previous sections for Peru's economy.

1.1   The Economic Boom of Maca

Maca is a perennial herbaceous plant native to the high Andean region of Peru and Bolivia that grows in a restricted ecological zone at about 3800 to 4000 meters above sea level (Tello, Hermann, and Calderon 1992; Gonzales et al. 2003; Clément et al. 2010). Although maca has been consumed by local communities for centuries, recent marketing of maca as the "new superfood" and the "new ginseng" has exploded its production in the last few years. As a result, throngs of foreign buyers have moved into the Peruvian highlands to be part of this new market opportunity. As a result, working in maca cultivation and processing has become a new livelihood activity for

local farmers. However, the future livelihoods in the area might be threaten by the rapid expansion of maca.

Although scientific evidence is scant, the production of maca has raised concerns due to its environmental impacts. The land use changes from grasslands to maca plantations are especially concerning. Since the undisturbed grasslands in the High Peruvian Andes area are thought to be rich in carbon (CIP 2010), this land use change could emit significant amounts of greenhouse gasses. The rapid expansion of maca is also concerning because it takes land several years to recover after maca is harvested. Even though most farmers depend heavily on land for their livelihood, the area of land farmers rent out for maca production continues to grow. It is possible that the future of women's main livelihood, grazing livestock, will be threaten as land becomes scarcer and more expensive in the area.

1.2   Consequences of Maca Production on Women's Livelihoods

The boom of maca has two main impacts on the communities in our study area. First, there is a significant flow of money going into these communities as maca is sold by farmers or as land is rented out to foreign producers. Second, the production of maca is driving land use changes at rates that are likely going to threaten the future of grazing livestock, the main livelihood of farmers, especially women, in the area. The objective of this section is to identify which groups will benefit and which groups will bear the costs of the impacts of the expansion of maca. To do so, we will try to answer two main questions. First, who is benefitting from producing maca? Second, whose livelihoods are likely to be more affected as land becomes scarcer? To do so we will draw from observations from our fieldwork as well as data collected for our study.

Producing maca is a lucrative but expensive option for farmers. Only those who can afford the investment costs and have access to land can become maca producers. As a result, relative to foreign buyers, very few local farmers have been able to enter the market. According to our data, 5 percent of women and 10 percent of men local farmers are producing maca (Table 11). These percentages are very low considering the current boom in maca production.

Table 11. Percentage of Local Farmers Producing Maca by Gender

	Percentage	
	Women	*Men*
Produces Maca	5.91	10
N	186	130
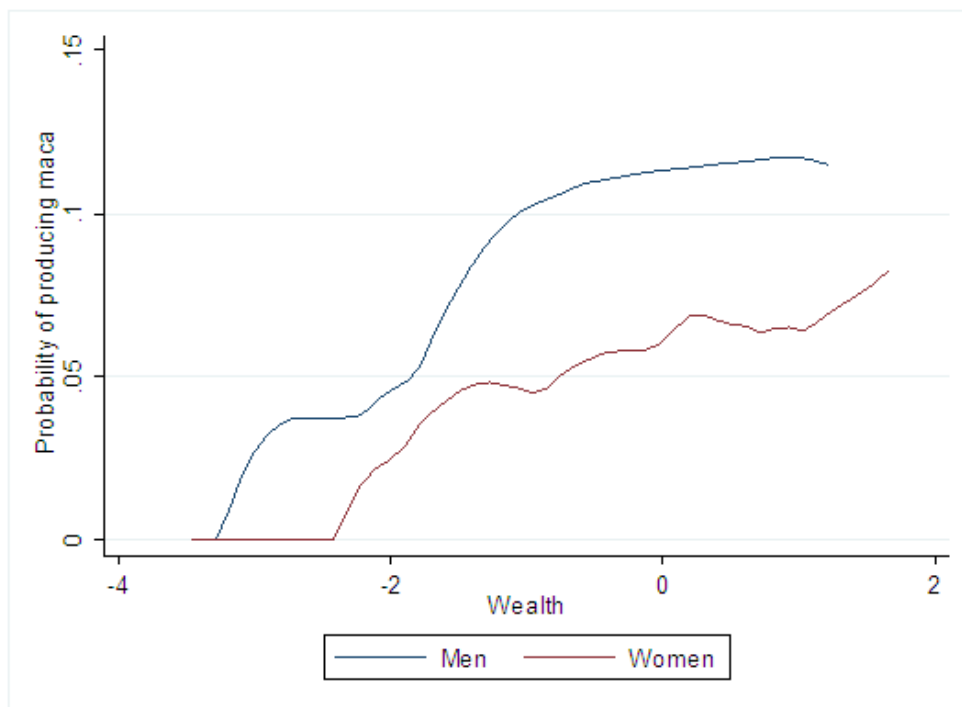
Figure 11. Probability of Producing Maca by Gender as a Function of Individual Wealth

The production of maca has two main constraints (1) investment costs and (2) access to land. First, we will try to identify who is more likely to overcome the investment constraints and

enter the market of maca. Figure 11 plots the probability of producing maca for men and women as wealth increases. The probability of men producing maca is higher for every level of wealth. We can also see from the cut-off points that women require a larger amount of wealth to have any probability of producing maca. Thus, this graph suggests that in general it is more likely for men to enter the market especially as their wealth increases and they can cover the investment costs of production.

Farmers producing or renting out land for maca are giving up any other alternative use of the land for several years. It is likely that only farmers with more than enough land to cover their grazing livestock needs are the ones that can afford to rent out their land or use their land for maca production. In Figure 12 we can see the probability of an individual producing maca as a function of total area of land in their households. The graph shows a slight increase in the probability of producing maca as the area of land increases. The increasing rate is especially evident in the range of 200 to 300 hectares of land. There are only a few observations of households with access to more than 300 hectares of land. It is possible that households with access to land outside this range are too involved in livestock operations to devote time to the labor intensive nature of maca production. During our data collection and fieldwork wealthier farmers seemed to be the most concerned about the environmental impacts of maca. Thus, wealthier farmers might be against the production of maca either because they are more aware of its environmental impacts or because they do not need the new economic opportunity it offers. Either possibility would explain the lack of maca producers among the largest landowners. With the exceptions of the largest landowners the graph suggests that the probability of producing maca is greater for households with more hectares of land.
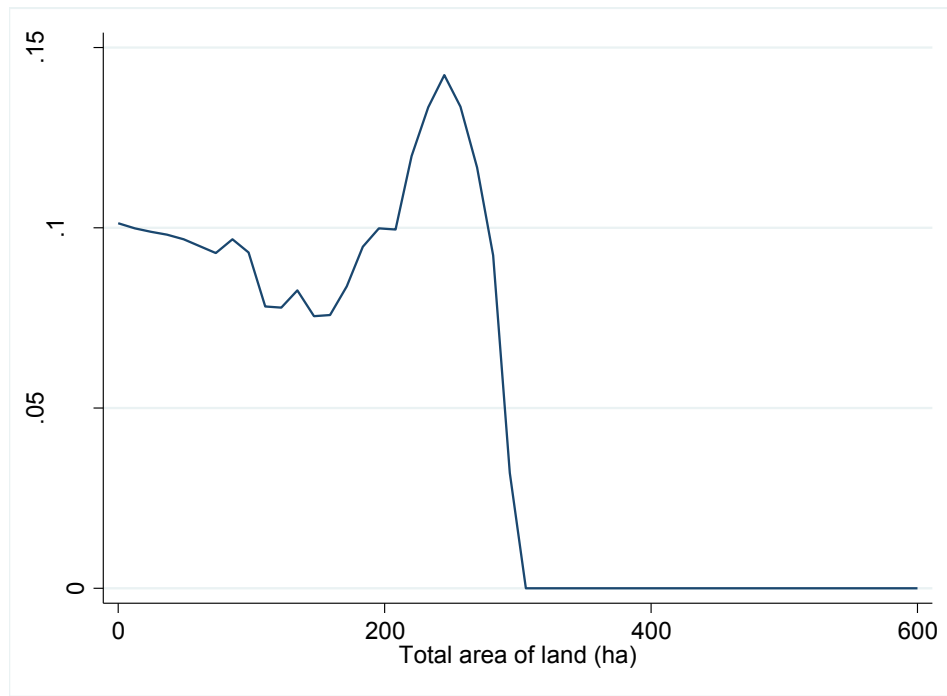
Figure 12. Household's Probability of Producing Maca as a Function of Total Area of Land

The expansion of maca is threatening livestock activities by competing with available land for grazing. Thus, to identify whose livelihoods will be more affected as land becomes scarcer we will analyze who is more dependent on grazing livestock. Figure 13 reports time allocation patterns between farm, off-farm, and domestic activities of women and men that are single or in partnerships. First, we can see that men alone do more farm and off-farm work than women alone. This difference could be due to higher work opportunities available for men relative to women or to higher responsibilities of women living alone. For instance, a divorced woman is more likely to look after her children than a divorced man. When women enter into a partnership with a man, however, they do less agriculture and more domestic work. This trade-off is not surprising given the expected gender roles of women as caregivers of the household.
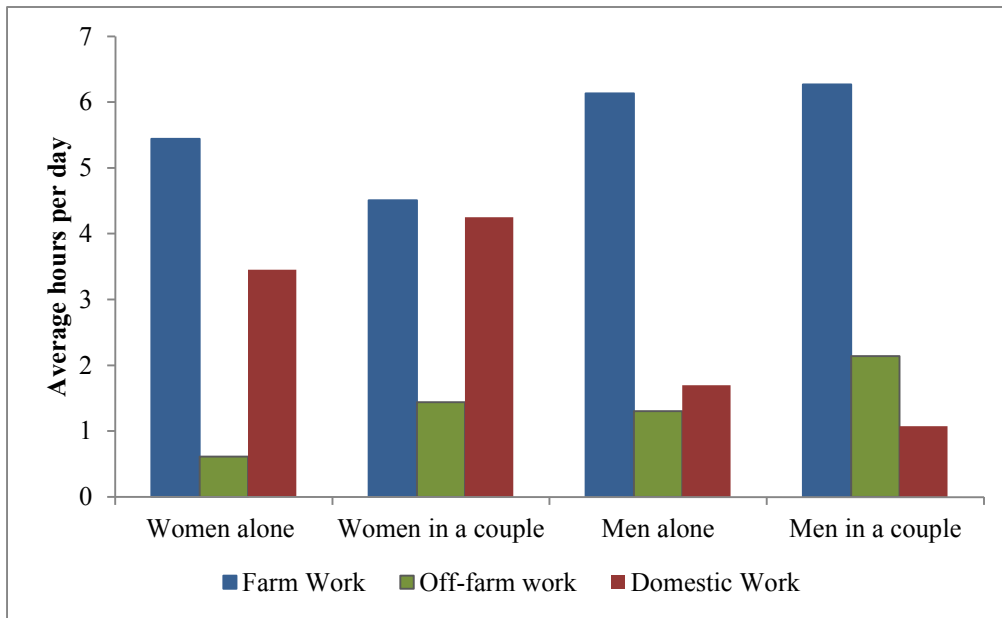
Figure 13. Time Allocation Patterns between Men and Women in Partnerships and Alone

While the farm work hours decrease, off-farm work hours surprisingly increase as women enter a partnership. In contrast, when men go into a partnership with women they do slightly more agriculture, more off-farm work, and less domestic work. This again is consistent with the role of women as a caregiver; the man is able to invest more time in work activities as his domestic work burden decreases and is taken over by the woman. In conclusion, we see that in both cases men have greater opportunities to do off-farm work while women's opportunities are mediated by men.

The previous graph describes the time allocation between farm, off-farm and domestic activities. In contrast, Figure 14 depicts the proportion of individuals within each group that depend solely on farm activities, solely on off-farm activities, or on both. As seen in the figure, the majority of women, both alone and in partnerships, rely solely on farm activities. In contrast, more than 25% of men alone and in partnerships rely on both farm and off-farm activities. In the case of men in partnerships, only about half of the sample relies solely on farm activities. Thus,

we can expect that a greater proportion of women relative to men will face direct impacts as land, an essential resource for their livelihoods, becomes scarcer.
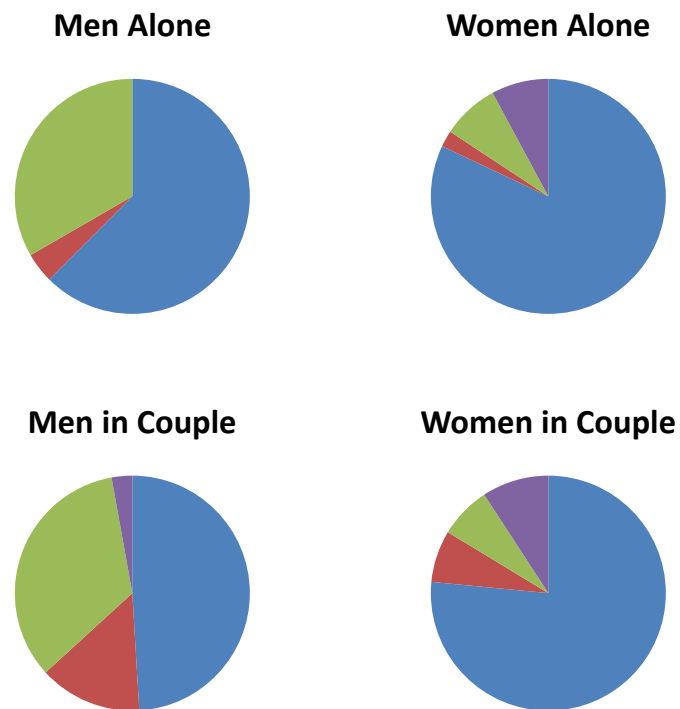
Figure 14. Proportion of Men and Women Relying on Farm Only, Off-farm Only, and Both Farm and Off-farm Activities

The previous discussion suggests that women are not only facing higher barriers to enter the market of maca but will also bear more of the impacts of its production. The descriptive results of our data suggest that women are stuck in farm activities and that a large proportion of women depend solely on farming. Thus, if the expansion of maca creates so much pressure on land resources affecting the productivity of grazing livestock it is possible that women will struggle to transition into other occupations in the future. This scenario would be more optimistic if women could use maca profits and invest them into productive assets. However, we also provide evidence that women might face higher barriers to enter the market of maca. Even if women are able to

overcome the investment costs of production, say by accessing credit, they are likely going to face an additional constraint of land.

1.3   Policy Application of Empowerment Thresholds and Sensitivities

In light of the implications of maca production as described above, policy interventions might be needed to protect women's livelihoods and achieve environmental goals. If policymakers were interested in using empowerment as a tool to protect women's wellbeing, then the results from our structural model could be used to identify the most effective way of increasing empowerment (e.g., by increasing joint land rights vs increasing women's education). The results from our measurement model could allow them to align the changes in influences resulting from an increase of empowerment with their policy objectives. For instance, let's assume that there are two policy outcome alternatives: (A) increasing women's participation in maca production so women can then invest and transition into other livelihood activities (B) reducing the land use changes driven by the expansion of maca to protect the future of women's grazing livestock operations. Let's assume that the probability of achieving each policy outcome is a function of specific influences. For example, increasing women's participation in maca production would require women's participation in decisions over credit and commercial crops. Since the land use changes are driven by renting land out or cultivating maca, policy B would be a function of the influences regarding whether or not to rent out land or buy commercial crops. Our policy alternatives could be therefore expressed as:

$$A = f(bank\ credit, buysell\ crops, crops\ inc)$$

$$B = f(buysell\ rented\ land, rented\ land\ inc, buysell\ crops)$$

Policymakers would therefore need to assess the feasibility of both options to make an informed decision. According to our estimated parameters, influence over bank credit has the

highest threshold and the lowest sensitivity. Influences over commercial crops decisions (over buying/selling and income decisions) also have high thresholds (but lower than influence over bank credit) but are also highly sensitive. Policy B, on the other hand, is a function of influence over renting out land instead of influence over bank credit. Although influences over renting out land are also not ideal for policymakers (since they have relatively high thresholds), they are still more sensitive and have lower thresholds than the influence over bank credit. Based on this information only, policy makers would prefer policy B over policy A.

Appendix B: Household Survey

Module 1. Household identification

Household Identification	Code
1. Household Identification:...	☐☐☐☐
2. Name of respondents currently being interviewed (code from roster in Section A of HH questionnaire): **2.10 Surname**:.................................... **2.11 Code**:........... **2.20 Surname**:.................................... **2.21 Code**:........... **2.30 Surname**:.................................... **2.31 Code**:......... **2.40 Surname**:.................................... **2.41 Code**:.........	

3. Type of household   Male and female adult 1
                           Female adult only..........................2
                           Male adult only.............................3
	☐

MODULE A. HOUSEHOLD LISTING AND DEMOGRAPHICS (REQUIRED). *Enumerator: Ask these questions about all household members.* The respondent should be the one most knowledgeable about the age, completed education, and other characteristics of household members.

Respondent ID:

First, we would like to ask you about each member of your household. Please list the names of everyone considered to be a member of this household, starting with the primary respondent.

ID CODE	Counting yourself, how many people live in your household; that is how many people sleep and eat together in the dwelling?____ Names of the people who habitually eat and sleep in the home, including those who have been absent less than six months and have not established another residence. [start with registered member, continue with the secondary respondent, and other members in descending order of age]	What is [NAME's] sex? 1 = M 2 = F	What is [NAME's] relationship to the registered member? CODE 1	What is [NAME's] age? (in complete years)	What is [NAME's] marital status? CODE 2	Can [NAME] read and write? CODE 3	Is [NAME] currently attending school? 1 = Yes 2 = No	What is the highest grade of education completed by [NAME]? CODE 4
	A01	A02	A03	A04	A05	A06	A07	A08
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								

Code 1 (A03) Relationship to primary respondent

Primary respondent............1	Nephew/niece of spouse.........9
Spouse..........................2	Cousin of primary respondent..10
Son/daughter....................3	Brother/sister-in-law.............11
Son/daughter-in-law............4	Mother/father-in-law.............12
Grandson/granddaughter 5	Cousin of primary respondent's
Mother/Father...................6	spouse..........................13
Brother/sister....................7	Other relative.....................14
Nephew/niece...................8	Maid................................15
	Other relationship (specify)......16

Code 2: (A05) Civil Status

Single/never married nor in a consensual union...................................1
Married..........................2
Consensual union................3
Divorced.........................4
Separated........................5
Widowed.........................6

Code 3 (A06): Literacy

Cannot read and write......1
Can sign (write) only........2
Can read only...............3
Can read and write 4

Code 4: (A08) Education level

Less than P1 (or no school)......0	Senior Secondary 3....................10
Primary level 1..................1	Senior Secondary 4....................11
Primary level 2..................2	Tertiary after O-level.................12
Primary level 3..................3	Secondary 5...........................13
Primary level 4..................4	Secondary 6...........................14
Primary level 5..................5	Diploma/ Univeristy degree or above...........15
Primary level 6..................6	Technical or vocational...............16
Primary level 7..................7	Adult literacy only (no formal education)........17
Senior Secondary 1..................8	Religious only (no formal education)..............18
Senior Secondary 2..................9	Don't know/no response.................98

MODULE B. DWELLING CHARACTERISTICS; *Respondent ID:* ☐☐

B03. This dwelling is [READ RESPONSES]: **(Code 1)**		
B06. Is there a water source inside the dwelling? 1=Yes, 2=No		
B07. What is the source of water of this dwelling **(Code 2)**		
B08. Does this dwelling have access to electricity? 1=Yes (>> C16); 2=No		
B09. What is the main source of cooking fuel for this household? **(Code 3)**		

Code 1: (B05) Ownership	Code 2: (B07) Water source	Code 3: (B09) Cooking fuel
Rented......................1	Private tap inside the home................1	Electricity...............................1
Owned......................2	Private tap inside the compound...........2	Piped or liquid propane gas (biogas).......2
Borrowed (no payment)......3	Public system.............................3	Kerosene................................3
Other, specify............4		Charcoal................................4
		Firewood................................5
		Animal dung.............................6
		Agricultural crop residue...............7
		Other, specify.........................8

MODULE C. LAND AND AGRICULTURE *Enumerator: Ask this section to the member with most knowledge about household land and agriculture. Respondent ID:*

Question	Answer	Options
C01. Do you have land assigned in Atocsayco?		Yes=1 No=2
C02. How big is the land?		Number in ha.
C03. What do you use the land for?			Doesn't use the land...1 Grazing livestock, cows.....2 Grazing livestock, sheep.......3 Potatoes.....4 Other (specify)...5

READ: Now I am going to ask you about the land that you use for productive purposes- whether you rent it, rent it out, share it or own it.

Land No.	How do you refer to the land? *Note: this is just to help the respondent keep track of the answers for each plot of land*	What is the area of [LAND]? a. Area b. Unit	Currently the tenancy status of this land is... Code 2↓	Who received the benefits or controls the revenue from this land? *[If HH member, list IDs, with primary owner first. If outside the household, list from Code 4]* Code 4↓	In what year did you start using the plot? 98= Don't know 99= Refused to answer	How did you acquire this plot? Code 5↓
ID	**Land Name**	**C01a**	**C01b**	**C02**	**C03a**	**C03b**	**C03c**	**C04**	**C05**
1									
2									
3									
4									
5									
6									
7									
8									

CODE 1: UNIT	CODE 2: Tenure Status	CÓDIGO 4: Who benefits	Code 5: Acquire method
Hectares................1 Square meters..........2 Acres....................3 Feet.....................4 Conversion factors: 1 hectare = 2.47 acres 1 meter sq = 0.000245 acres 1 foot = 0.30 meters 1 yard = 0.91 meters 1 km = 0.62 miles	Owner operated.................1 Rented in (cash)................2 Sharecropped in.................3 Borrowed (no payment)...........4 Rented out (cash)..............5 Sharecropped out..........6 Lending out (no payment).......7 Other (specify)................8	Everyone in the household jointly............29 Man outside the household.............30 Woman outside the household ....31 Government or other institution ....32 Family/relatives outside the household.......33	Obtained before marriage/conyugal relationship.............1 Obtained jointly while married/conyugal relationship............2 Obtained while married/conyugal relationship by the man....3 Obtained while married/conyugal relationship by the woman...4 Inheritance through the woman...............5 Inheritance through the man................6 Donation/gift at time of marriage to women.........7 Donation/gift at time of marriage to men.........8 Donation/gift at time of marriage to both...........9 Government program/ PETT...............10 Other................9

MODULE C. LAND AND AGRICULTURE CONTINUED. *Enumerator: Copy plots from previous page in same order.*

ID	What is the [LAND] name?	What is the land used for?		Do you have fencing on this plot?	Why is it fenced?
		USE CODE 5	MAIN CROPS/ANIMALS CODE 6	CODE 7	CODE 8
		C06	C07	C08	
1					
2					
3					
4					
5					
6					
7					
8					

CODE 5 (C06): USE OF LAND	CODE 6 (C07) : CROPS/ANIMALS	CODE 7 (C08) : FENCING	CODE 8 (C09): WHO BUILT THE FENCE
Agriculture/crop production.....1	Potato 1	No fences.............................1	Letting land rest........................1
Grazing for livestock.............2	Oats 2	No fences but planning on fencing land...2	Protect crops............................2
Undisturbed grasslands.........3	Maca 3	Rock wall..............................3	Protect lands............................3
Commerical/non ag enterprise..4	Cows...................................4	Wire fence.............................4	It was already fenced...................4
Fallow.................................5	Sheep..................................5	Stick fence............................5	Other (specify)...........................94
Other (specify).....................94	Alpaca.................................6	Barbed wire...........................6	
	Llamas.................................7	Other (specify).........................7	
	Vicunas................................8		

MODULE D. LIVESTOCK

ID	Livestock	a. Who are the individual or joint owners of [LIVESTOCK]? If "everyone in the household" is the owner report it in part 3. b. How many of [LIVESTOCK] are the property of [NAME]? c. If you were to sell the animals today how much would you be paid?						a. Does anyone in your household take care of [LIVESTOCK] that belongs to someone else from outside the household? If so, who takes care of them (List IDs) b. How many [LIVESTOCK] that belong to someone else do they take care of?			
		Individual property		Joint Property			Everyone in the household	IDs			Number
		ID of owner	Number	IDs of owners			Number	Number			
		D01a	D01b	D02a	D02b	D02c	D02d	D03	D04a	D04b	D04c	D04d
1	Cattle for dairy production											
2	Cattle											
3	Sheep											
4	Alpaca											
5	Cuy											
6	Other, specify											
7	Other, specify											
7												

MODULE E. CONSUMER DURABLES

ID	Consumer durable	a. Who are the individual or joint owners of [CONSUMER DURABLE? If "everyone in the household" is the owner report it in part 3. b. How many of [CONSUMER DURABLE] are the property of [NAME]?						
		Individual property		Joint Property				Everyone in the household
		ID of owner	Number	IDs of owners			Number	Number
		a	b	a	b	c	d	a
1	Bicycle							
2	Microwave							
3	Gas cooker							
4	Cellphone							
5	Motorcycle							
6	Car							
7	Refrigerator							
8	Radio							

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ID	Consumer durable	a. Who are the individual or joint owners of [CONSUMER DURABLE? If "everyone in the household" is the owner report it in part 3. b. How many of [CONSUMER DURABLE] are the property of [NAME]?						
		Individual property		Joint Property				Everyone in the household
		ID of owner	Number	IDs of owners			Number	Number
		a	b	a	b	c	d	a
9	Sound Equipment							
10	TV							
11	Cable							

Appendix C: Individual Survey and WEAI

Questionnaire modules for the INDIVIDUAL survey and Women's Empowerment in Agriculture Index

Enumerator: This questionnaire should be administered separately to individuals identified in the household roster (Section B) of the household level questionnaire as the registered member in the community and their partner or secondary adult in the household. You should complete this coversheet for each individual identified in the "selection section" even if the individual is not available to be interviewed for reporting purposes.

MODULE 1. INDIVIDUAL IDENTIFICATION

Household Identification	Code
1. Household Identification:..	☐☐☐☐
2. Name of respondent currently being interviewed (code from roster in Section B of HH questionnaire): **2.1 Surname:** .... **2.11 Code:**	
3. Sex of respondent: Male.........1 Female.....2	☐

4. Type of household   Male and female adult 1
                        Female adult only.........................2
                        Male adult only............................3
	☐

MODULE A. EMPLOYMENT

In the table below, please write down the code for all the occupations or activities that you were engaged in during a typical week in the following season:

Complete the following table for the RAINY SEASON:

Industry Enumerator: Complete after interview	Occupation Enumerator: complete Code after interview		Who do you work for?	Intensity of activity in each day of the last 7 days 1= 4 or more hours 0.5= 4 or less hours							Total number of days in each activity
CODE 1	Answer	Code 2	CODE 3	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	
A01		A02	A03								A04

MACA

Complete the following table for the DRY SEASON:

Industry Enumerator: Complete after interview	Occupation Enumerator: complete Code after interview		Who do you work for?	Intensity of activity in each day of the last 7 days 1= 4 or more hours 0.5= 4 or less hours							Total number of days in each activity
CODE 1	Answer	Code 2	CODE 3	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	
A05		A06	A07								A08

MACA

PNo.	Question	Answer	Options
A09	¿Have your activities or employment changed in the past 5 years?		Yes......................................1 No.......................................2

How have they changed?

Complete the following table for the RAINY SEASON:

Industry Enumerator: Complete after interview	Occupation Enumerator: complete Code after interview		Who do you work for?	Intensity of activity in each day of the last 7 days 1= 4 or more hours 0.5= 4 or less hours							Total number of days in each activity
CODE 1	Answer	Code 2	CODE 3	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	
A10		A11	A12								A13

MACA

Complete the following table for the DRY SEASON:

Industry Enumerator: Complete after interview	Occupation Enumerator: complete Code after interview		Who do you work for? CODE 3	Intensity of activity in each day of the last 7 days 1= 4 or more hours 0.5= 4 or less hours							Total number of days in each activity
CODE 1	Answer	Code 2		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	
A14		A15	A16								A17

MACA

CODE 1: Industry	CODE 2: Occupation	CODE 3: Who do you work for

CODE 1: Industry

Agriculture
Growing of crops
  Potatoes............................01119.1
  Maca................................01119.2
Farming of animals
  Dairy production...................0121.1
Grazing livestock
  Sheep 0121.2
  Cattle.............................0121.3
  Alpaca.............................0121.4
  Llamas.............................0121.5
  Vicuna.............................0121.6
Wholesale of agricultural products, live animals, food products......512

Wage labor
Transportation................................6021
Mining..1320
Construction labor (including public work).................452
Textile/crafts manufacturing..................171

Salaried worker
Public administration (government, community council)......751
NGO............................752
Education..................801
Wholesale of household goods (private enterprises).........513
Private households as employers of domestic staff..........950

Other (specify).........................12

CODE 2: Occupation

Agriculture
Ploughman....................9201.10
Cultivator (owner)....611.10
Cultivator (tenant)...611.40
Tractor Operator......8331.10
Livestock Worker, general....6121.20
Hersdman....6121.25
Dairy farm worker, general.....6121.35
Milker........6121.40

Wage labor
Mining Worker................7111
Laundry Worker..............9133.90
Car or taxi driver.............8322.20
Bus driver......................8322.30
Construction worker..........7141.90
Sweeper/Cleaner.............9162.90
Other wage labour (specify).....13

Salaried worker
Government worker.................1129.90
Cashier...........................4211.10
Sales person.....................5220
Manager/administrative work.....1214
Teachers.........................2310
House keeper/ Maid..............5121
Cook..............................5122
Other (specify).........................14

Trader
Small trader (roadside stand or stall)..... 5220.51
Medium trader (shop or small store).......5220.52
Large trader (large shop or whole sale)...5220.53

Other self-employed (specify)..............15

CODE 3: Who do you work for

Self-employed...................................1
For a family member or friend...............2
For the government/community............3
Mining company...............................4
Someone else (company, person outside the community)...5

MODULE B: LAND AND ASSETS

Land No.	How do you refer to the land? *Copy the list of plots from the agricultural land section of the household questionnaire*	Do you receive the benefits or control the revenues from this land? **Code 1↓**			
		Code	**IDs/FRCs**		
ID	**Land Name**	**B01**	**B02a**	**B02b**	**B02c**
1					
2					
3					
4					
5					
6					
7					
8					

CODE 1
Yes, I'm the only person that received the benefits.............................1
Yes, I receive the benefits jointly with (ID, FRC, include community lands)............2
No, I don't receive the benefits but another member of the household
does...3
Not applicable (it land is not property of a household member) 4

MODULE C: CAPITAL AND ECONOMIC ACTIVITIES

Productive capital		Is there someone that is involved or has the following? Yes .... 1 No ...... 2 >> next	Who would you say can decide whether to sell, buy, rent or manage [ITEM] most of the time? Code 1↓	Who would you say can decide how to distribute the benefits from [ACTIVITY]? Code 1↓	Who would you say would keep the majority of [ITEM] in the case a marriage is dissolved because of divorce or separation? Code 1↓
	Capital	C01	C02	C03	C04
1	Land				
2	livestock				
3	Commercial crops				▓
4	Non-economic activities				▓
5	Wage labor				▓
6	Renting or leasing of land				▓
7	Durable goods (TV, cable)			▓	
8	Transportation (bycicle, car, etc)			▓	

CODE 1 : Decision-making and control over capital	
Self...1	Someone (or group of people) outside the household.........7
Partner/Spouse................................2	Self and other outside people 8
Self and partner/spouse jointly...........3	Partner/Spouse and other outside people........................9
Other household member..................4	Self, partner/spouse and other outside people...................10
Self and other household member(s)..5	
Partner/Spouse and other household member(s).....................................6	

MODULE D: Access to Credit, CONTINUED

	Lending sources	Has anyone in your household taken any loans or borrowed cash/in-kind from [SOURCE] in the past 12 months? Yes, cash ....1 Yes, in-kind ....2 Yes, cash and in-kind.......3 No.........................4 >> C13B Don't know....................5 >> C13B	Who made the decision to borrow from [SOURCE]? CODE 1	Who makes the decision about what to do with the money/ item borrow from [SOURCE]? >> Next source CODE 1	If more credit had been available from this source, would you have used it? Yes .....1 >> Next source No........2
	Lending source names	D09	C10	C11	C12
A	Agriculture Bank				
B	Ministry				
C	Friends or relatives				
D					
E					

CODE 1 (for D02 – D11): Decision-making and control over capital	
Self...1	Someone (or group of people) outside the household.........7
Partner/Spouse..................................2	Self and other outside people 8
Self and partner/spouse jointly..........3	Partner/Spouse and other outside people.....................9
Other household member.................4	Self, partner/spouse and other outside people....................10
Self and other household member(s)..5	
Partner/Spouse and other household member(s)...6	

Question	Answer	Options
D09. Did you want to take out a loan in the last 12 months but couldn't?		Yes=1 No=2
D10. Why couldn't you take out the loan?		Have enough money..1 Afraid of losing collateral..2 Do not have enough collateral/did not qualify for the loan...............3 Afraid cannot pay back the money..4 Interest rate/other costs too high..5 Not allowed to borrow/family dispute in borrowing decision.............6 Place of lender is too far...7 Other, specify...8

MODULE D (Dimension 2): Access to Agriculture/livestock/extension, CONTINUED

QNo.	Question	Response	Response options
D14	Have you (yourself) ever met with an agricultural extension worker or livestock extension worker in the past 12 months?		Yes..1 No ....2 >> Next section
D15	How many times did you meet with the agricultural extension worker or livestock worker in the past 12 months?		[Enter number of visits]
D16	The last time you met with an extension worker, were they a male or female?		Male..1 Female...2 Both male and female 3

MODULE E: Individual leadership and influence in the community

Enumerator: The purpose of this module is to get an idea about men's and women's potential for leadership and influence in the communities where they live.

QNo.	Question	Response	Response options/Instructions
E01A	Do you feel comfortable speaking up in public during community meetings or regarding family arguments?		No, not at all comfortable.............................. 1 Yes, but with a great deal of difficulty .... 2 Yes, but with a little difficulty.......................... 3 Yes, fairly comfortable.................................... 4 Yes, very comfortable..................................... 5

Group membership		Is there a [GROUP] in your community? Yes...... 1 No ...... 2 >> next group	Are you an active member of this [GROUP]? Yes...... 1 No ...... 2 >> E09A	How much input do you have in making decisions in this [GROUP]? (>> next group) Code 1	CODE 1: (E04) Control over decisions No input .... 1 Input into very few decisions............ 2 Input into some decisions .... 3 Input into most decisions .... 4 Input into all decisions.................. 5
	Group Categories	E02	E03	E04	
A	Agricultural / livestock producer's group (including marketing groups)				
B	Vaso de leche (group for moms)				CODE 2: (E05) Why not member of group
D	Popular diners				Not interested..............................1 No time.....................................2
E	Trade and business association				Unable to raise entrance fees ....3 Unable to raise reoccurring fees 4
F	Civic groups (improving community) or charitable group (helping others)				Group meeting location not convenient. 5 Family dispute/unable to join 6
G	Local government				Not allowed because of sex ....7 Not allowed because of other reason. ...8
H	Religious group				Other, specify...............................9
I	Other women's group (only if it does not fit into one of the other categories)				
J	Other (specify)				

QNo.	Question	Answer	Options
E05	Is there any group you would like to join but you can't? Why can't you?		CODE 2
E06	Have you held a leadership position in any group in the past?		Yes....1 No.....2

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MODULE F: Income

PNo.	Question	Answer	Options of Answers
F01	Do you own any money that you can decide how to spend it?		Yes...................................1 No....................................2
F02	*ENUMERATOR: Skip this question if the participant does not have a partner* In comparison with your partner, you... [READ THE OPTIONS]		Make more money than your partner....1 Make less money than your partner......2 Makes the same amount of money than your partner...........................3 The couple does not make any money...4 You don't make any money.................5 Don't know how much your partner makes..6
F03	Do you receive any income from social programs?		No.........1 Pensión 65....2 Other (specify)....3 Retired......4 Retired or pension from partner.....5

MODULE G (Dimension 5): Time allocation

Enumerator: The purpose of this module is to get an idea about men's and women's time spent in both work and leisure activities and their satisfaction with their time use.

G01: Please record a log of the activities for the individual in the last complete 24 hours (starting yesterday morning at 4 am, finishing 3 am of the current day). The time intervals are marked in 15 min intervals and <u>one to two activities can be marked for each time period</u> by drawing a line through that activity. If two activities are marked, they should be distinguished with a P for the primary activity and S for the secondary activity written next to the lines. Please administer using the protocol in the enumeration manual.

		Night		Morning				Day								
	Activity	4	5	6	7	8	9	10	11	12	13	14	15			
A	Sleeping and resting															
B	Eating and drinking															
C	Personal care															
D	School (also homework)															
E	Work as employed															
F	Own business work															
G	Farming/livestock/fishing															
J	Shopping/getting service (incl health services)															
K	Weaving, sewing, textile care															
L	Cooking															
M	Domestic work (incl fetching wood and water)															
N	Care for children/adults/elderly															
P	Travelling and communiting															
Q	Watching TV/listening to radio/reading															
T	Exercising															
U	Social activities and hobbies															
W	Religious activities															
X	Other, specify…															

H01. Continued

	Activity			Evening		Night									
		16	17	18	19	20	21	22	23	24	1	2	3		
A	Sleeping and resting														
B	Eating and drinking														
C	Personal care														
D	School (also homework)														
E	Work as employed														
F	Own business work														
G	Farming/livestock/fishing														
J	Shopping/getting service (incl health services)														
K	Weaving, sewing, textile care														
L	Cooking														
M	Domestic work (incl fetching wood and water)														
N	Care for children/adults/elderly														
P	Travelling and commuting														
Q	Watching TV/listening to radio/reading														
T	Exercising														
U	Social activities and hobbies														
W	Religious activities														
X	Other, specify														

MODULE H (Dimension 5): Time allocation, CONTINUED

QNo.	Question	Response	Response options/Instructions
G02	Was yesterday a holiday or nonworking day?		Yes...1 No 2
G03	Regarding the amount of sleep you got last night, was that: [READ RESPONSES]:		Less than average ....1 Average ....2 More than average 3
G04	How satisfied are you with your available time for leisure activities like visiting neighbors, watching TV, listening to the radio, seeing movies or doing sports?		Not satisfied....1 Indiferent.......2 Satisfied.....3 Very Satisfied.....4

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