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

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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.

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

[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

[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.

Economic Commission for Africa 1972; Momsen 1991; Gupta 2009). However, the distribution 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.

The overall goal of this paper 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 notabley see Das, J., and T. Zajonc. 2010). 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).

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 hypopaper 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].

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

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. While land rights in the studies reviewed in the following section are defined more broadly, we define land rights as the inheritance of usufruct rights to land.

Land Rights and Women's Empowerment

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

[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)

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 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

[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).

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.

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).

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.

Primary Data Collection

Data for this study was collected by the first author with support and input of the International Potato Center (CIP) staff members from October to December 2014 and co-authors. 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 316 individual observations, 186 participants were women and 130 were men. See Appendix A for details on the WEAI implemented in the paper.

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. Descriptive statistics of all variables are in table 1. 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.

Assets and Wealth

We expect that ownership and control over assets would have a positive impact on women's empowerment. 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). Nonetheless. 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 (Doss 2013). 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 increases their empowerment.

Land Rights

To determine the effect of intra-household allocation of land rights on empowerment, we include three dummy variables in our basic 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 previously, 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. 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.

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. Unmarried women 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.

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 adults to have a negative impact on women's empowerment since they could replace women's role in decision-making. 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 (e.g., Speizer, Whittle, and Carter 2005, Jejeebhoy and Sathat 2001). Although we expect education to empower women, the education level of women relative to men is expected to be more important in determining their influence within the household. Thus, we include the variable *education difference* which is the difference between the man and the woman's level of education. We 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.

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.

Table 1. Definitions and Descriptive Statistics of the Determinant of Empowerment (N=186)

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	+

Empowerment Measure: 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 1 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.

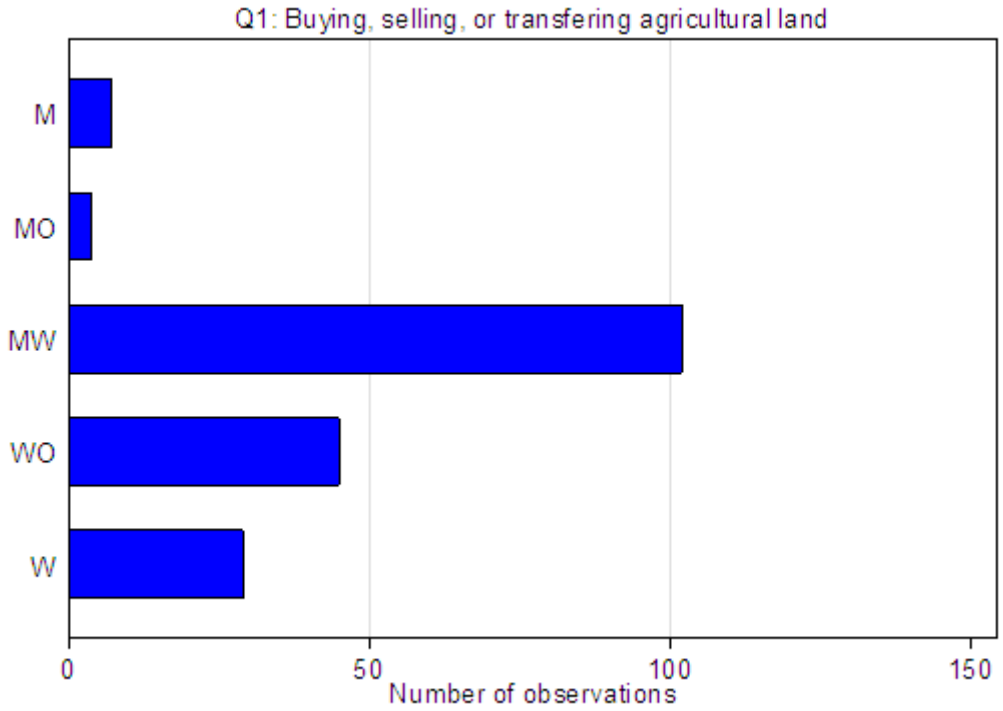

Figure 1. Distribution of Responses for the Influence over Decision-making over Buying, Selling, or Transferring Agricultural Land

Empirical Approach

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 latent trait (e.g., Embretson and Reise 2000; Hambleton and Swaminathan 1985; Hambleton, Swaminathan, and Rogers 1991).

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 9^{th} grade children from the Indian states of Orissa and Rajasthan with international benchmarks.

At the center of IRT are the quantities of difficulty and discrimination. Difficulty describes the minimum level of the latent trait required to answer a question correctly. Discrimination refers to an item's ability to at identifying respondents within a narrow range of the latent trait. the difficulty and discrimination parameters are estimated using the Item Characteristic Curve (ICC), a function that links individuals' item response probabilities to the latent trait.

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[9]. 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, 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.

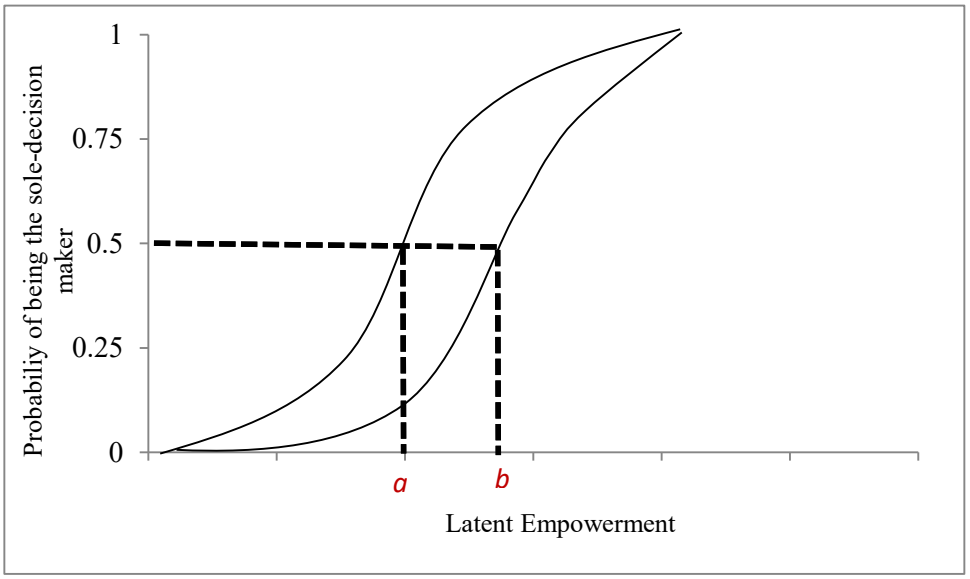

Figure 2. ICCs with Different Difficulties or Empowerment Thresholds

Figure 2 shows two hypothetical ICCs for two influence indicators with different difficulty values. 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 2, influence indicator 1 has a

[9] 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.

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 3, 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.

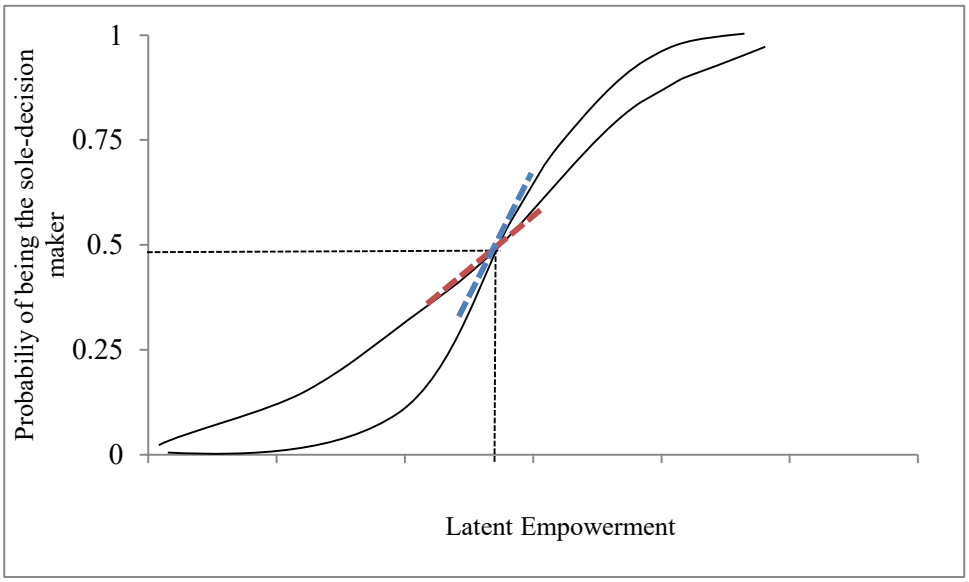

Figure 3. ICCs with Different Discriminations or Empowerment Sensitivities

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^*.

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

In Equation 1, ν_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).[10].

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

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:

[10] 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. Summarizing briefly, 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 responses 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).

Recent advances in the literature allow estimation of Structural Equation Models (SEMs) where the indicators are ordered using generalized structural equation modelling. 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 10 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.

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. We therefore 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. The results are available upon request.

Results

Structural Component Results

Table 2 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 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

Table 2. 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% (**), and1%(***) levels

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 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 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 3 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.

Table 3. Differential Item Functioning (DIF) (MODEL 5): Results of the Measurement Component showing the Effects of the Sex Dummy Variable (1=woman) on the Influence Indicators

	Model V	
Influence Indicator	**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 4. Differential Item Functioning (DIF) (MODEL 5): Results of Model V's Structural Component of Women's Empowerment as the Dependant Variable

	Coefficients (Standard Error)
Independent Variable	**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)
Junín	**-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

To determine if our results hold once DIF is accounted for we look at the structural part of our fifth model reported in Table 4. 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.

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[11]- 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

[11] 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.

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 4. 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 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 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.

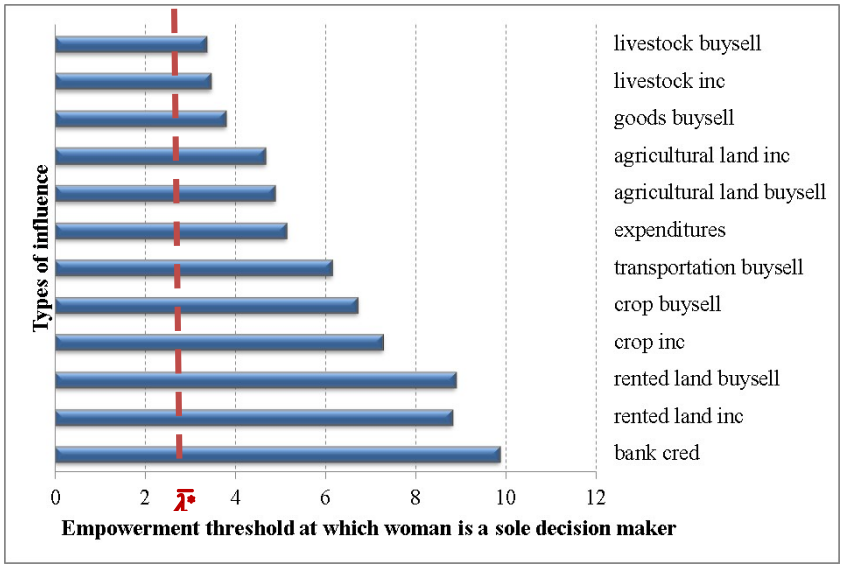

Figure 4. Empowerment Threshold of Each Indicator in the Measurement Component

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.

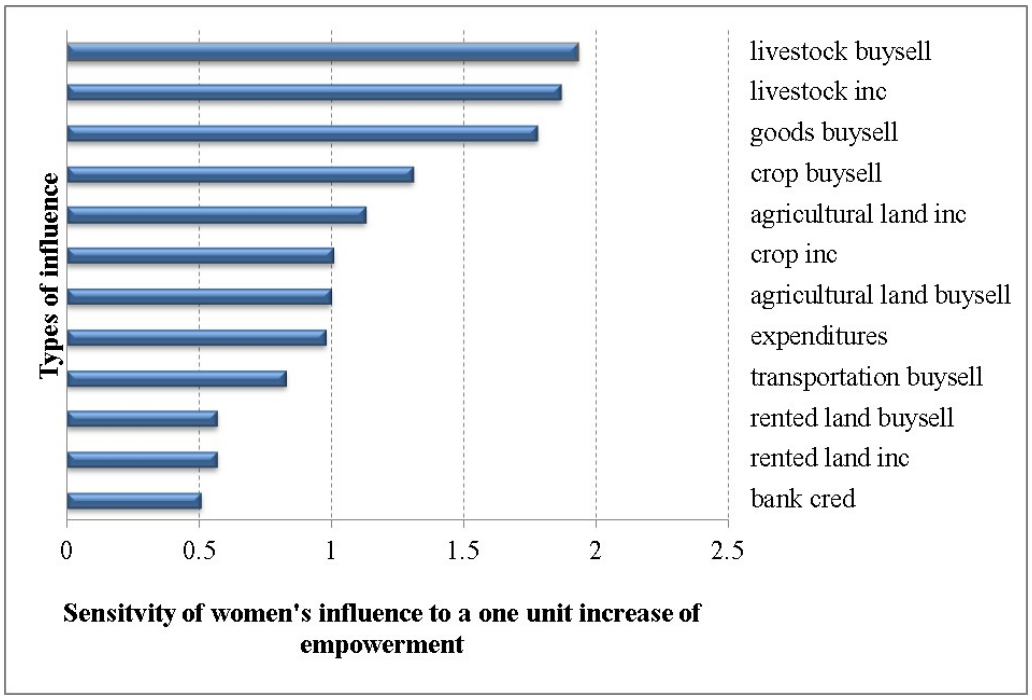

Figure 5. Empowerment Sensitivities of Each Indicator in the Measurement Component

Figure 5 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 5 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.

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 4 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.

Table 4. 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)

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.[12]

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

[12] 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

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

Conclusions

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

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. Unlike other narrower measurements of empowerment, this tool recognizes that empowerment in any domain that is important to agricultural livelihoods does not necessarily mean empowerment in other domains (Alkire et al. 2013). 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 6 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 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 5 provides a more detailed description of each component of the WEAI we included in our survey and the assets included in each question.

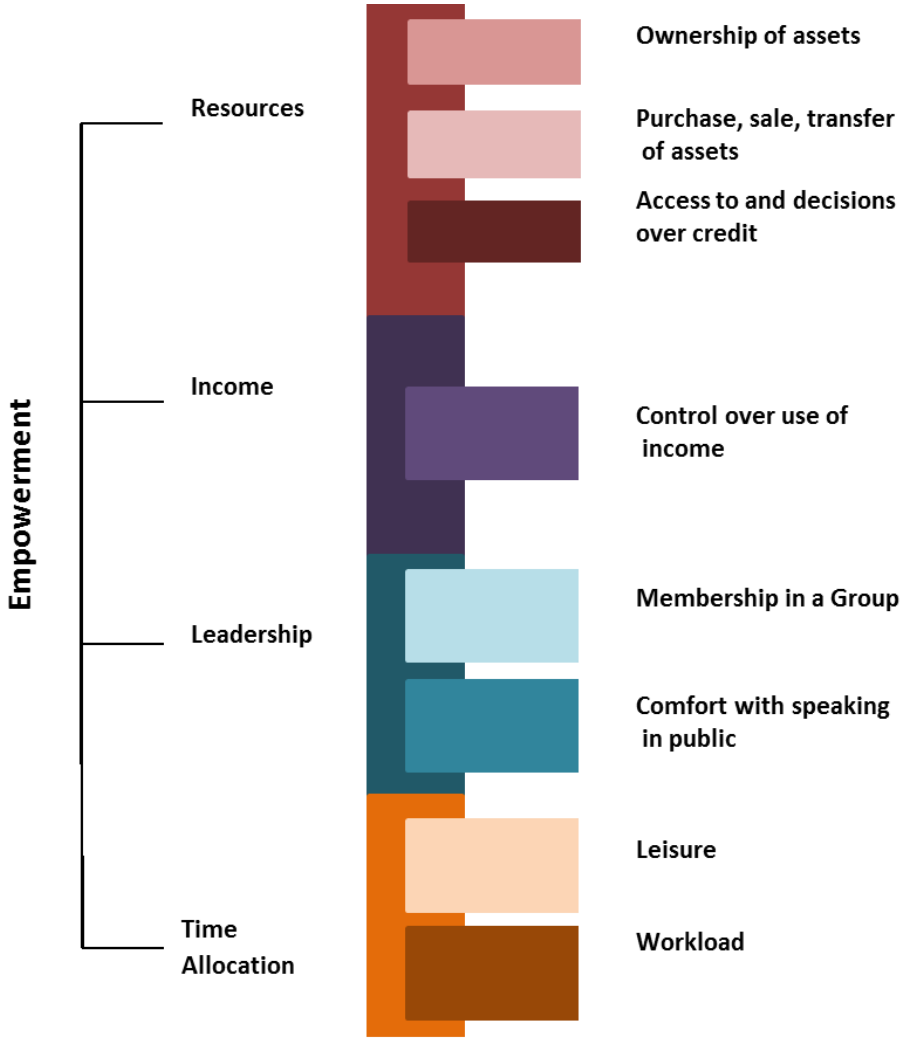

Figure 6. Women's Empowerment in Agriculture Index Domains and Indicators collected in our survey

Table 5. 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 contributions to decisions over buying, selling, or transferring different assets.
Livestock	
Commercial Crops	
Rented Land	
Goods	
Transportation	
Category 2*	Category 2 measures the individual's contributions to decisions over credit from different sources
Bank	
Friends or relatives	
Category 3*	
Agricultural Land	Category 3 measures the individual's contributions to decisions over the distribution of revenue from different productive assets
Livestock	
Commercial Crops	
Rented Land	
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 individual either individually or jointly with other household members
Sheep	
Alpacas	
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