Title
The Couple's Dilemma: Examining Assumptions of the Collective Model of the Household

Author
Kieran, Caitlin

Publication Date
2022

Peer reviewed|Thesis/dissertation

The Couple's Dilemma:
Examining Assumptions of the Collective Model of the Household

By

CAITLIN KIERAN
DISSERTATION

Submitted in partial satisfaction of the requirements for the degree of

DOCTOR OF PHILOSOPHY

in

Agricultural and Resource Economics

in the

OFFICE OF GRADUATE STUDIES

of the

UNIVERSITY OF CALIFORNIA

DAVIS

Approved:

_____

Travis Lybbert, Chair

_____

Arman Rezaee

_____

Michael Carter

Committee in Charge

2022

In memory of my mom, who taught me to love learning.

Abstract

An accurate understanding of how policies and programs affect individual and household welfare requires correctly modeling household decision making. This dissertation examines standard assumptions of the collective model that household members achieve efficiency (Essays 1 and 3), have perfect information (Essays 2 and 3), communicate, and make binding commitments (Essay 3). I analyze the theoretical implications of relaxing these assumptions and empirically assess how well these assumptions reflect reality in diverse contexts. The first essay calls into question the assumption that households in rural Ethiopia operate on the Pareto efficient frontier. The second essay examines differences in spouses' responses to questions regarding asset ownership and participation in household decisions in Nepal, and what these differences tell us about women's well-being. The third essay analyzes how introducing cellular network access in the Philippines affects wives' control over household resources and information asymmetries between spouses.

Do Property Rights Affect the Efficiency and Intrahousehold Labor Allocations of Rural Ethiopian Households?

If the share of land that a husband or wife claims in divorce differs from his or her share of other assets, does this induce inefficient allocations of productive resources? To address this question, the first essay examines the effects of two policies that altered the distribution of property rights upon marital dissolution in Ethiopia: (1) joint land certification, which shifted land rights from husbands to both husbands and wives and (2) changes to regional Family Codes, which shifted non-land rights from husbands to a more equal division between

spouses. Using two-way fixed effects, I analyze both panel and repeated cross-sectional data. My results suggest that, when regional Family Codes are in place, joint land certification increases real household consumption per capita and the probability of being above the poverty line relative to households governed by head-only certification. I then examine whether changes in time allocated to off-farm wage labor explain the implied inefficiencies in household production under certain policy combinations.

Spousal Concordance in Joint and Separate Households: Survey Evidence from Nepal

In household surveys, husbands and wives who are asked the same set of survey questions often provide different responses. Using data from Nepal, the second essay studies patterns of concordance between spouses on survey questions regarding household asset ownership and decision making. We analyze these patterns separately for couples that reside with the husband's parents and those that do not. We find that wives are much more likely than husbands to report their own participation in asset ownership and decision making, in both joint and separate households. In joint households, wives are also more likely to report that others own assets and make decisions. Wives reporting that they own assets or make decisions is correlated with some improved measures of wives' well-being, regardless of whether there is concordance between spouses. Concordance is not necessarily correlated with better outcomes for women, particularly when the point of agreement is that the wife does not own assets or make household decisions.

Call on Me: The Impact of Communication on Intrahousehold Information Asymmetries in the Philippines

In the final essay, I develop a conceptual framework to understand how communication affects information asymmetries and monetary transfers between spouses in the Philippines. I posit that improving spouses' ability to communicate increases the cost of hiding or withholding income and reduces the cost of monitoring. Using data from the first randomized control trial to provide communities with mobile networks access, I find suggestive evidence

that this intervention increased transfers from husbands to wives by reducing information asymmetries between spouses. I also present experimental games that could be conducted with spouses in order to test the implications of the model.

Acknowledgments

I am extremely grateful to my dissertation Chair, Travis Lybbert, and committee members, Arman Rezaee and Michael Carter, for their invaluable feedback. Travis, I appreciate your guidance and support on this dissertation and as your student, TA, and GSR over the past six years. You taught me so much of what I know about economics and being an economist. Arman, your comments are always thoughtful and constructive. Our regular meetings provided me with much-needed structure. Michael, thank you for pushing me to question my assumptions and see problems from different perspectives. I would also like to thank Diana Moreira, Jamie Hansen-Lewis, Ashish Shenoy, Dalia Ghanem, and Rich Sexton for providing me with feedback at various points in this process. I'm grateful to the numerous professors in the ARE and Economics Departments who taught me or worked with me, especially Steve Vosti, who helped me balance school and parenting.

I loved working with my co-authors, Kate Ambler, Cheryl Doss, and Simone Passarelli, on Essay 2. Cheryl, I do not know if I would have pursued a Ph.D. without your mentorship. I aspire to achieve your substance-to-ego ratio. For Essay 3, I am so thankful to Arman Rezaee, Joshua Blumenstock, Niall Keleher, and Erin Troland for allowing me to add questions to the endline survey, participate in the data collection, and analyze both the baseline and endline data. The team from Innovations for Poverty Action welcomed me to the Philippines and taught me a great deal about data collection and enumerator training. I am especially grateful to Nassreena Sampaco-Baddiri, Ann Mayuga, Yuna Liang, Sheila Pacris, and the entire team of enumerators. In addition, none of this research would have been possible

without the thousands of individuals across Ethiopia, Nepal, and the Philippines who were willing to take the time to respond to surveys.

This dissertation is the product of countless contributions from my peers and friends in the ARE Department and beyond. I would like to express my gratitude to the bubble, including Ashley Spalding, Bret Stevens, Charlotte Ambrozek, Chris Skidmore, Christine Hanon, Ethan Krohn, Lindsey Hall, and Tristan Hanon, who helped keep me sane during the height of the COVID-19 pandemic and fire season. Ashley and Charlotte, you are two of the smartest and most generous people that I know. Our daily chats/text messages have sustained me over the last six years. I am so lucky that you share your time, intelligence, humor, and baked goods with me. I am grateful to Arman's research discussion group, especially Laura Meinzen-Dick, Jessica Rudder, and Shotaro Nakamura, to my goal-setting group, including Joakim Weill, Karen Ortiz Becerra, and Xiurou Wu, my buddies big (Mo Alloush) and small (Tina Kotsakou, Sarah Smith, and Saloni Chopra), my co-GSR Tomoé Bourdier, who trusted me to help conduct field work in Bihar for her dissertation, and my friends, roommates, and office mates, Ben Dawson, François Castonguay, Julian Arteaga, Miki Doan, Laila Salimi, Daniel Mazzone, and many more. You all made this experience fun and fulfilling.

Thanks also to my external support system, including Laura Buck, Kristen Molloy, Rachel Lowdermilk, Sara Stesis, Adam Gauzza, and Rachel Stevens for always making me laugh and often making me cry. I am eternally grateful to my family for everything they have done for me. Chris Kieran, I have always looked up to you (both literally and figuratively). You make the mundane feel magical. My parents, Barbara DeGrange Kieran and Steve Kieran, instilled in me the confidence to pursue this Ph.D. Dad, your passion for your work motivated me to find a career that I love. Your unwavering support makes me feel safe to take risks. My mom, who passed away last August after a long battle with early-onset Alzheimer's disease, showed me that I can do anything and everything. She inspired me in innumerable ways, including by writing a dissertation that also focused on the relationship

between spouses. I am grateful for my son Riley, who brought so much joy and silliness into my life over the past year. I am in awe of your ability to learn new skills every day. Eric, from the day that I started taking math classes at night, you have been an amazingly supportive partner. You did not hesitate when I asked if we could uproot our lives in DC and move to Davis. You put up with me for years of stressing about exams and you picked up the slack whenever I took on too much. I truly could not have done any of it without you. I love you and am so thankful for you.

Contents

List of Figures

List of Tables

Introduction

Designing interventions to effectively reduce gender disparities, alleviate poverty, or improve human capital requires understanding how development interventions will interact with existing intrahousehold dynamics. Correctly targeting an intervention is necessary for its success. Agricultural interventions that fail to consider who makes technology adoption decisions, either solely or jointly, and who provides agricultural labor are unlikely to have the intended effects. An often-cited example is a project in The Gambia that failed to improve food production or security because it introduced irrigated rice varieties to men, ignoring the fact that women typically cultivated rain-fed rice (Dey, 1981)). Agricultural extension often targets men, but adoption of improved crop varieties in male-headed households in the Democratic Republic of the Congo is highest when both men and women receive extension services (Lambrecht, Vanlauwe, and Maertens, 2016). Many transfer programs target women with the dual aim of empowering them and improving the food security, health, and education of children. However, considering who to target is not sufficient for an intervention's success. Policymakers must also carefully consider who will benefit and how, which is not always straightforward. For example, an evaluation of a program that transferred livestock to women in Bangladesh shows that, although women retain control of the livestock and report increased social capital, this intervention also reduces women's movement outside the home and their control over income while increasing men's ownership of new investments (Roy et al., 2015). Understanding how decisions are made within households, as well as the root causes of gender inequities, can help policymakers minimize the risk of unintended

consequences.

If households had just one decision maker or if all decision makers in a household had uniform preferences, then the effect of an intervention would not depend on the identity of the recipient. However, the empirical literature has rejected the unitary model of household decision making (Alderman et al., 1995; Chiappori and Donni, 2011). Non-unitary models, including collective and non-cooperative models, allow for individuals within households to have different preferences. This implies that the identity of the recipient can influence the intervention's impact, including how any benefits are distributed. The collective model, formalized by Chiappori (1997), describes a bargaining process in which household members can make binding commitments with perfect information. These models implicitly assume that household members can communicate freely. Collective models assume that decisions within households produce Pareto efficient outcomes. This assumption has important policy implications since it suggests that policymakers need not worry about negative repercussions of interventions on household efficiency. Non-cooperative models, on the other hand, allow for equilibrium outcomes that are not Pareto efficient. These models typically posit that individuals maximize their own utility, subject to their budget constraint, while taking the decisions of other household members as given. Whether collective or non-cooperative models better characterize households remains an open question. The answer may vary across contexts.

This dissertation examines standard assumptions of the collective model that household members achieve efficiency (Essays 1 and 3), have perfect information (Essays 2 and 3), communicate, and make binding commitments (Essay 3). I analyze the theoretical implications of relaxing these assumptions and empirically assess how well these assumptions reflect reality in diverse contexts. The first essay calls into question the assumption that households operate on the Pareto efficient frontier. Using the testable implications of collective and non-cooperative models, I find that the non-cooperative model more accurately depicts rural Ethiopian households. The second essay examines differences in spouses' responses

to questions regarding women's asset ownership and participation in household decisions in Nepal, and what these differences tell us about women's well-being. The third essay analyzes how introducing cellular network access in the Philippines affects wives' control over household resources and information asymmetries between spouses.

If spouses fail to cooperate to achieve productive efficiency, then they may respond strategically to policy interventions in order to strengthen their exit option. For example, if the share of land that a husband or wife would claim in divorce differs from his or her share of other assets, does this induce inefficient allocations of productive resources during the marriage? To address this question, the first essay examines the effects of two policies that altered the distribution of property rights upon marital dissolution in Ethiopia: (1) joint land certification, which shifted land rights from husbands to both husbands and wives and (2) changes to regional Family Codes, which shifted non-land rights from husbands to a more equal division between spouses. I compare the predictions of collective and non-cooperative models of the household. While the collective model assumes that households achieve Pareto efficiency, the non-cooperative model suggests that implementing neither policy or both policies will result in more efficient labor allocations than implementing one policy in isolation.

Using two-way fixed effects, I analyze both panel and repeated cross-sectional data from rural Ethiopia. My results suggest that, when regional Family Codes are in place, joint land certification increases real household consumption per capita and the probability of being above the poverty line relative to households governed by head-only certification. Given this suggestive evidence in support of the non-cooperative model, I examine whether changes in time allocated to off-farm wage labor explain the implied inefficiencies in household production under certain policy combinations. Beyond the ramifications for how economists model household behavior, this study has important policy implications. Policies that strengthen wives' claims to non-land assets without enhancing their claims to land can unintentionally distort incentives for husbands and wives to allocate their scarce resources efficiently, with

negative repercussions on household consumption and poverty status.

The second essay, coauthored with Kate Ambler, Cheryl Doss, and Simone Passarelli, examines a different violation of the assumptions of the collective model: information asymmetries. Information asymmetries between household members are pervasive (Aker et al., 2016; Ambler et al., 2021; Ashraf, 2009; Ashraf, Field, and Lee, 2014; Castilla and Walker, 2013; Fiala and He, 2017). In household surveys, husbands and wives who are asked the same set of survey questions often provide different responses. Using data from Nepal, we document the extent of concordance between spouses regarding the asset ownership and decision making of wives and individuals other than the respondent couple. Given the different power structures, we analyze patterns of concordance separately for couples that reside in joint households with the husband's parents and those that do not. We find that discordance regarding wives' asset ownership and decision making is both substantial and systematic. Wives are much more likely than husbands to report their own participation in asset ownership and decision making, in both joint and separate households. Regarding the involvement of others, the modal response in joint households is concordance that others own assets and make decisions; however, wives are more likely than husbands to acknowledge this.

While discordance in spouses' responses to survey questions is not necessarily indicative of information asymmetries within the household, we argue that at least some of the discordance that we observe can be attributed to information asymmetries. Following Ambler et al. (2021), we consider three explanations for spousal discordance: (1) random measurement error, (2) asymmetric measurement error, and (3) asymmetric information. Random measurement error implies that discordance should be the same across husband and wives and across different assets and decisions. It does not provide insights into household behavior. Asymmetric measurement error implies that husbands and wives interpret questions differently but should not result in differences in the probability of discordance across assets and decisions. Asymmetric information, on the other hand, explains discordance across assets and activities. Although random measurement error and asymmetric measurement error

likely contribute to spousal discordance, the results suggest that there is also asymmetric information in the household, in the form of hidden assets and decisions.

The levels of concordance in responses to questions about who owns assets and makes decisions in a household may hold valuable information about household dynamics and women's well-being. Spousal concordance that wives own assets or make decisions, and discordance in which wives report that they own assets or make decisions, are both correlated with some improved measures of wives' well-being. In households with in-laws present, concordance that others are involved is correlated with worse outcomes for wives. These results highlight that spousal concordance is not necessarily indicative of wives' well-being, particularly in joint households, where the point of agreement is often that the wife does not own assets or make household decisions.

Building on the second essay, the final essay not only documents information asymmetries between spouses but also assesses whether introducing cellular network access to communities in the Philippines can reduce information asymmetries between spouses. I highlight situations in which spouses cannot easily communicate and examine how allowing them to communicate influences financial decisions. Using data from the first randomized control trial to provide communities with cellular network access, I find suggestive evidence that this intervention increased wives' control over household income by reducing information asymmetries between spouses and increasing transfers from husbands to wives. I argue that the findings are consistent with a model of the household in which communication between spouses increases the cost of hiding or withholding income from one's wife and reduces the cost of monitoring one's husband.

I assess whether there are heterogeneous treatment effects on remittances based on who migrates and the length of migration spells. As expected, I find evidence that cellular network access increased the amount of remittances that wives received and the net remittances from their short-term migrant spouses but not from long-term migrant spouses. Short-term migrants spend more time living with their spouse and therefore have more opportunities

than long-term migrants to be penalized for withholding income or hiding information on their income or expenditures, if they are caught doing so. They may also be more likely to be caught since they have fewer opportunities to spend their income prior to returning home. I also find that treatment effects vary depending on who manages the household budget. Treatment increased monthly food and energy expenditures and expenditure shares more in households with women budgeters than for households in which men or men and women jointly manage the budget. Based on previous studies, this is what we would expect if treatment increased the share of income controlled by wives.

Cellular network access may also reduce information asymmetries among cohabitating couples by reducing price variation and the cost of monitoring. I find evidence in support of this hypothesis. Specifically, among households with women budget managers, treatment reduced the absolute difference in reported fish prices and increased agreement between spouses on the price at which the household last sold fish or crops. These findings provide suggestive evidence that cellular networks increase women's control over household resources and reduce information asymmetries regarding agricultural prices in this setting.

Taken together, the findings in this dissertation highlight why policymakers must consider how decisions are made within households, how policies might alter the incentives of household members to cooperate, and who will benefit. Further research is needed to understand decision-making processes within households across diverse contexts. Essays 1 and 3 of this dissertation make the simplifying assumption that households have two decision makers: a husband and a wife. However, other decision makers such as additional wives or parents-in-law, as discussed in the second essay, play an important role in some settings. Complex household structures are understudied in the household literature and require further research.

These essays contribute to a body of literature suggesting that spouses do not necessarily achieve productive efficiency or make binding commitments with full information. While eliminating information asymmetries between spouses might improve household efficiency,

its effects on wives' well-being depends critically on existing gender norms. In the Philippines, introducing cellular network access is likely to increase wives' control over household resources because of existing norms mandating that wives control household budgets. As a result, expenditures more closely reflect their preferences, husbands have incentives to hide their income from their wives, and wives have incentives to monitor their husbands. However, in many other parts of the world, such as Nepal, men typically control most household resources, so wives may circumvent the bargaining process by hiding income, assets, or information from their spouse. Interventions that reduce information asymmetries could be detrimental to women in this context. Understanding existing gender dynamics will improve the design of interventions, but policymakers must also be careful not to reinforce harmful gender norms.

This dissertation provides examples of interventions, or combinations of interventions, that have the capacity to simultaneously enhance household efficiency and enhance women's control over resources. For example, ensuring that all assets are divided equally in the event of divorce in Ethiopia has the potential to both increase household resources—by reducing misallocations of productive resources—and increase the share of those resources that women control. Providing communities in the Philippines with cellular networks similarly increases household income and expenditures (Blumenstock et al., 2022). I argue that it also increases the share of household resources that women control. A large literature addresses the equity-efficiency trade-off, but the two are not necessarily separable (see Klasen (2008) for an overview of this literature and a discussion of why equity is essential for efficiency). Historically, some economists have posited that the "pursuit of efficiency necessarily creates inequalities" (Okun, 1975) while others have argued that poor countries cannot develop unless women have equal access to productive resources (Boserup, 1970). A consensus is emerging that inequalities are detrimental to economic growth.

Discussions regarding the relationship between equity and efficiency often focus on macroeconomic topics. For example, Kabeer and Natali (2013) argues that gender equality

contributes to economic growth. However, these arguments naturally extend to households, which are sites of both production and consumption, competing and collective interests, and private and public goods. Extreme levels of gender inequality may prevent women from marrying or result in the dissolution of households. In cases where each spouse's utility from entering into or remaining in a marriage exceeds their utility from not being married, it is possible that spouses distort their allocations of productive resources when the share of household resources that they control is below some threshold. For example, a lab-in-the-field experiment in Uganda varies both the wage rates that husbands and wives receive for a specific task as well as who receives the payment, finding that when wives' wages increase, but the income goes to the husband, wives lower their effort. When partners are paid separately, the gap between women's and men's output is smaller, relative to when the man receives the payment. However, changing who receives money from production does not systematically affect levels of effort (Masekesa and Munro, 2020). These findings are incompatible with the predictions of either collective or non-cooperative models of the household. Instead, the authors argue that the observed behavior may be explained by certain concepts of fairness and intrahousehold justice. Earlier research on consumption also asserts that individual preferences for equity play a role in household resource allocation and explores how distinct concepts of fairness result in different allocations (Farmer and Tiefenthaler, 1995). These studies suggest that economists need to broaden the ways in which we conceptualize and model household decision making.

Further research is needed to understand decision-making processes within households across diverse contexts in order to design interventions that promote both efficiency and gender equity. If potential gains from cooperation within the household have not been realized, then researchers and policymakers must endeavor to identify interventions that result in efficiency gains while also ensuring that women benefit from those gains. A potentially useful approach to investigating these questions is researching why some household members cooperate while others fail to. Quantitative methods, and especially lab-in-the-field experi-

ments, are well-suited for identifying whether spouses cooperate, but complementing them with qualitative methods could deepen our understanding of why and what to do about it.

References

Aker, J.C., R. Boumnijel, A. McClelland, and N. Tierney. 2016. "Payment Mechanisms and Antipoverty Programs: Evidence from a Mobile Money Cash Transfer Experiment in Niger." *Economic Development and Cultural Change* 65:1–37.

Alderman, H., P.A. Chiappori, L. Haddad, J. Hoddinott, and R. Kanbur. 1995. "Unitary versus collective models of the household: Is it time to shift the burden of proof?" *World Bank Research Observer* 10:1–19.

Ambler, K., C. Doss, C. Kieran, and S. Passarelli. 2021. "He Says, She Says: Spousal Disagreement in Survey Measures of Bargaining Power." *Economic Development and Cultural Change* 69:765–788.

Ashraf, N. 2009. "Spousal Control and Intra-Household Decision Making: An Experimental Study in the Philippines." *American Economic Review* 99:1245–1277.

Ashraf, N., E. Field, and J. Lee. 2014. "Household Bargaining and Excess Fertility: An Experimental Study in Zambia." *American Economic Review* 104:2210–2237.

Blumenstock, J., N. Keleher, A. Rezaee, and E. Troland. 2022. "The Impact of Mobile Phones: Experimental Evidence from the Random Assignment of New Cell Towers." Working paper.

Boserup, E. 1970. *Women in economic development*. London: Earthscan.

Castilla, C., and T. Walker. 2013. "Is Ignorance Bliss? The Effect of Asymmetric Information between Spouses on Intra-Household Allocations." *American Economic Review* 103:263–68.

Chiappori, P.A. 1997. "Introducing Household Production in Collective Models of Labor Supply." *Journal of Political Economy* 105:191–209.

Chiappori, P.A., and O. Donni. 2011. "Non-Unitary Models of Household Behavior: A Survey of the Literature." In A. Molina, ed. *Household Economic Behaviors*. Berlin: Springer, pp. 1–40.

Dercon, S., and J. Hoddinott. 2011. "The Ethiopian Rural Household Surveys 1989-2009: Introduction." Working paper, International Food Policy Research Institute (IFPRI), Centre for the study of African Economies (CSAE), Department of Economics, Addis Ababa University (AAU).

Dey, J. 1981. "Gambian Women: Unequal Partners in Rice Development Projects ?" *The Journal of Development Studies* 17:109–122.

Farmer, A., and J. Tiefenthaler. 1995. "Fairness concepts and the intrahousehold allocation of resources." *Journal of Development Economics* 47:179–189.

Fiala, N., and X. He. 2017. "Unitary or Noncooperative Intrahousehold Model? Evidence from Couples in Uganda." *The World Bank Economic Review* 30:S77–S85.

Kabeer, N., and L. Natali. 2013. "Gender Equality and Economic Growth: Is there a Win-Win?" *IDS Working Papers* 2013:1–58.

Klasen, S. 2008. "The Efficiency of Equity." *Review of Political Economy* 20:257–274.

Lambrecht, I., B. Vanlauwe, and M. Maertens. 2016. "Agricultural extension in Eastern Democratic Republic of Congo: does gender matter?" *European Review of Agricultural Economics* 43:841–874.

Masekesa, F., and A. Munro. 2020. "Intra-household inequality, fairness and productivity. Evidence from a real effort experiment." *World Development* 127.

Okun, A. 1975. *Equality and Efficiency: The Big Tradeoff*. Washington, DC: Brookings Institution Press.

Roy, S., J. Ara, N. Das, and A.R. Quisumbing. 2015. “"Flypaper effects" in transfers targeted to women: Evidence from BRAC’s "Targeting the Ultra Poor" program in Bangladesh.” *Journal of Development Economics* 117:1–19.

Essay 1

Do Property Rights Affect the Efficiency and Intrahousehold Labor Allocations of Rural Ethiopian Households?

Abstract

If the share of land that a husband or wife claims in divorce differs from his or her share of other assets, does this induce inefficient allocations of productive resources? To address this question, I examine the effects of two policies that altered the distribution of property rights upon marital dissolution in Ethiopia: (1) joint land certification, which shifted land rights from husbands to both husbands and wives and (2) changes to regional Family Codes, which shifted non-land rights from husbands to a more equal division between spouses. Using two-way fixed effects, I analyze both panel and repeated cross-sectional data. My results suggest that, when regional Family Codes are in place, joint land certification increases real household consumption per capita and the probability of being above the poverty line relative to households governed by head-only certification. I then examine whether changes in time allocated to off-farm wage labor explain the implied inefficiencies in household production under certain policy combinations.

Acknowledgements

The Ethiopian Rural Household Survey data have been made available by the Economics Department, Addis Ababa University, the Centre for the Study of African Economies, University of Oxford and the International Food Policy Research Institute. Funding for data collection was provided by the Economic and Social Research Council (ESRC), the Swedish International Development Agency (SIDA) and the United States Agency for International Development (USAID); the preparation of the public release version of these data was supported, in part, by the World Bank. AAU, CSAE, IFPRI, ESRC, SIDA, USAID and the World Bank are not responsible for any errors in these data or for their use or interpretation. I am grateful to Ezana Anley for his excellent research assistance in identifying the timing of policy reforms in Ethiopia and to the Henry A. Jastro Scholarship committee for funding this research. I appreciate the useful comments that I received from participants in sessions at the 2021 Agricultural and Applied Economics Association (AAEA) Annual Meeting, the 2021 Northeast Universities Development Consortium (NEUDC) Conference, and the University of California, Davis Department of Agricultural and Resource Economics Development Tea. All errors and omissions are my own.

1.1 Introduction

Policy typically advances incrementally. Political scientists have argued that lofty policy objectives such as alleviating poverty or eliminating gender disparities in control over resources can eventually be achieved through an iterative process of incremental steps.[1] While it is tempting to assume that policy reforms strengthening women's claims to any type of property will unambiguously improve their welfare, it is also possible that such incrementalism could have unintended consequences for women and their families. For example, shifting from a separate property regime, in which all assets are individual property, to a partial community property regime, in which assets brought to marriage are considered personal property while property acquired during marriage is considered the joint property of spouses, is likely to increase the assets that wives would receive upon divorce. However, in many countries, men are more likely than women to acquire land prior to marriage, either through inter vivos transfers from their family at the time of marriage or through government land allocations. Under a partial community property regime, this may give husbands a greater incentive than their wives to invest in the land they brought to marriage. Without laws in place to ensure that wives can claim half the household's land in the event of divorce, such a policy shift could result in inefficiencies such as husbands overinvesting in the land that they brought to the marriage rather than acquiring or investing in other assets.

If incrementalism impedes the productive efficiency of households, this will reduce total household consumption. While it is difficult to predict how a decrease in household consumption will affect the consumption of individual household members, especially because redistributing property rights will increase wives' bargaining power, wives are likely to bear at least some of the burden of lower total household consumption during their marriage. In the resource-constrained context of this study, even small reductions in consumption could have large effects on individuals' welfare. Implementing joint land certification—

[1] See, for example, Lindblom, Charles E. (1959). "The science of 'muddling through'." *Public Administration Review*, 19, pp. 79–88.

or registering land in the names of both husbands and wives—removes this incentive to misallocate resources.

In this paper, I analyze the synergies between two policies that altered the property rights of husbands and wives in Ethiopia: (1) joint land certification, which mandates that land certificates include the names of both husbands and wives and (2) the Revised Family Code (RFC), which stipulates that, upon divorce, each spouse has the right to claim his or her private property, but common property is divided equally between spouses (Federal Democratic Republic of Ethiopia (2000)). Joint certification increased the share of land that women can claim upon divorce, relative to head-only certification or no land certification. Similarly, the RFC increased women's share of other assets upon divorce, relative to the status quo of a separate property regime. If just one of these policies is implemented in isolation, does this cause inefficiencies that are corrected when both policies are in place? That is, is household consumption lower when the share of land that a husband or wife would claim in divorce differs from his or her share of other assets, relative to when the shares are equal across assets? If so, can these inefficiencies be explained by suboptimal labor allocations during the marriage?

An accurate understanding of how government policies affect individual welfare requires correctly modeling household decision making. In particular, the effects of the redistribution of property rights within marriage are sensitive to the choice of household model. Although the empirical literature has rejected unitary models of the household (Alderman et al. (1995)), whether collective or non-cooperative models better characterize households remains an open question. The collective model describes a bargaining process in which household members can make binding commitments and distribution factors are independent of the efficient allocation of productive resources (Chiappori (1997)). Non-cooperative models, on the other hand, allow changes in household members' outside options to affect the Pareto efficiency of their household (see Munro (2018) for a discussion of which household models assume Pareto efficiency). Numerous studies have observed productive inefficiencies (Duflo and Udry, 2004;

Kilic, Palacios-López, and Goldstein, 2015; Rangel and Thomas, 2019; Udry, 1996; Zou, Lybbert, and Vosti, 2021). If households do not necessarily achieve Pareto efficiency in production, it becomes important to consider how policies could affect spouses' incentives to cooperate. In this paper, I develop and test a model that rationalizes the finding that, under certain policy combinations, spouses may fail to cooperate. Individuals may achieve higher utility by sacrificing their household's productive efficiency in order to improve their outside options in the event of marital dissolution.

I build on a non-cooperative model with limited commitment developed by Walther (2018). The collective model suggests that simply redistributing property rights within households should not affect overall household consumption, although it may alter how much individual household members consume. The non-cooperative model, on the other hand, allows for the possibility that households are not allocating productive resources efficiently. The collective model reveals that the efficient solution is for each spouse to equalize the marginal products of off-farm wage labor and on-farm agricultural labor.[2] The non-cooperative model predicts that spouses will undersupply off-farm wage labor when the share of non-land wealth that they keep in divorce is less than their share of land wealth. These labor misallocations will reduce the household's total consumption. Given that the RFC shifts non-land wealth from husbands to a more equal division between spouses, and joint certification does the same for land, the non-cooperative model suggests that implementing both the RFC and joint land certification will (1) increase total household consumption, (2) decrease wives' off-farm labor, and (3) increase husbands' off-farm labor, relative to implementing the RFC without joint land certification. By testing these predictions, I can assess whether there are complementarities between the RFC and joint land certification.

According to the non-cooperative model, efficiency requires that the husband's share of land that he keeps in divorce is equal to his share of other assets. The same is true for

[2]Throughout this paper,"off-farm wage labor" refers to wage labor performed off of the household's land, including wage labor on someone else's farm."On-farm agricultural labor" refers to labor performed on the household's land, and excludes agricultural labor on someone else's farm.

the wife, based on the assumption that no one else claims any of the assets. Importantly, efficiency can be achieved by husbands claiming all of the assets, none of the assets, or anywhere in between, as long as the shares are the same across land and non-land assets. For this reason, households can achieve efficiency when neither the RFC nor joint land certification are implemented or when both policies are implemented. However, the size of each spouse's share will have important implications for equity. Wives are likely better off when they have rights to half of these assets, relative to a scenario in which they do not have any claim to the assets. While this paper focuses on how policies interact to affect the productive efficiency of households, efficiency and equity are not necessarily separable. Policies that reduce gender disparities in rights to land and other assets can achieve the double aim of improving efficiency and gender equity.

Using two-way fixed effects, I analyze panel data from 1477 households in Ethiopia spanning 1994 to 2009 to investigate the effect of joint land certification and revisions to regional Family Codes on total household consumption and individual labor allocations. Variation in the timing of these policy reforms across regions provides a quasi-experiment. These reforms were initiated by changes at the federal level that are plausibly exogenous to the households studied.

By examining the testable implications of the collective and non-cooperative models, I find that the non-cooperative model more accurately depicts the rural Ethiopian households in my sample. When the share of land and non-land assets that each spouse keeps in divorce are equal, monthly real consumption per capita increases by 12.5 percent and the probability of being above the poverty line increases by about 6.9 percentage points, relative to policy regimes in which the wife's share of non-land assets is greater than her share of land.

I then assess whether changes in spouses' time allocated to off-farm wage labor explain the implied inefficiencies in household production that arise under some policy combinations. I do not find any statistically significant differences across treatment groups between the days that individuals worked off the farm. This could be due to the blunt nature of this

measure or individual attrition. It is also possible that an alternative mechanism explains the differences in household consumption. For example, individuals could alter their time allocated to on-farm labor without changing their time allocated to off-farm wage labor. Alternatively, individuals may make strategic investments in land or non-land assets that are not reflected in their labor allocations.

In addition to testing for attrition bias, I also conduct a series of robustness checks, finding that the effects on real monthly consumption per capita and poverty status cannot be explained by differential effects of the policy reforms on the marriage market. The results are robust to the exclusion of individuals who were married after the reforms were implemented and those in polygynous unions. In addition, I conduct a falsification test by analyzing the treatment effects on consumption and poverty status in households in which the head never cohabitated with a spouse. Reassuringly, I do not find any statistically significant differences across treatment groups in this subsample.

Finally, to complement these findings, I conduct a similar analysis using the Demographic and Health Surveys (DHS) for Ethiopia from 2000 to 2011. Relative to the ERHS, the DHS surveys a larger sample of households and covers the entire country, including both rural and urban areas. However, it is not a panel, which precludes controlling for household or individual fixed effects. Despite these differences, the treatment effects on the wealth of rural households are similar in magnitude to the effects on household consumption and poverty status identified using the ERHS. Specifically, the RFC combined with joint land certification increases household wealth indices by 16-17 percent of the baseline means, relative to the RFC combined with head-only land certification. However, the wild bootstrap p-values, employed due to the small number of clusters, imply that these effects are not statistically significant.

This paper contributes to a growing body of research that questions whether the assumptions upon which the collective model is predicated will hold in all contextss (Carter and Katz (1997); Lundberg and Pollak (2003); Chen (2006); Basu (2006); Walther (2018); Zou,

Lybbert, and Vosti (2021)). For example, Lundberg and Pollak (2003) develop a theoretical model in which limited commitment and failure to cooperate explain inefficient household outcomes, but they do not empirically test the model. Walther (2018) proposes a similar model and tests it by comparing labor, consumption, and income in matrilineal and patrilineal communities of Malawi, finding evidence in support of a non-cooperative model. While she presents compelling support for this hypothesis, she cannot rule out the possibility that the results are driven by unobservable differences between matrilineal and patrilineal communities. Unlike Walther (2018), I exploit two sources of variation across time and space to compare the predictions of collective and non-cooperative models. I also present evidence that government policies, as opposed to cultural norms, can affect whether spouses cooperate.

Other studies have employed a difference-in-differences approach to analyze the effect of the RFC on women's labor force participation (Hallward-Driemeier and Gajigo (2015)) and the effect of joint land certification, relative to head-only certification, on human capital investments (Muchomba (2017)). However, these studies ignore the potential interactions between these two policies. An important contribution of this study is the observation that, according to the non-cooperative model, implementing neither policy or both policies will result in more efficient outcomes than implementing one policy in isolation.

A full community property regime, in which all assets are shared upon divorce regardless of how they are acquired or whose name is on the title, would not cause the distortions that can result from partial community property or separate property regimes. However, this may be politically infeasible in many contexts. Among the economies analyzed in the Women, Business and the Law report, 152 have partial community property or separate property regimes and only 6 have full community property regimes (World Bank Group (2018)). It is thus important for policymakers to consider whether changes in family law will affect all assets equally and how policies will interact with land laws. Failure to do so could result in inefficient allocations of productive resources within households.

The paper proceeds as follows. Section 2 describes relevant features of the rural Ethiopian context as well as the land certification and the RFC. Section 3 presents the collective and non-cooperative models of the household and outlines the key hypotheses. Next, I describe the Ethiopian Rural Household Survey data, the sample characteristics, attrition, and the estimation methodology in section 4. Section 5 displays the main empirical results on household wealth and labor allocations of spouses, followed by several robustness checks in section 6. Section 7 presents findings from the DHS and section 8 concludes with directions for future research and a discussion of the policy implications .

1.2 Context

The vast majority of Ethiopia's population lives in rural areas; just 16 percent of the population lives in urban centers (Dorosh and Rashid (2013)). Most Ethiopians (80 percent) depend in some way on agricultural and livestock production, which underscores the importance of access to land (World Bank/IFAD/FAO (2009)). Ethiopia's diversity is evident not only in the number of ethnic and religious groups, languages spoken, agroecological zones, and farming systems, but also in the gender norms and customs surrounding inheritance, ownership of property, and asset division upon divorce (Fafchamps and Quisumbing (2005)). Ethiopia has one of the highest rates of gender inequality in the world, ranking 117th out of 149 countries in the World Economic Forum's gender equality rankings (World Economic Forum (2018)). Recent policies in Ethiopia have aimed to reduce gender inequalities by strengthening women's property rights, from the community-based land certification efforts, which led to joint certification of land to husbands and wives in some regions, to the Revised Family Code (RFC) of 2000, which enhanced women's inheritance and property rights.

1.2.1 Land certification

The Ethiopian People's Revolutionary Democratic Front upheld many of the land policies introduced by the Derg in 1975 in which the state owned all land and distributed use-rights to farmers and livestock keepers. However, the 1995 Constitution provided additional rights to landholders, allowing them to rent land on short-term contracts and hire labor to

cultivate their land (Witten (2007)), while upholding universal access to rural land. The current legal framework still prohibits the sale or purchase of landholdings, but certified use rights are transferable through inheritance, gifting, divorce, and rent, providing some of the advantages of landownership. In addition, the Revised Federal Rural Land Proclamation only allows redistribution of land under specific circumstances, which vary by region (Girma and Giovarelli (2013)).[3]

The Government also devolved some authority from the federal to the regional governments, decentralizing the land administration process, resulting in local variations in land laws. For example, in 1997, a regional land law in Tigray halted land redistribution and granted perpetual user rights to households. In 1998-1999, Tigray became the first region to initiate the land certification process. The Amhara Region piloted a program in 2002, and both Amhara and Oromia started certifying land in 2003, followed by the Southern Nations, Nationalities, and Peoples' Region (SNNPR) in 2005 (Deininger et al. (2008)). As of March 2010, the certification program had registered most of the rural land in Tigray (97%), Amhara (87%), Oromia (85%), and SNNPR (84%). Most regional land proclamations limit migration, the size of land that can be rented out, and the length of the contracts. The regional rules governing the land registration processes, which have important implications for achieving gender equality in land rights, are outlined in detail for Tigray, Amhara, Oromia, and SNNPR in Deininger et al. (2008).

Importantly, Tigray did not mandate that certificates include the names of both husbands and wives, while Oromia, Amhara, and SNNPR did mandate joint certification. In Tigray, where certificates were registered in the name of the household head and do not include photographs, the vast majority of certificates (71 percent) were issued to men, as compared to 14 percent to women, and 13 percent jointly. In Oromia, where one certificate was issued per family with one photograph, 58 percent of certificates were issued in the husband's name only. In Amhara and SNNPR, joint certificates were issued with two names

[3]Tigray and SNNPR do not forbid land redistribution, Oromia only allows redistribution on irrigable land, and Amhara permits redistribution if supported by landholders.

and photographs of both husbands and wives. Less than 9 percent of certificates in Amhara and 21 percent in SNNPR were in the husband's name only (Deininger et al. (2008)).

1.2.2 Revised Family Code

The RFC of 2000 also improved women's legal position within marriage. While the RFC only directly applies to the cities of Addis Ababa and Dire Dawa, the Tigray Region Family Code of 1998 served as a model for the Federal Code and Amhara, Oromia, and SNNPR enacted their own Family Codes based on the RFC. Amhara's Family Code was enacted in 2003 (Proclamation No. 79/2003), followed by Oromia's Family Code in 2004 (Proclamation No. 83/2004) and the SNNPR Family Code in 2004 (Proclamation No. 75/2004).[4] The Tigray Region Family Code was later revised in 2007 (Proclamation 116/2007). The RFC stipulates that a spouse can no longer deny permission for their partner to work outside the home and that, upon divorce, each spouse has the right to claim his or her private property, but common property is divided equally between spouses. Private property is property which a spouse possesses on the day of marriage, property which they acquire after their marriage by succession or donation, or property acquired after marriage by onerous title by one of the spouses. All other property is considered common property (Federal Democratic Republic of Ethiopia (2000)). Men generally wait to marry until after their community allocates them land and are thus more likely than women to bring land into a marriage. If a woman's name is not on the land certificate, it will be difficult for a divorced or widowed woman to claim this land. Women often have low standing in courts, which many have accused of partiality towards men (Muchomba (2017)). Figure 1.1 displays the timing of each of these policies, in addition to the timing of the survey rounds, discussed in more detail below.

1.2.3 Asset Accumulation and Disposition Upon Divorce

Fafchamps and Quisumbing (2002) assess the value of the assets brought to marriage by both the bride and groom, gifts at the time of marriage, and inheritance after marriage, measured for couples married at the time of the 1997 survey (prior to the policy reforms). The majority

[4] Although SNNPR technically introduced their Family Code in 2004, Hallward-Driemeier and Gajigo (2015) categorize it as a late reformer, implying that the changes were implemented in 2005 or later.

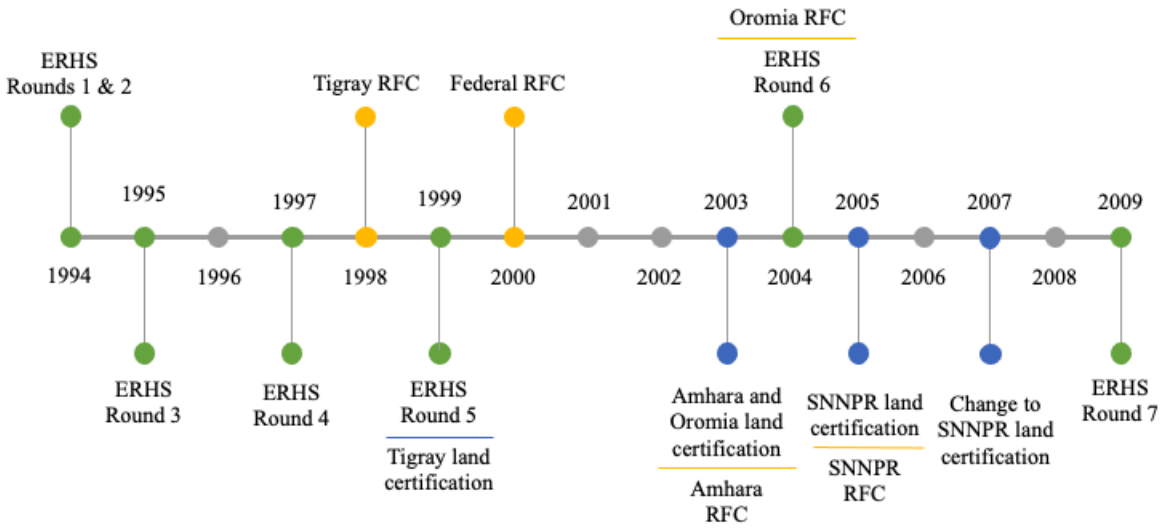

Figure 1.1: Timeline of policy reforms and survey rounds

of household assets are brought to the marriage by the groom or inherited by the husband during marriage. Only a small proportion of the household's asset value originates from gifts at the time of marriage. The large difference in the value of assets brought to marriage by the bride and groom and the relatively small role of gifts from family is likely due to the fact that land is allocated by Peasant Associations (PAs) and men often wait to marry until after receiving a land allocation from the PA. Two-thirds of the land user rights held by households in 1997 were distributed by the PA (Fafchamps and Quisumbing (2002)).

Ownership of assets prior to and during marriage affects asset disposition in divorce. When wives bring land to the marriage or inherit land, they expect to receive more land and jointly-owned livestock in divorce. If their husbands brought large quantities of land into the marriage, wives expect to receive less in a divorce (Fafchamps and Quisumbing (2002)).

Household heads typically control and manage most household assets. The husband alone decides what to grow in more than three-quarters of male-headed households, and he is involved in this decision in over 94 percent of these households. While there is more diversity in who manages livestock, and many decisions are made jointly, household heads are more likely than their spouses to have the right to sell livestock and keep the sale proceeds. However, women are more likely to have the right to keep money generated from the sale of

dairy products, most likely because women process these products. Control and management of assets affects the disposition of assets, and this effect is separate from asset ownership. Fafchamps and Quisumbing (2002) thus argue that the quantity of assets that a woman receives in divorce depends on the extent to which she controls assets during marriage.

While there is a gap between the *de jure* system of asset disposition in divorce and the *de facto* reality, evidence suggests that there was a large shift in perceptions between 1997 and 2009 regarding how land and other assets would be divided in divorce (Kumar and Quisumbing (2013); Kumar and Quisumbing (2015)). This is most likely due to joint certification and revisions to Family Codes, respectively.[5] Both the 1997 and 2009 survey rounds of the ERHS included a series of questions regarding how assets would be divided in divorce. For most respondents, these questions were hypothetical, except in cases in which the respondent had been divorced. The questions distinguish between no-fault divorces and fault-based divorces in which either the husband or wife is at fault. According to Kumar and Quisumbing (2015), the proportion of respondents who perceive that land, houses, and livestock will be split equally between spouses in a no-fault divorce almost doubled from 1997 to 2009. By 2009, the vast majority of respondents believe that these assets would be divided evenly. Livestock acquired after marriage are more likely to be split equally than livestock brought to marriage by either spouse, which is in line with the legal stipulation that assets acquired during marriage are common property. When the wife is at fault, assets are much less likely to be divided evenly. However, there is a substantial increase in the proportion of respondents who report that it would still be split equally and a dramatic decrease in the proportion of respondents reporting that the husband would receive all of the assets. When the husband is at fault, there is a slight increase in perceptions that land, house, and livestock brought to marriage would be divided equally or go to the wife (Kumar and Quisumbing (2015)).

Holden and Tefera (2008), in an analysis of the early impacts of land registration and

[5]Kumar and Quisumbing (2015) also argue that there are synergies between the RFC and a requirement that Land Administration Committees include at least one female member.

certification on women in Oromia and SNNPR, found that having women's names listed on the certificates increased perceptions that they would hold onto their land rights if the marriage were dissolved due to divorce or death. Approximately 41 percent of all wives and 43 percent of polygynous wives believed that having their name and photograph on the certificates would strengthen these rights after marriage. Among wives in polygynous unions, 35 percent of first wives and 51 percent of subsequent wives perceived that having their names and photographs on land certificates would strengthen their position in the case of divorce or death of their husband.

1.3 Theoretical Framework

In this section, I describe collective and non-cooperative models of the household, link these models to the policies described above, and lay out the testable implications of the models.

1.3.1 The Collective Model of the Household

The collective model of the household, formalized by Chiappori (1992), is the most general household model because it incorporates the unitary and cooperative models as special cases. The key assumption is that households are on the Pareto efficient frontier. Based on this assumption, we can model households as maximizing household welfare, which is defined according to Pareto weights on the utilities of individual household members. For simplicity, assume that a household has two agents, a husband (m) and a wife (f), whose utilities are $u^i(x^i)$ for $i = m, f$, where x^i represents individual i's consumption of private goods. Let the husband's Pareto weight be $\mu(z)$, where z is a vector of distribution variables that are independent of preferences and income within marriage but influence outside options and thus bargaining power. We can then define the household's welfare function as

$$W(\mu, z, u^i, x^i) = \mu(z)u^m(x^m) + u^f(x^f) \tag{1.1}$$

Household members can choose to spend their time working in wage labor (L_w^i) for wages (w^i) or working on agricultural land owned by one or both members of the household

(L_a^i). If we normalize their time to 1, their time allocation constraints are $L_a^m + L_w^m = 1$ for the husband and $L_a^f + L_w^f = 1$ for the wife. A represents agricultural productivity, so labor on household agricultural land produces output $AF(L_a^m, L_a^f)$, which is sold at price q. Thus, a household's income is $y = w \cdot L_w + qAF(L_a)$, where $w = (w^m, w^f)$, $L_w = (L_w^m, L_w^f)$, and $L_a = (L_a^m, L_a^f)$. Their budget constraint is $p \cdot \sum_i x^i = y$, where p is a vector of prices for private goods. In the collective model, the household solves

$$\begin{aligned} \max_{x, L_w^m, L_w^f, L_a^m, L_a^f} \quad & \mu(z) u^m(x^m) + u^f(x^f) \\ \text{s.t.} \quad & p \cdot \sum_i x^i = w \cdot L_w + qAF(L_a^m, L_a^f) \\ & L_a^i + L_w^i = 1, \forall i \end{aligned} \tag{1.2}$$

Profit maximization is a necessary condition for (1.2) in a household that produces agricultural goods and hires labor (Chiappori (1997)). Households solve

$$\max_{L_a} qAF(L_a) - w \cdot L_a, \tag{1.3}$$

yielding the following first-order condition:

$$w = qA \frac{dF(L_a)}{dL_a} \tag{1.4}$$

This implies that when households are efficient and there are no market failures, they choose to allocate their labor such that the value of production from an additional hour of on-farm agricultural labor equals the wages they would receive from an additional hour of off-farm wage labor. Labor allocation is independent of the Pareto weight and distribution factors.

1.3.2 The Non-cooperative Model of the Household

Following Walther (2018), I now propose a model in which household bargaining occurs after household members have earned wage income and produced agricultural output. However, since household members know the sharing rule, they take this into account when deciding

how to allocate their labor. As a result, production and consumption decisions are no longer separable.

Let $s^i(z)$ denote the share of wealth allocated to household member i in divorce, as a function of the distribution factors influencing each member's bargaining power. Most bargaining models assume that each individual's outside option determines his or her bargaining power. Since divorce laws and practices affect how much wealth each spouse would receive should their marriage dissolve, they can influence bargaining power within marriage. I define the husband's share of household non-land wealth upon divorce as $\alpha \in [0, 1]$ and his share of land upon divorce as $\lambda \in [0, 1]$. Conversely, if the marriage dissolves, the wife's share of non-land assets is $1 - \alpha$ and her share of land is $1 - \lambda$. The husband's and wife's shares of household wealth sum to 1, so we can define $s^f(z) = 1 - s^m(z)$ and $s^m(z)$ is increasing in z.

Building on Browning et al. (1994), Haddad and Hoddinott (1995), Mazzocco (2007), and Walther (2018), I assume that each member's bargaining power depends on their relative wealth outside of marriage. Chiappori, Fortin, and Lacroix (2002) employ divorce laws as distribution factors and Udry (1996) uses control of land as a proxy for outside options. In a similar vein, I argue that changes in divorce laws and control over land in Ethiopia altered shares of land and non-land assets in divorce for husbands and wives. Specifically, the husband's wealth share upon divorce is[6]

$$z = \frac{\alpha w L_w + \lambda q A F(L_a)}{y}. \tag{1.5}$$

[6]I follow the definition of the share of wealth kept by the husband in divorce employed by Walther (2018). As with any model, this is an abstraction from reality. While we are interested in the value of assets at the time of divorce, we proxy this with current income. A potentially promising approach to incorporating the value of assets at the time of death or divorce is modeling threat points that are endogenous to the investment in land. This could be achieved by adapting the conjugal contract model presented in Carter and Katz (1997). I lay out how I might set up this model in Appendix A. This approach would be especially useful for examining the effects of joint land titling in a context without simultaneous policy changes to the disposition of other assets.

I define the husband's indirect utility as

$$\begin{aligned} V^m(y,z) = \max_x \quad & u^m(x) \\ \text{s.t.} \quad & p \cdot x = s^m(z)y \end{aligned} \tag{1.6}$$

Departing from Walther (2018), I assume that wives also make labor allocation decisions. I define their indirect utility as

$$\begin{aligned} V^f(y,z) = \max_x \quad & u^f(x) \\ \text{s.t.} \quad & p \cdot x = (1 - s^m(z))y \end{aligned} \tag{1.7}$$

In the first stage, the husband and wife make their labor allocation decisions, so the husband solves

$$\begin{aligned} \max_{L_w^m, L_a^m} \quad & V^m(y,z) \\ \text{s.t.} \quad & y = wL_w + qAF(L_a) \\ & z = \frac{\alpha w L_w + \lambda q A F(L_a)}{wL_w + qAF(L_a)} \\ & L_w^m + L_a^m = 1 \end{aligned} \tag{1.8}$$

while the wife solves

$$\begin{aligned} \max_{L_w^f, L_a^f} \quad & V^f(y,z) \\ \text{s.t.} \quad & y = wL_w + qAF(L_a) \\ & 1 - z = \frac{(1-\alpha)(wL_w) + (1-\lambda)(qAF(L_a))}{wL_w + qAF(L_a)} \\ & L_w^f + L_a^f = 1. \end{aligned} \tag{1.9}$$

Next, in the bargaining stage, the household solves

$$\begin{aligned} x^i = argmax_x \quad & u^i(x) \\ \text{s.t.} \quad & p \cdot x = s^i(z)y. \end{aligned} \tag{1.10}$$

As discussed above, since both household members know the sharing rule, they allocate their labor to maximize their shares, so they are actually solving

$$\begin{aligned} \max_{L_w^i, L_a^i} \quad & s^i(z)y \\ \text{s.t.} \quad & L_w^i + L_a^i = 1. \end{aligned} \tag{1.11}$$

The first-order conditions for the husband's optimization problem yield

$$\frac{dy}{dL_w^m} = \frac{dy}{dL_a^m} + \frac{s^{m\prime}(z)}{s^m(z)} \left(\frac{dz}{dL_a^m} - \frac{dz}{dL_w^m} \right) y \tag{1.12}$$

and the first-order conditions for the wife's optimization problem yield

$$\frac{dy}{dL_w^f} = \frac{dy}{dL_a^f} - \frac{s^{f\prime}(z)}{s^f(z)} \left(\frac{dz}{dL_a^f} - \frac{dz}{dL_w^f} \right) y. \tag{1.13}$$

By evaluating $\frac{dz}{dL_a^i}$ and $\frac{dz}{dL_w^i}$ and plugging them into (1.12) and (1.13), we find that for the husband

$$w^m = qA \frac{dF(L_a)}{dL_a^m} + (\lambda - \alpha) \left(F(L_a) + L_w \frac{dF(L_a)}{dL_a^m} \right) \frac{qAw}{y} \frac{s^{m\prime}(z)}{s^m(z)}$$

and for the wife

$$w^f = qA \frac{dF(L_a)}{dL_a^f} + (\alpha - \lambda) \left(F(L_a) + L_w \frac{dF(L_a)}{dL_a^f} \right) \frac{qAw}{y} \frac{s^{f\prime}(z)}{s^f(z)}.$$

Thus, it is clear that, relative to wage labor, the husband oversupplies agricultural labor when $\lambda > \alpha$ and the wife oversupplies agricultural labor when $\alpha > \lambda$. This model rests

on the assumption that working on the land maintains or increases the value of the land. There are, of course, diminishing returns to labor. At some point, overfarming one's land can decrease the value. I assume that labor allocations have not yet reached the optimum.

According to this model, $\alpha = \lambda$ induces efficient labor allocations. The relative wealth shares of husbands and wives will not affect efficiency (as long as they are equitable enough for spouses to remain in the marriage), but they will have distributional effects.[7]

1.3.3 Model Predictions

The collective model suggests that, while policies could alter allocations of labor and capital, any reallocations will be efficient. This implies that overall consumption should not change when property rights are redistributed within the household, although the distribution of consumption among household members may change. The non-cooperative model, on the other hand, allows for the possibility that households are not allocating productive resources efficiently. If policies induce inefficient allocations of labor or capital, this should reduce overall consumption. Figure 1.2 categorizes the policy combinations into a "control" group, with neither land certification nor the RFC, and five treatment groups. It presents how we would expect each policy combination to alter α and λ, relative to the "control" group.

In order to understand the relationship between α and λ in the "control" group, it is useful to consider how assets were typically divided between spouses prior to the policy changes. Fafchamps and Quisumbing (2002) analyze the disposition of assets upon divorce among households whose heads were in monogamous unions during the 1997 survey round. In a no-fault divorce, more than half of respondents report that the husband would keep all of the land, while about 42 percent report that land would be divided equally between the husband and wife. With the exception of houses, non-land assets including livestock and household utensils are more likely than land to be split evenly between spouses. For livestock, the disposition depends on who owns it. Not surprisingly, jointly-owned livestock is more

[7] An incentive compatibility constraint must hold in order for spouses to uphold their marital contract. Spouses can leave the marriage at any time through divorce or separation, but they will only do so if their expected utility outside of marriage is higher than that within marriage for current and future periods.

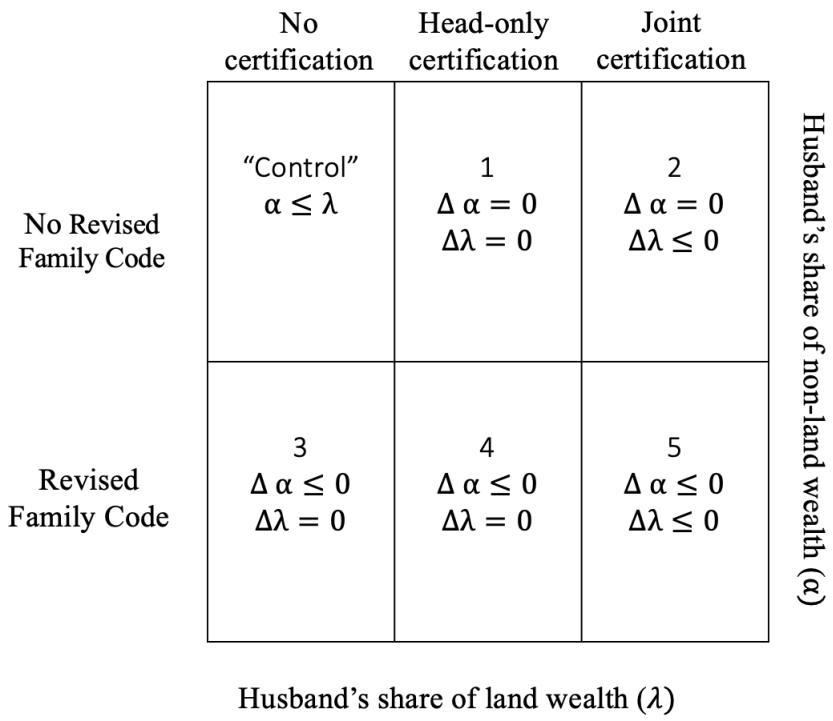

Figure 1.2: Policy treatment groups

likely to be divided evenly than individually-owned livestock. Over half of couples would split household utensils evenly. About a quarter of the respondents distinguish between no-fault and fault-based divorce. If the husband is at fault, this slightly increases the wife's chances of keeping all of the land or livestock in divorce. However, if the wife is at fault, the husband is much more likely to keep all assets (Fafchamps and Quisumbing (2002)). This suggests that, in a typical pre-reform household, the husband is likely to keep at least half of the assets in divorce and the share of land that he keeps is likely greater than the share of non-land assets that he would retain in divorce. That is, in general, $\frac{1}{2} \leq \alpha \leq \lambda \leq 1$ prior to the implementation of any policy reforms.

Given that the status quo is for men to control land, there may be no difference between the control group and treatment 1 in the allocation of property rights between spouses. However, since land certification can increase tenure security and thus household wealth, I focus on comparisons of treatment groups with some form of land certification. Comparing treatment group 4 to group 5 isolates the effects of changes in the husband's share of land

wealth (λ), holding land certification and his share of non-land wealth (α) fixed. Due to the timing of the reforms and ERHS data collection, depicted in Table 1.1, I only observe the control group and treatment groups 4 and 5.[8] I therefore test the following hypothesis of the non-cooperative model:

- Hypothesis 1: Joint land certification combined with the RFC (treatment 5) has a positive effect on consumption, relative to the effect of head-only land certification combined with the RFC (treatment 4).

Based on the model, if $\alpha = \lambda$ in the control group, then I would also hypothesize that consumption in treatment group 2 is lower than in treatment group 1. On the other hand, if $\alpha < \lambda$ in the control group, then consumption in treatment group 2 could be higher than in treatment group 1 if joint land certification decreases λ by a magnitude that diminishes the wedge between α and λ. However, due to the timing of the reforms, I do not observe either form of certification in the absence of the RFC and thus cannot test this prediction.

Table 1.1: Categorization of treatment groups across regions and survey rounds

	1994	1995	1997	1999	2004	2009
Tigray	Control	Control	Control	HeadxRFC (T4)	HeadxRFC (T4)	HeadxRFC (T4)
Amhara	Control	Control	Control	Control	JointxRFC (T5)	JointxRFC (T5)
Oromia	Control	Control	Control	Control	JointxRFC (T5)	JointxRFC (T5)
SNNPR	Control	Control	Control	Control	Control	HeadxRFC (T4)*

Given that I find suggestive evidence in support of the non-cooperative model with limited commitment, I examine potential mechanisms underlying the implied inefficiencies in production. I assess whether policy changes that altered the distribution of property upon divorce caused inefficient allocations of time spent on wage labor. For example, if a woman

[8] Although SNNPR implemented joint land certification, changes to their land proclamation in 2007 stipulated that land held by an individual prior to marriage remains their private property regardless of their marital status (Holden and Tefera (2008)). In the context of my model, this is more akin to head-only certification than to joint certification.

has rights over non-land assets acquired during marriage but does not have any rights over her household's land, we would expect her to allocate more time to off-farm labor.

Based on the collective model, we know that the efficient solution is to equalize the marginal products of wage and agricultural labor ($w = qA\frac{dF(L_a)}{dL_a}$). However, the non-cooperative model with limited commitment predicts that the husband will undersupply wage labor and the wife will oversupply wage labor if $\frac{dz}{dL_a^i} > \frac{dz}{dL_w^i}$. Thus, it is clear that, relative to agricultural labor, the husband undersupplies wage labor and the wife oversupplies wage labor when $\alpha < \lambda$. We should therefore observe that wives are more likely to participate in off-farm wage labor in any treatments in which $\alpha < \lambda$, compared to treatment groups in which $\alpha \geq \lambda$. The opposite labor patterns should hold for husbands. I therefore test the following hypotheses:

- Hypothesis 2: Joint land certification combined with the RFC (treatment 5) decreases wives' off-farm labor and increases husbands' off-farm labor, relative to head-only land certification combined with the RFC (treatment 4).

Ideally, one could distinguish between labor allocated to short-term production and labor allocated to long-term investments in the land. In the absence of such data, I simply assume that some proportion of an individual's labor on the land goes towards maintaining or increasing the value of the land.

Wives obtain higher shares of wealth in divorce in treatment 5 than in the control group or any other treatment group. I refrain from comparing outcomes measuring wives' well-being in treatment 5 to their outcomes in other treatments because it would conflate differences in wealth across treatments with differences in wives' outside options.

1.4 Data and Empirical Strategy

1.4.1 Overview of the Ethiopian Rural Household Survey (ERHS)

The ERHS, panel data collected by the International Food Policy Research Institute (IFPRI), Oxford University, and Addis Ababa University, began in 1989 from 450 households across

7 Peasant Associations in the regions of Amhara, Oromia and SNNPR. As a result of civil conflict, this first round of the survey excluded villages in the region of Tigray. The next round, conducted in 1994, expanded to a total of 1477 households in 15 villages across the country (see Figure 1.3). Additional survey rounds were conducted in 1994-1995, 1995, 1997, 1999, 2004, and 2009 (Dercon and Hoddinott (2011)). In order to take advantage of the panel structure of the data, I do not include the 1989 data in my analysis.

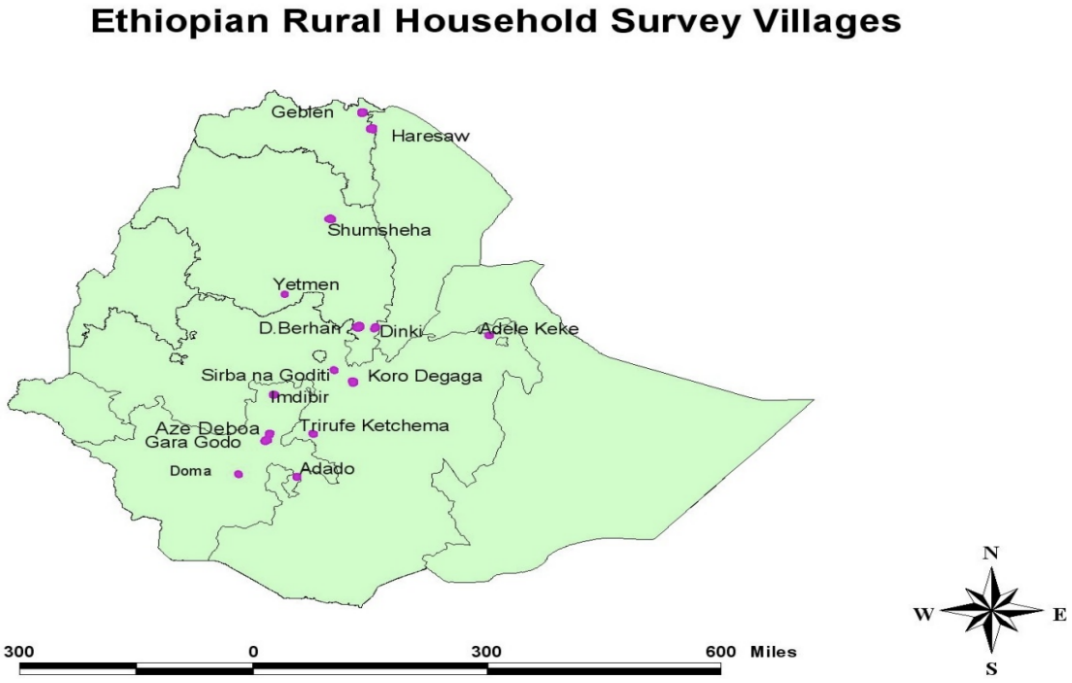

Figure 1.3: Map of ERHS villages (Dercon and Hoddinott (2011))

Researchers selected the 15 villages in order to reflect different farming systems within Ethiopia such as the grain-plough areas of the Northern and Central highlands, enset-growing areas, as well as sorghum-hoe areas. While these 15 villages are not a representative sample of the thousands of rural Ethiopian villages, the sampling frame was stratified across the main agro-ecological zones and sub-zones and one to three villages were selected per strata. Within the study communities, researchers selected households through a stratified random sample. Local Peasant Association officials provided lists of all households in a village.

Sampling was stratified by female-headed and male-headed households.

1.4.2 Sample Characteristics

The ERHS collects data on the current marital status of all household members in 1994 (round 2), 1999, 2004, and 2009 as well as detailed marital histories on certain household members in 1995 and 1997. Among household members 15 and older, rates of divorce appear to be low when inquiring about an individual's marital status at a given point in time (see Table 1.2). However, divorce is quite common, and the small proportion of individuals who are currently divorced reflects that remarriage is also common (Pankhurst (1992)). The proportion of individuals who were ever divorced or separated from a spouse is much higher than the proportion who were divorced or separated at the time of the survey. In 1995, a survey module on marital history was administered to women who were either heads of household or the spouse of the household head. 24% of these women were divorced or separated at some point, although only about 7% of these women were divorced or separated at the time of the survey. On average, these women had married 1.5 times (see Appendix table 1.B.1). In 1997, data on previous unions were collected from both men and women (male household heads and spouses of male household heads). About 42% of male household heads had at least one previous union, while approximately 28% of wives were previously married or cohabitating (see Appendix table 1.B.2). The most common way in which unions ended was divorce, followed by death. Women ex-spouses typically remarried (36%) or returned to living with their parents (34%). Half of the men ex-spouses remarried, while 19% remained in the same place and 18% returned to their parents' home (see Appendix tables 1.B.3 and 1.B.4).

Table 1.2: Current Marital Status, by Gender

Panel A: 1994, Round B

	Men			Women		
	Count	Mean	Std. Dev.	Count	Mean	Std. Dev.
Married or cohabitating	2322	0.56	0.50	2472	0.57	0.50
Divorced	2322	0.02	0.14	2472	0.06	0.23
Separated	2322	0.01	0.10	2472	0.03	0.18
Widowed	2322	0.02	0.14	2472	0.12	0.33
Never married/too young to marry	2322	0.39	0.49	2472	0.22	0.41

Panel B: 1999-2009, pooled

	Men			Women		
	Count	Mean	Std. Dev.	Count	Mean	Std. Dev.
Married (single spouse)	6362	0.47	0.50	6736	0.49	0.50
Single	6362	0.46	0.50	6736	0.29	0.45
Divorced	6362	0.03	0.16	6736	0.07	0.25
Widowed	6362	0.02	0.14	6736	0.14	0.35
Not together for any reason	6362	0.00	0.07	6736	0.01	0.12
More than one spouse	6362	0.02	0.14	6736	0.00	0.04

Table 1.3 displays baseline summary statistics for households in which the household head was ever cohabitating with their spouse.[9] The average real monthly consumption per capita is about 71 Ethiopian birr, measured in 1994 prices.[10] Wives are generally younger and less educated than their husbands. The average household size within the sample is over 6 members. This reflects that almost all of the couples in the sample live in the same household as their children, suggesting that childless couples are uncommon.[11] These households have 1.4 hectares of land, on average. About one-third of husbands are Amharas, one-fifth are Oromos, and one-tenth are Tigrean.

[9] I define a household head as cohabitating if their spouse is listed in the household roster. Data on marital status were not collected in all survey rounds.

[10] Consumption measures all food consumption, including food from one's own stock and gifts, as well as direct consumables such as matches, soap, and clothing. It excludes lumpy expenditures such as those for school, health, or taxes, although data were collected on these expenses. Any items with a one week recall period were scaled up to a month (by 4.28).

[11] While we might expect couples with children to behave differently than childless couples, the lack of childless couples in the present sample precludes analysis of this question. Given that couples with children may cooperate more than childless couples, we can view the results of this analysis as a lower bound on the effects for childless couples.

Table 1.3: Summary Statistics for Households with Cohabitating Couples, 1994

	Count	Mean	Std. Dev
Real monthly consumption per capita (ETB, 1994 prices)	1265	71.29	69.28
Husband's age	1122	45.77	16.12
Husband's age minus wife's age	1049	10.59	7.71
Husband has some schooling	1103	0.51	0.50
Husband's schooling minus wife's schooling	1009	0.21	0.49
Household size	1265	6.27	3.06
Land area (hectares)	1208	1.40	1.37
Husband's ethnicity: Amhara	1117	0.30	0.46
Husband's ethnicity: Oromo	1117	0.22	0.42
Husband's ethnicity: Tigrayan	1117	0.09	0.28
Husband's ethnicity: Other	1117	0.11	0.31

This table presents summary statistics for 1994 (round 1) on couples who ever cohabitated. 1 USD=5.23 ETB (Ethiopian birr) in 1994.

1.4.3 Attrition in the ERHS

Given the long time period covered by the ERHS panel, it is especially important to consider whether attrition is a threat to the internal validity of the results. I test for attrition bias in household wealth outcomes and conclude that attrition is not a major concern. However, I cannot formally test attrition bias in individual labor outcomes.

Previous studies using this panel report that household attrition rates are low: less than 8 percent from 1994 to 1999, 5.2 percent from 1999 to 2004, and 4.89 percent from 2004 to 2009. This is only about 1.2 percent per year from 1994 to 2009 (Dercon and Hoddinott (2011); Kumar and Quisumbing (2013)). Kumar and Quisumbing (2013) assert that it is not necessary to correct for attrition in their analysis because, apart from household size and whether the household owns any oxen, attrition between 2004 and 2009 is not statistically significantly correlated with any household characteristics. However, testing for attrition bias requires an outcome-specific approach (Ghanem, Hirshleifer, and Ortiz-Becerra (2021)).

Ghanem, Hirshleifer, and Ortiz-Becerra (2021) find no consensus on how to test for attrition bias within the literature on randomized control trials (RCTs). They thus lay out the identifying assumptions for average treatment effects in the presence of attrition and de-

rive testable restrictions for two cases: (1) internal validity for the respondent subpopulation (IV-R) and (2) internal validity for the study population (IV-P). The identifying assumption for IV-R is random assignment conditional on response status and the identifying assumption for IV-P is that the unobservables influencing response and the outcome of interest are independent and treatment is randomly assigned.

Table 1.4 displays the attrition rates in columns (1)-(3) for the log of real consumption per capita (panel A) and the proportion of non-poor households (panel B) for control and treated regions in 1999, 2004, and 2009, the three survey rounds conducted after the policies were implemented in at least one region. I define a household as an attritor if there are data on household consumption in both survey rounds conducted in 1994 but not for the follow-up rounds.[12] Since I am employing difference-in-differences rather than analyzing an RCT, I extrapolate from the regression-based tests of mean baseline outcomes proposed in Ghanem, Hirshleifer, and Ortiz-Becerra (2021) to test differences in baseline trends across "treatment" and "control" attritors and respondents. Columns (4)-(9) present the mean difference in outcomes between the second survey round of 1994 and the first survey round of the same year for control and treatment attritors and respondents. Columns (10)-(11) display the p-values for the IV-R test for each treatment group, followed by the IV-P tests in columns (12)-(13).

For the log of real consumption per capita, I fail to reject the IV-R and IV-P assumptions for both treatment groups, implying that I am identifying treatment effects for the respondent subpopulation as well as the study population. For the proportion of non-poor households, I also fail to reject both assumptions for treatment group 4, but I reject both assumptions for treatment group 5. I should therefore be cautious in interpreting the results on that outcome.[13]

[12] Note that the data on consumption are used to construct the variable on a household's poverty status, so the attrition rates are the same across both outcomes.

[13] Appendix table 1.B.5 reports the tests of attrition bias for the sample, including households with heads who never cohabitated with a spouse. The results are largely similar to those for the subsample of cohabitating spouses. The primary difference is that I fail to reject the IV-R assumption for the probability of being above the poverty line for treatment group 5.

In addition to household wealth variables, I also analyze individual labor outcomes. Table 1.5 displays the attrition rates for the days worked off the farm in the previous four months by wives (columns (1)-(3)) and husbands (columns (4)-(6)). An individual attrited if they are observed in 1997 but not in a given follow-up survey round. The attrition rates for these outcomes are much higher than those observed for wealth outcomes, largely due to higher attrition at the individual level than at the household level. The individual labor outcomes were only collected starting in 1997. In 1999, work in labor-sharing agreements were not disaggregated from other off-farm labor, so the data from 1999 are not directly comparable to the other three years. Unfortunately, this precludes analysis of baseline trends in these outcome variables since there is only one year of data prior to the implementation of the policy reforms in Tigray. As a result, I cannot test for attrition bias in these outcomes.

Table 1.4: Attrition Tests for Household Wealth Outcomes, Households with Cohabitating Spouses

	Attrition Rate			Baseline Trends By Group						Tests of IV-R p-value		Tests of IV-P p-value	
				Respondents			Attritors						
	C	T4	T5	C	T4	T5	C	T4	T5	T4	T5	T4	T5
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Panel A. Log of real consumption per capita													
1999	0.062	0.061	.	0.082	0.167	.	0.124	-0.136	.	0.429	.	0.636	.
2004	0.094	0.053	0.115	0.077	0.146	0.070	0.116	0.197	0.217	0.747	0.816	0.886	0.493
2009	.	0.098	0.110	.	0.104	0.066	.	0.017	0.259	.	.	.	.
Panel B. Proportion of non-poor households													
1999	0.062	0.061	.	0.011	0.065	.	0.100	-0.143	.	0.360	.	0.409	.
2004	0.094	0.053	0.115	-0.022	0.056	0.019	-0.026	0.000	0.190	0.468	0.089	0.668	0.024
2009	.	0.098	0.110	.	-0.004	0.014	.	-0.020	0.237	.	.	.	.

The baseline surveys were conducted in 1994. C is the control region(s), which is SNNPR, Amhara, and Oromia in 1999 and SNNPR only in 2004. T4 represents regions and time periods that have implemented head-only land certification and revised Family Codes, which is Tigray in 1999 and 2004 and Tigray and SNNPR in 2009. T5 represents regions and time periods that have implemented joint land certification and revised Family Codes, which is Amhara and Oromia in 2004 and 2009. The tests of IV-R and IV-P are the tests of internal validity for the respondent subpopulation and for the study populations, respectively, described in Ghanem, Hirshleifer, and Ortiz-Becerra (2021).

Table 1.5: Attrition Rates for Labor Outcomes, Households with Cohabitating Spouses

	Days wife worked off-farm			Days husband worked off-farm		
	Control	Treatment 4	Treatment 5	Control	Treatment 4	Treatment 5
	(1)	(2)	(3)	(4)	(5)	(6)
2004	0.521	0.404	0.571	0.276	0.477	0.421
2009	.	0.596	0.753	.	0.565	0.631

The baseline surveys were conducted in 1994. The control region is SNNPR in 2004. Treatment 4 represents regions and time periods that have implemented head-only land certification and revised Family Codes, which is Tigray in 2004 and Tigray and SNNPR in 2009. Treatment 5 represents regions and time periods that have implemented joint land certification and revised Family Codes, which is Amhara and Oromia in 2004 and 2009.

1.4.4 Estimation Methodology

Using two-way fixed effects, I analyze changes in regions across time. Muchomba (2017) also exploits the variation of land certification over time and space in order to examine the impact of Ethiopia's gendered land certification on investments in human capital, asserting that plausibly exogenous changes at the federal level initiated the land tenure reforms. In addition, the author argues that regional differences resulting from land certification are not due to greater participation of women in regions with joint certification, citing the fact that female household members in Tigray were more likely (51%) to attend informational meetings on land certification than in the other three regions (Muchomba (2017)). Hallward-Driemeier and Gajigo (2015) similarly employ a difference-in-differences approach to assess the impact of the RFC on women's outcomes. They confirm that the timing of the roll-out in different areas is not driven by outcomes of interest such as the share of women working outside the home. The only significant difference across early- and late-reformers is the age of first marriage, but there is no trend across age cohorts. Given that households in treated regions and periods may or may not have certified land and there is likely some noncompliance in including wives' names on certificates in joint certification regions, I conduct an intention-to-treat analysis.

Since we would only expect married couples to respond strategically to the policy

reforms, I restrict the sample to households whose heads were cohabitating with their spouse at any point during the survey period.[14] I estimate the following equation:

$$Y_{irt} = \beta_0 + \beta_1 Post_{rt} * RFC_r * LandCert_r + \delta Post_{rt} * RFC_r * Joint_r + \boldsymbol{X'_{it}}\boldsymbol{\zeta} + \theta_t + \eta_i + \epsilon_{irt} \quad (1.14)$$

where Y_{irt} represents the wealth and labor outcomes of interest for household or individual i in region r at time t. These outcomes include the natural logarithm of real monthly consumption per capita, the proportion of households above the poverty line,[15] and days worked off the farm by husbands and wives in the previous four months. $Post_{rt} * RFC_r * LandCert_r$ is an indicator equal to 1 when a household is in a region and time period in which both the RFC and land certification have been implemented, regardless of whether certification is head-only or joint. $Post_{rt} * RFC_r * Joint_r$ is an indicator equal to 1 when a household is in a region and time period with the RFC and joint land certification. Thus, δ represents the additional effect of joint land certification, above and beyond the effect of the RFC and any form of land certification. We can think of this as a triple difference since δ measures the difference between the effects of joint and head-only land certification when the RFC is in place. Recall that, due to the timing of the reforms and data collection, we do not observe the RFC in isolation and therefore cannot include it as a standalone variable in the equation (see Table 1.1). $\boldsymbol{X'_{it}}$ is a vector of controls including household size and land area, θ_t is a year fixed effect, and η_i is a household or individual fixed effect, depending on the outcome. Standard errors are clustered at the region level. Finally, ϵ_{irt} is the error term. I bootstrap the standard errors and test the hypotheses using the wild bootstrap with Webb weights to minimize issues that can arise with too few clusters.[16]

Several recent studies have criticized use of two-way fixed effects (TWFE), documenting

[14] Across all seven survey rounds, between 86 and 88 percent of household heads were cohabitating with a partner.

[15] A household is above the poverty line if monthly real consumption is at least 50 birr per capita.

[16] Colin Cameron and Miller (2015) recommend using the six-point version of Webb (2014) whenever there are less than ten clusters. This increases the possible combinations of weight draws, thus reducing the possibility of spurious precision.

the challenges in interpreting this estimator when there are more than two units and time periods because the coefficient is a weighted average of all of the two-group/two-period difference-in-differences estimators (for example, see Goodman-Bacon (2021) or Callaway and Sant'Anna (2021)). These weights can be negative if the treatment effect varies across time. To my knowledge, no papers have not addressed the issue of how to compare across treatment groups when the timing of different treatments varies. In the absence of methods for correcting for this potential bias, I rely on standard two-way fixed effects. However, it is important to acknowledge the limitations of this approach.

1.5 Results

1.5.1 Wealth

Table 1.6 presents the effects on household wealth of the RFC and any form of land certification as well as the additional effect of joint land certification. I do not analyze income because the consumption data are more complete than the household income data and less susceptible to shocks. The results provide support for hypothesis 1. As predicted, $\delta > 0$ for both the log of real monthly consumption per capita and the probability of being above the poverty line. Specifically, real consumption per capita is 12.5 percent higher under under joint certification and the RFC than under head-only land certification and the RFC. Joint certification also increases the probability of being above the poverty line by 6.9 percentage points, over 13 percent of the baseline mean. These results are similar in magnitude to those from experimental games conducted in Ethiopia and Kenya, which found that spouses left about 15-16 percent of their potential earnings in the hands of the researchers (Kebede et al. (2014); Hoel (2015)). This provides suggestive evidence that policies which promote the equal distribution of all property rights between spouses may increase household consumption. Conversely, policies or norms that provide husbands or wives with greater control over certain types of assets may unintentionally incentivize misallocation of productive resources.

Table 1.6: Wealth Outcomes of Rural Households with Cohabitating Spouses

	(1) Log of real per capita consumption	(2) Probability of being non-poor
Post*RFC*Land Certification	0.012	0.002
	(0.177)	(0.127)
Post*RFC*Joint Certification	0.118	0.069
	(0.065)	(0.038)
HH control variables	Yes	Yes
Year fixed effects	Yes	Yes
Household fixed effects	1,358	1,358
Mean (1994)	3.927	0.522
$\delta > 0$ (Wild p-value)	0.027	0.031
Observations	8,384	8,384
Adjusted R^2	0.146	0.072

Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
Household control variables include household size and land area.

Figure 1.4 displays the unconditional means in the log of real consumption per capita for each survey round by treatment and control for households with cohabitating spouses. Figure 1.5 presents the same information for the probability of being above the poverty line. Both the log of real consumption per capita and the probability of being above the poverty line dropped precipitously from 2004 to 2009 in households with the RFC and head-only certification, compared to households with the RFC and joint certification. The general downward trend in household consumption during this time period is most likely due to the global food price shocks of 2007-08. Households governed by the combination of the RFC and joint certification were more resilient to this shock than households under the RFC and head-only certification. Unfortunately, there is no control group in 2009. Given that the regional Family Codes of Amhara and Oromia were not implemented until 2004, we might not expect to observe differences between the two treatment groups until after 2004. It is thus important to include the final survey round in the analysis.

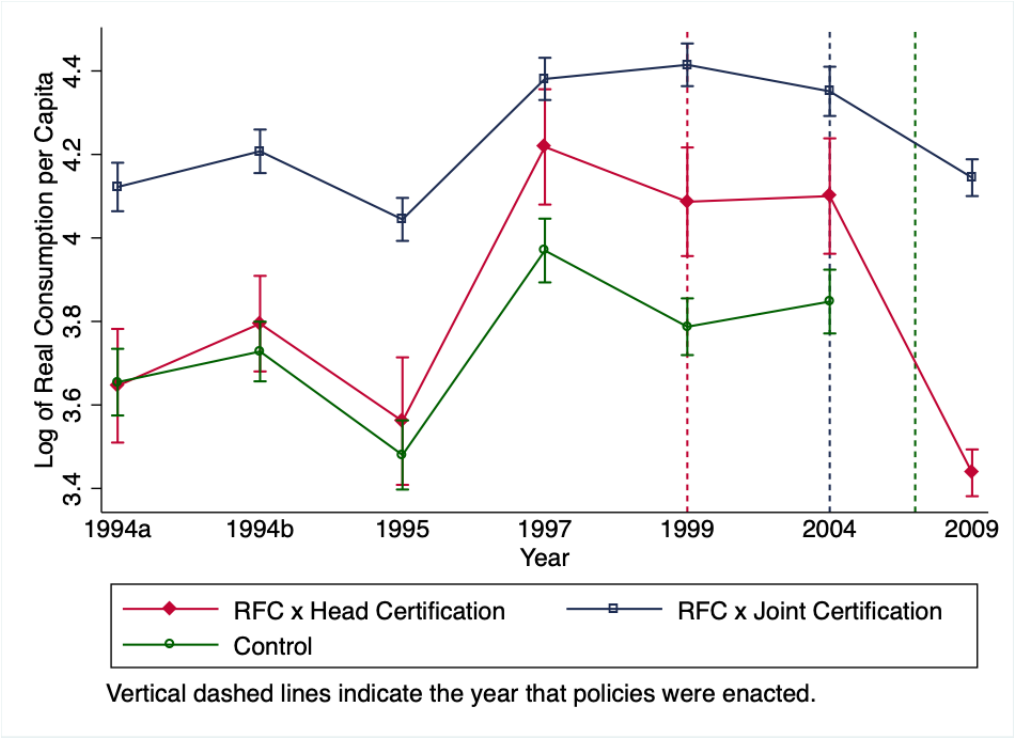

Figure 1.4: Log of real consumption per capita, households with cohabitating spouses

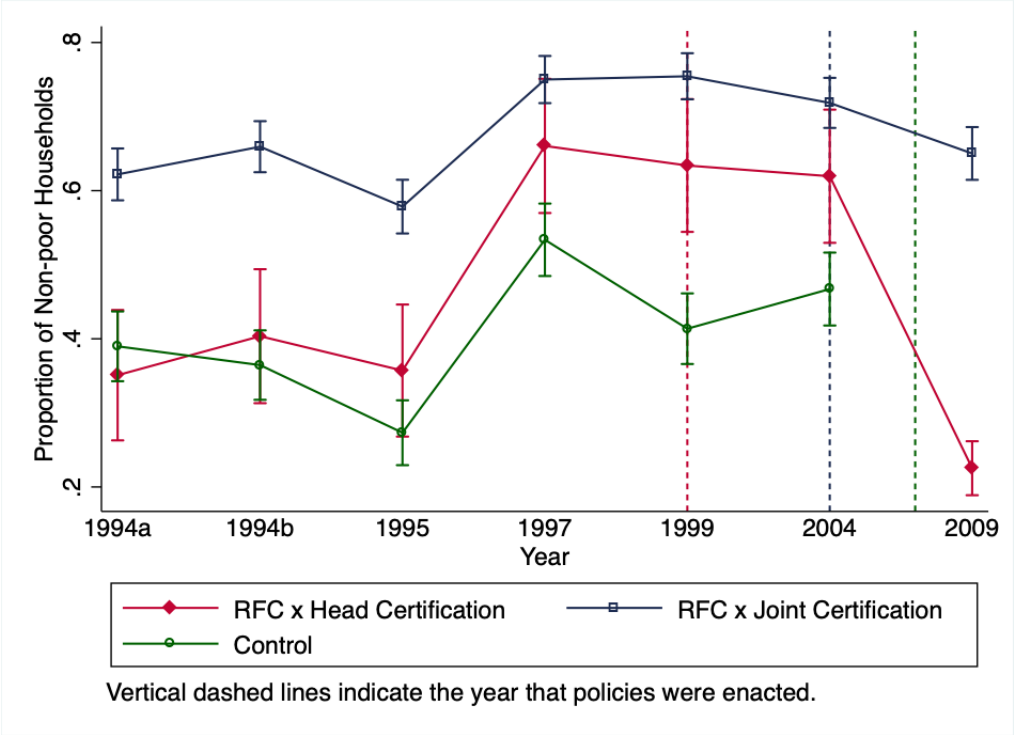

Figure 1.5: Probability of being non-poor, households with cohabitating spouses

1.5.2 Labor Allocation

Table 1.7 displays how the labor allocations of husbands and wives vary across treatment groups. I examine the number of days worked off the farm in the previous four months, either on someone else's land or in some other employment. This excludes days worked in a traditional labor-sharing agreement such as debbo or wonfel. I do not observe any statistically significant differences between the effects of head and joint land certification on days worked off the farm. The direction of the effect is in line with the prediction in hypothesis 2 for wives, but it is the opposite of what I predicted for husbands. Instead, husbands work fewer days off the farm under joint certification and the RFC than under head-only certification and the RFC. Given the lack of statistical significance, it is hard to draw concrete conclusions from the findings. It is possible that the direction of the observed effects are correct, but the measure is simply too blunt. Alternatively, the effects may be biased due to high levels of individual attrition.

Table 1.7: Labor Outcomes for Cohabitating Spouses

	(1) Days wife worked off-farm	(2) Days husband worked off-farm
Post*RFC*Land Certification	-3.330	1.765
	(4.688)	(5.611)
Post*RFC*Joint Certification	-0.073	-3.574
	(3.353)	(2.557)
HH control variables	Yes	Yes
Year fixed effects	Yes	Yes
Individual fixed effects	1,459	1,326
Mean (1997)	1.090	7.069
$\delta < 0$ (Wild p-value)	0.487	
$\delta > 0$ (Wild p-value)		0.925
Observations	2,287	2,396
Adjusted R^2	0.058	0.034

Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Household control variables include household size and land area. Data on days worked off-farm for payment in cash or in kind and days worked in labor-sharing agreements were collected in 1997, 2004, and 2009.

1.6 Robustness Checks

In this section, I conduct a series of robustness checks. First, I assess whether joint certification and the RFC had the same effect on the marriage market as head-only certification and the RFC. I then evaluate if the treatment effects on household consumption per capita and poverty status are the same as those presented in section 5 if I restrict the sample to households whose heads were cohabitating with a spouse in 1997, the last survey round conducted before implementation of any of the policies. I also confirm that the results hold when I exclude households whose heads were ever in a polygynous union. Finally, I conduct a falsification test by analyzing the treatment effects on consumption and poverty status in households in which the head never cohabitated with a spouse.

1.6.1 Marriage Market

Given that the policy reforms of interest alter the disposition of assets upon marital dissolution, I consider whether these reforms affect the marriage market. If so, then any observed effects could potentially be explained by differences in the types of couples who chose to marry after the reforms as opposed to changes in their behavior within marriage. I assess whether either treatment affects the likelihood that adults have never married, are currently married, or are divorced/separated. Among all individuals who were at least 15 years of age at baseline, the majority were married (57 percent of women and 56 percent of men). About 22 percent of women and 39 percent of men had never married, while 9 percent of women and 3 percent of men were divorced or separated at the time of the interview. The panel follows the same household over time, so we cannot observe individuals who leave the household. However, we can assess why individuals left. I thus analyze whether the treatments affect the probability that individuals left the household due to divorce. Almost no one left the household due to divorce between the first two survey rounds, which is to be expected given that these rounds were conducted in the same year. Tables 1.8 and 1.9 show that there are no statistically significant differences between the two treatment groups for women or men.[17]

[17]Note that I am assessing the wild bootstrap p-value to assess statistical significance.

Table 1.8: Marital Status of Women

	(1) Never married	(2) Married	(3) Divorced or separated	(4) Left household due to divorce
Post*RFC*Land Certification	0.029*	-0.023	-0.024*	0.002
	(0.010)	(0.012)	(0.009)	(0.003)
Post*RFC*Joint Certification	-0.024	0.028	0.008	0.021**
	(0.013)	(0.024)	(0.005)	(0.006)
HH control variables	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Individual fixed effects	4,670	4,683	4,670	5,791
Mean (1994, round 2)	0.220	0.570	0.089	0.000
$\delta = 0$ (Wild p-value)	0.458	0.399	0.344	0.136
Observations	9,048	9,063	9,048	17,036
Adjusted R^2	0.015	0.075	0.004	0.020

Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Household control variables include household size and land area. The data on marital status were only collected in the surveys conducted in 1994 (round 2), 1999, 2004, and 2009. The data on reason for leaving the household were collected in every survey round following the first one.

Table 1.9: Marital Status of Men

	(1) Never married	(2) Married	(3) Divorced or separated	(4) Left household due to divorce
Post*RFC*Land Certification	0.009	-0.001	-0.007	0.002
	(0.011)	(0.025)	(0.006)	(0.003)
Post*RFC*Joint Certification	-0.004	-0.044	0.032*	0.006
	(0.026)	(0.044)	(0.013)	(0.006)
HH control variables	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Individual fixed effects	4,504	4,520	4,504	5,490
Mean (1994, round 2)	0.394	0.556	0.031	0.000
$\delta = 0$ (Wild p-value)	0.786	0.627	0.376	0.645
Observations	8,545	8,562	8,545	16,085
Adjusted R^2	0.061	0.041	0.016	0.009

Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Household control variables include household size and land area. The data on marital status were only collected in the surveys conducted in 1994 (round 2), 1999, 2004, and 2009. The data on reason for leaving the household were collected in every survey round following the first one.

1.6.2 Marital status

Although I do not find any statistically significant differences in marital status across treatment groups, one might still be concerned that households whose heads married after the implementation of the policy reforms differ from households married prior to the reforms and that this could be driving the differences in household consumption across treatments. To further address this concern, I restrict the sample to households whose heads were cohabitating with their spouse in 1997, prior to implementation of any of the policy reforms. I find that the treatment effects on household consumption are largely similar to those presented in Table 1.6. Specifically, $\delta > 0$ for both consumption outcomes, but the wild bootstrap p-values suggest that this effect is only statistically significant for the log of real consumption per capita, possibly due to the decreased sample size.

Table 1.10: Wealth Outcomes of Households with Cohabitating Spouses in 1997

	(1) Log of real per capita consumption	(2) Probability of being non-poor
Post*RFC*Land Certification	0.039	0.029
	(0.179)	(0.133)
Post*RFC*Joint Certification	0.108	0.049
	(0.063)	(0.038)
HH control variables	Yes	Yes
Year fixed effects	Yes	Yes
Household fixed effects	1,098	1,098
Mean (1994, round 2)	4.022	0.548
$\delta > 0$ (Wild p-value)	0.036	0.115
Observations	7,112	7,112
Adjusted R^2	0.137	0.066

Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
Household control variables include household size and land area.

1.6.3 Polygynous households

There are several reasons why we might expect polygynous households to behave differently than monogamous households. For example, bargaining dynamics are more complex. In addition, the Rural Land Administration and Use Proclamations of each region differ in their treatment of polygyny. Oromia lists the husband as the holder, followed by a list of all of his wives. SNNPR, on the other hand, lists two holders on the certificate: the husband and his first wife. Parcels are then allocated to each of the remaining wives and registered in a separate certificate with each wife and her husband listed as the holders (Deininger et al. (2008)). However, polygyny is not common in the sample: among male household heads, only about 7% had more than one spouse in 1997 (see Appendix table 1.B.2). It is thus not surprising that excluding polygynous couples from the analysis does not substantively alter the findings. In Table 1.11, I present the treatment effects on household consumption for households that only ever had one spouse listed in the household roster. Similar to the results in Table 1.6, I find that $\delta > 0$ for both outcomes.

Table 1.11: Wealth Outcomes of Households with Cohabitating Spouses, Excluding Polygynous Households

	(1) Log of real per capita consumption	(2) Probability of being non-poor
Post*RFC*Land Certification	0.054	0.036
	(0.138)	(0.108)
Post*RFC*Joint Certification	0.070	0.042
	(0.050)	(0.028)
HH control variables	Yes	Yes
Year fixed effects	Yes	Yes
Household fixed effects	1,175	1,175
Mean (1994)	3.971	0.537
$\delta > 0$ (Wild p-value)	0.033	0.046
Observations	7,237	7,237
Adjusted R^2	0.152	0.075

Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
Household control variables include household size and land area.

1.6.4 Household heads who never cohabitated with a spouse

Based on the theoretical model, a single household head has no incentive to misallocate labor or other resources since they are not affected by policies altering the disposition of assets in divorce. I therefore conduct a "placebo" exercise by comparing consumption across treatment groups among households in which the household head was never cohabitating with a spouse. In this case, we might expect consumption to be the same across treatments 4 and 5. To conduct this falsification test, I re-estimate equation (1.14) using the sample of never cohabitating household heads. The results, presented in Table 1.12, reveal no statistically significant differences in wealth outcomes across treatment groups. This suggests that the additional effect of joint certification presented in Table 1.6 is not due to some peculiarity in the consumption data for these groups.

Table 1.12: Wealth Outcomes for Households Without Cohabitating Spouses

	(1) Log of real per capita consumption	(2) Probability of being non-poor
Post*RFC*Land Certification	-0.070	-0.031
	(0.082)	(0.070)
Post*RFC*Joint Certification	0.200	0.066
	(0.193)	(0.063)
HH control variables	Yes	Yes
Year fixed effects	Yes	Yes
Household fixed effects	236	236
Mean (1994)	3.870	0.493
$\delta > 0$ (Wild p-value)	0.331	0.267
Observations	1,205	1,205
Adjusted R^2	0.229	0.169

Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
Household control variables include household size and land area.

1.7 Analysis of the Demographic and Health Surveys (DHS)

The ERHS has several advantages over the DHS for this analysis. In particular, the ERHS panel started much earlier than the DHS, which began in 2000. Thus, unlike the DHS, the timing of the ERHS surveys enables observation of outcomes in the Tigray region prior to the implementation of any of the policy reforms analyzed in this study. In addition, the panel structure of the ERHS facilitates controlling for unobservable time-invariant household characteristics. The DHS, on the other hand, are repeated cross-sections. Finally, instead of collecting detailed consumption data, the DHS collects the data required to construct a wealth index. However, it is useful to complement analysis of the ERHS with that of the DHS for several reasons. While the ERHS only collects data on four regions, the DHS is nationally representative and collects data on all nine regional states as well as the two city administrations. As a result, the DHS includes a larger sample with more clusters and I can observe the effects of the RFC in the absence of land certification in the DHS (treatment group 3). Moreover, while the ERHS has no control regions in 2009, the additional

geographical units included in the DHS provide controls within each survey round. The DHS also collects additional data on labor outcomes. I therefore present analysis of the DHS in this section, finding that the treatment effects broadly align with those identified using the ERHS.

1.7.1 Overview of the DHS

The DHS are nationally-representative household surveys that cover topics related to population, health, and nutrition in 90 countries. These cross-sectional surveys are typically conducted every five years. The survey includes a household survey as well as individual surveys administered to women and men of reproductive age.[18] Ethiopia first conducted the DHS in 2000, followed by survey rounds in 2005, 2011, and 2016. Given the timing of the policy reforms of interest and the fact that I am comparing the DHS to the ERHS, which ended in 2009, I focus on the first three survey rounds. While all women between the ages of 15 and 49 in sampled households were eligible for the individual interview in every survey round, all men between the ages of 15 and 59 were only eligible for the individual interview starting in 2011. All men in this age range were deemed eligible in every fifth sampled household in 2000 and in every other household in 2005. The sample is designed to produce indicators that are representative at the national, urban, rural, and regional levels. Since I analyze the subsample of the population in which couples responded to the individual questionnaire, I do not include survey weights. As a result, the findings presented here should not be interpreted as representative at any level. However, they do provide useful insights into the behavior of couples across all areas of the country.

1.7.2 Sample Characteristics

Table 1.13 presents summary statistics on the current marital status of all respondents to the individual questionnaires. Among men ages 15 to 59, 53-55 percent were married at the time of each survey. Among women ages 15-49, 57-60 percent were married at the time of each survey. There is a slight rise in the proportion of couples who are living together but

[18]For more information on the DHS, visit https://dhsprogram.com.

not married in 2011, which increased from 1 percent in 2000 and 2005 to 3 percent for men and 4 percent for women in 2011. Men are more likely than women to remain single. About 40-41 percent of men and 26-27 percent of women have never been married. Men have a lower probability of being widowed or divorced at the time of interview, although both are uncommon for men and women. The difference in divorce rates by gender suggests that women remain single after divorce at higher rates than men. In the analysis that follows, I combine the categories of married and living together.

Table 1.13: Current Marital Status, by Gender

Panel A: 2000						
	Men (15-59)			Women (15-49)		
	Count	Mean	Std. Dev.	Count	Mean	Std. Dev.
Never married	2607	0.41	0.49	15367	0.26	0.44
Married	2607	0.54	0.50	15367	0.60	0.49
Living together	2607	0.01	0.10	15367	0.01	0.11
Widowed	2607	0.01	0.10	15367	0.04	0.20
Divorced	2607	0.02	0.15	15367	0.06	0.24
Not living together	2607	0.01	0.10	15367	0.03	0.16
Panel B: 2005						
	Men (15-59)			Women (15-49)		
	Count	Mean	Std. Dev.	Count	Mean	Std. Dev.
Never married	6033	0.41	0.49	14070	0.27	0.45
Married	6033	0.55	0.50	14070	0.60	0.49
Living together	6033	0.01	0.08	14070	0.01	0.12
Widowed	6033	0.01	0.10	14070	0.04	0.20
Divorced	6033	0.02	0.14	14070	0.05	0.21
Not living together	6033	0.01	0.10	14070	0.02	0.15
Panel C: 2011						
	Men (15-59)			Women (15-49)		
	Count	Mean	Std. Dev.	Count	Mean	Std. Dev.
Never married	14110	0.40	0.49	16515	0.27	0.44
Married	14110	0.53	0.50	16515	0.57	0.49
Living together	14110	0.03	0.16	16515	0.04	0.21
Widowed	14110	0.01	0.08	16515	0.04	0.18
Divorced	14110	0.02	0.14	16515	0.06	0.23
Not living together	14110	0.01	0.10	16515	0.02	0.15

For comparability with the ERHS, Table 1.14 displays baseline summary statistics for rural households in which the household head was married or cohabitating with their spouse in 2000. The majority (82 percent) of households in the 2000 DHS are located in rural areas. Similar to the ERHS, wives are, on average, younger and somewhat less educated than their husbands. Husbands appear to be younger in the DHS than in the ERHS, but this may simply reflect that the DHS does not interview men who are older than 59. Most couples have been married for at least 10 years, according to both husbands and wives. The average household size is about 5.6 members. This is slightly smaller than the average household size in the ERHS, which could reflect a decrease in fertility rates between 1994 and 2000. Husbands and wives typically share the same ethnicity. Across both the ERHS and the DHS rural sample, the most common ethnicities are Amhara and Oromo, followed by other ethnicities and Tigrean.

Table 1.14: Summary Statistics for Rural Households Whose Heads Are Married or Cohabitating, 2000

	Count	Mean	Std. Dev
Husband's age	1001	38.96	9.91
Husband's age minus wife's age	1001	8.00	5.77
Husband's years of education	1001	1.30	2.58
Husband's education minus wife's education	1001	0.90	2.22
Wife's report of marital duration: 0-4 years	1001	0.14	0.35
Wife's report of marital duration: 5-9 years	1001	0.20	0.40
Wife's report of marital duration: 10-14 years	1001	0.20	0.40
Wife's report of marital duration: 15-19 years	1001	0.16	0.37
Wife's report of marital duration: 20-24 years	1001	0.12	0.32
Wife's report of marital duration: 25-29 years	1001	0.12	0.32
Wife's report of marital duration: 30+ years	1001	0.07	0.25
Husband's report of marital duration: 0-4 years	1001	0.14	0.34
Husband's report of marital duration: 5-9 years	1001	0.19	0.39
Husband's report of marital duration: 10-14 years	1001	0.16	0.37
Husband's report of marital duration: 15-19 years	1001	0.14	0.35
Husband's report of marital duration: 20-24 years	1001	0.13	0.34
Husband's report of marital duration: 25-29 years	1001	0.13	0.34
Husband's report of marital duration: 30+ years	1001	0.10	0.31
Household size	1001	5.59	2.27
Wife's ethnicity: Other	1001	0.20	0.40
Wife's ethnicity: Affar	1001	0.05	0.22
Wife's ethnicity: Amhara	1001	0.24	0.42
Wife's ethnicity: Guragie	1001	0.03	0.16
Wife's ethnicity: Oromo	1001	0.28	0.45
Wife's ethnicity: Sidama	1001	0.04	0.19
Wife's ethnicity: Somali	1001	0.07	0.26
Wife's ethnicity: Tigrean	1001	0.08	0.27
Wife's ethnicity: Welaita	1001	0.02	0.13
Husband's ethnicity: Other	1001	0.20	0.40
Husband's ethnicity: Affar	1001	0.05	0.23
Husband's ethnicity: Amhara	1001	0.23	0.42
Husband's ethnicity: Guragie	1001	0.02	0.16
Husband's ethnicity: Oromo	1001	0.28	0.45
Husband's ethnicity: Sidama	1001	0.04	0.19
Husband's ethnicity: Somali	1001	0.07	0.26
Husband's ethnicity: Tigrean	1001	0.08	0.27
Husband's ethnicity: Welaita	1001	0.02	0.13

1.7.3 Timing of Policy Reforms

While analyzing the ERHS only required identifying the timing of revisions to Family Codes and land certification in four regions, analyzing the DHS requires information on the timing of these reforms in all regions and chartered cities of Ethiopia. As a result of conflicting or missing information on the timing of policy reforms, this is not a straightforward exercise. I present the policy timing used for this analysis in Table 1.15.[19]

Table 1.15: Categorization of treatment groups across regions and DHS survey rounds

	2000	2005	2011
Tigray	HeadxRFC (T4)	HeadxRFC (T4)	HeadxRFC (T4)
Amhara	Control	JointxRFC (T5)	JointxRFC (T5)
Oromia	Control	JointxRFC (T5)	JointxRFC (T5)
SNNPR	Control	JointxRFC (T5)	HeadxRFC (T4)*
Gambela	Control	Control	RFC only (T3)
Harari	Control	Control	RFC only (T3)
Addis Ababa	Control	RFC only (T3)	RFC only (T3)
Dire Dawa	Control	RFC only (T3)	RFC only (T3)
Affar	Control	Control	Control
Somali	Control	Control	Control
Benishangul-Gumuz	Control	Control	Control

According to Hallward-Driemeier and Gajigo (2015), no region or chartered city in Ethiopia had implemented changes to the Family Code in 2000, but Amhara, Oromia, Tigray, Addis Ababa, and Dire Dawa had done so by 2005. All regions had done so by 2011 (Kumar and Quisumbing (2013) citing an earlier version of Hallward-Driemeier and Gajigo (2011)). The main discrepancies with these categorizations are as follows: first, Tigray implemented changes to their regional Family Code in 1998 prior to the Revised Family Code of 2000, which was modeled on Tigray's code. Second, SNNPR enacted their regional Family Code in February 2004 (Proclamation 75/2004). Finally, Sisay (2015) reports that Afar and Somali had not implemented Family Codes by 2015. To my knowledge, there is also no record of a proclamation revising the Family Code of Benishangul-Gumuz.

[19] Analysis using alternative policy timing does not yield substantively different results. These results are available upon request.

Determining the timing of land certification also poses challenges. All but one of the nine regions in Ethiopia had enacted regional land proclamations by 2011.[20] However, enacting a regional land proclamation does not ensure that land has been registered and certified. For example, Afar enacted a land proclamation in 2009 (Proclamation 49/2009), Benishangul-Gumuz did so in 2010 (Proclamation 85/2010), and Gambela (Proclamation 185/2011) and Harari (Proclamation 98/2011) in 2011, but as of 2015, first level land certification had not taken place in Afar or Benishangul-Gumuz and less than 4 percent of rural households in Gambela and 8 percent in Harari had received certificates. Just 2 percent of rural households in Dire Dawa had received land certificates by 2015.[21] By contrast, between 77 and 99 percent of rural households in Amhara, Oromia, SNNPR, and Tigray had received first level land holding certificates (Hailu (2016)). I therefore make a simplifying assumption that only these four regions had certified land by 2011. As with the analysis of the ERHS, I follow Deininger et al. (2008) to determine the timing of land certification in these four regions.

1.7.4 Estimation Methodology

To increase comparability between the analyses of the ERHS and DHS samples, I restrict the sample to rural households in which the household head and their spouse both responded to the individual questionnaires.[22] I estimate the following equation:

$$Y_{irt} = \beta_0 + \gamma Post_{rt} * RFC_r + \beta_1 Post_{rt} * RFC_r * LandCert_r + \delta Post_{rt} * RFC_r * Joint_r + \boldsymbol{X'_{it}\zeta} + \theta_t + \eta_r + \epsilon_{irt} \quad (1.15)$$

where Y_{irt} represents the wealth and labor outcomes of interest for household or individual i in region r at time t. For wealth, these outcomes include two wealth indices: (1) the wealth

[20] Somali region was the last to do so in 2013 (Proclamation 128/2013).

[21] Dire Dawa includes surrounding rural kebeles, but Addis Ababa is entirely urban.

[22] In the DHS data, 97 percent of respondent couples are the household head and their spouse. It is therefore not surprising that the results are similar across the full sample of rural respondent couples and the sample restricted to rural household heads and spouses (see Appendix Table 1.B.6 compared to Table 1.16).

indices included in the DHS data files for each survey round, constructed using principal component analysis (PCA) and (2) a wealth index that I created using a similar approach but standardizing across all survey rounds. Due to differences in survey questions across rounds, the construction of the official wealth index used by the DHS program varies over time. $Post_{rt} * RFC_r$ is an indicator equal to 1 when a household is in a region and time period in which the RFC has been implemented and no land certification has taken place. $Post_{rt} * RFC_r * Landcert_r$ equals 1 when a household is in a region and time period in which both the RFC and land certification have been implemented, regardless of whether certification is head-only or joint. $Post_{rt} * RFC_r * Joint_r$ equals 1 when a household is in a region and time period with the RFC and joint land certification. Thus, γ represents the effect of the RFC without any land certification. δ has the same interpretation as in equation 1.14: it represents the effect of joint certification and the RFC minus the effect of and head-only certification and the RFC. $\boldsymbol{X'_{it}}$ is a vector of controls including the husband's ethnicity, age, and years of schooling, the wife's ethnicity, the difference in age and years of schooling between the husband and wife, household size, each spouse's report on the duration of the marriage, and whether the household head is a man or woman. θ_t is a year fixed effect and η_r is a regional fixed effect. Standard errors are clustered at the region level.[23] Finally, ϵ_{irt} is the error term.

1.7.5 Results

Wealth

Based on the conceptual framework, I would expect the effect on household wealth of the RFC, in the absence of land certification, to be negative or zero, relative to the control group (see treatment group 3 in Figure 1.2). In Table 1.16, I do not observe any statistically significant effects of the RFC on either wealth index. The model also predicts that $\delta > 0$. That is, relative to head-only land certification and the RFC, joint land certification and the RFC will increase household wealth (see hypothesis 1). In line with this prediction, Table

[23]This includes all regions as well as chartered cities.

1.16 displays that joint land certification increases the household wealth index by about 16-17 percent of the baseline mean (depending on the wealth index). This reinforces the ERHS results presented in section 5.1, which were similar in magnitude. However, these effects are only statistically significant using standard p-values. When I estimate the p-values using the wild cluster bootstrap-t procedure, this effect is not statistically significant. While there are more clusters in the DHS data than in the ERHS, there are still too few clusters for large-sample assumptions to hold.

Table 1.16: Wealth Outcomes of Rural Households Whose Heads are Married or Cohabitating With a Partner

	(1)	(2)
	Wealth index	Wealth index (standardized across survey rounds)
Post*RFC	-0.025	0.284
	(0.087)	(0.409)
Post*RFC*Land Certification	0.075	0.065
	(0.042)	(0.111)
Post*RFC*Joint Certification	0.089**	0.238**
	(0.028)	(0.085)
Control variables	Yes	Yes
Year fixed effects	Yes	Yes
Region fixed effects	Yes	Yes
Control mean (2000)	-0.534	-1.487
$\gamma < 0$ (Wild p-value)	0.428	0.660
$\delta > 0$ (Wild p-value)	0.193	0.175
Observations	8,400	8,400
Adjusted R^2	0.258	0.206

Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The sample is restricted to rural couples in which one member is the household head and both members responded to the individual questionnaire. Control variables are described above.

Labor Allocation

Next, I examine whether wives' labor allocations align with the model predictions. I hypothesize that the RFC will increase wives' off-farm labor and decrease their on-farm labor, relative to the control group. Conversely, I hypothesize that the RFC combined with joint

land certification will decrease wives off-farm labor and increase their on-farm labor, relative to the RFC combined with head-only land certification. Since the DHS does not collect data on whether wives worked on household land in each survey round,[24] I instead examine treatment effects on whether wives (1) work in agriculture for themselves, (2) work in agriculture for a family member, (3) work in agriculture for someone outside of their family, (4) work in any occupation for themselves, (5) work in any occupation for a family member, or (6) work in any occupation for someone other than a family member. All of these outcomes are conditional on the wife working.[25] As expected, Table 1.17 shows that the RFC combined with joint land certification decreases the probability that wives work for non-family members (in agriculture or any other occupation) and increases the probability that they work in any occupation for family members, relative to the RFC and head-only certification. The wild bootstrap p-value is only statistically significant for a one-sided test on whether wives work in any occupation for non-family members. It is not evident *a priori* how the treatments will affect the self-employment of wives. While not statistically significant based on the wild bootstrap p-values, δ is negative for both self-employment in agriculture and self-employment in any field, which could imply that there is less incentive to work for oneself if all assets are divided evenly in divorce.

[24]The DHS does, however, collect data on whether women worked on their own land/family land in 2000 and in 2005, but not in 2011.

[25]The DHS does not count housework as working. Appendix Table 1.B.7 presents the same set of outcomes, but without conditioning on employment. The results are similar.

Table 1.17: Labor Outcomes of Rural Wives

	(1) Works in agriculture (self-employed)	(2) Works in agriculture (for family member)	(3) Works in agriculture (for non-family member)	(4) Works for self	(5) Works for family member	(6) Works for non-family member
Post*RFC	-0.004	-0.064	0.005	0.140	-0.073	-0.067*
	(0.165)	(0.067)	(0.016)	(0.163)	(0.146)	(0.035)
Post*RFC*Land Certification	0.267	0.041	-0.021	0.207***	-0.175*	-0.033
	(0.148)	(0.083)	(0.014)	(0.061)	(0.083)	(0.030)
Post*RFC*Joint Certification	-0.176	0.084	-0.009**	-0.233**	0.262***	-0.029***
	(0.105)	(0.090)	(0.003)	(0.077)	(0.075)	(0.005)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Control mean (2000)	0.396	0.329	0.009	0.555	0.409	0.036
$\gamma =$ (Wild p-value)	0.977	0.478	0.812	0.600	0.653	0.265
$\delta = 0$ (Wild p-value)	0.482	0.563	0.360	0.434	0.420	0.118
Observations	3,811	3,810	3,810	3,858	3,858	3,858
Adjusted R^2	0.426	0.133	0.027	0.108	0.125	0.089

Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The sample is restricted to rural wives in couples in which one member is the household head and both members responded to the individual questionnaire. Control variables are described above. For simplicity, the table presents the wild bootstrap p-values of two-sided tests.

The model predicts that the RFC will increase husbands' labor allocations on household land, relative to the control group, and the RFC combined with joint land certification will decrease their labor on household land, relative to the RFC and head-only certification. In the absence of data on whether rural husbands are working on their own land, I examine treatment effects on whether husbands work in agriculture. Unlike with women, the DHS does not collect data on whether men are self-employed, work for a family member, or work for someone outside of the family. Table 1.18 does not reveal any statistically significant treatment effects on the probability that husbands work in agriculture. This could be a true null result, or it may reflect the fact that the treatments are likely to have opposite effects on self-employment in agriculture and working for people outside of the family. Without more detailed data on individual labor allocations, it is difficult to draw firm conclusions.[26]

[26] As with wives, the results are similar when we do not condition on the husband's employment (see Appendix Table 1.B.8).

Table 1.18: Labor Outcomes of Rural Husbands

	(1) Works in agriculture
Post*RFC	0.037
	(0.032)
Post*RFC*Land Certification	0.005
	(0.026)
Post*RFC*Joint Certification	0.000
	(0.007)
Control variables	Yes
Year fixed effects	Yes
Region fixed effects	Yes
Control mean (2000)	0.916
$\gamma > 0$ (Wild p-value)	0.307
$\delta < 0$ (Wild p-value)	0.478
Observations	8,294
Adjusted R^2	0.133

Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The sample is restricted to rural wives in couples in which one member is the household head and both members responded to the individual questionnaire. Control variables are described above.

Overall, analysis of the DHS data provides some support for the findings presented on the ERHS. However, most of the results are not statistically significant when accounting for the small number of clusters.

1.7.6 Robustness Checks

Marriage Market

Following the approach used to analyze the ERHS, I assess whether any of the treatments affect the marriage market. According to Table 1.19, the RFC did not statistically significantly alter the probability that rural women ages 15 to 49 or rural men ages 15 to 59 were (1) never married, (2) married or cohabitating, (3) widowed, (4) divorced, or (5) not living together. That is, based on the wild bootstrap p-values, we fail to reject the null hypotheses that $\gamma = 0$ for each marriage market outcome. Similarly, there is no statistically significant difference in these outcomes based on the type of land certification (we fail to reject the null hypotheses that $\delta = 0$). This suggests that the observed effects on wealth and labor outcomes cannot be explained by changes in the structure of the marriage market.

Table 1.19: Marital Status of Rural Women

	(1) Never married	(2) Married or cohabitating	(3) Widowed	(4) Divorced	(5) Married, but not cohabitating
Post*RFC	-0.021	-0.033	0.003	0.018*	0.013
	(0.019)	(0.033)	(0.011)	(0.009)	(0.012)
Post*RFC*Land Cert.	-0.022	-0.085*	0.022***	-0.013	0.002
	(0.015)	(0.043)	(0.005)	(0.018)	(0.007)
Post*RFC*Joint Cert.	0.027	0.063*	-0.014*	0.018	-0.002
	(0.018)	(0.030)	(0.007)	(0.014)	(0.005)
Control variables	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes	Yes
Control mean (2000)	0.194	0.692	0.039	0.050	0.018
$\gamma = 0$ (Wild p-value)	0.451	0.512	0.921	0.122	0.516
$\delta = 0$ (Wild p-value)	0.178	0.549	0.298	0.437	0.861
Observations	31,655	31,655	31,655	31,655	31,655
Adjusted R^2	0.382	0.303	0.159	0.085	0.022

Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 1.20: Marital Status of Rural Men

	(1) Never married	(2) Married or cohabitating	(3) Widowed	(4) Divorced	(5) Married, but not cohabitating
Post*RFC	-0.010	-0.040	-0.011**	0.013	0.012**
	(0.011)	(0.026)	(0.004)	(0.011)	(0.005)
Post*RFC*Land Cert.	-0.045	-0.017	-0.001	0.016**	0.005
	(0.029)	(0.027)	(0.005)	(0.006)	(0.005)
Post*RFC*Joint Cert.	0.020	0.044	0.000	-0.017**	-0.008**
	(0.021)	(0.025)	(0.006)	(0.006)	(0.003)
Control variables	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes	Yes
Control mean (2000)	0.359	0.592	0.011	0.026	0.009
$\gamma =$ (Wild p-value)	0.392	0.341	0.167	0.542	0.266
$\delta = 0$ (Wild p-value)	0.398	0.256	0.967	0.219	0.394
Observations	16,226	16,226	16,226	16,226	16,226
Adjusted R^2	0.543	0.470	0.021	0.018	0.008

Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Urban Households

Finally, I conduct a "placebo" exercise by analyzing treatment effects on wealth and labor allocations for urban households. Given that urban households do not typically own and operate agricultural land, I would not expect the RFC alone to cause spouses in urban areas to allocate their productive resources inefficiently nor would I expect the RFC combined with joint land certification to increase efficiency, relative to the RFC with head-only certification. Reassuringly, there are no statistically significant treatment effects for any of the outcomes of interest, based on the wild bootstrap p-values. The patterns also differ from what we observe for rural households, especially for the wealth indices.

Table 1.21: Wealth Outcomes of Urban Households Whose Heads are Married or Cohabitating With a Partner

	(1)	(2)
	Wealth index	Wealth index (standardized across survey rounds)
Post*RFC	0.020	-0.311
	(0.108)	(0.294)
Post*RFC*Land Certification	0.488***	2.011***
	(0.122)	(0.384)
Post*RFC*Joint Certification	-0.529***	-1.995***
	(0.076)	(0.239)
Control variables	Yes	Yes
Year fixed effects	Yes	Yes
Region fixed effects	Yes	Yes
Control mean (2000)	1.524	4.494
$\gamma = 0$ (Wild p-value)	0.900	0.353
$\delta = 0$ (Wild p-value)	0.482	0.466
Observations	2,096	2,096
Adjusted R^2	0.613	0.586

Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The sample is restricted to urban couples in which one member is the household head and both members responded to the individual questionnaire. Control variables are described above.

Table 1.22: Labor Outcomes of Urban Wives

	(1) Works in agriculture (self-employed)	(2) Works in agriculture (for family member)	(3) Works in agriculture (for non-family member)	(4) Works for self	(5) Works for family member	(6) Works for non-family member
Post*RFC	0.028	-0.005	-0.012	0.185*	-0.340	0.156
	(0.029)	(0.018)	(0.012)	(0.085)	(0.207)	(0.128)
Post*RFC*Land Certification	0.048	0.035	-0.069	0.382***	-0.563**	0.180
	(0.046)	(0.026)	(0.048)	(0.120)	(0.250)	(0.178)
Post*RFC*Joint Certification	-0.010	-0.015	-0.001	-0.035	0.160*	-0.125*
	(0.009)	(0.017)	(0.014)	(0.034)	(0.084)	(0.062)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Control mean (2000)	0.017	0.017	0.008	0.513	0.109	0.378
$\gamma = 0$ (Wild p-value)	0.490	0.797	0.334	0.253	0.556	0.712
$\delta = 0$ (Wild p-value)	0.522	0.411	0.945	0.294	0.326	0.320
Observations	1,082	1,082	1,082	1,103	1,103	1,103
Adjusted R^2	0.107	0.077	0.087	0.162	0.193	0.246

Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The sample is restricted to urban wives in couples in which one member is the household head and both members responded to the individual questionnaire. Control variables are described above. For simplicity, the table presents the wild bootstrap p-values of two-sided tests.

Table 1.23: Labor Outcomes of Urban Husbands

	(1) Works in agriculture
Post*RFC	-0.049
	(0.054)
Post*RFC*Land Certification	0.009
	(0.050)
Post*RFC*Joint Certification	0.056**
	(0.021)
Control variables	Yes
Year fixed effects	Yes
Region fixed effects	Yes
Control mean (2000)	0.061
$\gamma = 0$ (Wild p-value)	0.586
$\delta = 0$ (Wild p-value)	0.796
Observations	2,000
Adjusted R^2	0.241

Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The sample is restricted to urban husbands in couples in which one member is the household head and both members responded to the individual questionnaire. Control variables are described above. For simplicity, the table presents the wild bootstrap p-values of two-sided tests.

1.8 Conclusion

Using data from rural Ethiopia, I find suggestive evidence that policies affecting spouses' outside options alter the productive efficiency of agricultural households. Households governed by laws requiring more equal division of property upon marital dissolution have significantly higher per capita consumption than households in regions and time periods in which non-land assets are divided more equally than land. The non-cooperative model presented here suggests that, in theory, efficient outcomes can be achieved if the husband keeps all assets in divorce, the wife keeps all assets in divorce, or they split all assets evenly. In the extreme case in which one spouse retains all assets, one might worry about equity, but the model is silent on this point, relegating it to normative judgements. In this paper, I argue that both efficiency and equity can be achieved if land and non-land assets are divided evenly in divorce.

I also acknowledge that an incentive compatibility constraint must hold in order for spouses to remain married. However, future work on this topic could adapt the non-cooperative model to allow for non-separabilities between efficiency and equity in the household. For example, the model could explicitly incorporate the idea that the wife might distort her labor allocations above some threshold for α or λ. Similar behavior is often observed among spouses playing the ultimatum game, who simply reject shares below a certain threshold.

Further research is also required to better understand the mechanisms driving differences in total consumption across treatment groups. While land certification likely reduces the risk of appropriation from someone outside the household, joint land certification alters claims to land within the household. When husbands hold sole certificates, working on the land should not affect their claim to it upon marital dissolution, although it may increase the value of the land. Wives typically only have joint claims to land. It is plausible that both husbands and wives enhance their claim under joint certification by contributing more to on-farm labor. Given the data available, I cannot directly analyze the effect of joint certification on husbands' and wives' on-farm labor. Thus, it is possible that husbands and wives are altering their on-farm labor, even if they do not change their off-farm labor. It is also possible that the observed inefficiencies are caused by changes in investments in land and non-land assets that are unrelated to the time allocations of husbands or wives. For example, an individual could invest in their land by hiring someone to plant trees or install an irrigation system. This study focuses on potential labor misallocations. However, the model could be extended to produce predictions on the allocation of capital. The ideal data set for future analyses on this topic would include data on hours worked on investments in the value of the land, hours worked off-farm (paid or unpaid), and hours spent on leisure activities as well as information on capital investments and who made decisions regarding such investments.

The extensions to the model proposed above may further enhance its ability to accurately describe spouses' behavior. However, the differences in household consumption across

treatment groups suggest that the non-cooperative model better reflects the behavior of the average household head and spouse in the study context than does the collective model. Beyond the ramifications for how economists model household behavior, this study has important policy implications. The results suggest that policies can unintentionally distort incentives for husbands and wives to allocate their scarce resources efficiently, with negative repercussions on household consumption. While few studies investigate complementarities in government policies, those that do find that it is important to consider how policies regulating divorce and property rights interact with one another (for example, see Voena (2015) and Kumar and Quisumbing (2015)). Kumar and Quisumbing (2015) examine the mutually reinforcing effects of the RFC and a requirement that Land Administration Committees, which helped oversee the land certification process at the local level, include at least one female member. The authors find that each policy improves women's rights and welfare and the two policies complement each other. My results suggest that implementing both the RFC and joint land certification increases household consumption relative to implementing the RFC with head-only certification.

Joint certification is an appealing method for strengthening women's land rights, particularly when providing individual certificates for men and women in the same household is not a feasible policy option. Beyond potentially enhancing women's bargaining power and strengthening their claim to land should their marriage dissolve, these policies may also increase the efficiency of agricultural households. However, if implemented without laws in place to ensure equitable division of other assets upon marital dissolution, joint land certification could foster inefficient labor and capital allocations. Understanding what combination of policies effectively increase household consumption while reducing gender inequalities can help inform how governments design reforms.

References

Alderman, H., P.A. Chiappori, L. Haddad, J. Hoddinott, and R. Kanbur. 1995. "Unitary versus collective models of the household: Is it time to shift the burden of proof?" *World Bank Research Observer* 10:1–19.

Basu, K. 2006. "Gender and Say: a Model of Household Behaviour with Endogenously Determined Balance of Power." *Economic Journal* 116:558–580.

Browning, M., F. Bourguignon, P.A. Chiappori, and V. Lechene. 1994. "Income and Outcomes: A Structural Model of Intrahousehold Allocation." *Journal of Political Economy* 102:1067–1096.

Callaway, B., and P.H. Sant'Anna. 2021. "Difference-in-Differences with multiple time periods." *Journal of Econometrics* 225:200–230.

Carter, M.R., and E.G. Katz. 1997. "Separete Spheres and the Conjugal Contract: Understanding the Impact of Gender-Biased Development." In *Intrahousehold Resource Allocation in Developing Countries*. pp. 95–111.

Chen, J.J. 2006. "Migration and Imperfect Monitoring: Implications for Intra-Household Allocation." *American Economic Review* 96:227–231.

Chiappori, P.A. 1992. "Collective Labor Supply and Welfare." *Journal of Political Economy* 100:437–467.

—. 1997. "Introducing Household Production in Collective Models of Labor Supply." *Journal of Political Economy* 105:191–209.

Chiappori, P.A., B. Fortin, and G. Lacroix. 2002. "Marriage Market, Divorce Legislation, and Household Labor Supply." *Journal of Political Economy* 110:37–72.

Colin Cameron, A., and D.L. Miller. 2015. "A practitioner's guide to cluster- robust inference." *Journal of Human Resources* 50:317–372.

Deininger, K., D.A. Ali, S. Holden, and J. Zevenbergen. 2008. "Rural Land Certification in Ethiopia: Process, Initial Impact, and Implications for Other African Countries." *World Development* 36:1786–1812.

Dercon, S., and J. Hoddinott. 2011. "The Ethiopian Rural Household Surveys 1989-2009: Introduction." Working paper, International Food Policy Research Institute (IFPRI), Centre for the study of African Economies (CSAE), Department of Economics, Addis Ababa University (AAU).

Dorosh, P.A., and S. Rashid. 2013. "Food and Agriculture in Ethiopia: Progress and Policy Challenges." *IFPRI Issue Brief* 74.

Duflo, E., and C. Udry. 2004. "Intrahousehold Resource Allocation in Côte D'Ivoire: Social Norms, Separate Accounts and Consumption Choices." Working paper, National Bureau of Economic Research.

Fafchamps, M., and A.R. Quisumbing. 2005. "Assets at marriage in rural Ethiopia." *Journal of Development Economics* 77:1–25.

—. 2002. "Control and ownership of assets within rural Ethiopian households." *Journal of Development Studies* 38:47–82.

Federal Democratic Republic of Ethiopia. 2000. "The Revised Family Code Proclamation No. 213/2000." Working paper, Federal Democratic Republic of Ethiopia, Addis Ababa.

Ghanem, D., S. Hirshleifer, and K. Ortiz-Becerra. 2021. "Testing for Attritiona Bias in Field Experiments." Unpublished.

Girma, H., and R. Giovarelli. 2013. "Focus on Land in Africa Brief: Gender Implications of Joint Land Titles in Ethiopia." Working paper.

Goodman-Bacon, A. 2021. "Difference-in-differences with variation in treatment timing." *Journal of Econometrics* 225:254–277.

Haddad, L., and J. Hoddinott. 1995. "Does female income share influence household expenditures? Evidence from Côte d'Ivoire." *Oxford Bulletin of Economics and Statistics* 57:77–96.

Hailu, Z. 2016. "Land Governance Assessment Framework Implementation in Ethiopia: Final Country Report." Working paper.

Hallward-Driemeier, M., and O. Gajigo. 2015. "Strengthening economic rights and women's occupational choice: The impact of reforming ethiopia's family law." *World Development* 70:260–273.

Hoel, J.B. 2015. "Heterogeneous households: A within-subject test of asymmetric information between spouses in Kenya." *Journal of Economic Behavior and Organization* 118:123–135.

Holden, S., and T. Tefera. 2008. "From Being Property of Men to Becoming Equal Owners? Early Impacts of Land Registration and Certification on Women in Southern Ethiopia." Working paper, UNHABITAT, Shelter Branch, Land Tenure and Property Administration Section.

Kebede, B., M. Tarazona, A. Munro, and A. Verschoora. 2014. "Intra-household efficiency: An experimental study from Ethiopia." *Journal of African Economies* 23:105–150.

Kilic, T., A. Palacios-López, and M. Goldstein. 2015. "Caught in a productivity trap: A distributional perspective on gender differences in Malawian agriculture." *World Development* 70:416–463.

Kumar, N., and A.R. Quisumbing. 2013. "Gendered impacts of the 2007-2008 food price crisis: Evidence using panel data from rural Ethiopia." *Food Policy* 38:11–22.

—. 2015. "Policy Reform toward Gender Equality in Ethiopia : Little by Little the Egg Begins to Walk." *World Development* 67:406–423.

Lundberg, S.J., and R.A. Pollak. 2003. "Efficiency in Marriage." *Review of Economics of the Household* 1:153–167.

Mazzocco, M. 2007. "Household intertemporal behaviour: A collective characterization and a test of commitment." *Review of Economic Studies* 74:857–895.

Muchomba, F.M. 2017. "Women's Land Tenure Security and Household Human Capital: Evidence from Ethiopia's Land Certification." *World Development* 98:310–324.

Munro, A. 2018. "Intra-Household Experiments: A Survey." *Journal of Economic Surveys* 32:134–175.

Pankhurst, H. 1992. *Gender, development and identity: an Ethiopian study*. London: Zed Books.

Rangel, M., and D. Thomas. 2019. "Decision-Making in Complex Households." Unpublished.

Sisay, M.G. 2015. "Departure of Ethiopian Family Laws: The Need To Redefine The Place of Societal Norms In Family Matters." *Haramaya Law Review* 4:81–105.

Udry, C. 1996. "Gender, Agricultural Production, and the Theory of the Household." *Journal of Political Economy* 104:1010–1046.

Voena, A. 2015. "Yours , Mine , and Ours: Do Divorce Laws Affect the Intertemporal Behavior of Married Couples?" *American Economic Review* 105:2295–2332.

Walther, S. 2018. "Noncooperative decision making in the household: Evidence from Malawi." *Journal of Development Economics* 134:428–442.

Webb, M. 2014. "Reworking Wild Bootstrap Based Inference for Clustered Errors." Working paper, Economics Department, Queen's University.

Witten, M.W. 2007. "The Protection of Land Rights in Ethiopia." *Afrika Focus* 20:153–184.

World Bank Group. 2018. "Women, Business and the Law." Working paper, Washington, DC.

World Bank/IFAD/FAO. 2009. *Gender in Agriculture Sourcebook Gender in Agriculture*. Washington, DC: The World Bank.

World Economic Forum. 2018. *Insight Report: The Global Gender Gap Report 2018*.

Zou, W., T.J. Lybbert, and S.A. Vosti. 2021. "A United Family Prospers: Intrahousehold Economic Discord, Household Income and Child Growth in Burkina Faso."

1.A Appendix A: Adapting the Conjugal Contract Model

In the simple conjugal contract model described in Carter and Katz (1997), the husband and wife each consume a private good as well as a public good. The production of this public good links their decisions regarding how to allocate their labor. They define θ as an income transfer from husbands to wives. A positive income transfer will induce wives to increase their time allocated to production of the public good. They discuss the process through which the conjugal contract is determined, which is influenced by each partner's "voice" and their "exit" options. In order to examine how joint land certification, which strengthens the wife's exit option while weakening the husband's exit option, influences the equilibrium income transfer and spouse's labor allocations and consumption, I adapt this model as follows.

First, I define the wife's utility maximization problem

$$\begin{aligned} &\max_{x_f, l_f^w . l_f^I} U_f(x_f(\theta)) \\ &s.t.\ l_f^w + l_f^I \leq L_f \\ &p_f x_f \leq w_f l_f^w + \theta(l_f^I, \hat{l}_m^I) \end{aligned} \tag{1.16}$$

where x_f represents the wife's consumption, θ is a monetary transfer from husbands to wives, l_f^w is the amount of time the wife allocates to wage labor, l_f^I is the wife's time allocated to investments in household land, and the sum of these cannot exceed the wife's total time available for labor. The wife's purchase of x_f at the gender-specific price p_f is constrained by the amount of income that she receives for her wage labor at the gender-specific wage rate w_f plus the monetary transfer from her husband.

The husband's utility maximization problem is

$$\begin{aligned} &\max_{x_m, l_m^w . l_m^I} U_m(x_m(\theta)) \\ &s.t.\ l_m^w + l_m^I \leq L_m \\ &p_m x_m \leq w_m l_m^w - \theta(\hat{l}_f^I, l_m^I) \end{aligned} \tag{1.17}$$

Note that θ is a function of the amount of time that each spouse allocates to investment in the land, a deviation from Carter and Katz (1997). $\hat{l}_m^I$ represents the wife's conjecture regarding the amount of labor her husband will supply towards investing in the value of the land, whereas $\hat{l}_f^I$ is the husband's conjecture about the amount of labor his wife will contribute to maintaining or increasing the value of the land.

Unlike the model presented in Carter and Katz (1997), there is no public good in this model. Thus, the husband will only transfer money to his wife if he wants to induce greater investment of her time towards increasing or maintaining the value of the land. His incentive to make this transfer depends on how the value of the land ($A(l_f^I, l_m^I)$) would be distributed in the event of a divorce. I define his share of the value of land that he keeps in divorce as α and the wife's share is $1 - \alpha$. If $\alpha < 1$, then the wife also has incentives to invest her own labor in maintaining or increasing the value of the land.

Each spouse solves their individual optimization problem by treating the amount of time their partner will contribute to land investments as fixed. The optimization produces a set of conditional demand and supply functions that are considered "best-reply mappings."

The Lagrangian for the wife is

$$\mathcal{L}_f = U_f(x_f(\theta(l_f^I, \hat{l}_m^I))) + \lambda_f * [(w_f * (L_f - l_f^I) + \theta(l_f^I, \hat{l_m^I}) - p_f x f] \tag{1.18}$$

The first-order conditions for interior solutions are

$$\frac{\partial \mathcal{L}}{\partial x_f} : \frac{\frac{\partial U_f}{\partial x_f}}{p_f} = \lambda_f \tag{1.19}$$

$$\frac{\partial \mathcal{L}}{\partial l_f^I} : \frac{\partial U_f}{\partial x_f(\theta(l^I))} \frac{\partial x_f}{\partial \theta(l^I)} \frac{\partial \theta}{\partial l_f^I} = \lambda_f \left[w_f - \frac{\partial \theta}{\partial l_f^I} + p_f \frac{\partial x_f}{\partial \theta} \frac{\partial \theta}{\partial l_f^I} \right] \tag{1.20}$$

$$\frac{\partial \mathcal{L}}{\partial \lambda_f} : w_f * (L_f - l_f^I) + \theta(l_f^I, \hat{l_m^I}) - p_f x f = 0 \tag{1.21}$$

The husband can increase the value of the land (A) either by increasing l_m^I or by increasing θ, which will increase l_f^I by increasing the wife's consumption of her private good, reducing $\frac{\partial U_f}{\partial x_f}$, and thus lowering the shadow price of her own income.

Next, I consider how the conjugal contract might be determined. Following Carter and Katz (1997), I define the wife's indirect utility from exiting the marriage as V_f^e and the husband's indirect utility from leaving the marriage as V_m^e. While Carter and Katz (1997) do not specify how these are determined, I define these indirect utilities as a function of the value of land and the share of that land that each spouse keeps in divorce. If spouses are non-cooperative, then $\theta = 0$. However, if spouses cooperate, then we can define a Nash-cooperative bargaining model for determining the conjugal contract as follows:

$$\begin{aligned} \max_{\theta, l^I} N = [V_f^*(\theta(l^I)) - V_f^e(\alpha, A(l^I)][V_m^*(\theta(l^I)) - V_m^e(\alpha, A(l^I)] \\ s.t.\ \theta \leq Y_m^* \\ V_f^* \geq V_f^e \\ V_m^* \geq V_m^e \end{aligned} \tag{1.22}$$

where Y_m^* is the husband's monetary income, which must be at least as large as his monetary transfer to his wife. For simplicity, I do not present notation indicating dependence on prices and other factors. In order for spouses to remain married, a requirement for bargaining, their indirect utility within marriage must be at least as large as their indirect utility from exiting

the marriage. The first-order conditions are

$$\frac{\partial V_f^*}{\partial \theta} G_m + \frac{\partial V_m^*}{\partial \theta} G_f \geq 0 \tag{1.23}$$

$$\frac{\partial V_f^*}{\partial \theta}\frac{\partial \theta}{\partial l^I} G_m + \frac{\partial V_m^*}{\partial \theta}\frac{\partial \theta}{\partial l^I} G_f \geq \frac{\partial V_f^e}{\partial A}\frac{\partial A}{\partial l^I} G_m + \frac{\partial V_m^e}{\partial A}\frac{\partial A}{\partial l^I} G_f \tag{1.24}$$

where $G_m = V_m(\theta) - V_m^e$ is the husband's gain from bargaining and $G_f = V_f(\theta) - V_f^e$ is the wife's gain from bargaining.

Historically, husbands in Ethiopia typically kept most of the land in divorce. In theory, mandating joint titling reduces the husband's share so that $\alpha = 1/2$. Under the assumptions of the model, this implies that husbands and wives have the same exit constraint under joint titling. Let V_{k0}^e denote spouse k's indirect utility exit constraint before joint titling and let V_{k1}^e denote spouse k's indirect utility after the policy change. The new Nash-cooperative bargained conjugal contract will be determined by maximizing the following

$$[V_f^*(\theta(l^I)) - V_{f1}^e(\alpha, A(l^I))][V_m^*(\theta(l^I)) - V_{m1}^e(\alpha, A(l^I))] \tag{1.25}$$

By adding and subtracting V_{m0}^e and V_{f0}^e, we can rewrite this as

$$[(V_f^* - V_{f0}^e)(V_m^* - V_{m0}^e)] + [(V_f^* - V_{f0}^e)(V_{m0}^e - V_{m1}^e)] + [(V_m^* - V_{m0}^e)(V_{f0}^e - V_{f1}^e)] + [(V_{f0}^e - V_{f1}^e)(V_{m0}^e - V_{m1}^e)] \tag{1.26}$$

The first term is what Carter and Katz (1997) describe as a reallocation effect on the conjugal contract and the second and third terms represent the bargaining effect.

1.B Appendix B: Tables

Table 1.B.1: Summary Statistics on Women's Marital History, 1995

	Count	Mean	Std. Dev.
Proportion ever divorced or separated	1480	0.24	0.43
Number of times married	1341	1.50	0.87
Age at first marriage	1320	16.45	4.65
If female headed, years as head	351	9.42	10.32
If marriage ended, years of marriage	844	12.53	17.86
Current marital status			
Single	1369	0.08	0.27
Legally married	1369	0.75	0.44
Other types of union	1369	0.02	0.14
Separated	1369	0.02	0.12
Divorced	1369	0.05	0.21
Widowed	1369	0.09	0.29
Type of union			
Monogamous marriage	1976	0.86	0.35
Polygamous marriage	1976	0.13	0.34
How union ended			
Death of husband	902	0.28	0.45
Divorce	902	0.54	0.50
Separation	902	0.09	0.29

This represents the responses of women who are the household head or spouse of the head. The survey treats living together as if married. For type of union, the count is the number of marriages. For years of marriage and and reason for end of union, the count is the number of marriages that ended. For all other variables, the count represents the number of women.

Table 1.B.2: Summary Statistics on Marital History, 1997

	Count	Mean	Std. Dev.
Male household head in polygynous union	1008	0.07	0.26
Male household head had at least one previous union	1075	0.42	0.49
Female spouse of household head had at least one previous union	1079	0.28	0.45
Number of previous unions of male household head	1075	0.76	1.22
Number of previous unions of female spouse of household head	1079	0.42	0.92

Table 1.B.3: Summary Statistics for Previous Unions of the Household Head, 1997

	Count	Mean	Std. Dev.
Married to previous spouse	1196	0.96	0.20
How long did you live together?	1157	9.89	11.25
Union formally ended	936	0.80	0.40
How union ended			
Death	997	0.44	0.50
Divorce	997	0.51	0.50
Annulment	997	0.01	0.11
Repudiation	997	0.04	0.20
Where ex-spouse went after marriage ended			
To a previous spouse	760	0.05	0.22
To their parents	760	0.34	0.47
Remarried	760	0.36	0.48
Same place	760	0.11	0.31
Don't know	760	0.14	0.35

This represents the responses of household heads regarding previous unions. The count is the number of previous unions among male household heads who had previous spouses.

Table 1.B.4: Summary Statistics for Previous Unions of Spouses of Male Household Heads, 1997

	Count	Mean	Std. Dev.
Married to previous spouse	388	0.97	0.18
How long lived with the person	367	5.21	6.41
Union formally ended	384	0.86	0.35
How union ended			
Death	329	0.22	0.41
Divorce	329	0.64	0.48
Annulment	329	0.03	0.17
Repudiation	329	0.11	0.32
Where ex-spouse went after marriage ended			
To a previous spouse	313	0.02	0.15
To their parents	313	0.18	0.38
Remarried	313	0.50	0.50
Same place	313	0.19	0.39
Don't know	313	0.11	0.31

This represents the responses of spouses of male household heads regarding previous unions. The count is the number of previous unions among female spouses of male household heads who had previous spouses.

Table 1.B.5: Attrition Tests for Household Wealth Outcomes (Full Sample)

	Attrition Rate			Baseline Trends By Group						Tests of IV-R p-value		Tests of IV-P p-value	
				Respondents			Attritors						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	C	T4	T5	C	T4	T5	C	T4	T5	T4	T5	T4	T5
Panel A. Log of real consumption per capita													
1999	0.083	0.048	.	0.086	0.189	.	0.139	-0.136	.	0.271	.	0.438	.
2004	0.106	0.055	0.152	0.080	0.175	0.076	0.073	0.144	0.202	0.535	0.664	0.733	0.453
2009	.	0.116	0.148	.	0.116	0.076	.	0.004	0.207		.	.	.
Panel B. Proportion of households that are non-poor													
1999	0.083	0.048	.	0.009	0.072	.	0.130	-0.143	.	0.220	.	0.106	.
2004	0.106	0.055	0.152	-0.028	0.065	0.022	0.043	0.000	0.136	0.261	0.243	0.402	0.041
2009	.	0.116	0.148	.	-0.004	0.016	.	0.030	0.171		.	.	.

The baseline surveys were conducted in 1994. C is the control region(s), which is SNNPR, Amhara, and Oromia in 1999 and SNNPR only in 2004. T4 represents regions and time periods that have implemented head-only land certification and revised Family Codes, which is Tigray in 1999 and 2004 and Tigray and SNNPR in 2009. T5 represents regions and time periods that have implemented joint land certification and revised Family Codes, which is Amhara and Oromia in 2004 and 2009. The tests of IV-R and IV-P are the tests of internal validity for the respondent subpopulation and for the study populations, respectively, described in Ghanem, Hirshleifer, and Ortiz-Becerra (2021).

Table 1.B.6: Wealth Outcomes of Rural Households with Married or Cohabitating Partners

	(1)	(2)
	Wealth index	Wealth index (standardized across survey rounds)
Post*RFC	-0.023	0.286
	(0.087)	(0.409)
Post*RFC*Land Certification	0.073	0.075
	(0.041)	(0.110)
Post*RFC*Joint Certification	0.087**	0.230**
	(0.028)	(0.085)
Control variables	Yes	Yes
Year fixed effects	Yes	Yes
Region fixed effects	Yes	Yes
Control mean (2000)	-0.534	-1.487
$\gamma < 0$ (Wild p-value)	0.430	0.340
$\delta > 0$ (Wild p-value)	0.187	0.174
Observations	8,649	8,649
Adjusted R^2	0.253	0.202

The sample is restricted to rural couples in which both members responded to the individual questionnaire. Household control variables include the husband's ethnicity, age, and years of schooling, the wife's ethnicity, the difference in age and years of schooling between the husband and wife, household size, and each spouse's report of the duration of their marriage.

Table 1.B.7: Labor Outcomes of Rural Wives, Unconditional on Employment

	(1) Works in agriculture (self-employed)	(2) Works in agriculture (for family member)	(3) Works in agriculture (for non-family member)	(4) Works for self	(5) Works for family member	(6) Works for non-family member
Post*RFC	-0.015	-0.058	0.002	-0.009	-0.090	-0.029
	(0.097)	(0.038)	(0.004)	(0.095)	(0.053)	(0.016)
Post*RFC*Land Certification	0.127	0.057	-0.006	0.203**	-0.002	0.004
	(0.147)	(0.046)	(0.006)	(0.085)	(0.062)	(0.021)
Post*RFC*Joint Certification	-0.064	-0.004	-0.005**	-0.192***	0.047	-0.014**
	(0.048)	(0.037)	(0.002)	(0.036)	(0.034)	(0.006)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Control mean (2000)	0.250	0.208	0.005	0.350	0.258	0.023
$\gamma = 0$ (Wild p-value)	0.877	0.328	0.778	0.864	0.324	0.295
$\delta = 0$ (Wild p-value)	0.465	0.926	0.332	0.457	0.425	0.311
Observations	8,346	8,345	8,345	8,392	8,392	8,392
Adjusted R^2	0.279	0.100	0.012	0.102	0.079	0.044

Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The sample is restricted to rural wives in couples in which one member is the household head and both members responded to the individual questionnaire. Control variables are described above. For simplicity, the table presents the wild bootstrap p-values of two-sided tests.

Table 1.B.8: Labor Outcomes of Rural Husbands, Unconditional on Employment

	(1) Works in agriculture
Post*RFC	0.035
	(0.031)
Post*RFC*Land Certification	0.010
	(0.032)
Post*RFC*Joint Certification	-0.003
	(0.010)
Control variables	Yes
Year fixed effects	Yes
Region fixed effects	Yes
Control mean (2000)	0.908
$\gamma > 0$ (Wild p-value)	0.267
$\delta < 0$ (Wild p-value)	0.408
Observations	8,361
Adjusted R^2	0.129

Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The sample is restricted to rural wives in couples in which one member is the household head and both members responded to the individual questionnaire. Control variables are described above.

Essay 2

Spousal Concordance in Joint and Separate Households: Survey Evidence from Nepal

Abstract

In household surveys, husbands and wives who are asked the same set of survey questions often provide different responses. The levels of concordance in responses to questions about who owns assets and makes decisions in a household may hold valuable information about household dynamics and women's well-being. These relationships may be especially indicative in the South Asian context where couples often reside in joint households with the husbands' parents, resulting in different power structures. Using data from Nepal, we study patterns of concordance between spouses on survey questions regarding household asset ownership and decision making. We analyze these patterns separately for couples that reside with the husband's parents and those that do not. We consider concordance regarding both the asset ownership and decision making of wives and individuals other than the respondent couple. We find that discordance regarding wives' asset ownership and decision making is both substantial and systematic. Wives are much more likely than husbands to report

their own participation in asset ownership and decision making, in both joint and separate households. Regarding the involvement of others, the modal response in joint households is concordance that others own assets and make decisions; however, wives are more likely than husbands to acknowledge this. Spousal concordance that wives own assets or make decisions, and discordance in which wives report that they own assets or make decisions, are both correlated with some improved measures of wives' well-being. In households with in-laws present, concordance that others are involved is correlated with worse outcomes for wives. These results highlight that spousal concordance is not necessarily indicative of wives' well-being, especially in joint households.

Acknowledgements

My co-authors and I are grateful to Agnes Quisumbing and Kenda Cunningham for feedback on early versions of this research. We also appreciate the helpful feedback that we received from participants of the International Food Policy Research Institute's 2016 Research Day, the Population Association of America's 2016 Annual Meeting, the IFPRI Markets, Trade, and Institutions Division Work in Progress Seminar, the 2016 Midwest International Economic Development Conference, and two anonymous referees from *World Development*, where this essay was recently published. This work was undertaken as part of, and funded by, the CGIAR Research Program on Policies, Institutions, and Markets (PIM) led by the International Food Policy Research Institute. PIM is in turn supported by the CGIAR Fund donors. The opinions expressed in this essay belong to the authors and do not necessarily reflect those of PIM or CGIAR.

2.1 Introduction

Husbands and wives often provide different responses when asked the same questions in a household survey. The extent of their concordance in responses may provide important information about intrahousehold dynamics, beyond what we can learn from their individual responses. In particular, it may provide insights into women's well-being (Ambler et al., 2021). Yet most research on concordance has focused exclusively on the couple, ignoring the broader structure of the households in which couples live. This obscures the potential significance of other adults who may play a role in household decision making. Particularly in the Global South, many households may have more than two adults. Globally, over a third of the population lives in extended family households, with rates of 45

In this paper, we build upon the conceptual framework developed in Ambler et al. (2021) to understand how the concordance of husbands' and wives' responses to questions regarding their asset ownership and decision making is related to the household structures in which they live. We focus on responses to these questions because a growing body of evidence demonstrates the importance of women's ownership of and control over assets and decision making as being related to their well-being and that of their children (Allendorf, 2007a; Beegle, Frankenberg, and Thomas, 2001; Doss, 2006; Duflo, 2003; Quisumbing and Maluccio, 2003; Reggio, 2011). Using data from Nepal, we analyze the patterns of concordance separately for two of the most common household types; those in which the couple lives with the husband's parents (a joint household) and those in which they have formed a separate household. We then extend this analysis to consider how these patterns of concordance are associated with a set of outcomes for wives.

Asking the same questions to multiple household members generates a wealth of information, but it also creates the challenge of determining how to analyze multiple—and sometimes contradictory—answers to the same question. Frequently, studies find that husbands and wives provide different answers when asked the same survey questions about assets (Ambler et al., 2021; Deere and Twyman, 2012), household decisions (Ambler et al., 2021; An-

derson, Reynolds, and Gugerty, 2017; Becker, Fonseca-Becker, and Schenck-Yglesias, 2006; Deere and Twyman, 2012; Hillesland et al., 2020), and women's autonomy (Allendorf, 2007b; Ghuman, Lee, and Smith, 2006; Jejeebhoy, 2002). In most of these studies, however, husbands' and wives' responses are included separately in econometric analyses rather than explicitly analyzed based on their concordance.

The analysis in this paper is an extension of the ideas developed in Ambler et al. (2021), in which the authors examine responses regarding wives' asset ownership and decision making in Bangladesh and develop a framework to investigate potential drivers of any observed discordance. Their framework indicates that random measurement error leads to discordance that is balanced between men and women, while asymmetric measurement error (for example, differential understanding of survey questions across genders) leads to discordance that is unbalanced across men and women but constant across asset types and decisions. Any variation across types of assets and decisions is indicative of asymmetric information in asset ownership and decision making. Their findings suggest that while measurement error likely accounts for some portion of discordance, asymmetric information in the form of hidden assets or decisions also contributes to the patterns in the data. Analyzing responses about income and expenditures, Chen and Collins (2014) similarly argue that the lack of concordance indicates information asymmetries.

Other studies have adopted varying approaches to conceptualizing spousal concordance. Anderson, Reynolds, and Gugerty (2017) study "intrahousehold accord," which is conceptualized as whether the husband and wife have the same understandings as to who has decision-making authority. They predict intrahousehold accord based on wife's assets, relative spousal attributes, household characteristics, and the type of decision and find that the patterns vary across decisions. Annan et al. (2021) conceptualize disagreement over the wife's involvement in decision making as women "taking power" or men "giving power" depending on the direction of the discordance. They relate patterns of discordance in the wife's role in decision making in Sub-Saharan Africa to theories of power, arguing that women claiming

power is an important element of empowerment.

We extend the analysis in Ambler et al. (2021), applying it to the Nepalese context and considering how the presence of others, specifically the husband's parents, can change the patterns of concordance. We examine concordance in two dimensions: whether the wife owns assets and makes decisions and whether others own assets and make decisions. We then analyze these patterns of concordance separately for households that include the husband's parents and those that do not. Finally, our analysis considers how concordance is correlated with outcomes related to wives' well-being.

The presence of additional adults complicates the understanding of asset ownership and decision making and is of particular interest in this context due to the well-documented influence that in-laws have in South Asian households. In Nepal, the structure of the household and a woman's social location within it influences how she is able to exercise her property rights (Pradhan, Meinzen-Dick, and Theis, 2019) and whether she has any say in household decisions. There is an extensive literature on intergenerational struggles and the low status of daughters-in-law within households in South Asia (see Gram et al. (2018) for a review). For example, Self (2015) shows that a husband is likely to perceive his wife to be less autonomous when his mother is in the home. Doss et al. (2022) find that when couples live with the husband's parents, wives are less empowered when their husbands have migrated. Perhaps the most significant component of this literature focuses on fertility and decisions related to antenatal care. Anukriti et al. (2020) find that mobility constraints imposed by mothers-in-law can reduce contraceptive use among women, while Simkhada, Porter, and van Teijlingen (2010) find that mothers-in-law can restrict access to antenatal care during pregnancy.

To analyze spousal concordance, we use responses to survey questions about asset ownership and decision making. These questions were asked as part of a survey designed to capture two components of the Women's Empowerment in Agriculture Index (WEAI). The WEAI is a measure of empowerment, agency, and inclusion of women in the agriculture

sector (Alkire et al., 2013). In our treatment of concordance, we follow the typology used in Ambler et al. (2021) and focus on whether or not wives and husbands report the same information regarding wives' asset ownership and decision making. We also adapt this typology to examine husbands' and wives' reports regarding the role of individuals other than the respondent couple.

We find that discordance regarding the wife's asset ownership and decision making is both substantial and systematic; wives' asset ownership and decision making are much more likely to be reported by wives themselves than by their husbands. The amount of discordance varies across assets and decisions, suggesting that information asymmetry is present. The qualitative pattern of discordance is similar across household types, but the levels are different. In particular, concordance (usually that the wife is not involved) is higher in households with in-laws, suggesting less scope for information asymmetries between couples. Regarding the role of others, the modal response in households with in-laws is concordance that others own assets and make decisions. We also find that wives are more likely than husbands to acknowledge the role of others, again suggesting that there are information asymmetries between the husband and wife, likely regarding the role of the mother-in-law in asset ownership and decision making.

Finally, we examine how these measures of concordance are correlated with measures of the wife's well-being. Spousal concordance that wives own assets or make decisions is correlated with higher measures of well-being for wives. The same is true of one form of discordance: when wives report owning assets or making decisions while their husbands do not acknowledge wives' involvement. In households with in-laws present, concordance that others are involved is correlated with worse outcomes for wives, relative to concordance that others are not involved. Additionally, when only the wife reports that others are involved in decision making, the negative correlations with measures of the wife's well-being are even stronger. In other words, the involvement of others is associated with worse outcomes for wives, especially when the husband is unaware of this involvement.

These results suggest that analyzing concordance in the context of multi-generational households is both feasible and informative. Patterns of concordance can be highly revealing of the intrahousehold dynamics facing those couples who live in multi-generational households. However, to our knowledge, no studies have analyzed how a couple's position within the household is related to the concordance of their responses. In part, this may be because surveys with multiple respondents typically interview the household head and spouse. In joint households, this often leads to older couples (e.g., grandparents) being interviewed rather than younger couples. As a result, we systematically lack information on intrahousehold dynamics in these settings. This, in turn, means that much of what we currently know about intrahousehold dynamics ignores those couples who have selected into living with their elders. As we show in this paper, there are important differences between these households and the households in which young couples live on their own.

In the remainder of this paper, we explore these points in greater detail. Section 2 presents a conceptual discussion of spousal concordance. Section 3 discusses the context and data. Section 4 provides a description of the extent of concordance and discordance in the data. Section 5 examines whether concordance on wives' or others' asset ownership and decision making are correlated with wives' outcomes. Section 6 discusses the results and Section 7 highlights the policy implications and concludes.

2.2 Conceptual framework

In this section, we describe the framework we use to understand what spousal concordance tells us about household behavior, and whether that concordance may be correlated with positive outcomes for wives. We define spousal concordance as a situation in which a husband and wife separately provide the same information in response to privately asked household survey questions.

2.2.1 The drivers of discordance

In this paper we apply a framework of information asymmetry based on Ambler et al. (2021) to understand our results. In that model, discordance over women's asset ownership and

decision making can arise from several sources. One is random measurement error in surveys, which will give rise to apparent discordance. A second source is asymmetric measurement error, driven by differences in the way men and women may understand the survey questions. The third source of discordance in this framework is information asymmetry in the form of hidden assets or decisions. In other words, husbands and wives report differently about wives' involvement because the husband is unaware of assets owned or decisions made by the wife. This model leads to the following conclusions: (1) when discordance is caused by random measurement error, women's responses should not be systematically different than men's; (2) when discordance is caused by asymmetric measurement error, responses can differ across genders on average, but should not vary across assets or decisions; and (3) if discordance is not constant across assets and decisions, then information asymmetry in the form of hidden assets or decisions is present. This last conclusion is based on the fact that certain types of assets and decisions are easier to hide. For example, land ownership is relatively well understood, but women may own small animals or make day-to-day decisions without their husband's knowledge.

This framework and these predictions regarding wives' involvement in asset ownership and decision making are the same in households with in-laws and without. However, the empirical patterns and levels of discordance may be different. The presence of in-laws may influence spousal concordance in several ways, with ambiguous overall effects. First, households with in-laws tend to own more assets, make more decisions, and have more adults who could potentially own assets and make decisions—all of which increase the scope for measurement error-driven discordance. However, concordance that the wife is not involved may increase because it is understood that the in-laws own assets and make decisions, reducing measurement error. More complicated family dynamics may increase the likelihood that wives seek to hide assets or decisions, leading to stronger evidence of discordance driven by information asymmetries. On the other hand, monitoring by more household members such as mothers-in-law may decrease information asymmetries between spouses. Finally,

husbands and wives in a joint household may need to work together more closely to protect their own interests and thus share information with each other.

This discussion focuses on concordance regarding the role of the wife in asset ownership and decision making. The same framework can be applied to consider concordance regarding whether others in the household own assets or make decisions. The predictions are similar to when the role of the wife is considered; (1) when discordance is caused by random measurement error, husband and wife responses will be the same on average; (2) when discordance is caused by systematic measurement error total discordance should not vary across assets and decisions, and (3) discordance that varies across assets and decisions is evidence of information asymmetries regarding the role of others. In this case asymmetries would concern differences in husbands' and wives' knowledge regarding the extent to which the husbands' parents own assets and make decisions. For example, husbands may not understand the role of their mothers in household management because they do not witness the day-to-day decisions.

2.2.2 Concordance and well-being

The second component of our analysis examines how these patterns of concordance correlate with measures of women's well-being and agency. Qualitative literature from a range of countries indicates that family harmony is often highly valued and may be correlated with better outcomes for women (Meinzen-Dick et al., 2019), suggesting a positive association between concordance and measures of women's well-being. However, concordance related to asset ownership and decision making could instead indicate high levels of male power or monitoring by a suspicious spouse. Both Ambler et al. (2021) and Annan et al. (2021) find that wives' reporting that they are involved in decision making, even when their husbands disagree, is associated with better outcomes for wives. The association is even stronger when there is concordance that wives are involved in decision making.

The analysis in this paper will provide further evidence on how concordance and discordance regarding wives' asset ownership and decision making are related to their agency

and well-being. Based on previous findings, we expect a wife's well-being to be positively associated with the case in which she and her husband agree that she owns assets and makes decisions. But good outcomes may also be associated with the case when only the wife asserts that she owns assets and/or makes decisions. While the levels of wife's involvement, concordance, and information asymmetries may vary by household structure, there is no a priori reason to predict that the associations between concordance regarding wives' involvement and wives' well-being would also vary.

We do not expect that concordance between the husband and wife that others own assets and make decisions will necessarily be positively associated with the wife's well-being. Unlike concordance regarding the wife's asset ownership and decision making, there are no existing studies that analyze the association between concordance on others' involvement and the wife's well-being. In joint households, concordance may reflect a shared understanding that wives do not own assets or make decisions, which would be disempowering for wives. As the framework described above suggests, spousal discordance regarding whether others own assets and make decisions may be further evidence of information asymmetries and reflect that they do not have a shared understanding of the power structures within the extended household. For example, husbands may not understand the large role that their mothers play in household decision making, with potentially detrimental impacts on the wife's well-being.

2.3 Context and data

We analyze the Nepal Suaahara Baseline Survey, which includes the Women's Empowerment in Agriculture (WEAI) modules (Kadiyala et al., 2020). This survey is designed to evaluate Suaahara, a five-year USAID funded initiative to improve nutritional status among young children and their mothers in Nepal. The baseline survey was administered to households with at least one child under five years of age. The survey covered 16 districts spanning the three agroecological zones of mountains, hills, and the Terai lowlands. Enumerators administered a questionnaire to the mother of the index child (a randomly selected child under five) and a separate questionnaire to her husband, who is generally the father of the

index child. Thus, we have answers to the same questions from the husband and wife. Because married men often live with their parents in Nepal, almost 30% of the couples in the sample are the son and daughter-in-law of the household head. We restrict the sample to the 1,660 cases where both members of a married couple responded to the individual questionnaire, excluding 34% of the surveyed households for which only a woman responded. We conduct the analysis separately for households with and without the husband's parents. For simplicity, we refer throughout the paper to the respondent couple as the husband and wife.

2.3.1 Context

Although the current Constitution in Nepal decrees equality for all, and reforms have promoted gender equality over the last several decades, discriminatory practices and patriarchal norms persist (Asian Development Bank (ADB), 2010). Until recently, daughters only had a claim to a share of their father's property if they were not married and they traditionally relinquished their claims to other heirs if they married after inheriting property. The passage of the Gender Equality Act in 2006 granted married women the legal right to keep inherited property and gave women the right to use property without a male family member's consent. Despite these efforts, women are much less likely than men to own property. According to the 2016 Demographic and Health Survey (DHS) in Nepal, just 8% of women own a house alone or jointly as compared to 19% of men. Similarly, 11% of women own land alone or jointly while 23% of men do (Ministry of Health, New-ERA, and ICF, 2017).

Findings from the DHS also suggest that women's participation in household decision making in Nepal is limited. For example, 42% of currently married women ages 15 to 49 say that they do not decide, either alone or jointly with their husbands, about their own health care. The comparable number for men is less than 15%. And notably, about one-fourth of women indicate that they do not decide, whether alone or jointly, how to use their pewa, the inherited assets they receive before marriage (Ministry of Health, New-ERA, and ICF, 2017; Pradhan, Meinzen-Dick, and Theis, 2019).

In Nepal, the social locations of women within households play a key role in determining women's property rights and involvement in decision making (Allendorf, 2007a; Pradhan, Meinzen-Dick, and Theis, 2019; Singh, 2016). When a woman marries, she generally moves into a joint household with her parents-in-law. Daughters-in-law in joint households typically have weak rights and little to no decision-making authority over joint property of the household. While the rights of daughters-in-law over personal property are stronger than their rights to joint property, even these rights are not guaranteed (Pradhan, Meinzen-Dick, and Theis, 2019). The couple may eventually split off from the joint household to form a separate household, which may expand when their sons marry.

2.3.2 Description of variables and methods

Our analysis begins by assessing spousal concordance and discordance using two indicators of women's empowerment: ownership of productive assets and decision making on household activities. The wording of these questions is important for understanding what is being measured (see Doss, Kieran, and Kilic (2020) for a review on measuring intrahousehold ownership, control, and use of assets; see Anderson, Reynolds, and Gugerty (2017) or Annan et al. (2021) for reviews on measuring intrahousehold decision making). We assess asset ownership using the survey question: "Who would you say owns most of the [productive capital]" and allow for multiple people to be indicated as participating in the process. Norms regarding what "ownership" means vary across contexts, but "ownershi" typically includes rights of alienation. The categories of productive capital include agricultural land, other land not used for agriculture, large livestock (e.g., cattle, horse), small livestock (e.g., goats, pigs, sheep, chickens), fish pond or fishing equipment, non-mechanized farm equipment, mechanized farm equipment, non-farm business equipment, house (and other structures), large consumer durables (e.g., fridge, TV, sofa), small consumer durables (e.g., radio, cookware), mobile phone, and transportation (e.g., bicycle, motorcycle, car, rickshaw, horse cart).

For decision making, we consider the question, "Who normally takes the decision regarding [activity]?" The activities include agricultural production (what to grow and types

of crops to plant), taking crops to market, livestock raising, non-farm business activity, major household expenditures (e.g., refrigerator, TV), minor household expenditures (e.g., food for daily consumption or other necessities), use of family planning products, and children's health care.

For all of these questions, the response options include self; spouse; self and spouse jointly; other male household member; other female household member; self and other household member(s); spouse and other household member(s); self, spouse, and other household member(s); someone (or group of people) outside the household; self and other outside people; spouse and other outside people; and self, spouse, and other outside people.

Since the combinations of all possible responses of husbands and wives would be too numerous to effectively analyze, we collapse responses into a smaller number of categories. We are particularly interested in whether there is concordance in responses about the wife's asset ownership and decision making. Following Ambler et al. (2021), we thus analyze the following categories: (1) neither spouse says the wife owns or decides; (2) both spouses say the wife owns or decides; (3) the wife says she owns or decides, but the husband reports that she does not; and (4) the husband says the wife owns or decides, but she reports that she does not. The first two categories represent measures of concordance, and the latter two represent discordance. Concordance does not necessarily mean that spouses provided exactly the same responses, but rather that they agreed on the wife's involvement in ownership and decision making, either solely or jointly. By simplifying the categories, this approach focuses on meaningful variation and reduces measurement error.

In addition to analyzing concordance on responses regarding wives' ownership and involvement in decision making, we also analyze concordance on responses regarding the involvement of others – those other than the couple, whether inside or outside the household – as owners or decision makers. Similar to our approach for concordance regarding the wife's involvement, we define four additional categories of concordance regarding whether other individuals own assets or make decisions. These include: (1) neither spouse says that others

own or decide; (2) both spouses say that others own or decide; (3) the wife says that others own or decide, but the husband says they do not; and (4) the husband says that others own or decide, but the wife says they do not.

The questions regarding who owns assets and makes decisions were skipped when the respondent said that no one in the household possessed the asset or engaged in the activity. Thus, we occasionally have responses from only one spouse. In this situation, we use the information from the spouse who provided the information and assign a response of "wife or husband doesn't own or make decision" to the other spouse per the approach of Ambler et al. (2021). We code the responses on whether others own or decide similarly.

Although we analyze patterns of discordance across the different types of assets and decisions in the survey, given the large number of these categories, we follow the approach used in Ambler et al. (2021) to create a set of aggregate measures for use in regression analysis. For household asset ownership, we aggregate the data on assets. This allows us to compute a measure of the proportion of the household's assets for which the couple agreed on the wife's [others] ownership. We create similar measures for household decision making.

The final dimension of our analysis is to consider the relationship between these various indicators of concordance within the household and a set of outcome measures. These outcomes have all been identified in the literature as related to women's empowerment or bargaining power. The outcomes include the number of groups in which the wife is an active member (Alkire et al., 2013; Narayan, 2002), current use of any method to delay or avoid pregnancy (Schuler, Hashemi, and Riley, 1997), number of antenatal visits during her last pregnancy (Beegle, Frankenberg, and Thomas, 2001), satisfaction with leisure time (Brown, 2009), and the proportion of decisions made in which she participates (Hou and Ma, 2013). Importantly, since all of the wives who responded to the survey are mothers of children under five, questions regarding antenatal visits and methods to delay or avoid pregnancy are relevant for all women respondents. Questions regarding antenatal visits require respondents to recall events that took place within the previous five years and nine months. All of these

outcomes are collected only from wives.

Group membership, participation in decision making, and satisfaction with leisure time are chosen as outcomes because they are the best available measures, within the survey, of individual well-being and agency. Use of birth control and access to antenatal care are included because the literature suggests that the presence of her mother-in-law limits a woman's access to both of these services. In general, our analysis is meant to identify general patterns about well-being across outcomes, rather than ascribing specific interpretations to each variable.

We conduct OLS regressions to examine the correlations between concordance (on both asset ownership and decision making) and wives' well-being, clustering standard errors at the level of the primary sampling unit. While we present these regressions separately for households with and without in-laws, we also run a pooled regression with an interaction term for the household type in order to test whether differences between joint and separate households are statistically significant. We control for demographic and income/wealth variables, including the wife's age, the difference between her age and her husband's age, her education level, the difference between her education level and that of her husband, her height, whether the household has a woman head, household size and composition based on age and sex, whether the household is Hindu, region, acres of cultivable land, whether the household has access to electricity, and roof material. In addition, we control for the number of assets that the household owns or the number of activities for which the household makes decisions.

Although this approach is motivated by our conceptual framework, our goal is not to prove causality. While the control variables will address some differences between the two types of households, the results are ultimately descriptive. Our analysis focuses on patterns of correlation, which are meaningful in themselves, but we do not suggest that spousal concordance should be a target for interventions.

2.3.3 Summary statistics

In Table 2.1, we present summary statistics on wives' outcomes, along with descriptive statistics, for the control variables included in the subsequent analyses. We disaggregate all results by whether or not the couple lives with the husband's parents. All outcome variables are coded positively, so that a higher value is associated with greater well-being. Across the two types of household structures (with and without in-laws), we find similar average values for several outcome variables: wives' participation in groups; the use of contraceptive methods; and satisfaction with leisure time. By contrast, the number of antenatal visits during the wife's last pregnancy is higher in households with in-laws (3.7) than in households without (3.1), and wives' participation in decision making is lower in households with in-laws (55%) than in those without (76%).

Table 2.1: Summary Statistics

	Households with in-laws		Households without in-laws	
VARIABLES	(1) Mean	(2) Standard deviation	(3) Mean	(4) Standard deviation
Outcome variables				
Number of groups in which wife is active member	0.23	0.61	0.21	0.55
Current use of method to delay or avoid pregnancy	0.49	0.50	0.53	0.50
Number of antenatal visits during last pregnancy	3.70	2.02	3.06	2.05
Wife's satisfaction with leisure time	3.60	1.10	3.57	1.13
Proportion of decisions made in which wife participates	0.55	0.25	0.76	0.25
Demographic variables				
Age of husband	29.15	6.56	35.15	8.92
Age of wife	25.68	5.73	29.88	6.87
Age difference (husband-wife)	3.46	3.58	5.26	5.56
Years of education for husband	7.26	3.66	5.46	4.12
Years of education for wife	5.92	5.01	4.97	5.40
Difference in years of education (husband-wife)	1.33	4.66	0.49	5.55
Wife's height (in cm)	151.79	5.53	151.22	5.87
Proportion of woman-headed households	0.12	0.33	0.00	0.07
Household size	7.39	2.50	5.14	1.66
Number of women in household ages 16+	2.40	0.87	1.15	0.41
Number of men in household ages 16+	2.09	0.94	1.13	0.42
Proportion of girls in household, ages 0-15	0.20	0.14	0.29	0.19
Proportion of women in household, ages 16+	0.34	0.09	0.24	0.07
Proportion of boys in household, ages 0-15	0.18	0.13	0.24	0.17
Proportion of men in household, ages 16+	0.29	0.10	0.23	0.08
Hindu	0.91	0.29	0.88	0.32
Mountain region	0.30	0.46	0.30	0.46
Hill region	0.37	0.48	0.43	0.50
Terai region	0.33	0.47	0.27	0.44
Acres of cultivable land	0.61	0.88	0.29	0.34
Access to electricity	0.86	0.35	0.80	0.40
Improved roof	0.79	0.41	0.72	0.45
Number of assets owned by household (out of 12)	8.11	1.24	7.14	1.42
Number of decision categories made by household (out of 8)	6.24	1.12	5.84	1.20
N	730		913	

In households with in-laws, current use of method to delay or avoid pregnancy has 665 observations and wife's satisfaction with leisure time and years of education for husband have 729 observations each. For households without in-laws, current use of method to delay or avoid pregnancy has 856 observations, number of antenatal visits during last pregnancy has 911 observations, and age of husband, age difference, and the proportion of girls, women, boys, and men have 912 observations each.

Husbands are, on average, older and more educated than their wives. The age gap is larger in households without in-laws while the education gap is larger in households with in-laws. Not surprisingly, households with in-laws also have more land, a greater probability of access to electricity and finished roofing, more adults, more total household members, and more assets than households without in-laws.

2.4 Spousal concordance

In this section, we assess spousal concordance on four issues: whether the wife owns assets; whether she makes decisions; and whether others own assets and make decisions.

2.4.1 Concordance on wives' asset ownership and decision making

The patterns of concordance regarding the assets owned by the wife are presented in Table 2.2, disaggregated by household structure. Each asset is listed in a separate row, with each column representing one of the four response categories. We first show the proportion of couples who agree that the wife does not own each asset type and the proportion who agree that she does. We then present the proportion of couples in which the wife reports that she owns the asset, but her husband does not, followed by the proportion of couples in which the husband reports that his wife owns the asset, but she does not. Finally, we sum the first two columns to present total concordance. The number of observations represents households where at least one spouse reports that the household owns the asset. Following the same structure, Table 2.3 displays information regarding the wife's involvement in decision making.

Table 2.2: Concordance and discordance regarding wife's asset ownership

	Panel A: Households with in-laws						***Panel B: Households without in-laws***					
	Concordance		Discordance				Concordance		Discordance			
	Wife does not own	Wife owns	Wife says wife owns, husband does not	Husband says wife owns, wife does not	*Total con-cordance*	*Number of observations*	Wife does not own	Wife owns	Wife says wife owns, husband does not	Husband says wife owns, wife does not	*Total con-cordance*	*Number of observations*
Agricultural land	0.84	0.12	0.04	0.01	0.96	713	0.68	0.19	0.08	0.04	0.88	833
Non-agricultural land	0.87	0.07	0.05	0.01	0.94	329	0.74	0.13	0.08	0.04	0.87	365
Large livestock	0.49	0.16	0.30	0.05	0.65	657	0.24	0.34	0.34	0.07	0.59	629
Small livestock	0.43	0.19	0.31	0.07	0.62	623	0.24	0.38	0.29	0.08	0.62	637
Fish pond or fishing equipment	0.47	0.13	0.30	0.11	0.59	64	0.64	0.06	0.10	0.20	0.70	50
Farm equipment (non mechanized)	0.32	0.23	0.39	0.06	0.54	724	0.22	0.41	0.29	0.08	0.63	874
Farm equipment (mechanized)	0.83	0.08	0.04	0.04	0.92	24	0.44	0.11	0.33	0.11	0.56	9
Non-farm business equipment	0.68	0.11	0.15	0.06	0.79	80	0.50	0.18	0.21	0.11	0.68	84
House	0.75	0.16	0.06	0.02	0.92	727	0.63	0.17	0.12	0.08	0.79	874
Large durables	0.41	0.19	0.32	0.08	0.59	395	0.27	0.30	0.32	0.11	0.57	371
Small durables	0.31	0.23	0.36	0.11	0.54	722	0.22	0.43	0.23	0.12	0.65	899
Mobile phone	0.47	0.13	0.35	0.05	0.60	639	0.47	0.23	0.22	0.08	0.70	682
Means of transportation	0.63	0.20	0.12	0.05	0.83	223	0.75	0.06	0.16	0.04	0.80	216

We sum the first two columns of each panel to present total concordance. The number of observations represents households where at least one spouse reports that the household owns the asset.

Table 2.3: Concordance and discordance regarding wife's decision making

	Panel A: Households with in-laws						***Panel B: Households without in-laws***					
	Concordance		Discordance				Concordance		Discordance			
	Wife does not decide	Wife decides	Wife says wife decides, husband does not	Husband says wife decides, wife does not	*Total con-cordance*	*Number of observations*	Wife does not decide	Wife decides	Wife says wife decides, husband does not	Husband says wife decides, wife does not	*Total con-cordance*	*Number of observations*
Agricultural production	0.57	0.21	0.20	0.02	0.78	706	0.34	0.23	0.40	0.02	0.57	803
Taking crops to market	0.74	0.13	0.11	0.03	0.86	262	0.54	0.10	0.28	0.08	0.64	249
Livestock raising	0.51	0.21	0.24	0.04	0.72	701	0.27	0.26	0.41	0.05	0.54	753
Non-farm business activity	0.70	0.12	0.16	0.02	0.82	396	0.63	0.07	0.25	0.04	0.71	502
Major household expenditures	0.58	0.18	0.20	0.04	0.76	420	0.42	0.18	0.36	0.05	0.59	443
Minor household expenditures	0.49	0.23	0.23	0.05	0.72	730	0.34	0.23	0.36	0.07	0.58	913
Use of family planning	0.20	0.30	0.42	0.08	0.50	610	0.21	0.37	0.34	0.08	0.58	753
Health care of children	0.28	0.27	0.44	0.02	0.55	730	0.37	0.38	0.23	0.02	0.75	913

We sum the first two columns of each panel to present total concordance. The number of observations represents households where at least one spouse reports that the household makes the decision.

Overall, there are high levels of concordance in responses. For all assets and decisions, there is concordance among at least 50% of couples, with particularly high rates for the ownership of land (both agricultural and non-agricultural), housing, and means of travel. For most assets and decisions, levels of concordance about the wife's role in ownership and decision making are higher in households with in-laws than in households without in-laws. This is driven by high levels of concordance that the wife does not own assets or make decisions when in-laws are present, presumably because other household members play a role in ownership and decision making.

Conversely, there is more concordance that wives own assets when in-laws are not present, suggesting that wives have stronger property rights when there is less competition from their parents-in-law. The only exceptions are fish ponds/fishing equipment and means of transportation. Similarly, there is more concordance that wives make decisions when in-laws are not present. The exceptions are taking crops to market and non-business farm activities. For both minor and major household expenditures, the proportion of couples who agree that the wife decides is approximately the same across household types.

Only in households without in-laws do we ever see that the most common response is concordance that the wife owns assets. Even here, this holds only for relatively minor assets: small livestock, non-mechanized farm equipment, and small durables. This suggests that even if wives own some small assets, husbands are unlikely to acknowledge their ownership if they live in a joint household. Discordance is also frequent and systematic. Across both household types, the most common form of discordance is for the wife to say that she owns the assets or makes the decisions, but her husband says that she does not. In line with the framework discussed in Section 2, the systematic nature of this discordance indicates that it is not due only to random measurement error. There is also substantial variation in levels of discordance across types of assets and activities, indicating that asymmetric measurement error also cannot completely explain the observed patterns. In general, we observe suggestive evidence that discordance is higher for assets and decisions that are easier

to hide. These discordance patterns are consistent with the empirical evidence presented in Ambler et al. (2021) from Bangladesh, which found that discordance is likely a function of both measurement error and the presence of asymmetric information in the household.

Although the patterns of discordance are similar across household type, the levels do vary. In general, discordance is higher in households without in-laws than households with in-laws—possibly because wives' lack of asset ownership and decision making is well understood when in-laws are present. Wives are also, in general, more likely to report that they own assets or participate in decisions when in-laws are not present. Across both types of households, total concordance is high for large assets such as land and houses and decisions such as taking crops to market and non-farm business activities, which are difficult to hide. In households with in-laws, concordance is low for assets such as non-mechanized farm equipment and small durables and for decisions such as use of family planning and the health care of children. In households without in-laws, on the other hand, concordance is low for mechanized farm equipment and large durables as well as agricultural production and livestock raising. Overall, these patterns likely indicate both the strong property rights and agency of the in-laws themselves as well as reduced scope for information asymmetries regarding wives' roles in asset ownership and decision making because she is monitored by her mother-in-law.

2.4.2 Concordance on the asset ownership and decision making of others in the household

Table 2.4 presents spousal concordance regarding the asset ownership of other individuals, while Table 2.5 focuses on others' role in decision making. The patterns of concordance differ dramatically across households with and without in-laws. In households with in-laws, others play a large role in asset ownership, and the most common response is concordance that others own assets. The exceptions are for non-farm business equipment, mobile phones, and means of transportation. The most common response regarding decision making in households with in-laws is concordance that others decide on agricultural production, taking

crops to market, raising livestock, and minor household expenditures, and concordance that others do not decide on non-farm business activities, major household expenditures, use of family planning, and child health care. Concordance is far from universal, with rates ranging from near 60 percent to 90 percent across assets and activities.

Table 2.4: Concordance and discordance regarding others' asset ownership

	Panel A: Households with in-laws						***Panel B: Households without in-laws***					
	Concordance		Discordance				Concordance		Discordance			
	Others do not own	Others own	Wife says others own, husband does not	Husband says others own, wife does not	*Total con-cordance*	*Number of observations*	Others do not own	Others own	Wife says others own, husband does not	Husband says others own, wife does not	*Total con-cordance*	*Number of observations*
Agricultural land	0.09	0.81	0.08	0.02	0.90	713	0.46	0.39	0.11	0.05	0.85	833
Non-agricultural land	0.13	0.61	0.16	0.11	0.74	329	0.54	0.27	0.12	0.07	0.80	365
Large livestock	0.11	0.74	0.10	0.06	0.84	657	0.86	0.04	0.07	0.03	0.90	629
Small livestock	0.13	0.65	0.14	0.09	0.77	623	0.88	0.03	0.06	0.04	0.90	637
Fish pond or fishing equipment	0.27	0.36	0.25	0.13	0.63	64	0.92	0.00	0.02	0.06	0.92	50
Farm equipment (non mechanized)	0.09	0.75	0.11	0.04	0.85	724	0.84	0.04	0.08	0.04	0.88	874
Farm equipment (mechanized)	0.08	0.50	0.25	0.17	0.58	24	0.67	0.11	0.11	0.11	0.78	9
Non-farm Business Equipment	0.46	0.21	0.15	0.18	0.68	80	0.89	0.02	0.04	0.05	0.92	84
House	0.10	0.78	0.09	0.03	0.88	727	0.57	0.26	0.10	0.07	0.83	874
Large durables	0.24	0.43	0.18	0.15	0.67	395	0.86	0.02	0.06	0.05	0.88	371
Small durables	0.11	0.66	0.13	0.10	0.77	722	0.86	0.03	0.05	0.06	0.89	899
Mobile phone	0.44	0.30	0.13	0.13	0.74	639	0.87	0.05	0.04	0.04	0.92	682
Means of Transportation	0.48	0.18	0.19	0.15	0.66	223	0.91	0.02	0.03	0.05	0.93	216

We sum the first two columns of each panel to present total concordance. The number of observations represents households where at least one spouse reports that the household owns the asset.

Table 2.5: Concordance and discordance regarding others' decision making

	Panel A: Households with in-laws						***Panel B: Households without in-laws***					
	Concordance		Discordance				Concordance		Discordance			
	Others do not decide	Others decide	Wife says others decide, husband does not	Husband says others decide, wife does not	*Total con-cordance*	*Number of observations*	Others do not decide	Others decide	Wife says others decide, husband does not	Husband says others decide, wife does not	*Total con-cordance*	*Number of observations*
Agricultural production	0.21	0.62	0.12	0.04	0.84	706	0.92	0.02	0.03	0.02	0.94	803
Taking crops to market	0.26	0.43	0.19	0.13	0.68	262	0.95	0.00	0.02	0.02	0.96	249
Livestock raising	0.20	0.61	0.13	0.06	0.82	701	0.94	0.01	0.03	0.02	0.95	753
Non-farm business activity	0.60	0.17	0.13	0.10	0.77	396	0.96	0.01	0.02	0.02	0.96	502
Major household expenditures	0.40	0.27	0.21	0.12	0.67	420	0.96	0.00	0.02	0.01	0.96	443
Minor household expenditures	0.30	0.46	0.14	0.10	0.76	730	0.96	0.01	0.01	0.02	0.97	913
Use of family planning	0.99	0.00	0.00	0.01	0.99	610	1.00	0.00	0.00	0.00	1.00	753
Health care of children	0.53	0.10	0.08	0.29	0.63	730	0.97	0.00	0.01	0.03	0.97	913

We sum the first two columns of each panel to present total discordance. The number of observations represents households where at least one spouse reports that the household makes the decision.

By contrast, and as is to be expected, households without in-laws generally agree that others do not own assets and do not make decisions. It is occasionally reported that others own the land and house, but in more than 80 percent of cases there is concordance that others do not own assets. In general, concordance that others do not participate in decision making is over 90 percent. This is because these households typically do not have other adults living in them. However, it also indicates a level of independence from extended family; couples that are not living in the joint family home do not have others involved in their decisions.

Given the high rates of concordance on the role of others in households without in-laws, the analysis of the patterns of discordance is most interesting in household with in-laws. We find that discordance is systematic: when there is discordance regarding asset ownership and decision making by others, it is more common for the wife to say that others own the asset or make the decision, but the husband does not. This suggests that random measurement error does not fully describe these results. There is also variation across assets and decisions, indicating the asymmetric measurement error is not fully driving these patterns. As such, this pattern could be further evidence of asymmetric information in the household, possibly indicating that the husband is not aware of the extent to which his mother owns assets or makes decisions.

The one interesting exception to this pattern is regarding the health care of children. In 29% of households with in-laws, the husband says that others are involved in these decisions, but only 8% of wives report others being involved. This could be evidence that husbands believe others are taking on a larger role in child health care than they actually are. Qualitative research from rural Nepal suggests that daughters-in-law feel especially worried about convincing their in-laws to pay health care expenses (Gram et al., 2018). To deal with this concern, it is possible that some wives privately save some cash to ensure that they can cover their children's health care costs without involving their in-laws.

2.5 Is concordance related to outcomes?

The previous section demonstrated that although spouses often give the same answers to questions regarding who owns assets and who makes decisions, they do not always do so. In addition, the levels of concordance differ based on whether the couple lives with their in-laws. In this section, we consider whether the patterns of concordance are correlated with outcomes of the wife's well-being.

We conduct OLS regressions to examine the correlations of concordance on asset ownership or decision making with wives' well-being, controlling for a set of demographic and income/wealth variables described in section 3.2. We include the two sets of categorical measures of concordance on wives' and others' involvement (as described in Section 3.2) in each regression, with concordance that the wife is not involved and concordance that others are not involved as the omitted categories. In each table, Panel A displays results for households with in-laws while Panel B displays results for households without in-laws. Table 2.6 addresses asset ownership while Table 2.7 presents the same information for decision making. In this section, we describe the results from this analysis and provide further discussion in Section 6. In order to test differences across household types, we also run a pooled model in which we interact all independent variables with the presence of parents-in-law. Appendix Tables 2.A.1 and 2.A.2 present the p-values for the interaction terms of interest.

Table 2.6: Correlation of concordance on wives' and others' asset ownership with wives' outcomes

	Panel A: Households with in-laws						***Panel B: Households without in-laws***					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Mean percent of assets	Group partici-pation	Current use of birth control	Antenatal visits during last pregnancy	Satisfied with leisure time	Partici-pation in decisions	*Mean percent of assets*	Group partici-pation	Current use of birth control	Antenatal visits during last pregnancy	Satisfied with leisure time	Partici-pation in decisions
Concordance on wives' ownership												
Both: Wife does not own (omitted)	*54*						*42*					
Both: Wife owns	*17*	0.140	-0.157	-0.003	-0.187	0.203***	*29*	0.007	0.076	-0.051	0.055	0.357***
		(0.152)	(0.111)	(0.428)	(0.273)	(0.063)		(0.079)	(0.086)	(0.281)	(0.165)	(0.034)
W: Wife owns	*24*	0.199*	0.063	-0.214	-0.036	0.400***	*21*	-0.072	0.064	0.400	-0.116	0.267***
H: Wife does not own		(0.104)	(0.087)	(0.361)	(0.230)	(0.049)		(0.079)	(0.086)	(0.353)	(0.210)	(0.042)
W: Wife does not own	*5*	0.153	-0.016	-0.104	-0.477	0.237***	*8*	-0.136	0.030	-0.930*	-0.240	0.047
H: Wife owns		(0.167)	(0.183)	(0.651)	(0.408)	(0.081)		(0.125)	(0.122)	(0.509)	(0.284)	(0.063)
Concordance on others' ownership												
Both: Others do not own (omitted)	*18*						*76*					
Both: Others own	*62*	0.136	-0.194**	-0.068	-0.355*	-0.096*	*12*	-0.168	-0.006	0.046	-0.260	0.023
		(0.111)	(0.096)	(0.378)	(0.205)	(0.055)		(0.134)	(0.105)	(0.367)	(0.249)	(0.050)
W: Others own	*12*	0.187	-0.147	-0.185	0.053	-0.050	*7*	-0.054	-0.197*	0.106	-0.194	-0.116*
H: Others do not own		(0.151)	(0.131)	(0.534)	(0.262)	(0.074)		(0.118)	(0.118)	(0.440)	(0.262)	(0.060)
W: Others do not own	*8*	0.250	-0.091	-0.184	-0.679*	-0.010	*5*	0.286	0.057	-0.268	-0.765*	-0.017
H: Others own		(0.212)	(0.167)	(0.653)	(0.360)	(0.092)		(0.214)	(0.176)	(0.564)	(0.392)	(0.072)
R-squared		0.100	0.089	0.230	0.068	0.317		0.087	0.029	0.208	0.064	0.229
Observations		729	664	729	728	729		911	854	909	911	911
DV mean		0.23	0.49	3.69	3.60	0.48		0.21	0.53	3.06	3.57	0.76

Robust standard errors in parentheses are clustered at the PSU level. All regressions include the controls described in section 3.2. *** p<0.01, ** p<0.05, * p<0.1

Table 2.7: Correlation of concordance on wives' and others' decision making with wives' outcomes

	Panel A: Households with in-laws					***Panel B: Households without in-laws***				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Mean percent of decisions	Group partici-pation	Current use of birth control	Antenatal visits during last pregnancy	Satisfied with leisure time	*Mean percent of decisions*	Group partici-pation	Current use of birth control	Antenatal visits during last pregnancy	Satisfied with leisure time
Concordance on wives' decision making										
Both: Wife does not decide(omitted)	*47*					*36*				
Both: Wife decides	*22*	0.195	0.209*	-0.327	0.282	*26*	0.169*	0.381***	0.220	0.264
		(0.133)	(0.110)	(0.386)	(0.250)		(0.097)	(0.075)	(0.321)	(0.195)
W: Wife decides	*27*	0.237**	0.184*	-0.753**	0.065	*33*	0.206**	0.098	-0.269	-0.099
H: Wife does not decide		(0.120)	(0.095)	(0.336)	(0.214)		(0.087)	(0.078)	(0.310)	(0.199)
W: Wife does not decide	*4*	0.139	-0.128	-0.246	-0.010	*5*	0.237	0.027	-0.430	-0.592
H: Wife decides		(0.218)	(0.192)	(0.787)	(0.485)		(0.197)	(0.177)	(0.831)	(0.462)
Concordance on others' decision making										
Both: Others do not decide (omitted)	*44*					*96*				
Both: Others decide	*35*	-0.037	-0.175**	-0.051	-0.443**	*1*				
		(0.112)	(0.088)	(0.342)	(0.216)					
W: Others decide	*12*	-0.328**	-0.394***	-0.354	-0.212	*2*				
H: Others do not decide		(0.141)	(0.121)	(0.432)	(0.266)					
W: Others do not decide	*10*	-0.084	-0.049	-0.578	-0.374	*2*				
H: Others decide		(0.145)	(0.137)	(0.541)	(0.320)					
R-squared		0.106	0.125	0.255	0.080					
Observations		729	664	729	728		911	854	909	911
DV mean		0.23	0.49	3.69	3.60		0.21	0.53	3.06	3.57

Robust standard errors in parentheses are clustered at the PSU level. All regressions include the controls described in section 3.2. *** p<0.01, ** p<0.05, * p<0.1

2.5.1 Is concordance on wives' asset ownership correlated with wives' outcomes?

In Table 2.6, we first consider the association between the concordance of responses on the wife's asset ownership and her outcomes. Wives reporting that they own more types of assets is positively correlated with their participation in decision making, both when her husband agrees and when he does not. This is true whether or not in-laws are present in the household, but the magnitude of the coefficient varies across household type (see Appendix Table 2.A.1). In households with in-laws present, either spouse reporting that the wife owns assets is correlated with the wife's participation in decision making (see Panel A).

Only the wife reporting asset ownership in households with in-laws present is positively correlated with her group participation (see Panel A), and the difference across household type is statistically significant (see Appendix Table 2.A.1). While we do not observe a significant correlation between concordance and current use of birth control in households with or without in-laws, the relationship does vary across household type (see Appendix Table 2.A.1). The one surprising finding is that in households without in-laws, only the husband reporting that the wife owns assets is negatively correlated with antenatal visits (see Panel B).

2.5.2 Is concordance on others' asset ownership correlated with wives' outcomes?

Table 2.6 also presents correlations between the concordance of responses on others' asset ownership and the wife's outcomes. In joint households, concordance that others own assets is negatively correlated with outcomes, including current use of birth control, satisfaction with leisure time, and participation in decisions (see Panel A). In separate households, concordance that others own assets is not correlated with wives' outcomes. It is only in households without in-laws that there is any relationship between wives' outcomes and discordance in which only wives report others' asset ownership (see Panel B). Discordance in this instance

is associated with decreased use of birth control and less participation in decisions. Across household types, when only the husband claims that others own assets, wives are less satisfied with the time available for leisure activities. However, most of the differences across household types are not statistically significant (see Appendix Table 2.A.1).

2.5.3 Is concordance on wives' decision making correlated with wives' outcomes?

Table 2.7 reveals that concordance that the wife participates in decisions is associated with greater use of birth control, in both types of households (see Panels A and B). For households without in-laws, the coefficient on group participation is also statistically significant (see Panel B). In households with in-laws, only the wife reporting that she decides is positively correlated with both current use of birth control and group membership but is negatively correlated with the number of antenatal visits (see Panel A). In households without in-laws, only the wife reporting that she decides is similarly correlated with increased group membership (see Panel B). Only the husband reporting that his wife decides is not significantly correlated with any outcomes for wives in either type of household. These differences across household types are not statistically significant (see Appendix Table 2.A.2).

2.5.4 Is concordance on others' decision making correlated with wives' outcomes?

Finally, we examine the relationship between the concordance of spouses' responses regarding others' involvement in decision making and wives' outcomes. Table 2.7 demonstrates that the difference between joint and separate households is also evident in the proportion of decisions made by others. Couples in households with in-laws are in concordance that others do not decide for 44 percent of the household decision categories. When in-laws are not present, there is concordance that others are not involved in 96 percent of the decisions, on average. Thus, we do not analyze households without in-laws.

In households with in-laws, concordance that others decide is negatively correlated

with current use of birth control and satisfaction with leisure time. Only wives claiming that others decide is negatively correlated with group participation and use of birth control (see Panel A).

2.6 Discussion

Our results demonstrate several patterns related to couples' concordance and discordance on who owns assets and makes decisions, how couples' responses are related to the presence of in-laws, and how concordance pertains to measures of wives' well-being.

First, although overall concordance between spouses is relatively high in Nepal for both assets and decision making, this often comes from concordance that the wife does not own assets or make decisions; thus, such concordance may be indicative of a wife's disempowerment. Similar to the findings from Ambler et al. (2021) in Bangladesh, responses that wives own assets and make decisions are more common from wives than from husbands in Nepal. This, combined with the observation that these patterns differ across assets and decisions, supports the framework of Ambler et al. (2021) that suggests these patterns of discordance are partly driven by information asymmetries in the form of hidden or invisible assets and decisions.

Second, we observe different levels of concordance regarding asset ownership and decision making based on the presence or absence of the husband's parents. The levels of concordance are higher in households with in-laws, primarily driven by higher levels of concordance that the wife does not own assets or make decisions; again, concordance coexists with disempowerment. Wives are much more likely to report asset ownership and decision making in separate households, which could indicate a higher level of empowerment and bargaining power. Close monitoring by mothers-in-law may also provide fewer opportunities for wives to hide assets and decisions in joint households. Additionally, it may also be true that wives residing in households without in-laws are inherently more empowered; for example, wives with higher bargaining power are better able to form an independent household with their husbands. Young married couples in Nepal often cooperate with one another to hide

income from their in-laws in order to gain sufficient financial autonomy to form a separate household (Gram et al., 2018). However, once the intergenerational power struggle is resolved, husbands typically manage money for their households, so wives may have incentives to hide information from him.

In households without in-laws, very few decisions are made by people other than the husband or wife. This suggests that when couples form their own households, they are relatively independent and decisions are not made by in-laws or other family members. We also find that, among joint households, the division of labor is one in which the in-laws are responsible for agricultural decisions, similar to previous findings (Pradhan, Meinzen-Dick, and Theis, 2019).

Third, when observing the associations between concordance and wives' well-being, we see stronger relationships with concordance about decision making compared to asset ownership, consistent with the findings in Ambler et al. (2021). We find that, in general, responses indicating that the wife owns an asset or makes a decision are positively associated with her well-being. In contrast with past work (Ambler et al., 2021; Annan et al., 2021), our results do not indicate that the correlation with wives' well-being is stronger for concordance that wives are involved than for discordance in which only the wife says she is involved. However, we lack the statistical power to draw definitive comparisons.

Concordance on others making decisions is negatively associated with current use of birth control and satisfaction with leisure time in joint households. Social norms put pressure on wives to have sons as soon as possible after marriage (Gram et al., 2018) and wives who fail to do so in the first few years of their marriage may be abandoned by their husband's family (Clarke et al., 2014). Since wives who live with their in-laws are younger than those living in separate households, they may feel a higher sense of reproductive pressure. In addition, the expectations of their domestic responsibilities in joint households may prevent them from having leisure time. A study in Nepal found that wives in couples who separated from the joint household frequently described how this separation allowed them to make

autonomous decisions about their leisure time (Gram et al., 2018).

While patterns of concordance had differential levels of associations with women's well-being depending on the household structure, in pooled analyses we most often did not observe statistically significant differences in these relationships based on household type. This is most likely because we lack power to detect differences. While spouses' agreement on others' involvement could indicate a more cooperative and efficient household, which in turn could lead to improved outcomes for wives, we do not observe this pattern. Wives living with their in-laws are generally worse off when they report that others decide, regardless of whether their husband agrees. Recall that women were more likely than men to report that others owned assets or were involved in decision making, suggesting that women are interacting with their mothers-in-law in ways that are unobserved by their husbands. The regression analysis suggests that women may be worse off when this occurs. This is broadly consistent with findings from a recent study in Nepal which finds that in joint households, wives are more empowered when their husbands have not migrated, suggesting that having one's husband in residence protects wives from being disempowered by their mother-in-law (Doss et al., 2022).

2.7 Conclusion and Policy Implications

Concordance between spouses is not necessarily correlated with better outcomes for women, particularly when the point of agreement is that the wife does not own assets or make household decisions. The data show clearly that patterns of concordance vary depending on whether the couple lives in a joint or separate household. The relationship of concordance with outcomes of women's well-being also varies depending on the structure of the household. These key findings have a number of implications for both data collection and policy.

First, these findings reinforce the message that collecting data from both the husband and the wife can be highly informative and that indicators of concordance have value for assessing women's well-being. Typically, survey modules on asset ownership and agricultural production only interview the household head, usually a man. In contrast, survey modules

on decision making about consumption, health, nutrition and women's empowerment issues often interview only a woman. When both spouses are interviewed on the same topics, we find evidence of information asymmetries. This suggests that analysis may be biased if only one person is interviewed. Ultimately, the choice of who and how many people to interview will depend on the particular research goals and budget and time constraints. For example, if the goal is to understand women's well-being, our analysis shows that a wife's reports of asset ownership and decision making are more predictive of her well-being than her husband's reports (see Appendix Tables 2.A.3 and 2.A.4).

Our findings also indicate that, in this context in Nepal, the patterns of concordance are different for young couples who live with the husband's parents and those who do not. This raises important questions for household surveys conducted in other countries. These young couples living in joint households are usually missed in household surveys because the most senior adults would typically be the ones interviewed. Thus, these young couples—often with children—are invisible in analyses of intrahousehold dynamics, and their needs and assets might be missed. Instead, policy recommendations are based only on data from those young couples who have formed independent households. These two groups of young couples are substantively different in many dimensions. Finally, these results have implications for policy. Biases in reporting stemming from interviewing only one spouse could result in interventions that are targeted at the wrong individuals within households or at the wrong households altogether. For example, households may score differently on means tests depending on who within a household responds to the asset questions. In a context in which wives hide assets from their husbands, interviewing the husband only will result in underestimates of household asset ownership. As another example, in separate households, responses from husbands suggest that only a quarter of wives make decisions about agricultural production, while almost three quarters of wives report making such decisions. Failing to ask the wife about her involvement may result in targeting agricultural extension services or other agricultural interventions only to men, when wives would also benefit.

Understanding the differences between households with and without in-laws is also important from a policy perspective. First, our results point to reduced information asymmetries regarding the involvement of the wife in joint households, but these reductions may be driven by increased agreement that the wife has no involvement in asset ownership or decision making and monitoring of the wife's activities by her mother-in-law. At the same time, it is clear that in-laws play important roles in asset ownership and decision making in these households. In addition, information asymmetries matter not only for the wife's asset ownership and decision making, but also for that of other individuals. In particular, husbands may not understand the full extent of their mothers' activities. Policy makers must thus make special efforts in these households to ensure that programming and resources reach wives, and carefully consider whether mothers-in-law and husbands should be included in any program-related outreach. This conclusion is supported by our regression analysis: women's well-being is negatively correlated with their perception that other adults in the household take part in decision making and own assets, whether or not their husbands share that perception.

More generally, these results indicate the need for more research on joint households. Whether or not a young couple in a joint household owns assets or makes decisions may affect their ability to form their own household. We need to move beyond looking at the dynamics of couples within nuclear families and also consider more explicitly the relationships among various adults living within joint households.

References

Alkire, S., R. Meinzen-Dick, A. Peterman, A. Quisumbing, G. Seymour, and A. Vaz. 2013. "The Women's Empowerment in Agriculture Index." *World Development* 52:71–91.

Allendorf, K. 2007a. "Couples' Reports of Women's Autonomy and Health-Care Use in Nepal." *Studies in Family Planning* 38:35–46.

—. 2007b. "Do Women's Land Rights Promote Empowerment and Child Health in Nepal?" *World Development* 35:1975–1988.

Ambler, K., C. Doss, C. Kieran, and S. Passarelli. 2021. "He Says, She Says: Spousal Disagreement in Survey Measures of Bargaining Power." *Economic Development and Cultural Change* 69:765–788.

Anderson, C.L., T.W. Reynolds, and M.K. Gugerty. 2017. "Husband and Wife Perspectives on Farm Household Decision-making Authority and Evidence on Intra-household Accord in Rural Tanzania." *World Development* 90:169–183.

Annan, J., A. Donald, M. Goldstein, P. Gonzalez Martinez, and G. Koolwal. 2021. "Taking power: Women's empowerment and household Well-being in Sub-Saharan Africa." *World Development* 140.

Anukriti, S., C. Herrera-Almanza, P.K. Pathak, and M. Karra. 2020. "Curse of the Mummy-ji: The Influence of Mothers-in-Law on Women in India†." *American Journal of Agricultural Economics* 102:1328–1351.

Asian Development Bank (ADB). 2010. "Overview of Gender Equality and Social Inclusion in Nepal." Working paper, Asian Development Bank, Mandaluyong City, Philippines.

Becker, S., F. Fonseca-Becker, and C. Schenck-Yglesias. 2006. "Husbands' and wives' reports of women's decision-making power in Western Guatemala and their effects on preventive health behaviors." *Social Science & Medicine* 62:2313–2326.

Beegle, K., E. Frankenberg, and D. Thomas. 2001. "Bargaining Power Within Couples and Use of Prenatal and Delivery Care in Indonesia." *Studies in Family Planning* 32:130–146.

Brown, P.H. 2009. "Dowry and Intrahousehold Bargaining Evidence from China." *The Journal of Human Resources* 4425318446:25–4658.

Chen, J.J., and L.a. Collins. 2014. "Let's Talk About the Money: Spousal Communication, Expenditures, and Farm Production." *American Journal of Agricultural Economics* 96:1272–1290.

Clarke, K., N. Saville, B. Bhandari, K. Giri, M. Ghising, M. Jha, S. Jha, J. Magar, R. Roy, B. Shrestha, B. Thakur, R. Tiwari, A. Costello, D. Manandhar, M. King, D. Osrin, and A. Prost. 2014. "Understanding psychological distress among mothers in rural Nepal: a qualitative grounded theory exploration." *BMC Psychiatry* 14:60.

Deere, C.D., and J. Twyman. 2012. "Asset Ownership and Egalitarian Decision Making in Dual-headed Households in Ecuador." *Review of Radical Political Economics* 44:313–320.

Doss, C. 2006. "The effects of intrahousehold property ownership on expenditure patterns in Ghana." *Journal of African Economies* 15:149–180.

Doss, C., C. Kieran, and T. Kilic. 2020. "Measuring Ownership, Control, and Use of Assets." *Feminist Economics* 26:144–168.

Doss, C.R., R. Meinzen-Dick, A. Pereira, and R. Pradhan. 2022. "Women's empowerment, extended families and male migration in Nepal: Insights from mixed methods analysis." *Journal of rural studies* 90:13–25.

Duflo, E. 2003. "Grandmothers and Granddaughters: Old-Age Pensions and Intrahousehold Allocation in South Africa." *The World Bank Economic Review* 17:1–25.

Ghuman, S.J., H.J. Lee, and H.L. Smith. 2006. "Measurement of women's autonomy according to women and their husbands: Results from five Asian countries." *Social Science Research* 35:1–28.

Gram, L., J. Skordis-Worrall, J. Mannell, D.S. Manandhar, N. Saville, and J. Morrison. 2018. "Revisiting the patriarchal bargain: The intergenerational power dynamics of household money management in rural Nepal." *World Development* 112:193–204.

Hillesland, M., V. Slavchevska, H. Henderson, P. Okello, and F.N. Oumo. 2020. "Beyond the sex of the holder: understanding agricultural production decisions within household farms in Uganda." *Journal of Gender, Agriculture and Food Security* 05:14–27.

Hou, X., and N. Ma. 2013. "The effect of women's decision-making power on maternal health services uptake: evidence from Pakistan." *Health policy and planning* 28:176–184.

Jejeebhoy, S.J. 2002. "Convergence and Divergence in Spouses' Perspectives on Women's Autonomy in Rural India." *Studies in Family Planning* 33:299–308.

Kadiyala, S., M. Ruel, P. Menon, C. Kieran, K. Ambler, C. Doss, and S. Passarelli. 2020. "[dataset] Suaahara I - spouses only."

Meinzen-Dick, R., D. Rubin, M. Elias, M.A. Annet, and M. Emily. 2019. "Women's empowerment in agriculture: Lessons from qualitative research." Working paper, International Food Policy Research Institute, Washington, DC.

Ministry of Health, N., New-ERA, and ICF. 2017. "Nepal Demographic and Health Survey, 2016." Working paper, Ministry of Health, Nepal, Kathmandu, Nepal.

Narayan, D. 2002. "Empowerment and Poverty Reduction: A Sourcebook." Working paper, World Bank, Washington, DC.

Pradhan, R., R. Meinzen-Dick, and S. Theis. 2019. "Property rights, intersectionality, and women's empowerment in Nepal." *Journal of Rural Studies* 70:26–35.

Quisumbing, A.R., and J.A. Maluccio. 2003. "Resources at Marriage and Intrahousehold Allocation: Evidence from Bangladesh, Ethiopia, Indonesia, and South Africa." *Oxford Bulletin of Economics and Statistics* 65:283–327.

Reggio, I. 2011. "The Influence of the Mother's Power on Her Child's Labor in Mexico." *Journal of Development Economics* 96:95–105.

Schuler, S.R., S.M. Hashemi, and A.P. Riley. 1997. "The Influence of Women's Changing Roles and Status in Bangladesh's Fertility Transition: Evidence From A Study of Credit Programs and Contraceptive Use." *World Development* 25:563–575.

Simkhada, B., M.A. Porter, and E.R. van Teijlingen. 2010. "The role of mothers-in-law in antenatal care decision-making in Nepal: a qualitative study." *BMC Pregnancy and Childbirth* 10:34.

Singh, A. 2016. "Rethinking Empowerment: Gender identities, agency, and women's empowerment discourse and practice in Nepal." *Studies in Nepali History and Society* 21:227–249.

2.A Appendix Tables

Table 2.A.1: Is correlation of concordance on wives' and others' asset ownership with wives' outcomes equal across household types?

	(1) Group participation	(2) Current use of birth control	(3) Antenatal visits during last pregnancy	(4) Satisfied with leisure time	(5) Participation in decisions
Households with in-laws=Households without in-laws (p-values)					
Both: Wife owns	0.431	0.086	0.920	0.454	0.024
W: Wife owns; H: Wife does not own	0.030	0.994	0.214	0.793	0.035
W: Wife does not own; H: Wife owns	0.160	0.950	0.273	0.643	0.041
Both: Others own	0.072	0.192	0.829	0.757	0.125
W: Others own; H: Others do not own	0.196	0.776	0.680	0.532	0.473
W: Others do not own; H: Others own	0.908	0.566	0.918	0.867	0.955

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

Table 2.A.2: Is correlation of concordance on wives' and others' decision making with wives' outcomes equal across household types?

	(1) Group participation	(2) Current use of birth control	(3) Antenatal visits during last pregnancy	(4) Satisfied with leisure time
Households with in-laws=Households without in-laws (p-values)				
Both: Wife decides	0.874	0.191	0.226	0.951
W: Wife decides; H: Wife does not decide	0.815	0.462	0.269	0.563
W: Wife decides; H: Wife does not decide	0.717	0.510	0.863	0.365

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

Table 2.A.3: Correlation of wives' and others' asset ownership with wives' outcomes

	Panel A: Households with in-laws						***Panel B: Households without in-laws***					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Mean percent of assets	Group partici-pation	Current use of birth control	Antenatal visits during last pregnancy	Satisfaction with leisure time	Partici-pation in decisions	*Mean percent of assets*	Group partici-pation	Current use of birth control	Antenatal visits during last pregnancy	Satisfaction with leisure time	Partici-pation in decisions
Wives' responses												
Wife owns	*35*	0.199**	0.131*	-0.258	0.287	0.453***	*53*	0.032	0.001	0.295	0.067	0.380***
		(0.087)	(0.077)	(0.312)	(0.195)	(0.038)		(0.074)	(0.068)	(0.254)	(0.161)	(0.033)
Others own	*77*	0.051	-0.178**	-0.117	-0.071	-0.084**	*20*	-0.116	-0.066	0.100	-0.195	-0.001
		(0.100)	(0.080)	(0.346)	(0.176)	(0.042)		(0.095)	(0.080)	(0.272)	(0.173)	(0.038)
R-squared		0.099	0.089	0.230	0.061	0.379		0.083	0.025	0.201	0.057	0.264
Husbands' responses												
Wife owns	*16*	0.125	0.071	-0.045	0.150	0.224***	*39*	0.024	-0.049	-0.439*	0.070	0.202***
		(0.130)	(0.089)	(0.375)	(0.207)	(0.049)		(0.059)	(0.063)	(0.238)	(0.136)	(0.029)
Others own	*71*	0.072	-0.098	0.068	-0.344*	-0.071*	*18*	-0.020	0.022	-0.009	-0.340	0.061
		(0.084)	(0.077)	(0.267)	(0.175)	(0.042)		(0.101)	(0.083)	(0.298)	(0.217)	(0.045)
R-squared		0.094	0.082	0.229	0.064	0.259		0.081	0.026	0.203	0.060	0.167
Observations		729	664	729	728	729		911	854	909	911	911
DV Mean		0.23	0.49	3.69	3.60	0.48		0.21	0.53	3.06	3.57	0.76

Robust standard errors in parentheses are clustered at the PSU level. All regressions include the controls described in section 3.2. *** p<0.01, ** p<0.05, * p<0.1

Table 2.A.4: Correlation of wives' and others' decision making with wives' outcomes

	Panel A: Households with in-laws					***Panel B: Households without in-laws***				
	(1) *Mean percent of decisions*	(2) Group participation	(3) Current use of birth control	(4) Antenatal visits during last pregnancy	(5) Satisfaction with leisure time	(6) *Mean percent of decisions*	(7) Group participation	(8) Current use of birth control	(9) Antenatal visits during last pregnancy	(10) Satisfaction with leisure time
Wives' responses										
Wife decides	*48*	0.215**	0.212***	-0.764**	0.253	*76*	0.146*	0.188***	-0.117	0.067
		(0.101)	(0.077)	(0.321)	(0.189)		(0.076)	(0.071)	(0.303)	(0.174)
Others decide	*49*	-0.092	-0.245***	-0.143	-0.333*	*3*	-0.279*	-0.014	-0.317	0.345
		(0.095)	(0.072)	(0.307)	(0.177)		(0.146)	(0.153)	(0.474)	(0.331)
R-squared		0.105	0.132	0.254	0.080		0.089	0.061	0.205	0.054
Husbands' responses										
Wife decides	*23*	0.194	0.201**	-0.038	0.380*	*45*	0.054	0.254***	0.181	0.119
		(0.129)	(0.085)	(0.368)	(0.196)		(0.066)	(0.061)	(0.223)	(0.135)
Others decide	*46*	0.016	-0.063	-0.039	-0.371**	*3*	-0.146	-0.051	-0.688	0.176
		(0.086)	(0.076)	(0.277)	(0.175)		(0.165)	(0.148)	(0.508)	(0.389)
R-squared		0.099	0.110	0.246	0.084		0.084	0.074	0.206	0.054
Observations		729	664	729	728		911	854	909	911
DV Mean		0.23	0.49	3.69	3.60		0.21	0.53	3.06	3.57

Robust standard errors in parentheses are clustered at the PSU level. All regressions include the controls described in section 3.2. *** p<0.01, ** p<0.05, * p<0.1

Essay 3

Call on Me: The Impact of Communication on Intrahousehold Information Asymmetries in the Philippines

Abstract

I develop a conceptual framework to understand how communication affects information asymmetries and monetary transfers between spouses in the Philippines. I posit that improving spouses' ability to communicate increases the cost of hiding or withholding income and reduces the cost of monitoring. Using data from the first randomized control trial to provide communities with mobile networks access, I find suggestive evidence that this intervention increased transfers from husbands to wives by reducing information asymmetries between spouses. I also present experimental games that could be conducted with spouses in order to test the implications of the model.

Acknowledgements

The Community Cellular Network (CCN) project was funded by the Bill and Melinda Gates Foundation, NetHope, USAID, the Center for Effective Global Action, and University of California Berkeley Hellman Fellows Fund.

3.1 Introduction

Gender disparities in control over resources are pervasive. Women typically earn less than men, have less control over their own income, household income (Ortiz-Ospina and Roser, 2018), and are less likely to own property such as land and housing (Doss and Meinzen-Dick, 2015; Gaddis, Lahoti, and Swaminathan, 2020; Kieran et al., 2015). Correcting these disparities is important from an equity perspective. Women should not have to depend on their relationships with men in order to access resources. Evidence suggests that transferring cash to women can increase women's decision-making power and reduce physical intimate partner violence (Bastagli et al., 2019). Many development actors also have an instrumental justification for aiming to augment the share of resources that women control.[1] This stems from a large body of research rejecting the hypothesis of full income pooling within households, suggesting that who earns income or receives a transfer matters for consumption patterns (Browning et al., 1994; Duflo, 2003; Haddad and Hoddinott, 1995; Thomas, 1994). Most cash transfer programs target women as recipients under the assumption that this will catalyze broader multiplier effects on the food security, health, and education of children. However, the evidence on whether targeting transfers to mothers is better for children, relative to making transfers to fathers, is mixed.[2].

Numerous studies examine the determinants of resource allocation within the household such as assets brought to marriage, income, and education (see Doss (2013) for a discussion of this literature). Another large strand of literature assesses how an exogenous shock to one household member's income impacts a variety of outcomes (Thomas, 1990; Thomas, 1994; Duflo, 2003; Ambler, 2016; Hidrobo, Peterman, and Heise, 2016).[3] Fewer studies investigate

[1]The argument that achieving gender equality can promote development goals has been circulating for at least 50 years (for example, see the discussion of the "women in development" approach from the 1970s in Koczberski, Gina (1998). Women in Development: A Critical Analysis. *Third World Quarterly, 19* (3), 395-409.

[2]For example, Armand et al. (2020) randomize whether transfers are targeted to mothers or fathers in the Republic of North Macedonia, finding that transfers to mothers increase expenditures shares on food. However, prior to this study, a review of this topic found no conclusive evidence that the identity of the recipient influences the impacts of a transfer on child outcomes (Bastagli et al., 2019)

[3]See Bastagli et al. (2016) for a review of the literature on targeting cash transfers within households.

how exogenous changes to other components of intrahousehold decision-making processes, such as information or communication, affect households and the individuals within them.

In the intrahousehold literature, some experimental games shed light on how information and communication can influence decisions within households. These games reveal that spouses often hide information from one another (Munro, 2018). Spouses also frequently exploit information asymmetries for their personal gain, even when doing so is costly for their household (Ashraf, 2009; Castilla and Walker, 2013; Hoel, 2015; Mani, 2020). In a survey of lab-in-the-field experiments on intrahousehold decision making, Munro (2018) finds a lack of efficiency in intrahousehold decisions.[4] Most experimental games do not allow spouses to communicate, but one exception is a study by Ashraf (2009), who analyzes how communication between spouses during a field experiment affects their financial decisions. These experimental games provide insights into how information and communication affect decisions within households, but our ability to predict real-world behavior from actions in these controlled settings may be limited (Doss, 2013).

Using data from the first randomized control trial (RCT) to provide communities with cellular network access, I find suggestive evidence that the ability to communicate by mobile phone increased wives' control over household income by reducing information asymmetries between spouses and increasing transfers from husbands to wives. I argue that the findings are consistent with a model of the household in which communication between spouses increases the cost of hiding or withholding income from one's wife and reduces the cost of monitoring one's husband.

Although cohabitating spouses can easily communicate, as a practical matter, split migrant couples face communication challenges. Communication is much more convenient if both spouses are in an area with cellular networks. Globally, about 5.2 billion people subscribed to mobile services by the end of 2019 (GSM Association, 2020), but many rural

[4]These studies typically measure Kaldor-Hicks efficiency. The games employ different procedures, including voluntary contribution mechanisms, dictator, or trust games, but they all include a strategy that maximizes household payoffs.

areas still lack access. Using a new mobile phone technology called the Community Cellular Network (CCN), researchers from UC Davis, UC Berkeley, and the University of the Philippines-Diliman recently completed an RCT on the impacts of providing rural communities in Aurora Province of the Philippines with access to cellular networks. Temporary migration of one member of a couple is common in this context. Data from the endline survey reveal that about one-third of individuals with spouses left their barangay, the smallest administrative unit in the Philippines, at some point in the previous year.

There are several pathways through which cellular access might affect how spouses make financial decisions. Prior to bargaining over resource allocation, spouses first decide how much of their income to reveal to their partner (Ashraf, 2009; Castilla, 2019; Castilla and Walker, 2013; Kebede et al., 2014). According to cultural norms in many parts of the Philippines, wives manage household budgets. Husbands are supposed to turn over their entire income to their wives, but they do not necessarily do so.[5] Wives also devote their earnings to the household budget. Wives then decide how much allowance to allocate to their husbands for their daily expenditures (Illo, 1989). Among split migrant couples, the physical distance and income variability associated with migration facilitate private information (Chen, 2013). I hypothesize that introducing cellular networks increases the cost of both withholding observable income and hiding information from one's wife.

Ashraf (2009) argues that, in the Philippines, a wife will punish her husband if she finds out that he hid or spent money without her knowledge. If a wife communicates her preferences to her husband when he makes the decision, she will then enact a greater penalty if he defies her than she would if she does not have the opportunity to communicate her preferences at the time of the decision. Ashraf (2009) confirms this hypothesis in an experiment with couples at a bank in Mindanao, an island in the Philippines. She gives subjects a sum of money and asks them to choose whether they want to deposit it in their own bank account, their spouse's account, or consume it rather than save it. She assigns spouses to one of

[5]In Tagolog, the term *kupit* refers to the practice of men secretly keeping some of their income (Ashraf, 2009).

three treatment arms: (1) in the "Private" arm, spouses are separated and are not given any information on their partner's decisions or choice set; (2) in the "Public" arm, spouses know their partner's decisions and choice set and they make their decisions simultaneously; (3) the "Negotiation" arm is the same as the "Public" arm, except that spouses communicate before making their decisions. When husbands make a private financial decision, they put money into their personal bank account. When husbands make public financial decisions without first communicating with their spouse, they spend money on their own consumption. When spouses are allowed to communicate about a public endowment, husbands are more likely to put money into their wife's bank account. Based on this research, I assume that introducing cellular networks will increase the cost of withholding observable income from one's wife.

Ashraf (2009) does not test whether allowing spouses to communicate about a private endowment increases the transfer from husbands to wives. I argue that communication increases the cost of hiding income and expenditures for several reasons. Similar to withholding observable income, communication will increase the severity of the penalty that wives enact if they catch their husbands hiding information. In addition, husbands most likely experience greater disutility from lying to their wives than from simply enacting lies of omission. Moreover, if cellular networks increase the likelihood that wives monitor their husbands, as discussed below, or improve the information that they obtain through monitoring, then this would increase the husband's risk of being caught hiding income. Husbands face a trade-off between paying to hide income in order to retain control without their wife's knowledge, or revealing their income and choosing to withhold some of it from their wife. If communication increases the costs of both hiding and withholding observable income, then its effect on the ratio of these two costs will determine whether husbands choose to hide income from their wives.

The introduction of mobile networks may also affect the financial decisions of spouses by reducing the price of monitoring. In much of the Philippines, wives are typically expected to enforce the marital contract mandating that wives manage the household budget (Ashraf,

2009). Thus, she must decide how much to invest in monitoring her husband's income. If direct communication with her husband is a substitute for monitoring, this will reduce the wife's willingness to pay to monitor his income. However, if the wife does not trust her husband to share accurate information on his income or expenditures, she can monitor it. For example, she could call individuals in her shared network with her husband to ask questions about her husband's income and expenditures or inquire more broadly about wages in her husband's field or the price of certain goods. Cellular networks likely reduce the cost of monitoring by making it easier for wives to communicate with individuals in this network.

A key finding of the impact evaluation of the CCN experiment is that providing communities with cellular network access increased household income. About one-quarter of the increase in income is explained by increases in net remittance flows into households (Blumenstock et al., 2022). The authors do not analyze who sent or received these remittances. While the survey did not collect information on how much income husbands transferred to their wives among cohabitating couples, I do observe the size of remittances sent and received among split migrant couples. In this paper, I assess whether there are heterogeneous treatment effects on remittances based on who migrates and the length of migration spells. I hypothesize that mobile network access increases the cost of hiding or withholding income from a spouse more for short-term than for long-term male migrants. Short-term migrants spend more time living with their spouse and therefore have more opportunities than long-term migrants to be penalized for withholding income or hiding information on their income or expenditures, if they are caught doing so. They may also be more likely to be caught since they have fewer opportunities to spend their income prior to returning home. Thus, we might expect cellular networks to increase the amount of remittances that migrant husbands send home to their wives more for short-term than for long-term migrants. In line with this hypothesis, I find evidence that cellular network access increased the amount of remittances that women received and the net remittances from their short-term migrant spouses but not from long-term migrant spouses.

Mobile network access increased household expenditures and food security (Blumenstock et al., 2022). Blumenstock et al. (2022) do not assess whether treatment affected expenditure shares on public goods. By considering how intrahousehold dynamics interact with the introduction of cellular networks, can we better understand the pathways through which this intervention affected expenditures and food security? Increasing household income will not necessarily increase expenditures or expenditure shares on public goods for the household. Typically, as income increases, we would expect expenditure shares on food to decrease. However, the literature suggests that increasing the share of income that wives control will increase public good expenditure shares and especially expenditure shares on food. I find that treatment increased monthly food and energy expenditures and expenditure shares more in households with women budgeters than for households in which men or men and women jointly manage the budget. Based on previous studies, this is what we would expect if treatment increased the share of income controlled by wives. I do not observe heteregeneous treatment effects on total monthly expenditures based on who manages the household budget, so the effects cannot be explained by differences in total expenditures.

Cellular network access may also reduce information asymmetries among cohabitating couples by reducing price variation and the cost of monitoring. For example, the construction of cell phone towers along the Kerala coastline in India reduced daily price variation in local fish markets (Jensen, 2007). In theory, greater observability and less variability should reduce information asymmetries regarding household profits from farming and fishing. I find evidence in support of this hypothesis. Specifically, among households with women budget managers, treatment reduced the absolute difference in reported fish prices and increased agreement between spouses on the price at which the household last sold fish or crops. These findings provide suggestive evidence that cellular networks increase women's control over household resources and reduce information asymmetries regarding agricultural prices in this setting.

Asymmetric information within households may result in inefficiencies, especially when

these asymmetries are intentional and strategic. Hiding income from one's spouse often requires allocating resources away from easily observed or monitored goods. This may result in underinvestment in public goods for the household such as food and education. Moreover, distrusting one's spouse may result in wasting resources on monitoring. A study in Kenya finds that migrant husbands spend substantial resources on monitoring their wives (De Laat (2014)). Communication technologies may be a useful tool for reducing information asymmetries, which could increase investment in human capital. Income hiding also has methodological implications for survey design. For example, many surveys collect financial information from one individual within a household who is knowledgeable about the household's finances. Proxy reporting will be unreliable in the presence of asymmetric information on income or expenditures.

The chapter proceeds as follows. Section 2 describes the conceptual framework that guides my analysis. Next, Section 3 provides background on the CCN RCT and the survey data from that experiment. Section 4 presents the results of my analysis and Section 5 concludes with a discussion of the findings and policy implications.

3.2 Conceptual Framework

This section lays out a theoretical model of financial decisions within households in the Philippines. I then describe how communication is likely to affect these decisions. While I am not able to formally test most of the hypotheses of the theoretical model using the available data, I present the design and analysis plan for a lab-in-the-field experiment that would allow one to test how communication, private information, and the interaction between communication and information affect the size of transfers from husbands to wives, public good allocations, and efficiency.[6] This conceptual framework sets the stage for the empirical analysis that follows in Section 4. It guided the development of the hypotheses that I test using existing survey data and captures a structured way of conceptualizing how the

[6]While I planned to conduct these lab-in-the-field experiments with couples in Aurora Province of the Philippines, COVID-19 restrictions prevented me from returning to the Philippines after helping to conduct the endline survey for the CCN experiment.

introduction of cellular network access is likely to influence information and resource sharing of spouses in the Philippines.

3.2.1 Theoretical Model

Before spouses bargain over how to allocate income within a household, they first decide how much of their income to reveal to their partner (Ashraf, 2009; Castilla, 2019; Castilla and Walker, 2013; Kebede et al., 2014). In the Philippines, husbands are expected to turn over their entire income to their wives in order for wives to manage the household budget. The wife is expected to enforce this informal marital contract dictating that the wife serves as budget manager. In this subsection, I develop a model in which husbands decide how much of their income to turn over to their wives, who decide how much to allocate to public goods for the household. Husbands may choose to hide some portion of their income, but must incur a cost to do so. In order to enforce the contract, wives may choose to monitor the husband's income, but must pay to do so. These costs may reflect monetary costs spent on hiding or monitoring or the disutility of lying to one's spouse or expressing distrust through monitoring. In addition, when the husband's endowment is observable to his wife, he incurs a cost for deviating from the expectation that he turn over his income to his wife. This penalty may also be monetary, for example, if the wife invests less in the public good when she observes her husband withholding income from her, or nonmonetary.[7] This theoretical framework draws from an intrahousehold bargaining model with asymmetric information over monetary transfers (Castilla and Walker, 2013), but I introduce the option of monitoring and assume that hiding or withholding income from one's spouse is not free.

Let the utility functions of a husband (1) and wife (2) be defined as $U_i = v(Q) + u(x_i)$ for $i = 1, 2$, where Q is a public good such as housing or school fees for children, x_1 is the husband's private good, and x_2 is the wife's private good. Assume that U_i is separable in both goods and the functions u and v satisfy the following conditions: $u' > 0$, $v' > 0$, $u'' < 0$, $v'' < 0$. The intrahousehold bargaining model has 3 stages. In stage 0, the husband and

[7] Ashraf (2009) cites an example in which a wife refuses to do her husband's laundry for 3 weeks.

wife each earn an exogenous income Y_i. The wife's income Y_2 is always observable to both spouses and is strictly less than the husband's income, Y_1. The husband's endowment is either public, in which case it is common knowledge to the husband and wife, or private, in which case only the husband can observe it. Husbands can pay p_h to hide the endowment from their wives and wives can pay p_m in order to monitor their husband's income. At the end of this stage, the wife's information about the husband's endowment is common knowledge.[8]

In stage 1, husbands decide how much to send to their wives (r) and how much to allocate to their private good (x_1). When the husband's endowment is public, he incurs a cost for deviating from the informal contract that he should turn over his income to his wife. He pays a price (p_d) for each unit withheld from his wife ($Y_1 - r$). However, when his endowment is private, he does not experience any disutility from deviating from their agreement.

In stage 2, wives decide how much to allocate to the household's public good (Q) and how much to allocate to their private good (x_2). For simplicity, I follow Castilla and Walker (2013) in assuming that spouses face the same price for private goods and this is normalized to 1. The price of the public good is p. I examine four potential cases: (1) the husband's endowment is private and the husband did not have to pay for the endowment to be private, (2) the husband's endowment is public because the wife pays to monitor her husband's endowment, (3) the husband's endowment is public and the wife did not have to pay for this information, and (4) the husband's endowment is private because he paid to hide it from his wife.

[8]That is, if the endowment is private or if the husband paid for a private endowment, the husband knows that the wife has no information regarding the size of his endowment, but if the endowment is public or the wife paid to monitor, then the husband knows that the wife is aware of the size of his endowment. If the husband pays to hide income, then the probability that the wife observes this income is zero. If the wife pays to monitor, then she knows his income with certainty.

Case 1: Private endowment

When the husband's endowment is private, we solve through backwards induction by starting with stage 2, in which the wife decides how much to allocate to the public good

$$\begin{aligned} \max_{Q \geq 0} U_2 &= v(Q) + u(x_2) \\ s.t.\ x_2 &\leq Y_2 + r - pQ \end{aligned} \tag{3.1}$$

Substituting in the budget constraint, the first-order condition with respect to Q is

$$\frac{\partial U_2}{\partial Q} = v'(Q) - pu'(Y_2 + r - pQ) \leq 0 \tag{3.2}$$

Using the Implicit Function Theorem to conduct comparative statics on this first-order-condition (FOC) with respect to the amount that the husband sends to the wife yields

$$\frac{\partial Q}{\partial r} = \frac{pu''(Y_2 + r - pQ)}{v''(Q) + p^2 u''(Y_2 + r - pQ)} > 0 \tag{3.3}$$

Not surprisingly, the amount of the public good that is consumed is increasing in the amount of money that the husband sends to his wife. This holds across all four cases.

The public good allocation will be strictly positive, so equation (3.2) will hold with equality. Taking the wife's FOC as given, the husband chooses the optimal quantity to send to his wife.

$$\begin{aligned} \max_{r \geq 0} U_1 &= v(Q) + u(x_1) \\ s.t.\ x_1 &\leq Y_1 - r \\ v'(Q) - pu'(Y_2 + r - pQ) &= 0 \quad [\lambda_1] \end{aligned} \tag{3.4}$$

Using Cramer's Rule, conducting comparative statics on the amount the husband sends to

the wife with respect to an increase in his own income yields

$$\frac{\partial r}{\partial Y_1} = \frac{u''(x_1)[p^2u''(x_2) + v''(Q)]^2}{D_1} > 0, \tag{3.5}$$

where D_1 is the determinant of the Hessian, which is negative.

Thus, when the endowment is private, the amount that the husband sends to the wife is increasing in his endowment. Similarly, the wife's public good allocation is increasing in the husband's endowment:

$$\frac{\partial Q}{\partial Y_1} = \frac{u''(x_1)u''(x_2)[p^3u''(x_2) + pv''(Q)]}{D_1} > 0. \tag{3.6}$$

Case 2: Wife pays to monitor endowment

In the pre-bargaining stage, the wife decides whether or not to monitor the husband's endowment at a price of p_m. For simplicity, I assume that if she pays to monitor the endowment then she will know the size of the endowment with certainty. If she chooses to monitor, then her optimization problem is

$$\begin{aligned} &\max_{Q \geq 0} U_2 = v(Q) + u(x_2) \\ &s.t.\ x_2 \leq Y_2 + r - pQ - p_m \end{aligned} \tag{3.7}$$

Substituting in the budget constraint, the first-order condition with respect to Q is

$$\frac{\partial U_2}{\partial Q} = v'(Q) - pu'(Y_2 + r - pQ - p_m) \leq 0 \tag{3.8}$$

Taking the wife's FOC as given, the husband solves

$$\begin{aligned} \max_{r \geq 0} U_1 &= v(Q) + u(x_1) \\ s.t.\ x_1 &\leq Y_1 - r - p_d(Y_1 - r) \\ v'(Q) - pu'(Y_2 + r - pQ - p_m) &= 0 \quad [\lambda_2] \end{aligned} \tag{3.9}$$

Conducting comparative statics demonstrates that the amount the husband sends to the wife and the public good allocation are increasing in the husband's endowment, as we observed in case 1:

$$\frac{\partial r}{\partial Y_1} = \frac{(p_d - 1)^2 u''(x_1)[p^2 u''(x_2) + v''(Q)]^2}{D_2} \geq 0 \tag{3.10}$$

$$\frac{\partial Q}{\partial Y_1} = \frac{p(p_d - 1)^2 u''(x_1)u''(x_2)[p^2 u''(x_2) + v''(Q)]}{D_2} \geq 0 \tag{3.11}$$

The numerators of equations 3.10 and 3.11 equal 0 when $p_d = 1$ and are strictly positive otherwise.

In order to determine whether the amount sent to the wife is increasing or decreasing in the price of monitoring we need to make additional assumptions about $u'''(x_2)$ and $v'''(Q)$. Conducting comparative statics yields

$$\frac{\partial r}{\partial p_m} = \frac{-pu''(x_2)\left(-pu''(x_2)v''(Q) + p^2 v'(Q)u'''(x_2) + (p_d - 1)u'(x_1)\left[p^3 u'''(x_2) - v'''(Q)\right]\right)}{D_2} \tag{3.12}$$

As we would expect, conditional on choosing to monitor the husband's endowment, the amount that the wife allocates to the public good is decreasing in the price of monitoring

$$\frac{\partial Q}{\partial p_m} = \frac{-p(p_d - 1)^2 u''(x_1)u''(x_2)\left[p^2 u''(x_2) + v''(Q)\right]}{D_2} \leq 0, \tag{3.13}$$

where the numerator equals 0 if $p_d = 1$ and is strictly decreasing otherwise.

Next, we examine how the amount that the husband sends to the wife and the amount

that she allocates to the public good changes with the price of deviating from the marital contract

$$\frac{\partial r}{\partial p_d} = \frac{[u'(x_1) + (p_d - 1)(r - Y_1)u''(x_1)][-(p^2u''(x_2) + v''(Q))^2]}{D_2} \tag{3.14}$$

$$\frac{\partial Q}{\partial p_d} = \frac{p[-u'(x_1) - (p_d - 1)(r - Y_1)u''(x_1)]u''(x_2)[p^2u''(x_2)] + v''(Q)]}{D_2} \tag{3.15}$$

Assuming that husbands do not borrow money to send to their wives, we know that $r \leq Y_1$. If the husband sends his entire endowment to his wife ($r = Y_1$), then $\frac{\partial r}{\partial p_d} > 0$ and $\frac{\partial Q}{\partial p_d} > 0$. If, on the other hand, $r < Y_1$, then $p_d \leq 1$ because $(p_d - 1)(r - Y_1) = x_1 \geq 0$. If $p_d = 1$, then $\frac{\partial r}{\partial p_d} > 0$ and $\frac{\partial Q}{\partial p_d} > 0$, as we observed when $r = Y_1$. If $p_d < 1$, then $\frac{\partial r}{\partial p_d} > 0$ and $\frac{\partial Q}{\partial p_d} > 0$ if $u'(x_1) + x_1u''(x_1) > 0$, and $\frac{\partial r}{\partial p_d} \leq 0$ and $\frac{\partial Q}{\partial p_d} \leq 0$ otherwise. We therefore cannot predict how increasing p_d will affect the amount the husband sends to the wife or the amount the wife allocates to the public good without specifying a functional form for $u(x_1)$.

The wife will choose to monitor her husband's endowment if her indirect utility in case 2 exceeds her indirect utility in case 1. We would expect to observe monitoring if the wife believes that her husband behaves opportunistically by sending her more when his endowment is public than when it is private. For monitoring to be worthwhile, this difference in r would have to be large enough to at least offset p_m.

Case 3: Public endowment

When the husband's endowment is public and the husband does not pay to hide income, stage 2 is the same as in case 1. Stage 1 differs from case 1 because the husband incurs a penalty for withholding income from his wife since she can now observe how much he is withholding. Thus we can write stage 1 as follows

$$\begin{aligned} \max_{r \geq 0} U_1 &= v(Q) + u(x_1) \\ s.t.\ x_1 &\leq Y_1 - r - p_d(Y_1 - r) \\ v'(Q) - u'(Y_2 + r - pQ) &= 0 \quad [\lambda_1] \end{aligned} \tag{3.16}$$

Conducting comparative statics yields

$$\frac{\partial r}{\partial Y_1} = \frac{(p_d - 1)^2 u''(x_1)[p^2 u''(x_2) + v''(Q)]^2}{D_3} \geq 0 \tag{3.17}$$

$$\frac{\partial Q}{\partial Y_1} = \frac{p(1 - p_d)^2 u''(x_1)u''(x_2)[p^2 u''(x_2) + v''(Q)]}{D_3} \geq 0 \tag{3.18}$$

Thus, as we observed in the previous two cases, the amount the husband sends to the wife and the amount the wife allocates to the public good are weakly increasing in the husband's endowment. Comparative statics also reveal that $\frac{\partial r}{\partial p_d}$ and $\frac{\partial Q}{\partial p_d}$ are the same as in case 2, except that $x_2 = Y_2 + r - pQ$ because there are no monitoring costs in this case. Again, we cannot predict how an increase in p_d will affect r or Q because it depends on the functional form of $u(x_1)$.

Case 4: Husband pays for private endowment

In the pre-bargaining stage, the husband decides whether or not to hide his endowment from his wife. If he hides his endowment, he incurs a cost of p_h, but he does not incur any cost for withholding income from his wife because she does not know the size of his endowment. Solving through backwards induction, we start with stage 2, in which the wife chooses the optimal public good allocation. This stage is the same as in cases 1 and 3 because the wife cannot pay for monitoring.

Taking the wife's FOC as given, the husband's optimization problem is

$$\begin{aligned} \max_{r \geq 0} U_1 &= v(Q) + u(x_1) \\ s.t.\ x_1 &\leq Y_1 - r - p_h \\ v'(Q) - pu'(Y_2 + r - pQ) &= 0 \quad [\lambda_1] \end{aligned} \tag{3.19}$$

It is clear that $\frac{\partial r}{\partial Y_1}$ and $\frac{\partial Q}{\partial Y_1}$ are the same as in case 1, except that $x_1 = Y_1 - r - p_h$ because

the husband can pay to hide in this case. Across all cases, r and Q are weakly increasing in Y_1.

Conducting comparative statics on the price of hiding demonstrates that both the amount that the husband sends to the wife and the amount that the wife allocates to the public good are decreasing in the price of hiding income. This is not surprising given that, conditional on choosing to hide income, an increase in the price of hiding reduces the funds available for husbands to send to their wives.

$$\frac{\partial r}{\partial p_h} = \frac{-u''(x_1)[p^2u''(x_2) + v''(Q)]^2}{D_4} < 0 \tag{3.20}$$

$$\frac{\partial Q}{\partial p_h} = \frac{-pu''(x_1)u''(x_2)[p^2u''(x_2) + v''(Q)]}{D_4} < 0 \tag{3.21}$$

The husband will choose to hide income from his wife if his indirect utility in case 4 exceeds his indirect utility in case 3. We would expect to observe hiding if the cost of hiding his endowment (p_h) is greater than the cost of withholding his endowment ($p_d(Y_1 - r)$). The decision to hide could also depend on whether the husband expects the wife to behave strategically by basing her public good allocation on the share of the endowment that he sends to her, when she observes this endowment. The comparative statics from all four cases are summarized in Appendix Table 3..9. They are categorized into two families of outcomes: Family A is the amount that husbands send to their wives (r) and Family B is the public good allocation (Q). Appendix A also presents a more detailed description of the math in this section.

3.2.2 The Role of Communication

I hypothesize that allowing spouses to communicate prior to making financial decisions will alter the price and willingness to pay for withholding observable income (p_d), hiding income (p_h), and monitoring income (p_m). Ashraf (2009) finds that, in the absence of communication with their spouse, when husbands make a private financial decision, they put money into a

personal bank account and when the make public financial decisions, they spend money on their own consumption. However, when they communicate about this public decision, they put money into their wives' bank account. Ashraf (2009) argues that this behavior can be explained by the fact that a wife will punish her husband if she finds out that he hid or spent money without her knowledge and this punishment will be more severe if the wife perceives that her husband intentionally ignored her preferences instead of simply misinterpreting them.

To my knowledge, there are no studies assessing how communication affects the cost of hiding income or willingness to pay to hide income from one's spouse. When spouses cannot communicate, for example, if one of them is on migration and there is no cellular network, husbands cannot easily share information about their income. They may, however, send remittances home, which can serve as a signal of their income. Since communicating impedes husbands' ability to enact lies of omission, it increases the probability that hiding income requires explicitly lying to one's spouse. I assume that husbands experience greater disutility from lying to their wives than from simply signaling that their income is lower than it is. Thus, communication should increase the price of hiding income (p_h). If communication increases both p_d and p_h, then the effect on the likelihood that a husband will choose to hide income from his spouse is ambiguous. The effect of communication on income hiding will depend on how it affects $\frac{p_d(Y_1-r)}{p_h}$, which is an empirical question.

Cellular access most likely reduces monitoring costs by reducing information frictions on wages and prices. For example, among cohabitating couples, cellular access makes it easier to acquire information on fish and crop prices in different markets, thus reducing the costs of monitoring a spouse's income. This would increase monitoring. However, if wives can increase the amount of money that their husbands share with them simply through direct communication, even when his endowment is private, this would reduce the benefits of monitoring. We would thus observe a reduction in monitoring when spouses communicate, relative to a scenario in which they cannot communicate.

3.2.3 Lab-in-the-Field Experiment

To test the hypotheses of this theoretical framework, I designed lab-in-the-field experiments to be conducted with couples (due to COVID-19 travel restrictions, I did not conduct these games). These games are a hybrid of trust games and public goods games in which the husband receives an endowment that is either public or private, decides how much to send to his wife, and his wife decides how much to invest in a public good. Each couple plays three rounds. In the first round, spouses are not allowed to communicate, but in the second round they communicate prior to making their decisions. After conducting the first two rounds, we elicit the sender's and recipient's willingness to pay and willingness to accept for communication with their spouse. In the third round of the game, they will not communicate if neither is willing to pay to communicate and they will communicate if both partners are willing to pay to communicate. If only one member of the couple has a positive willingness to pay, then we will flip a coin to determine whether they communicate. See Appendix B for a complete description of the design and analysis plan for this lab-in-the-field experiment.

This lab-in-the-field experiment would shed light on how information and communication interact to affect the financial decisions of spouses. To my knowledge, no intrahousehold games have been designed to test whether communication about a private endowment increases the amount that husbands send to their wives. It would also be the first to measure whether communication increases efficiency, even when one spouse has an information advantage, and the first to measure willingness to pay for monitoring a spouse's behavior.

3.3 Background and Survey Data

I examine survey data from a recent randomized controlled trial that introduced a new mobile phone technology to assess the economic impacts of first-time access to cellular networks.

3.3.1 The Community Cellular Network (CCN) Experiment

The CCN is a low-cost alternative to traditional cellular towers that is designed to function in rural settings, where power is intermittent and where community members may have

limited technical training (Heimerl and Brewer, 2010). The research team randomly selected 7 villages to receive a CCN from a set of 14 geographically isolated villages in Aurora province along the east coast of Luzon, the largest island in the Philippines (see Figure 3.1). None of the sites had cellular access at baseline. Although almost two-thirds of households owned at least one cell phone at baseline, accessing a mobile network generally required travelling for several hours by boat or bus.

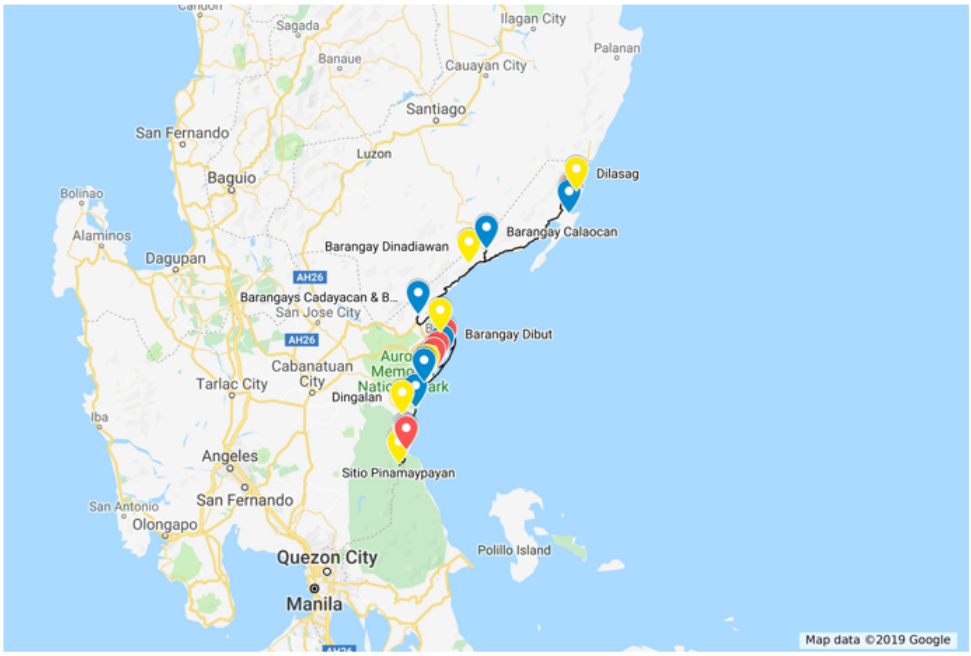

Figure 3.1: Aurora sites

Starting in 2016 and ending in 2018, researchers conducted a baseline census of 2,370 households in the 14 eligible sites. Using a matched-pairs random assignment design, a team from the University of the Philippines led the construction, testing, and network management in a phased roll out of CCNs across the 7 selected sites. After CCN installation in each site, the research team assigned each of the 1,131 households in treated sites to one of the following promotional treatment groups: (1) no promotions, (2) free phone credit (100 Pesos loaded directly to the customer's balance), (3) 50% discount on local calls, (4) local discount plus free credit, (5) 50% discount on long-distance calls, and (6) long-distance discount plus free

credit (see Table 3.1 for the number of households assigned to each treatment).[9] Finally, we conducted an endline survey of 2,692 households in the 14 sites from May to September, 2019. 1,967 of these households were interviewed at baseline. For a more detailed description of the site selection, CCN tower installation, customer registration, random assignment to promotions, and data collection processes, see Blumenstock et al. (2022).

Table 3.1: Promotional Treatment Groups

	No Discount	50% Local Discount	50% Long-distance Discount
No Free Load	187	183	191
Free Load	191	186	193

Note: Numbers in cells represent household counts.

3.3.2 Data and Summary Statistics

The baseline and endline surveys consist of a household roster, with data on each household member who is at least 15 years old, a household module, which collects information about the household from one respondent, and an adult survey module, administered to one or two adults per household. Enumerators attempted to complete two adult surveys for each household, with priority given to interviews with the household head and their spouse. If this was not possible, enumerators were instructed to interview two adults of the opposite sex. In some cases, only two adults of the same sex were available or only one adult was available. In the endline survey, priority was placed on interviewing the same individuals surveyed at the time of the baseline.

The household roster includes information on the demographic characteristics, travel, communication while away, and remittances sent home by each adult household member. We define a household member as a person who has lived regularly in the dwelling for at least 6 of the last 12 months or intends to live in the dwelling for at least 6 of the next 12

[9]Note that the promotions were rolled out across sites in the same order as the CCN installation, but the amount of time between CCN installation and the promotions start date varied across site pairs.

months. The household module collects information on household assets, expenditures, food security, primary income sources, and risk sharing at the household level. The adult survey module collects data on the respondent's subjective well-being, travel, knowledge assessment, information sources, household decision making, prices and other information on the sale of fish and crops, and their social network, including how frequently they communicate with their contacts, the topics they discuss, and remittances received from and sent to contacts. Social network contacts cannot be members of the same household as the respondent but may include family such as spouses who have migrated.

3.4 Empirical Analysis

Given my interest in assessing how communication affects the financial decisions of spouses, I restrict the sample to respondents who report having a partner. Since divorce is illegal in the Philippines, we collect information on the marital status of all adult household members by asking if they are (1) single, (2) married, (3) separated and not living with a partner, (4) separated and living with a new partner, (5) never married, but living with a partner, or (6) widowed. If a member of the household roster is married or living with a partner, the endline survey collects the ID of spouses living in the household. I create the following variable as an indicator of relationship status: (1) if the household member is single, separated and not living with a partner, or widowed and no one else in the household reports them as the spouse; (2) if the household member is single, separated and not living with a partner, or widowed, but another household member reports them as their spouse; (3) if the household member is married or living with a partner, but no one in the household reports them as their spouse; (4) if the household member is married or living with a partner and someone reports them as their spouse; and (5) if the household member is married or living with a partner and both members of the couple report each other as their spouse. I define an individual as a member of a couple if they are in categories (3), (4), or (5). Throughout this paper, I use the term "spouse" to refer to anyone in this category, regardless of their legal marital status.

Table 3.2 presents the endline characteristics for this subsample of respondents.[10] The majority of respondents with a spouse are married.[11] Slightly less than one-fifth have never been married but live with a partner. In most cases, spouses symmetrically report each other as their spouse. However, 9 percent of women and 6 percent of men in this sample report having a spouse, but no one in the household reports them as a spouse, most likely reflecting that their spouse is on long-term migration and is thus excluded from the household roster.

In this section, I examine whether treatment effects on remittances vary depending on length of migration and whether effects on household expenditures, expenditure shares, and information asymmetries between cohabitating couples vary based on the gender of the household budget manager.

[10] There are more women than men who responded to the survey.

[11] This holds both for this subsample and for the full sample of adult women, 52 percent of whom are married. Adult men are slightly less likely to be married (46 percent). In the full sample, 16 percent of women and 14 percent of men have never been married but live with a partner.

Table 3.2: Summary Statistics for Respondents with Spouses

	(1) Women	(2) Men
Age	41.47	44.86
	(13.14)	(13.32)
Married	0.81	0.80
	(0.39)	(0.40)
Separated, living with new partner	0.01	0.01
	(0.11)	(0.09)
Never married, living with partner	0.18	0.19
	(0.38)	(0.39)
Spouse lives in household	0.92	0.94
	(0.28)	(0.23)
Has partner; no one reports them as spouse	0.09	0.06
	(0.29)	(0.24)
Has partner; someone reports them as spouse	0.00	0.00
	(0.02)	(0.05)
Has partner; both spouses report each other as spouse	0.91	0.94
	(0.29)	(0.25)
Woman partner manages HH budget	0.73	0.75
	(0.44)	(0.43)
Man partner manages HH budget	0.04	0.05
	(0.19)	(0.22)
Couple manages HH budget together	0.14	0.12
	(0.35)	(0.33)
Woman partner decides what to buy at market	0.56	0.50
	(0.50)	(0.50)
Man partner decides what to buy at market	0.05	0.08
	(0.22)	(0.27)
Couple decides what to buy at market together	0.29	0.35
	(0.46)	(0.48)
Woman partner buys expensive items	0.27	0.28
	(0.44)	(0.45)
Man partner buys expensive items	0.11	0.11
	(0.32)	(0.31)
Couple buys expensive items together	0.51	0.53
	(0.50)	(0.50)
Income over past 30 days	2165.61	4102.84
	(8984.16)	(11551.40)
Income while away in last 12 months	782.51	2549.09
	(9267.68)	(15748.64)
Complete weeks away in last 12 months	1.60	2.09
	(5.14)	(6.67)
Weeks away for work (excluding job search) in last 12 months	0.41	1.24
	(3.15)	(5.45)
Observations	1857	1550

Sample includes all individuals who report having a spouse, regardless of whether they cohabitate. Standard deviation in parentheses.

3.4.1 Heterogeneous treatment effects by migration status

Hypothesis 1: Treatment will have heterogeneous effects on the remitting behavior of short- and long-term male migrants.

Communication likely increases the cost of withholding income (p_d) and hiding income (p_h) more for short-term male migrants than for long-term male migrants because there are more opportunities for them to be penalized by their wives, so an increase in the severity of the penalty will affect them more. For example, having to sleep on the couch will affect a short-term migrant, who spends more time at a home, more than a long-term migrant. As long as there is not a large increase in the likelihood of hiding income, then cellular network access will increase the amount that male partners share with their spouses more for short-term male migrants than for long-term male migrants.

Restricting the sample to respondents who report having a partner, I estimate the following:

$$\begin{aligned} Y_i = \beta_0 + \beta_1 T_\nu + \beta_2 Woman_i + \beta_3 SM_i + \beta_4 LM_i + \beta_5 T_\nu Woman_i + \beta_6 T_\nu * SM_i + \\ \beta_7 T_\nu * LM_i + \beta_8 Woman_i * SM_i + \beta_9 Woman_i * LM_i + \beta_{10} T_\nu * Woman_i * SM_i + \\ \beta_{11} T_\nu * Woman_i * LM_i + \mathbf{X}_i' \eta + \nu_s + \epsilon_i \end{aligned} \tag{3.22}$$

where T_ν represents a dummy for the village-level installation of a cell phone tower, $Woman_i$ represents a dummy for whether individual i is a woman, SM_i is a dummy for whether individual i has a spouse who left on short-term migration in the previous 12 months, and LM_i is a dummy for whether individual i has a spouse who left on long-term migration in the previous 12 months. I define a short-term migrant as a household member who left the barangay for less than 26 weeks in the previous 12 months and a long-term migrant as household members who left for at least 26 weeks or spouses who are not household

members but are part of a household member's social network.[12] $\mathbf{X}_i$ is a vector of control variables. Blumenstock et al. (2022) used machine-learning techniques to select a precision-maximizing control set. The set of possible controls exclude outcome variables and variables with more than 5% non-response rates. I employ the same set of controls, as well as a control for relationship status, to improve precision of the estimates. Finally, ν_s represents stratum dummies for each matched pair of villages. Following Blumenstock et al. (2022), since asymptotic assumptions are unlikely to hold with just 14 villages in the sample, I report in brackets the p-values from the wild bootstrap cluster-t procedure with 1000 simulations. The coefficients reflect the intention-to-treat effect.

Table 3.3 presents results for outcomes Y_i including whether individual i received remittances from their partner in the last 12 months, the amount received from their partner, whether individual i sent remittances to their partner, the amount sent to their partner, and the net remittances from the household member's partner, which I estimate by subtracting the amount that individual i sent in remittances to their spouse from the amount that individual i received in remittances from their spouse.[13] Among women whose spouse left on short-term migration in the previous 12 months, treatment statistically significantly increased the amount received and the net remittances from their male partners, compared to women whose spouse did not leave the barangay. By contrast, treatment had no statistically significant effect on the remitting behavior of long-term male migrants.[14] Next, I test the null hypothesis that there is no difference in the treatment effects on remittances for women whose spouses left on short-term versus long-term migration. I reject this hypothesis for the amount of remittances received and net remittances from male spouses. This finding supports the hypothesis that short- and long-term migrants respond differently to treatment. Although the ability to communicate with one's spouse while on short-term migration in-

[12] Only 70 men and 115 women have spouses in their social network.

[13] If a household member did not leave the barangay for at least one complete week in the previous 12 months, the dummy indicating if they sent remittances and the amount sent are coded as 0.

[14] If anything, treatment reduced the amount women received and their net remittances from their spouse, but the wild cluster bootstrapped p=values for two-tailed hypothesis tests are not significant.

creased the remittances that men sent to their spouse, I do not observe the same effect on the remitting behavior of long-term male migrants.

Table 3.3: Remittances between spouses

	(1) Received remittances from spouse	(2) Amount received from spouse (PHP)	(3) Sent remittances to spouse	(4) Amount sent to spouse (PHP)	(5) Net remittances from spouse (PHP)
Sitio treated	0.003	500.521	0.001	571.393	-87.580
	(0.006)	(508.672)	(0.012)	(472.481)	(899.732)
Woman	0.001	38.577	-0.038***	-788.520**	828.854**
	(0.000)	(50.154)	(0.007)	(299.219)	(313.476)
Treated x woman	0.001	-120.645	-0.003	-680.753	554.541
	(0.001)	(86.721)	(0.012)	(807.536)	(836.292)
Migration status					
Short-term (ST) migrant spouse	0.040***	1344.214	0.016	-102.379	1427.444*
	(0.008)	(764.309)	(0.010)	(312.253)	(779.255)
Long-term (LT) migrant spouse	0.116**	-499.228	0.021	7.880	-635.108
	(0.041)	(1810.859)	(0.013)	(1226.592)	(2757.645)
Interaction: Treatment x migration status					
Treated x ST migrant spouse	-0.015	-1022.523	-0.018	662.735	-1670.507*
	(0.011)	(774.879)	(0.016)	(445.125)	(819.448)
Treated x LT migrant spouse	0.050	12724.740	0.118**	-870.555	13575.683
	(0.084)	(7620.915)	(0.041)	(1667.842)	(7945.191)
Interaction: Woman x migration status					
Woman x ST migrant spouse	0.130***	339.240	-0.015	-324.849	660.819*
	(0.017)	(287.058)	(0.014)	(519.673)	(369.974)
Woman x LT migrant spouse	0.267***	22476.564***	-0.053***	-1348.593	23789.212***
	(0.083)	(4074.613)	(0.015)	(1255.606)	(4259.532)
Interaction: Treatment x woman x migration status					
Treated x woman x ST migrant spouse	-0.036	2221.967*	0.026	-180.956	2421.962
	(0.023)	(1196.405)	(0.019)	(630.885)	(1410.285)
Wild p-value	[0.197]	[0.080]	[0.336]	[0.786]	[0.036]
Treated x woman x LT migrant spouse	-0.051	-14040.465	-0.027	3540.433	-17586.427*
	(0.116)	(10758.949)	(0.056)	(2217.070)	(9756.542)
Wild p-value	[0.700]	[0.240]	[0.689]	[0.243]	[0.106]
Test: Treated x woman x ST migrant spouse>					
Treated x woman x LT migrant spouse [Wild p-value]	[0.455]	[0.075]	[0.206]	[0.870]	[0.028]
Mean in controls	0.048	1541.334	0.033	755.873	792.188
# clusters	14	14	14	14	14
N	3878	3910	3896	3896	3895
R-squared	0.369	0.233	0.037	0.015	0.168

Regressions include a control for predicted treatment probability following Wager et al (2016).

There is no observable effect on the extensive margin. In other words, treatment does not affect whether spouses sent or received remittances. This is not surprising for two reasons: first, the cell phone towers did not support mobile money, so they did not affect the method of remitting. About 62 percent of remittances were sent through money transfer platforms such as Western Union or Cebuana Lhuiller and 31 percent were delivered in person in the sitio.[15] Second, most people only left the barangay for short periods for work. Excluding the job search, female partners left for an average of 0.41 weeks of work and male partners left for 1.24 weeks of work in the previous year.

3.4.2 Heterogeneous treatment effects by household budget manager

Based on previous research suggesting that responses to asymmetric information and communication are determined by one's role in managing household finances (Ashraf, 2009), I interact treatment with whether the woman partner manages the household's budget. The results in Ashraf (2009) are driven by the behavior of husbands whose wives manage the household budget. Wives with husbands who control household savings behave similarly, suggesting that the findings should not be attributed to innate differences in the behavior or preferences of husbands and wives but rather to their roles in the household. Although the norm is for wives to manage the household budget, there is some variation across households in wives' control over household resources. Since we ask each respondent to the adult survey who manages the household budget, respondents in the same household do not necessarily provide the same information. However, we find that women and men provide similar information on who manages the household budget (see Table 3.2).[16] Table 3.2 shows that wives manage the household budget without their spouse in about three-quarters of the subsample

[15] Note that we only observe 165 remittances from household members who left for short-term migration to household members who stayed at home.

[16] Table 3.2 also presents patterns regarding who decides what to buy at the market, showing that women partners often make this decision alone, but many couples decide together. Unlike budgeting and market purchases decisions, most couples buy expensive items together, but more women than men make this decision alone.

of households with respondents who have a partner. Between 12 and 14 percent of spouses report that the couple manages the household budget together, in which case the wife has less control over household resources.[17] Only about 4-5 percent of households deviate from the norm by having husbands manage the household budget.[18] In the analysis that follows, I compare outcomes in households in which wives report having complete control over the household budget (that is, households in which the wife reports that she manages the budget alone) to outcomes in households in which they do not (that is, households in which the wife reports that she manages the household budget with her partner or that her partner manages the household budget alone).

Household Expenditures

Hypothesis 2: if introducing cellular networks increases the amount (r) shared with women budget managers, then treatment will increase expenditures on public goods (Q) in households with women budget managers.

A large body of research suggests that households in which women control income or assets have larger expenditure shares on food, clothing, education, and health care than households in which men control more resources (Doss, 2006; Haddad, Hoddinott, and Alderman, 1997; Quisumbing and Maluccio, 2003). Instead of measuring the expenditure preferences of husbands and wives directly, most studies infer that women prefer a particular outcome, such as food security, when a proxy for women's bargaining power has a significant impact on that outcome (Doss, 2013).[19] In Ghana, for example, the share of farmland owned by women significantly increased household budget shares on food (Doss, 2006). In Ethiopia, food expenditure shares increased when wives brought more assets to

[17] This is in line with the findings in Ashraf (2009) that wives in Mindanao do the household budgeting in more than 80 percent of couples.

[18] Husbands report that wives generally hold the income in the family because husbands will just spend it"impulsive[ly]" or on their "vices." Husbands only managed the household budget if their wife "just wasn't good with money" (Ashraf, 2009).

[19] One exception is Kusago and Barham (2001), which measures couple's preference heterogeneity across 13 categories.

marriage than their husbands (Quisumbing and Maluccio, 2003). In Côte d'Ivoire, rainfall shocks associated with high yields for women's crops shifted the composition of household expenditures toward food consumption, while shocks affecting cash crops cultivated by men had no effect on food purchases (Duflo and Udry, 2004).[20]

Using the subsample of respondents who have partners, I examine whether there are heterogeneous treatment effects on household expenditures for households in which women partners report managing the household budget without their spouse. I estimate the following:

$$Y_i = \beta_0 + \beta_1 T_\nu + \beta_2 WomanBudgeter_i + \beta_3 T_\nu^* WomanBudgeter_i + \mathbf{X}_i'\eta + \nu_s + \epsilon_i \quad (3.23)$$

where T_ν represents a dummy for the village-level installation of a cell phone tower, $WomanBudgeter_i$ is a dummy variable indicating whether the woman respondent manages household i's budget without her spouse (or agreement on this in the regressions on the subset of couples who both responded), and $T_\nu * WomanBudgeter_i$ is the interaction between treatment and whether a household's budget is managed by the woman respondent. The coefficients reflect the intention-to-treat effect.

Table 3.4 presents heterogeneous treatment effects on total monthly expenditures and monthly expenditures on food, school, business, health, energy, clothing, transportation, and communication for household i. Table 3.5 presents the same information for household expenditure shares. While there is no interaction effect on total monthly expenditures, treatment statistically significantly increases monthly food expenditures and monthly energy expenditures among households in which the a woman manages the household budget relative to households in which she does not. Similarly, treatment statistically significantly increases monthly food expenditure shares and energy expenditure shares for households with women financial managers. While we do not know individual spending preferences, if we assume

[20]There are also cases in Bangladesh and South Africa in which wives have an inferred preference for education over food expenditures (Quisumbing and Maluccio, 2003), thus reinforcing the need to collect data on preferences in my study context.

that women prefer to shift allocations towards public goods, then these results provide some suggestive evidence that mobile network access increased the amount that men turned over to their spouses.

Table 3.4: Household Expenditures

	(1) Total monthly expenditure	(2) Food	(3) School	(4) Business	(5) Health	(6) Energy	(7) Clothing	(8) Trans-portation	(9) Comm-unication
Sito treated	1159.377	-245.218	50.879	465.849*	686.976	125.772	13.502	56.211	36.289
	(693.472)	(151.139)	(60.271)	(232.433)	(393.512)	(81.490)	(69.766)	(73.374)	(54.823)
Woman budgeter	-627.568	-190.792	-121.005*	-142.985	-307.021	-35.075	-13.419	-279.645	6.983
	(562.048)	(148.007)	(57.925)	(266.256)	(294.344)	(24.614)	(38.435)	(163.909)	(39.783)
Sitio treated x	-77.973	471.420**	86.856	-597.229*	-212.786	108.674**	68.177	137.821	0.569
woman budgeter	(703.255)	(208.230)	(65.691)	(288.750)	(446.445)	(38.837)	(86.397)	(159.548)	(39.483)
Wild p-val	[0.930]	[0.085]	[0.255]	[0.146]	[0.671]	[0.022]	[0.466]	[0.549]	[0.989]
Mean in controls	9670.330	4849.355	766.853	1390.969	1066.195	422.008	267.774	824.251	188.829
# clusters	14	14	14	14	14	14	14	14	14
N	2182	2302	2278	2278	2310	2314	2306	2301	2256
R-squared	0.033	0.052	0.028	0.008	0.006	0.084	0.017	0.013	0.016

Wild cluster bootstrapped p-values for two-tailed hypothesis tests reported in brackets. Regressions include a control for predicted treatment probability following Wager et al (2016). Columns (2)-(9) present the results for monthly expenditures on each spending category.

Table 3.5: Household Expenditure Shares

	(1) Food	(2) School	(3) Business	(4) Health	(5) Energy	(6) Clothing	(7) Trans-portation	(8) Comm-unication
Sito treated	-0.062**	0.007	0.005	0.021	0.008	0.002	0.011*	0.008
	(0.021)	(0.005)	(0.009)	(0.014)	(0.007)	(0.006)	(0.005)	(0.006)
Woman budgeter	-0.008	0.010	-0.007	0.014**	-0.010**	0.001	-0.002	0.001
	(0.009)	(0.006)	(0.011)	(0.006)	(0.004)	(0.003)	(0.006)	(0.003)
Sitio treated x	0.030**	-0.008	-0.010	-0.014	0.013**	0.003	-0.010*	-0.004
woman budgeter	(0.013)	(0.006)	(0.008)	(0.013)	(0.005)	(0.006)	(0.005)	(0.005)
Wild p-val	[0.056]	[0.246]	[0.265]	[0.330]	[0.069]	[0.611]	[0.111]	[0.543]
Mean in controls	0.598	0.077	0.079	0.072	0.050	0.027	0.080	0.016
# clusters	14	14	14	14	14	14	14	14
N	2179	2179	2179	2179	2179	2179	2179	2179
R-squared	0.041	0.029	0.053	0.013	0.075	0.018	0.020	0.025

Wild cluster bootstrapped p-values for two-tailed hypothesis tests reported in brackets. Regressions include a control for predicted treatment probability following Wager et al (2016). Columns (1)-(8) present the results for monthly expenditure shares on each spending category.

Fish and Crop Sales

Hypothesis 3: if treatment reduces price variation and/or the cost of monitoring one's spouse (p_m), this is likely to reduce information asymmetries between spouses regarding fish and crop prices in households with women budget managers.

Table 3.6 presents summary statics on the subsample of respondents for which both members of the couple responded to the adult survey module. This excludes couples in which one spouse was on migration at the time of the survey. 4,113 individuals from 2,316 households completed the adult survey and 1,317 households had both members of a couple complete the survey. Thus, we have responses from 2,634 individuals with a partner who also responded.[21]About 78 percent of women and 82 percent of men in this sample of couples report that the woman manages the household budget without her spouse and 72 percent of couples agree on this. In my analysis of this subsample, I define the woman as managing the household budget if both spouses report that she takes on this responsibility without her partner. Only 2 percent of couples agree that the male partner manages the budget without his spouse and about 7 percent of couples agree that both spouses manage the budget.

[21]Over 99 percent of these couples are the household head and their spouse. The 4 couples that do not fall in this category are the children or parents of the household head.

Table 3.6: Summary Statistics for Cohabitating Couples

	(1) Women	(2) Men	(3) Difference (2)-(1)	(4) Couple Agrees
Age	41.26	44.97	-3.71	
	(12.95)	(13.26)	(5.27)	
Married	0.81	0.81	0.00	
	(0.39)	(0.39)	(0.06)	
Separated, living with new partner	0.01	0.01	0.00	
	(0.10)	(0.08)	(0.09)	
Never married, living with partner	0.18	0.18	-0.00	
	(0.38)	(0.38)	(0.11)	
Income over past 30 days	2233.88	4107.35	-1859.36	
	(10012.19)	(12270.46)	(15401.50)	
Income while away in last 12 months	760.24	2573.81	-1811.47	
	(9750.29)	(16040.25)	(15785.82)	
Complete weeks away in last 12 months	1.51	1.91	-0.39	
	(5.00)	(6.06)	(5.31)	
Weeks away for work (excluding job search)	0.36	1.20	-0.84	
	(3.04)	(5.32)	(5.44)	
Woman partner manages HH budget	0.78	0.82	-0.05	0.72
	(0.42)	(0.38)	(0.41)	(0.45)
Man partner manages HH budget	0.05	0.04	0.00	0.02
	(0.21)	(0.21)	(0.23)	(0.14)
Couple manages HH budget together	0.17	0.13	0.04	0.07
	(0.38)	(0.33)	(0.38)	(0.26)
Woman partner decides what to buy at market	0.57	0.54	0.03	0.40
	(0.49)	(0.50)	(0.56)	(0.49)
Man partner decides what to buy at market	0.06	0.07	-0.01	0.03
	(0.24)	(0.26)	(0.28)	(0.16)
Couple decides what to buy at market together	0.35	0.38	-0.03	0.20
	(0.48)	(0.49)	(0.57)	(0.40)
Woman partner buys expensive items	0.26	0.30	-0.04	0.14
	(0.44)	(0.46)	(0.54)	(0.35)
Man partner buys expensive items	0.13	0.11	0.02	0.05
	(0.33)	(0.31)	(0.38)	(0.21)
Couple buys expensive items together	0.59	0.57	0.01	0.41
	(0.49)	(0.49)	(0.59)	(0.49)
Woman partner made last fish sale	0.30	0.08	0.12	0.07
	(0.46)	(0.27)	(0.33)	(0.26)
Man partner made last fish sale	0.45	0.80	-0.19	0.57
	(0.50)	(0.40)	(0.40)	(0.50)
Couple made last fish sale together	0.17	0.09	0.05	0.05
	(0.38)	(0.29)	(0.44)	(0.22)
Woman partner made last crop sale	0.32	0.17	0.07	0.16
	(0.47)	(0.38)	(0.35)	(0.37)
Man partner made last crop sale	0.35	0.52	-0.09	0.30
	(0.48)	(0.50)	(0.48)	(0.46)
Couple made last crop sale together	0.31	0.29	0.01	0.23
	(0.46)	(0.45)	(0.46)	(0.42)
Observations	1317	1317	1317	1317

This sample only includes partners who both responded to the adult survey.
Standard deviation in parentheses.

In the endline adult survey, we asked each adult separately whether the household participates in fishing or farming and, if so, which type of fish and/or crop is most important for their household's income. Next, we inquire whether anyone in the household sold that type of fish and/or crop in the previous 12 months and, if so, we ask questions regarding the date of sale, the price (PHP) per kilogram sold, and who made the sale. By addressing these questions to all respondents to the adult survey, we allow for the possibility that there will be discrepancies in their responses. In general, selling fish is a more male-dominated activity than selling crops. About 80 percent of men in the subsample report making the last fish sale without their spouse, but only 45 percent of women report that their spouse made the last fish sale without them. About 57 percent of couples agree that the man made the last fish sale alone.[22] Crop sales are more evenly split between partners. About 52 percent of men report making the last crop sale without their spouse, 35 percent of women report that their spouse made the last crop sale without them, and 30 percent of couples agree that the man made the last crop sale.[23]

I test the hypothesis that cellular network access decreased the spousal difference in reported fish and crop prices. Table 3.7 presents treatment effects on the difference and absolute difference in reported fish and crop prices, and a dummy variable indicating whether spouses report the same fish or crop price. These regressions control for agreement on the type of fish or crop that contributes most to the household income as well as agreement on who last sold the fish or crop.[24] By interacting whether a woman manages the budget with the randomly assigned treatment, I demonstrate that the effect of receiving access to cellular

[22]Note that the proportion of couples agreeing that the man made the last fish sale without his spouse is higher than the proportion of women reporting that her spouse made the sale. This is because 64 women reported who made the last fish sale and 89 men reported, but there are only 42 couples in which both spouses report who made the last fish sale.

[23]295 men and 272 women in the subsample report who last made crop sales for their household and there are 207 couples in which both partners responded to these questions. Farming is more common than fishing, so it is not surprising that more households report who last made crop sales than who last made fish sales.

[24]This includes agreement that the man made the sale without his spouse, the woman made the sale without her spouse, or the couple made the sale together. While not presented here, I assess whether treatment increased agreement on who last sold the fish or crop and find no treatment effects on this outcome. When I include these as controls, they do not substantively alter the findings. However, they increase precision by improving the likelihood that spouses are referring to the same sale.

networks depends on who manages the household budget. For example, among households in which the woman does not manage the household budget, treatment increases the absolute difference in reported fish price by approximately 33 pesos, while treatment only increases the absolute difference in reported fish prices by about 6 pesos for households in which the woman manages the budget. In addition, while treatment decreases agreement on fish and crop prices among households in which women do not manage the budget, it increases agreement in households in which women do manage the budget.

Table 3.7: Agreement on fish and crop prices

	(1) Absolute difference in reported fish price	(2) Absolute difference in reported crop price	(3) Difference in reported fish price (husband-wife)	(4) Difference in reported crop price (husband-wife)	(5) Agreement on price last sold fish	(6) Agreement on price last sold crop
	(1)	(2)	(3)	(4)	(5)	(6)
Sito treated	33.369*	-0.506	-56.348***	-1.086	-0.505	-0.045
	(17.487)	(1.089)	(15.852)	(1.503)	(0.283)	(0.066)
Woman budgeter	21.010***	-0.622	11.476	1.828**	-0.621***	-0.170***
	(4.742)	(0.472)	(12.199)	(0.686)	(0.082)	(0.041)
Sitio treated x woman budgeter	-27.246***	1.569	4.056	0.310	0.597*	0.141***
	(7.229)	(1.381)	(14.099)	(1.658)	(0.264)	(0.043)
Constant	77.125*	9.991***	-113.722**	-7.664*	0.826**	0.232**
	(40.622)	(3.114)	(43.568)	(3.911)	(0.347)	(0.104)
Wild p-val	[0.045]	[0.289]	[0.655]	[0.841]	[0.276]	[0.063]
Mean in controls	24.583	4.145	12.083	-1.333	0.333	0.481
# clusters	10	14	10	14	10	14
N	40	207	40	207	40	207
R-squared	0.507	0.182	0.602	0.128	0.656	0.243

Wild cluster bootstrapped p-values reported in brackets. The fish (crop) regressions control for agreement on the type of fish (crop) that contributes most to household income and who last sold the fish or crop. All regressions include a control for predicted treatment probability following Wager et al (2016).

3.4.3 Exploratory Analysis

Before concluding, I present exploratory analysis on the subjective well-being of individuals with partners. Blumenstock et al. (2022) hypothesize that cellular network access will improve subjective well-being, but they do not find statistically significant effects on the subjective well-being index in their analysis of the full sample. Given the heterogeneous treatment effects presented in this essay, we might expect to observe differences in how treatment affects the subjective well-being of individuals based on who manages the household budget. However, the theoretical model does not clarify the predicted direction of these effects, implying that this is an empirical question.

If cellular network access enhances women's control over resources in households in which they manage the budget, this could increase their subjective well-being, and especially their satisfaction with their financial situation. Conversely, if the reduced price of monitoring induces more monitoring, then they are more likely to experience the disutility of expressing distrust in their spouse, which could reduce their subjective well-being. For men, increasing the price of hiding or withholding information from their partner might reduce their subjective well-being by reducing their control over their income. On the other hand, no longer hiding or withholding income could improve their subjective well-being because they do not experience the discomfort of lying to or defying their spouse and they do not have to worry about being caught hiding information or being penalized by their wife. As discussed previously, many men and women in this setting perceive that men spend money more impulsively than women (Ashraf, 2009). It is possible that men's subjective well-being, including their satisfaction with their financial situation, is actually better when their partner controls more of the household resources. Finally, if introducing cellular networks improves efficiency in households with women budget managers, this could also improve the subjective well-being of couples.

In Table 3.8, the outcomes Y_i are the subjective well-being index of individual i, specified in the pre-analysis plan for Blumenstock et al. (2022), and its components, including

whether the respondent sees themselves as part of the local community, whether they do not feel isolated from the rest of their country, their life satisfaction on a scale from 1 for completely dissatisfied to 10 for completely satisfied, whether their quality of life is better than 12 months before the survey and 5 years before the survey, and their satisfaction with their financial situation on a scale from 1 to 10. I observe that treatment increased the subjective well-being index of respondents with partners in households where the woman respondent manages the budget without her spouse, relative to households in which the woman respondent does not manage the budget alone. However, none of the wild p-values for individual components of the index are statistically significant at traditional levels.[25] As discussed above, I cannot isolate the precise reason for these improvements in the subjective well-being of respondents in households with women budget managers.

[25]The direction of the interaction effect is positive for every component except whether the respondent sees themselves as part of their local community. We would not necessarily expect this to differ based on whether the household budget is managed by a woman.

Table 3.8: Subjective Well-Being

	(1) Well-being index	(2) Do you see yourself as part of your local community?	(3) Do you feel isolated from the rest of your country?	(4) 1-10 life satisfaction	(5) QoL better than 12 months ago	(6) QoL better than 5 years ago	(7) Satisfaction with financial situation
Sito treated	-0.049	0.073*	0.014	-0.319	-0.099*	-0.015	-0.413
	(0.056)	(0.041)	(0.055)	(0.303)	(0.047)	(0.046)	(0.251)
Woman budgeter	-0.015	0.040**	-0.017	-0.172	-0.009	0.001	-0.222**
	(0.041)	(0.018)	(0.043)	(0.100)	(0.024)	(0.036)	(0.092)
Sitio treated x woman budgeter	0.122**	-0.012	0.096	0.467*	0.079	0.031	0.420*
	(0.056)	(0.032)	(0.065)	(0.264)	(0.045)	(0.058)	(0.222)
Wild p-val	[0.098]	[0.742]	[0.233]	[0.221]	[0.117]	[0.612]	[0.238]
Mean in controls	0.001	0.849	0.448	6.611	0.433	0.557	5.942
# clusters	14	14	14	14	14	14	14
N	3235	3224	3204	3235	3235	3235	3235
R-squared	0.013	0.024	0.033	0.005	0.006	0.008	0.010

Wild cluster bootstrapped p-values for two-tailed hypothesis tests reported in brackets. Regressions include a control for predicted treatment probability following Wager et al (2016).

3.5 Conclusions

In this study, I assess how introducing communication technologies affects the financial decisions of spouses. Although men are the primary income earners, they do not typically manage the household budget. As a result, they may benefit from hiding or withholding income from their partners, but communication most likely increases the costs of doing so. I hypothesize that cellular network access increases the cost of withholding income more for short-term male migrants than for long-term male migrants and find suport for this hypothesis. I also find evidence that cellular network access increases expenditures and expenditure shares on public goods, reduces information asymmetries between spouses regarding fish and crop prices, and improves the subjective well-being of individuals in households with women budget managers. These results align with the findings in Ashraf (2009) that communication increases transfers from husbands to wives and that this is driven by the behavior of husbands whose wives control household savings. Husbands are less likely to explicitly defy their wives' wishes than to tacitly defy them. This implies that the results extrapolate beyond the controlled setting of a lab-in-the-field experiment.

These findings suggest that improving communication between spouses could be an important mechanism to increases wives' control over resources as well as reduce information asymmetries within households. The results of this study are most likely to generalize to other cultures in which men are the primary income earners and women manage the household budget. For example, women are the traditional pursekeepers in parts of Indonesia and Thailand, in addition to the Philippines (Malapit, 2012). Communication may not have the same effect in a setting in which women do not manage the household budget. We must exercise caution when considering the repercussions of reducing information asymmetries between spouses in contexts where women have less financial control. In a setting in which men have greater incentives to monitor their wives' income and expenditures, improved cellular access could actually reduce wives' control over resources. It could also have unintended consequences on intimate partner violence.

Future research on this topic could take several forms. Conducting intrahousehold games such as those outlined in the Appendix would provide novel data on how communication affects financial decisions regarding private endowments. In other words, they could explain how communication and information interact. They could also provide an opportunity to measure willingness to pay for private information, public information, and communication. Future research could also assess the effects of cellular network access on additional outcomes such as expenditures on monitoring one's spouse, in-person transfers between spouses, and information asymmetries regarding the income of one's spouse. Moreover, detailed data on the preferences and decisions of each spouse would enhance our understanding of the pathways through which communication affects households and the individuals living within them.

References

Anderson, M.L. 2008. "Multiple inference and gender differences in the effects of early intervention: A reevaluation of the Abecedarian, Perry Preschool, and Early Training Projects." *Journal of the American Statistical Association* 103:1481–1495.

Armand, A., O. Attanasio, P. Carneiro, and V. Lechene. 2020. "The Effect of Gender-Targeted Conditional Cash Transfers on Household Expenditures: Evidence from a Randomized Experiment." *The Economic Journal* 130:1875–1897.

Ashraf, N. 2009. "Spousal control and intra-household decision making: An experimental study in the Philippines." *American Economic Review* 99:1245–77.

Bastagli, F., J. Hagen-Zanker, L. Harman, V. Barca, G. Sturge, and T. Schmidt. 2019. "The Impact of Cash Transfers: A Review of the Evidence from Low- and Middle-income Countries." *Journal of Social Policy* 48:569–594.

Blumenstock, J., N. Keleher, A. Rezaee, and E. Troland. 2022. "The Impact of Mobile Phones: Experimental Evidence from the Random Assignment of New Cell Towers." Working paper.

Browning, M., F. Bourguignon, P.A. Chiappori, and V. Lechene. 1994. "Income and Outcomes: A Structural Model of Intrahousehold Allocation." *Journal of Political Economy* 102:1067–1096.

Castilla, C. 2019. "What's yours is mine, and what's mine is mine: Field experiment on income concealing between spouses in India." *Journal of Development Economics* 137:125–140.

Castilla, C., and T. Walker. 2013. "Is Ignorance Bliss? The Effect of Asymmetric Information between Spouses on Intra-Household Allocations." *American Economic Review* 103:263–68.

Chen, J.J. 2013. "Identifying non-cooperative behavior among spouses : Child outcomes in migrant-sending households ." *Journal of Development Economics* 100:1–18.

De Laat, J. 2014. "Household allocations and endogenous information : The case of split migrants in Kenya ." *Journal of Development Economics* 106:108–117.

Doss, C. 2013. "Intrahousehold bargaining and resource allocation in developing countries." *World Bank Research Observer* 28:52–78.

—. 2006. "The effects of intrahousehold property ownership on expenditure patterns in Ghana." *Journal of African Economies* 15:149–180.

Doss, C.R., and R. Meinzen-Dick. 2015. "Collective Action within the Household: Insights from Natural Resource Management." *World Development* 74:171–183.

Duflo, E. 2003. "Grandmothers and Granddaughters: Old-Age Pensions and Intra-household Allocation in South Africa." *The World Bank Economic Review* 17:1–25.

Duflo, E., and C. Udry. 2004. "Intrahousehold Resource Allocation in Côte D'Ivoire: Social Norms, Separate Accounts and Consumption Choices." Working paper, National Bureau of Economic Research.

Gaddis, I., R.S. Lahoti, and H. Swaminathan. 2020. "Women's Legal Rights and Gender Gaps in Property Ownership in Developing Countries." Working paper, World Bank, Washington, DC.

GSM Association. 2020. "The Mobile Economy 2020." Working paper.

Haddad, L., and J. Hoddinott. 1995. "Does female income share influence household expenditures? Evidence from Côte d'Ivoire." *Oxford Bulletin of Economics and Statistics* 57:77–96.

Haddad, L., J. Hoddinott, and H. Alderman, eds. 1997. *Intrahousehold resource allocation in developing countries: Models, methods, and policy*. Baltimore, MD: Johns Hopkins University Press for the International Food Policy Research Institute.

Hoel, J.B. 2015. "Heterogeneous households: A within-subject test of asymmetric information between spouses in Kenya." *Journal of Economic Behavior and Organization* 118:123–135.

Illo, J.F. 1989. "Who Heads the Household? Women in Households in the Philippines." In A. T. Torres, ed. *The Filipino Woman in Focus: A Book of Readings*. Bangkok: UNESCO.

Jensen, R. 2007. "The digital provide: Information (technology), market performance, and welfare in the South Indian fisheries sector." *Quarterly Journal of Economics* 122:879–924.

Kebede, B., M. Tarazona, A. Munro, and A. Verschoora. 2014. "Intra-household efficiency: An experimental study from Ethiopia." *Journal of African Economies* 23:105–150.

Kieran, C., K. Sproule, C. Doss, A. Quisumbing, and S.M. Kim. 2015. "Examining gender inequalities in land rights indicators in Asia." *Agricultural Economics (United Kingdom)* 46:119–138.

Kusago, T., and B.L. Barham. 2001. "Preference Heterogeneity, Power, and Intrahousehold Decision-Making in Rural Malaysia." *World Development* 29:1237–56.

Malapit, H.J.L. 2012. "Why do spouses hide income?" *Journal of Socio-Economics* 41:584–593.

Mani, A. 2020. "Mine, Yours or Ours? The Efficiency of Household Investment Decisions: An Experimental Approach." *The World Bank Economic Review* 34:575–596.

Munro, A. 2018. "Intra-Household Experiments: A Survey." *Journal of Economic Surveys* 32:134–175.

Ortiz-Ospina, E., and M. Roser. 2018. "Economic inequality by gender."

Quisumbing, A.R., and J.A. Maluccio. 2003. "Resources at Marriage and Intrahousehold Allocation: Evidence from Bangladesh, Ethiopia, Indonesia, and South Africa." *Oxford Bulletin of Economics and Statistics* 3:283–327.

Thomas, D. 1994. "Like Father, like Son; Like Mother, like Daughter: Parental Resources and Child Height." *Journal of Human Resources* 29:950–988.

Appendix A: Additional Details of the Theoretical Framework

This Appendix presents additional details of the math used to assess the comparative statics for each of the cases discussed in the theoretical framework: (1) the husband's endowment is private and the husband did not have to pay for the endowment to be private, (2) the husband's endowment is public because the wife pays to monitor her husband's endowment, (3) the husband's endowment is public and the wife did not have to pay for this information, and (4) the husband's endowment is private because he paid to hide it from his wife.

Case 1: Private endowment

The Lagrangian for the husband's problem in stage 1, taking the wife's first-order condition as given, is

$$\mathcal{L} = v(Q) + u(Y_1 - r) + \lambda_1[pu'(Y_2 + r - pQ) - v'(Q)] \tag{3.24}$$

The Kuhn-Tucker first-order conditions are

$$\frac{\partial \mathcal{L}}{\partial r} = -u'(Y_1 - r) + \lambda_1 pu''(Y_2 + r - pQ) \leq 0 \tag{3.25}$$

$$\frac{\partial \mathcal{L}}{\partial Q} = v'(Q) - \lambda_1[p^2u''(Y_2 + r - pQ) + v''(Q)] \leq 0 \tag{3.26}$$

$$\frac{\partial \mathcal{L}}{\partial \lambda_1} = pu'(Y_2 + r - pQ) - v'(Q) = 0 \tag{3.27}$$

$$Q\frac{\partial \mathcal{L}}{\partial Q} = 0,\ r\frac{\partial \mathcal{L}}{\partial r} = 0,\ \lambda_1\frac{\partial \mathcal{L}}{\partial \lambda_1} = 0,\ Q \geq 0,\ r \geq 0$$

To find the Subgame Perfect Nash Equilibrium, we would solve this system of first-order conditions.

I solve equations 3.25 and 3.26 for λ_1 to create the following system of equations for r and Q

$$F_1 = u'(Y_1 - r)[p^2u''(Y_2 + r - pQ) + v''(Q)] - v'(Q)pu''(Y_2 + r - pQ) = 0$$
$$F_2 = pu'(Y_2 + r - pQ) - v'(Q) = 0$$

Next, I use Cramer's Rule to conduct comparative statics on the amount the husband sends to the wife (r) with respect to an increase in his own endowment (Y_1) and on the amount the wife invests in the public good (Q) with respect to the husband's endowment (Y_1). I find that

$$\frac{\partial r}{\partial Y_1} = \frac{u''(x_1)[u''(x_2) + v''(Q)]^2}{D_1} > 0, \tag{3.28}$$

$$\frac{\partial Q}{\partial Y_1} = \frac{\frac{\partial F_1}{\partial Y_1}\frac{\partial F_2}{\partial r} - \frac{\partial F_2}{\partial Y_1}\frac{\partial F_1}{\partial r}}{D_1} = \frac{u''(x_1)u''(x_2)[p^3u''(x_2) + pv''(Q)]}{D_1} > 0, \tag{3.29}$$

where D_1 is the determinant of the Hessian, which is negative by assumption:

$$D_1 = \begin{vmatrix} \frac{\partial F_1}{\partial Q} & \frac{\partial F_2}{\partial Q} \\ \frac{\partial F_1}{\partial r} & \frac{\partial F_2}{\partial r} \end{vmatrix}$$

$$\begin{aligned} &= -u''(x_1)[p^2u''(x_2) + v''(Q)]^2 + p[-pu''(x_2)^2v''(Q) + \\ &(pu'(x_1) - v'(Q))v''(Q)u'''(x_2) + u'(x_1)u''(x_2)v'''(Q)] < 0 \end{aligned} \tag{3.30}$$

Based on the second-order conditions, we know that the numerators of equations (3.28) and (3.29) are negative. Since the denominators are also negative, $\frac{\partial r}{\partial Y_1} > 0$ and $\frac{\partial Q}{\partial Y_1} > 0$.

Case 2: Wife pays to monitor endowment

The Lagrangian for the husband's optimization problem in stage 1, taking the wife's first-order condition as given, is

$$\mathcal{L} = v(Q) + u(Y_1 - r - p_d(Y_1 - r)) + \lambda_2(pu'(Y_2 + r - pQ - p_m) - v'(Q)) \tag{3.31}$$

The Kuhn-Tucker first-order conditions are

$$\frac{\partial \mathcal{L}}{\partial r} = (p_d - 1)u'(Y_1 - r - p_d(Y_1 - r)) + \lambda_2 pu''(Y_2 + r - pQ - p_m) \leq 0 \tag{3.32}$$

$$\frac{\partial \mathcal{L}}{\partial Q} = v'(Q) - \lambda_2(p^2u''(Y_2 + r - pQ - p_m) + v''(Q)) \leq 0 \tag{3.33}$$

$$\frac{\partial \mathcal{L}}{\partial \lambda_2} = u'(Y_2 + r - pQ - p_m) - v'(Q) = 0 \tag{3.34}$$

$$Q\frac{\partial \mathcal{L}}{\partial Q} = 0,\ r\frac{\partial \mathcal{L}}{\partial r} = 0,\ \lambda_2\frac{\partial \mathcal{L}}{\partial \lambda_2} = 0,\ Q \geq 0,\ r \geq 0$$

Using the same approach as in case 1, I solve for λ_2 and create the following system of equations for r and Q

$$F_3 = (1 - p_d)u'(Y_1 - r - p_d(Y_1 - r))[p^2u''(Y_2 + r - pQ - p_m) + v''(Q)] - v'(Q)pu''(Y_2 + r - pQ - p_m) = 0$$

$$F_4 = pu'(Y_2 + r - pQ - p_m) - v'(Q) = 0$$

I then apply Cramer's rule as follows in order to qualitatively assess how increases in the husband's endowment (Y_1), the price of monitoring (p_m), and the price of withholding (p_d) affect the amount the husband sends to the wife (r) and the wife's public good allocation (Q).

$$\frac{\partial Q}{\partial Y_1} = \frac{\frac{\partial F_3}{\partial Y_1}\frac{\partial F_4}{\partial r} - \frac{\partial F_4}{\partial Y_1}\frac{\partial F_3}{\partial r}}{D_2}$$

$$\frac{\partial r}{\partial Y_1} = \frac{\frac{\partial F_3}{\partial Q}\frac{\partial F_4}{\partial Y_1} - \frac{\partial F_4}{\partial Q}\frac{\partial F_3}{\partial Y_1}}{D_2}$$

$$\frac{\partial Q}{\partial p_m} = \frac{\frac{\partial F_3}{\partial p_m}\frac{\partial F_4}{\partial r} - \frac{\partial F_4}{\partial p_m}\frac{\partial F_3}{\partial r}}{D_2}$$

$$\frac{\partial r}{\partial p_m} = \frac{\frac{\partial F_3}{\partial Q}\frac{\partial F_4}{\partial p_m} - \frac{\partial F_4}{\partial Q}\frac{\partial F_3}{\partial p_m}}{D_2}$$

$$\frac{\partial Q}{\partial p_d} = \frac{\frac{\partial F_3}{\partial p_d}\frac{\partial F_4}{\partial r} - \frac{\partial F_4}{\partial p_d}\frac{\partial F_3}{\partial r}}{D_2}$$

$$\frac{\partial r}{\partial p_d} = \frac{\frac{\partial F_3}{\partial Q}\frac{\partial F_4}{\partial p_d} - \frac{\partial F_4}{\partial Q}\frac{\partial F_3}{\partial p_d}}{D_2}$$

Case 3: Public endowment

The Lagrangian for the husband's optimization problem is

$$\mathcal{L} = v(Q) + u(Y_1 - r - p_d(Y_1 - r)) + \lambda_1[u'(Y_2 + r - Q) - v'(Q)] \tag{3.35}$$

The Kuhn-Tucker first-order conditions are

$$\frac{\partial \mathcal{L}}{\partial r} = (p_d - 1)u'(Y_1 - r - p_d(Y_1 - r)) + \lambda_1 u''(Y_2 + r - Q) \tag{3.36}$$

$$\frac{\partial \mathcal{L}}{\partial Q} = v'(Q) - \lambda_1[u''(Y_2 + r - Q) + v''(Q)] \leq 0 \tag{3.37}$$

$$\frac{\partial \mathcal{L}}{\partial \lambda_1} = u'(Y_2 + r - Q) - v'(Q) = 0 \tag{3.38}$$

$$Q\frac{\partial \mathcal{L}}{\partial Q} = 0,\ r\frac{\partial \mathcal{L}}{\partial r} = 0,\ \lambda_1\frac{\partial \mathcal{L}}{\partial \lambda_1} = 0,\ Q \geq 0,\ r \geq 0$$

I create the following system of equations for r and Q

$$\begin{aligned} F_5 = (1 - p_d)u'(Y_1 - r - p_d(Y_1 - r))[p^2u''(Y_2 + r - pQ) + \\ v''(Q)] - v'(Q)pu''(Y_2 + r - pQ) = 0 \\ F_2 = pu'(Y_2 + r - pQ) - v'(Q) = 0 \end{aligned}$$

I then apply Cramer's rule as follows in order to qualitatively assess how increases in the husband's endowment (Y_1) and the price of withholding (p_d) affect the amount the husband sends to the wife (r) and the wife's public good allocation (Q).

$$\frac{\partial Q}{\partial Y_1} = \frac{\frac{\partial F_5}{\partial Y_1}\frac{\partial F_2}{\partial r} - \frac{\partial F_2}{\partial Y_1}\frac{\partial F_5}{\partial r}}{D_3}$$

$$\frac{\partial r}{\partial Y_1} = \frac{\frac{\partial F_5}{\partial Q}\frac{\partial F_2}{\partial Y_1} - \frac{\partial F_2}{\partial Q}\frac{\partial F_5}{\partial Y_1}}{D_3}$$

$$\frac{\partial Q}{\partial p_d} = \frac{\frac{\partial F_5}{\partial p_d}\frac{\partial F_2}{\partial r} - \frac{\partial F_2}{\partial p_d}\frac{\partial F_5}{\partial r}}{D_3}$$

$$\frac{\partial r}{\partial p_d} = \frac{\frac{\partial F_5}{\partial Q}\frac{\partial F_2}{\partial p_d} - \frac{\partial F_2}{\partial Q}\frac{\partial F_5}{\partial p_d}}{D_3}$$

Case 4: Husband pays for private endowment

The Lagrangian for the husband's optimization problem is

$$\mathcal{L} = v(Q) + u(Y_1 - r - p_h) + \lambda_1[u'(Y_2 + r - Q) - v'(Q)] \tag{3.39}$$

The Kuhn-Tucker first-order conditions are

$$\frac{\partial \mathcal{L}}{\partial r} = -u'(Y_1 - r - p_h) + \lambda_1 u''(Y_2 + r - Q) \leq 0 \tag{3.40}$$

$$\frac{\partial \mathcal{L}}{\partial Q} = v'(Q) - \lambda_1[u''(Y_2 + r - Q) + v''(Q)] \leq 0 \tag{3.41}$$

$$\frac{\partial \mathcal{L}}{\partial \lambda_1} = u'(Y_2 + r - Q) - v'(Q) = 0 \tag{3.42}$$

$$Q\frac{\partial \mathcal{L}}{\partial Q} = 0,\ r\frac{\partial \mathcal{L}}{\partial r} = 0,\ \lambda_1\frac{\partial \mathcal{L}}{\partial \lambda_1} = 0,\ Q \geq 0,\ r \geq 0$$

I create the following system of equations for r and Q

$$F_6 = u'(Y_1 - r - p_h)[p^2u''(Y_2 + r - pQ) + v''(Q)] - v'(Q)pu''(Y_2 + r - pQ) = 0$$

$$F_2 = pu'(Y_2 + r - pQ) - v'(Q) = 0$$

I then apply Cramer's rule as follows in order to qualitatively assess how increases in the husband's endowment (Y_1), the price of withholding (p_d), and the price of hiding (p_h) affect the amount the husband sends to the wife (r) and the wife's public good allocation (Q).

$$\frac{\partial Q}{\partial Y_1} = \frac{\frac{\partial F_6}{\partial Y_1}\frac{\partial F_2}{\partial r} - \frac{\partial F_2}{\partial Y_1}\frac{\partial F_6}{\partial r}}{D_4}$$

$$\frac{\partial r}{\partial Y_1} = \frac{\frac{\partial F_6}{\partial Q}\frac{\partial F_2}{\partial Y_1} - \frac{\partial F_2}{\partial Q}\frac{\partial F_6}{\partial Y_1}}{D_4}$$

$$\frac{\partial Q}{\partial p_d} = \frac{\frac{\partial F_6}{\partial p_d}\frac{\partial F_2}{\partial r} - \frac{\partial F_2}{\partial p_d}\frac{\partial F_6}{\partial r}}{D_4}$$

$$\frac{\partial r}{\partial p_d} = \frac{\frac{\partial F_6}{\partial Q}\frac{\partial F_2}{\partial p_d} - \frac{\partial F_2}{\partial Q}\frac{\partial F_6}{\partial p_d}}{D_4}$$

$$\frac{\partial Q}{\partial p_h} = \frac{\frac{\partial F_6}{\partial p_h}\frac{\partial F_2}{\partial r} - \frac{\partial F_2}{\partial p_h}\frac{\partial F_6}{\partial r}}{D_4}$$

$$\frac{\partial r}{\partial p_h} = \frac{\frac{\partial F_6}{\partial Q}\frac{\partial F_2}{\partial p_h} - \frac{\partial F_2}{\partial Q}\frac{\partial F_6}{\partial p_h}}{D_4}$$

Appendix B: Lab-in-the-Field Experiment Design and Analysis Plan

In this section, I describe lab-in-the-field experiments that one could conduct with couples in order to test the hypotheses of this theoretical framework. I then present the analysis plan.

Design

The games described in this section are a hybrid of trust games and public goods games in which the husband receives an endowment that is either public or private, decides how much to send to his wife, and his wife decides how much to invest in a public good. In the first round, spouses will not be allowed to communicate, but in the second round they may communicate prior to making their decisions. These games would shed light on how information and communication interact to affect the financial decisions of spouses. They would also provide data on willingness to pay for private information, public information, and communication.

When a couple arrives to the training, they each receive a show-up fee of 100 pesos. The husband is assigned the role of the sender and the wife is the receiver. The sender receives an endowment on top of the show-up fee, reflecting that men are typically the primary income earners in this context. The senders and recipients are then trained together before going to separate rooms to play the games. At the beginning of each round, the sender is allocated an endowment. Using the Becker-DeGroot-Marschak (BDM) mechanism, one can elicit the recipient's willingness to pay to know the size of the endowment (monitoring) and the sender's willingness to pay to keep the endowment size private (hiding).

Each couple is then randomly assigned to a treatment arm: (1) endowment is private information (only the sender knows the size of the endowment), (2) endowment is private information unless the recipient pays for it to be public, (3) endowment is public information (both the sender and recipient know the size of the endowment), or (4) endowment is public

information unless the sender pays for it to be private. Next, the research team randomly draws the price for monitoring and hiding income. For couples in treatment group 2, if the cost of monitoring is less than or equal to the recipient's willingness to pay, the endowment size will be revealed. For couples in treatment group 4, if the cost of hiding income is less than or equal to the sender's willingness to pay, the endowment size will not be revealed to the recipient.

At this point in the game, everyone will know whether the endowment is public or private and the cost of hiding and monitoring income, but the senders will not know whether their spouse paid to monitor their income and the recipients will not know whether their spouse paid to hide income. Next, the sender receives two envelopes and is asked to divide their endowment plus the show-up fee (minus any amount spent on income hiding) between the envelope that they will keep and the envelope that they will send to their spouse. An enumerator will bring the second envelope to the sender's spouse. The recipient then decides how to divide the amount that they received from their spouse plus their show-up fee (minus any amount spent on monitoring income) between a joint account and their personal account. Any amount that they put in the joint account will be doubled and then divided evenly between both spouses.

In the first round of the game, spouses cannot communicate with each other. In the second round, they must communicate with each other after the sender receives the endowment and before they decide how much to send to the recipient. Enumerators will bring spouses to the same room and give them 10 minutes to communicate. They will not be observed by enumerators during this time and they will be informed that they can discuss whatever they would like. If the endowment is private, the sender does not have to reveal the endowment size. They also do not have to reveal how much they plan to share and the recipient does not have to reveal how much they plan to allocate to the joint account, but they can share this information if they so choose. After all rounds are completed, each spouse will complete a separate questionnaire that will include questions about what

information they shared. If recipients report that their spouse revealed the size of their private endowment, the enumerators will ask them to report the endowment amount. One can then confirm whether the sender shared accurate information. Similarly, if senders report that their spouse told them how much they would allocate to the joint account, enumerators will inquire about this quantity and compare it to the actual amount allocated to the joint account. After conducting the first two rounds of the game, the enumerators elicit the sender's and recipient's willingness to pay and willingness to accept for communication with their spouse. In the third round of the game, they will not communicate if neither is willing to pay to communicate and they will communicate if both partners are willing to pay to communicate. If only one member of the couple has a positive willingness to pay, flip a coin to determine whether they communicate.

In order to prevent learning across rounds and to ensure plausible deniability regarding monitoring and hiding, the researchers must not reveal the results of each game. While the recipient will always know how much the sender shared with them, the sender will not know how much the recipient placed in the joint account. After all rounds are completed, the enumerators will randomly select one round to pay out for the recipient and one round to pay out for the sender. Figure 3..2 describes each of the treatment arms and the associated payoffs.

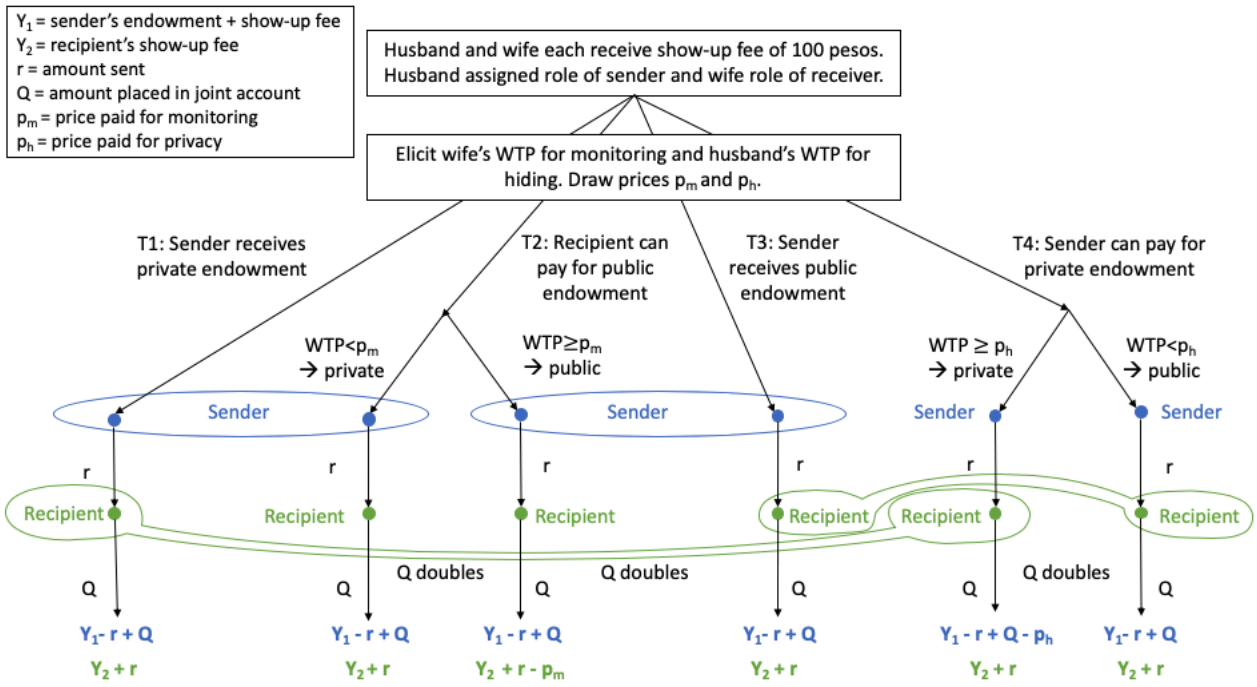

Figure 3..2: Design of lab-in-the-field experiment

To examine how increasing women budget managers' control over resources would alter household expenditures, one could also measure the budgetary knowledge and preferences of husbands and wives. After conducting the lab-in-the-field experiments, one would ask each participant questions regarding household expenditures on different categories, including food, and adequacy of household food consumption. Next, ask husbands and wives to rank the categories on which they would like to spend more money using the earnings from the games. This allows one to control for each individual's stated average food expenditure and test whether there's an additional preference difference. Recognizing that greater expenditures do not necessarily improve food security for the household as a whole or for specific individuals within the household, one could then assess household and individual dietary diversity and food security by collect data for the reduced coping strategy index, the household dietary diversity score (HDDS), and the Minimum Dietary Diversity for Women of Reproductive Age (MDD-W) indicator.

Analysis Plan

Within-subject Communication Treatment

By exploiting the within-subject design of the communication treatment, one can analyze the effect of communication across different information treatments using the following fixed-effect model

$$Y_{ir} = \beta_0 + \beta_1 Communication_r + \alpha_i + \mathbf{X}_i'\eta + \epsilon_{ir} \tag{3.43}$$

where $Communication_r$ is a dummy variable indicating whether couples were allowed to communicate in round r and α_i is the couple fixed-effect. Using this fixed effect specification controls for heterogeneity across couples. Controlling for the endowment size will reduce the standard errors, which should be clustered at the couple level. The outcomes Y_{ir} include the amount of the husband's endowment sent to the recipient (r), the share the husband's endowment sent to the recipient ($\frac{r}{Y_1}$), the amount the recipient invests in the joint account (Q), whether the sender paid to hide their endowment, willingness to pay to hide the endowment, whether the recipient paid to monitor the sender's endowment, willingness to pay to monitor the endowment, efficiency levels (or the ratio of income received to potential income earned), a dummy indicating whether a couple maximized household payoffs, and willingness to pay to communicate.

Between-subject Information Treatment

Since the information treatment only varies between couples, one cannot use a couple fixed-effects strategy to analyze differences across information treatment arms. Thus, one would estimate

$$\begin{aligned} Y_{ir} = \beta_0 + \beta_1 Communication_r + \beta_2 InformationTreatment_i + \\ \beta_3 Communication_r * InformationTreatment_i + \mathbf{X}_i'\eta + \epsilon_{ir} \end{aligned} \tag{3.44}$$

where $Communication_r$ is a dummy variable indicating whether couples were allowed to communicate in round r, $InformationTreatment_i$ indicates which of the four treatment arms the couple was in, and the interaction of the two indicates if a couple communicated in round r and their treatment arm. The vector of control variables $\mathbf{X}_i$ includes the endowment size and whether the wife manages the household budget.

Hypotheses

Based on a review of the literature and the theoretical model, I group the hypotheses into four families: (A) amount husbands share with their wives (r), (B) amount wives allocate to public goods (Q), (C) efficiency, and (D) willingness to pay to communicate. Following Anderson (2008), one could correct for multiple hypothesis testing within each of the four families by controlling for the False Discovery Rate.

The hypotheses in Table 3..9 are all categorized under families A or B. As discussed in the theoretical framework, communication is likely to reduce the price of monitoring income (p_m) and increase the price of hiding income (p_h). It is not possible to test this directly using data from the lab-in-the-field experiment, but one could examine the effects of experimentally varying these prices. One could analyze how wives in treatment group 2 respond to reducing the price of monitoring and how husbands in treatment group 4 respond to increasing the price of hiding income. The theoretical model predicts that, in treatment 2, conditional on choosing to monitor, a decrease in the price of monitoring (p_m) will weakly increase the amount wives invest in the public good (Q). In treatment 4, conditional on hiding income, husbands will send less to their wives (r) and wives will invest less in public goods (Q) in response to an increase in the price of hiding (p_h).

One could also examine how the magnitudes of the effects differ across treatment groups and how communication affects the discrete choice of whether to monitor or hide income. While experimental evidence regarding whether information asymmetries affect behavior is mixed, previous research in the Philippines finds that husbands are more likely to invest

money in their private accounts when this decision is private than when their wives can observe this decision (Ashraf, 2009). Similarly, in an experiment in Kenya, some husbands send more to their wives when their endowment is public than when it is private (Hoel, 2015). I thus hypothesize that, on average, husbands will behave strategically by sending more to their wives when their wives can observe their endowment than when the endowment is private. In addition, Ashraf (2009) finds that communication increases the amount that husbands send to their wives when their endowment is public. Unlike with p_m and p_h, in the lab-in-the-field experiment, the price of deviating from the informal marital contract that husbands turn over their income to their wives (p_d) is not experimentally varied. Instead, one could test if r is higher when husbands communicate about a public endowment than when they do not. If this holds, it suggests that communication increases the total cost of withholding income from one's wife ($p_d(Y_1 - r)$). A novel contribution of this experiment would be to test whether communication about a private endowment increases the amount that husbands send to their wives.

Family A: Amount husbands send to wives (r)

I hypothesize that

R1. r is higher when Y_1 is public than when it is private.

R2. In treatment groups 1 and 3, communication increases r.

R3. In treatment groups 2 and 4, communication changes r.

R4. r is highest when Y_1 is public and spouses communicate.

R5. The share of Y_1 sent to the wife ($\frac{r}{Y_1}$) is decreasing in the husband's willingness to pay to hide income.

Family B: Public good allocations (Q)

I also hypothesize that

Q1. Q is higher when Y_1 is public than when it is private.

Q2. In treatment groups 1 and 3, communication increases Q.

Q3. In treatment groups 2 and 4, communication changes Q.

Q4. Q is highest when Y_1 is public (treatment group 3) and spouses communicate.

Q5. Holding r constant, Q increases in the share of Y_1 sent to the wife ($\frac{r}{Y_1}$) when Y_1 is public.

Family C: Efficiency

These lab-in-the-field experiments would allow one to directly test whether communicating with one's spouse increases household efficiency. Since individuals must pay for monitoring and hiding, these actions result in deadweight loss for the household. While monitoring is always inefficient, it may be more efficient than not monitoring, depending on the opportunism of the husband. If spouses are fully cooperative, then neither will invest any money in hiding or monitoring income, the husband will send his entire endowment to the wife, and the wife will allocate all available funds to the public good. This strategy maximizes the household's earnings. On the other hand, if control over resources matter, then spouses may not maximize the household's total income. Lab-in-the-field experiments suggest that spouses often behave inefficiently. In a review of 26 studies on household efficiency, Munro (2018) finds that somewhere between 2.3 and 79.5 percent of individuals maximize their household's payoffs. There is substantial variation even across studies within the same country. Efficiency levels, which measure the ratio of income received to potential income earned, are about 75 percent on average (Munro, 2018). Potential income earned is defined as the amount that the household would receive if the husband sent his entire endowment to the wife and she invested it all in the joint account. I thus do not expect all couples to behave efficiently. However, I hypothesize that

E1. Efficiency is higher when Y_1 is public than when it is private.[26]

E2. In treatment groups 1 and 3, communication increases efficiency.

E3. In treatment group 2, communication decreases the wife's willingness to pay for monitoring income and the probability that she monitors.

E4. In treatment group 4, communication alters the husband's willingness to pay for hiding income and the probability that he hides income.

E5. In treatment group 4, communication between spouses alters efficiency.

Family D: Willingness to Pay for Communication with Spouse

If communication increases the amount that husbands send to their wives (r), then I would hypothesize that

C1. Wives are willing to pay more than their husbands to communicate with their spouse.

[26]Efficiency refers to efficiency levels and the proportion of couples maximizing household payoffs.

Table 3..9: Summary of Comparative Statics

Family A: Amount husband sends to wife (r)				
	Case 1: Private	Case 2: Wife pays p_m	Case 3: Public	Case 4: Husband pays p_h
$\frac{\partial r}{\partial Y_1}$	> 0	≥ 0	≥ 0	> 0
$\frac{\partial r}{\partial p_d}$	N/A	If $r = Y_1$, > 0 If $r < Y_1$ and $p_d = 1$, > 0 If $r < Y_1$ and $p_d < 1$, sign depends on x_1, $u'(x_1)$, and $u''(x_1)$	Same as Case 2	N/A
$\frac{\partial r}{\partial p_m}$	N/A	Depends on $u'''(x_2)$ and $v'''(Q)$	N/A	N/A
$\frac{\partial r}{\partial p_h}$	N/A	N/A	N/A	< 0
Family B: Amount wife allocates to public good (Q)				
	Case 1: Private	Case 2: Wife pays p_m	Case 3: Public	Case 4: Husband pays p_h
$\frac{\partial Q}{\partial r}$	> 0	> 0	> 0	> 0
$\frac{\partial Q}{\partial Y_1}$	> 0	≥ 0	≥ 0	> 0
$\frac{\partial Q}{\partial p_d}$	N/A	Same as $\frac{\partial r}{\partial p_d}$ above	Same as $\frac{\partial r}{\partial p_d}$ above	N/A
$\frac{\partial Q}{\partial p_m}$	N/A	≤ 0	N/A	N/A
$\frac{\partial Q}{\partial p_h}$	N/A	N/A	N/A	< 0