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Who Does What in a Household after Genocide? Evidence from Rwanda

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Abstract: This paper investigates the determinants of intra-household time allocation in post-war Rwanda. A decade after the 1994 genocide, Rwanda still bears the demographic impact of the war, in which at least 800,000 people died and the majority of casualties were adult males. The paper explores two unique features: exogenous variation in household types and large variation in regional cohort-specific sex ratios. Results indicate that, first, exposure to violence and male death can be a trigger of change in gender roles. Second, there is little flexibility to negotiate responsibilities within the household. Third, the local marriage market impacts the division of labor. Young, unmarried women engage more intensely in typical female activities when the shortage of men is severe. Conforming to the female gender role may be a strategy to improve their chances to marry.

Keywords: conflict, gender roles, Rwanda, time allocation

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1 Introduction

War obviously causes damage to human beings, assets and institutions. Yet it can also be a trigger for social change (Keen 1997). War may provide an opportunity to renegotiate gender roles and assign women greater economic responsibilities. Qualitative accounts from El Salvador show that during the war women acquired new skills that previously were the preserve of men and became the breadwinners in their households (Ibáñez 2001). Some studies caution that gender roles are only temporarily modified for the duration of conflict and often return to the pre-conflict norm when conflict ends (Ridd and Callaway 1987).

The 1994 genocide severely altered the demographic structure of Rwandan society. The majority of the more than 800,000 people who died during the genocide were adult males, leaving many women widowed. Using household survey data from post-war Rwanda, this paper analyzes how households allocate tasks amongst their members and how this is interrelated with gender and family status. The post-war Rwandan context allows us to compare the impact of gender roles across two household types, namely male-headed and widow-headed households. It is shown that widows who head a household were exogenously forced into widowhood and into becoming the head of the household.

The paper first explores the impact of household composition on the division of labor. Second, it investigates whether the local marriage market, which was heavily affected by the genocide, influences who does what in rural households. The estimation procedure builds on the work of Fafchamps and Quisumbing (2003) who propose a parameterization of household composition that makes it possible to compare the division of labor in households of different sizes. Results indicate that intra-household time allocation in male-headed and widow-headed households is driven by different factors. Moreover, gender roles are followed as strictly in tasks performed in the homestead as in publically performed activities. The availability of potential partners in the local marriage market leads women – and single women in particular – to conform more closely to the cultural ideal.

The analysis contributes to the literature in three ways. First, the post-war context of Rwanda has two unique features: exogenous variation in household types and large variation in regional cohort-specific sex ratios. These features allow us to capture the impact of norms more accurately than much of the empirical literature on time allocation that often interprets

gender norms as the unexplained residual after controlling for individual and household-specific factors. Second, a large body of demographic research estimates conflict mortality rates (Anderson and Silver 1985; de Walque 2006; Guha-Sapir and Degomme 2010; Urdal et al. 2003), yet there is little research exploring the impact of demographic shifts induced by violence on socio-economic outcomes. Some examples of the latter are studies examining the effects of conflict-induced displacement on labor market outcomes in Bosnia and Herzegovina (Kondylis 2010) and female reproductive behavior and age of first marriage in post-war Tajikistan (Shemyakina 2007) and Rwanda (Jayaraman et al. 2009). Third, there is a dearth of research exploring if and in what way gender role norms impose constraints on women in Rwanda in the aftermath of the genocide. This is surprising, given that frictions associated with gender roles were among the factors contributing to social tensions before the genocide. It is well documented how the gender crisis of young, unemployed, impoverished and frustrated Hutu men contributed to their willingness to engage in genocidal violence (Baines 2003; Jones 2002; Schäfer 2008; Taylor 1999). At the same time, sanctions were imposed on financially independent women who overstepped the boundaries of traditional roles and threatened the image of men as providers. Understanding gender roles in the post-genocide context hence contributes to understanding the long-term impact of the 1994 genocide.

The paper is structured as follows. Section 2 discusses the state of the art in research on time allocation and gender norms. The following section provides an overview of the demographic consequences of the genocide. Moreover, it reviews culturally defined norms on gender roles in Rwanda and formulates hypotheses. The estimation strategy is detailed in Section 4, followed in Section 5 by a description of the household survey data set, the *Enquête Intégrale sur les Conditions de Vie de Ménage* (EICV). Empirical results are discussed in Section 6. The last section provides some concluding thoughts.

2 Review of previous work

In Becker's (1965) seminal work on time allocation, household members specialize in the kind of activity – market work or work in the home – in which they have a comparative advantage. Yet it is a stylized fact that women's contribution to housework exceeds the time their husbands spend on housework even when women earn more than their husbands in

market work, contradicting the comparative advantage and specialization theorem (Fernandez and Sevilla-Sanz 2010).

Both theoretical and empirical research on time allocation resort to norms attached to gender in order to better explain the division of labor within households (Ilahi 2000). Akerlof and Kranton (2000) suggest a model of identity in which individuals derive higher utility from adapting their behavior to societal expectations regarding their gender role. One implication that follows is that wives who engage more intensively in work outside the household than their husbands violate the male breadwinner norm. Wives compensate for this violation by conforming closely to the stereotype of females doing the housework. Similarly, in their model of female labor allocation, Kevane and Wydick (2001) include a term capturing the benefits from conforming to social norms. A woman's utility decreases if she deviates from the average behavior of her group. Moreover, a large number of empirical time allocation studies interpret results in terms of norms on the gendered division of labor. Yet most merely control for individual and household characteristics while assuming that social norms account for the variation in behavior not explained by economic incentives (Eberharter 2001; Fernandez and Sevilla-Sanz 2010; Ilahi 2001; Khandker 1988; Medeiros et al. 2007).

A small number of empirical studies aim to isolate the effects of gender norms, using a variety of approaches. One set breaks down the impact of norms on particular spheres that can be measured more easily with proxy variables. For instance, Kevane and Wydick (2001) compare the impact of different social norms on women's labor allocation within two ethnic groups in Burkina Faso that differ in the degree of patriarchy, activities prescribed to women, and threat points. They find that only women subject to less conservative norms (captured by an ethnicity variable) respond to changes in farm asset endowments. In a cross-country study on partnership formation and fertility, Giminez et al. (2007) use the ratio of female to male time spent on childcare for each country and year to establish proxy norms on the intra-household division of labor. They find evidence that more traditional norms reduce a woman's gains from entering a partnership and hence there is less likelihood of partnership formation.

Another strand of research applies a bargaining model of intra-family decision-making to investigate the impact of power relations and threat point variations on time allocation decisions of spouses. This approach allows gender roles to be negotiated (at least to a certain

degree) based on the characteristics of the spouses, the wife's reservation welfare and institutional characteristics. Variables used to capture bargaining power include a husband's authority to decide over his wife's travel and personal income as well as a wife's autonomy in hiring a household maid (Bayudan 2006). Other studies use the characteristics of a wife's father and her siblings (Kevane and Wydick 2001) and the type of legal divorce settlement (Carlin 1991) as proxies for threat points. The studies cited do not find unequivocal evidence: The concentration of intra-household power in the husband causes women to allocate more time on housework in some contexts, while it makes no difference in others.

A third group of studies compares the time allocation patterns of individuals of different status within the household. For example, Cunningham (2001) compares the time allocation of single mothers, wives, and husbands in Mexico. She finds that "labor patterns are more similar for those with the same household roles than for those of the same sex" (Cunningham 2001: p. 29). Fafchamps and Quisumbing (2003) focus on the impact of an individual's status within the household, defined by an individual's relationship to the head of the household. Their approach to intra-household gender roles, which is adopted here, is described in more detail in Section 4.

3 The Rwandan context

3.1 The demographic impact of the genocide

Rwanda has a long history of violent conflict dating back to its colonial period[1]. Ethnically motivated violence against the Tutsi minority resulted in waves of migration into neighboring countries after Rwanda's 1962 independence. The violence peaked with the 1994 genocide, when extremist Hutus, backed by the government, organized massacres of the Tutsi minority and, to a lesser degree, moderate Hutu intellectuals who opposed the regime of President Habyarimana. The human suffering caused by the genocide is inconceivable, with estimates ranging from over 500,000 deaths (Desforges 1999; Prunier 1999) to over a million deaths (African Rights 1995). Most of these individuals were killed in one-sided violence. A small number of soldiers died in combat between the Rwandan Armed Forces (FAR) and the rebel

[1] For analyses of the historical context, see Desforges (1999), Mamdani (2001), Newbury and Newbury (1999), Prunier (1999) and the special issue on Rwanda of ISSUE (1995).

army, the Rwandan Patriotic Front (RPF), which eventually stopped the genocide and took over power. The breakdown of the health care system and displacement also contributed to excess mortality (de Walque and Verwimp 2010).

Estimates of death tolls are politically sensitive in Rwanda and the available demographic data are scant. Reconciliation policies enacted after 1994 strictly prohibit the collection of information on ethnicity and other characteristics that would facilitate the reconstruction of the demographic impact of the genocide in more detail. The few studies attempting to differentiate deaths according to sex (de Walque and Verwimp 2010; Ministry for Local Government 2002; Verpoorten 2005) conclude that adult men made up the majority of casualties.

In the aftermath of the genocide, sex ratios (the number of males for every 100 females) were severely unbalanced. Primarily, this is because more men than women were killed. Further, many of the genocide perpetrators, mostly male, escaped to the Democratic Republic of Congo or Tanzania immediately after the genocide, in fear of revenge by the RPF and persecution for their crimes (Newbury 2005). Figure 1 indicates sex ratios derived from the 2002 census, the first demographic data available after the genocide. The sharp drop in sex ratios of cohorts born before 1983 captures the effect of mass deaths, while the decrease in the ratio of cohorts born before 1948 may indicate an age effect due to the lower overall life expectancy of men, even prior to the genocide. The nationwide sex ratio of prime age adults was 0.88 in 2002; in several provinces, sex ratios were below 0.6 for some birth cohorts. Still, sex ratios derived from census data overestimate the number of men potentially available on the marriage market, as tens of thousands of male perpetrators of genocide were in jail (Ministry of Finance and Economic Planning et al. 2003).

An immediate implication following from the unbalanced sex ratios is the reduced chance of women being able to get married or to remarry after being divorced or widowed. In the distribution of marital status by sex and birth cohort (Fig. 2), four observations are of particular interest. First, widowhood is a widespread phenomenon among women. In contrast, the proportion of widowed men is very low, even in the oldest birth cohorts (which inhibits the comparison of widowers and widows). Second, women become widowed at a younger age than men. Third, widowhood seems to be a permanent status for women, as the proportion of widows rises steadily with older birth cohorts, while the proportion of male widowers remains

relatively stable. This seems to indicate that men either remarry, perhaps marrying women of younger birth cohorts, or die soon after becoming widowed. Fourth, a larger proportion of women than men are divorced. In fact, data from several waves of Rwanda Demographic and Health Surveys indicate that the proportion of divorced prime-age women increased from 6.1 percent in 1992 (ONAPO and Macro International 1994) to 9.4 percent in 2005 (INSR and ORC Macro 2006), while less than 2 percent of men were divorced in both years.

The unbalanced sex ratio is mirrored in the large proportion of female-headed households, making up 23.3 percent of rural households in Rwanda.[2] In the following, the behavior of male-headed households and widow-headed households is compared. The choice to focus on widow-headed households (instead of the whole group of female-headed households) is motivated by two reasons. On the one hand, the civil status of widows is fixed at least in the medium-term. The majority of widows are very likely to be genocide widows (that is, formerly wives of Tutsi husbands or moderate Hutu), but the data at hand does not allow us to reconstruct the nature of their husbands' deaths.[3] My qualitative fieldwork reveals that many genocide widows suffer from trauma and other violence-related health problems, which often rules out the option of remarriage. Others decide against remarrying out of fear of losing their entitlements to the government's survivors' fund and other assistance as well as claims to their deceased husband's property (Brück and Schindler 2009). Widowhood is therefore exogenously forced upon women by circumstance. On the other hand, widow-headed households are a much more homogenous group compared to non-widowed female heads of households. Particularly, women heads of households living in an (informal) polygamous

[2] Of female heads of households in rural Rwanda in 2005, 79 percent are widowed, 12 percent are divorced, 7 percent are single, and 2 percent are married (calculated using EICV data). The latter two groups are likely to live in an informal polygamous relationship, which is officially prohibited but still practiced in rural areas.

[3] Attempts are made to distinguish between different categories of widows. EICV does not collect information on the number of births given by a woman, the number of deceased household members, their cause of death, or ethnicity. Also, migration data collected in EICV is rather weak and does not allow us to reconstruct a person's location during the genocide. A conflict intensity index was calculated from the PRIO/ACLED database (Raleigh and Hegre 2005), yet it only correlates very weakly with the proportion of widows per province. The conclusion from this exercise is that it is impossible to distinguish genocide widows from HIV/AIDS widows or widows who lost their husbands for other reasons. Still, this does not pose a major problem to the analysis. According to qualitative accounts, the livelihoods of Hutu and Tutsi did not differ prior to the genocide (Desforges 1999) although Tutsi were better educated (Jayaraman, et al. 2009). Hence, there is no reason to expect systematic differences in gender roles or the intra-household division of tasks across Hutu and Tutsi households. Potential differences in education and asset endowments across households are controlled for in the multivariate analysis.

relationship have better access to support networks, male labor and secure land tenure through their male partners compared to widow heads of households.

3.2 Gender roles in Rwanda

For a long time, women in Rwanda have been constrained in their choices and activities. There are various factors that enforce this discrimination: intra-household gender relations, norms on the ideal behavior of women, and legal discrimination. Given a lack of research exploring how gender roles changed as a result of the genocide, the following review relies both on sources that depict gender relations long before the war and on studies conducted after 1994.

The role of women across households is shaped by the idealized image of the woman as child-bearer. “As of early age, Rwandan girls are prepared for their future roles in society, which are centred around her functions as wife and mother” (UNICEF 1997: p. 103). Until recently, fertility in Rwanda ranked among the highest in the world, with total fertility rates of 8.5 and 6.2 in 1983 and 1992, respectively (Jayaraman, et al. 2009). Many women used to remain at home after reaching puberty and engaged in domestic tasks and cultivation of food crops that are easily combined with their role as mothers. These activities received less remuneration and often entailed more hard physical labor than activities typically assigned to men, such as cultivation of cash crops, livestock grazing, and off-farm production. The commercial non-farm sector used to be male domain before the genocide, with women only making up 19 percent of the labor force in this sector (Nowrojee 1996: p. 13). Employment in the (predominantly urban) public sector was more balanced across genders, although women often held lower-ranking and lower-paid positions than men. This, in turn, prevented many women from acquiring skills and gaining experience in interactions with political authorities, banks, and the commercial sector (Burckhardt 1996; Newbury and Baldwin 2000).

In addition, women were systematically subordinated in intra-household decision-making processes. Husbands decided most issues concerning expenditures and household maintenance (Csete 1993) as well as household member labor allocation; their labor was “said to belong to him” (UNICEF 1997: p. 9). Women also lacked the capacity to employ resources and surplus freely, as they “can and do earn cash, but can only control small amounts of the income they generate” (Jefremovas 1991: p. 382). Similarly, girls used to receive less

education than boys. This is reinforced by patterns of patrilocal residence (a married couple living with or near the husband's parents) which implies that investments in a girl's schooling benefitted her husband's family once she marries (Hamilton 2000).

There are strong notions of the ideal behavior for women inside and outside the household. Rwandan girls are brought up to be modest, reserved, silent, obedient, and with a submissive attitude (Hamilton 2000; Sharlach 1999; UNICEF 1997). Conforming to this stereotypical female role is also a coping strategy since "most women try to enforce their claims by asserting that they have behaved in an appropriate manner, as upright wives, virginal daughters, good mothers, and virtuous widows" (Jefremovas 1991: p. 382). Moreover, sanctions are imposed on women who overstep the roles assigned to them since the pre-colonial era (Baines 2003: p. 482-483). Sanctions were enacted against independent women in 1983. In Kigali, hundreds of young urban women – many of them well-educated, well employed, financially independent, stylishly dressed, and single – were publicly harassed by soldiers and police forces, with many put in detention centers charged with prostitution and vagabondage (Taylor 1999: p. 161-163). This discouraged other women from pursuing their economic independence from men.

A number of culturally defined taboos imposed on women are enforced more strictly whenever women appear in public, that is, outside the home. There is a taboo against women in Rwanda building or repairing their houses and fences around the compound, engaging in activities related to cattle, cutting firewood, and making decisions on farm management (den Biggelaar 1995; Kimenyi 1992; Newbury and Baldwin 2000). According to Kimenyi (1992), the limitations on women engaging in certain activities are also reflected and perpetuated by language. Women are not allowed to be the subject of some categories of verbs, denying them an active role therein.

Women were also discriminated against by formal legislation. The Family Code of 1992 automatically designated husbands as the head of household, who, upon death, is replaced by his eldest son (Sharlach 1999). The Commercial Code, dating back to the colonial period, required the written consent of the husband whenever a wife wanted to engage in commercial activities, take up employment outside the household, obtain credit, or take legal action (Jefremovas 1991; Nowrojee 1996). Under pressure from aid donors, the process of revising laws that do not comply with international standards of gender equality began after 1994.

Most importantly, new legislation on succession and marital property regimes became law in 1999, granting women the right to hold ownership of property, including land, and to inherit (Burnet and RISD 2001). Still, the law only secures the rights of women who formally registered their marriage with civil authorities (African Rights 2007), a procedure uncommon before the genocide. For the majority of widows, the law did not reduce their vulnerability in land tenure, neither *de jure* nor *de facto*.

Modest improvements in the situation of women were achieved in other respects in the post-genocide period. Women participate more intensively in associations, farm cooperatives and credit groups (Colletta and Cullen 2000) and Rwandan women have the highest proportion of parliamentary representation in the world (Devlin and Elgie 2008). Yet the increased presence of women in the public and policy domain is restricted to Kigali, the Rwandan capital, and mostly benefits well-educated middle-class women; the patterns have not really changed in rural areas.

3.3 Hypotheses

From this review, three hypotheses are derived on how gender roles impact the intra-household division of labor in the post-war period. First, restrictive female gender roles within the household are likely to be mitigated by war-induced changes in household composition. This is more likely to have taken place in widow-headed households than in other types of households. Given that the majority of widows are likely to be genocide widows, many of them lost not only their husband, but also other male household members. Hence, widows often became the breadwinner and the principal decision-maker in their household. On the contrary, households characterized by a traditional composition – a male head, his wife, children – are likely to stick to traditional gender roles.

Second, women and men are likely to closely adhere to gender roles if activities are carried out outside the homestead, that is, visible to neighbors and other community members. In contrast, behavior may be less defined by gender roles for tasks that performed within the homestead where responsibilities are more easily negotiated.

Third, the availability of potential partners on the marriage market is likely to have an impact on how closely gender norms are followed. An extreme surplus of women in a particular

province may pose a threat to marriage. Given the increasing divorce rates after the genocide, wives may have an incentive to conform to the cultural norm of female behavior. Similarly, many of the younger female household members will eventually marry and leave the household. For these women, conforming to the female norms may be a strategy to improve their standing on the marriage market.

4 Estimation strategy

One challenge in estimating the determinants of time allocation in this empirical setting is that sample households differ in size and composition, which means there is different scope for dividing tasks among household members. For instance, about 4 percent of rural households consist of only one or two members, while about 6 percent have more than nine members. Most households are made up of a core couple with children, while multi-generation households are rare. Given the extremely high population density of 321 inhabitants per square kilometer in Rwanda (Ministry of Finance and Economic Planning et al. 2002), household size is often limited by the carrying capacity of its land endowments (André and Platteau 1998).

To address the issue of the unequal distribution of household size, a reduced form approach developed by Fafchamps and Quisumbing (2003) for analyzing time allocation in Pakistan – a context that shares several similarities with rural Rwanda – is used. The procedure involves two steps. First, household-level regressions on total time spent in domestic and income-generating activities, aggregated for all household members, are estimated. From a utility maximization framework, Fafchamps and Quisumbing derive a series of reduced form individual labor supply functions. In order to estimate this equation for households of different sizes, individual-specific variables are replaced with household averages:

$$L_a = f_a\left(\overline{H}, K, U, \overline{w}\right) \qquad (1)$$

where household labor supply L in activity a is a function of human capital H, averaged over all household members, semi-fixed production inputs K, unearned income U, and welfare weights w. Moreover, Fafchamps and Quisumbing (2003) propose a parameterization for household composition:

$$N_1 + \sum_{j=2}^{J}(1+\alpha_j)N_j \approx Ne^{\sum_{j=2}^{J}\frac{\alpha_j N_j}{N}} \qquad (2)$$

that takes into account total household size *N*, the number of different positions within the household hierarchy relative to the head *J*, the number of household members in each position N_j, and a parameter, α, measuring the difference of a position relative to the position omitted. Linearizing term (2) results in shares that individuals of each position in the household hierarchy make up relative to total household size.[4]

In the following, the mutually exclusive household position categories comprise male head, widow head, wife of head, other adult man, other adult woman, teenage boy, teenage girl, and children younger than 12 years (see Table 1 below).[5] While more detailed information on the kinship ties to the head of household is available – e.g. son, grandson, foster son – positions are aggregated in order to have a sufficient number of observations in each category. A person's intra-household position is hence defined along the lines of gender and family status. This strongly correlates with marital status and age. The purpose of the household-level estimation is to test, first, whether widow-headed households differ from male-headed households in terms of the drivers of total labor supply. Second, it is tested whether gender roles and household hierarchy pose a binding constraint on the household's allocation decision.

As proxies for human capital, I calculate the mean value for female household members and the mean value for male household members of age, age squared, number of classes completed, and number of days sick during the two weeks prior to the interview.

Unearned income from remittances and rents is divided in three categories (no, low, and high unearned income), each corresponding roughly to a third of the sample households. The production inputs, size of land under cultivation, livestock and the current value of agricultural assets are controlled for. Given that loop-backs between productive assets and time-use potentially exist, a stepwise approach is used in estimating equation 1, adding one

[4] For example, a three-person household consisting of a head and two teenage sons would have a share of head of one-third, share of sons of two-thirds, and all other shares zero.

[5] Teenagers are of age 12-17 years and adults of age 18 years and older.

production input at a time to ensure that coefficients of other variables do not change as a consequence. In addition, community infrastructure is controlled for, as it seems plausible that household labor supply is shaped by local conditions in rural Rwanda. Dummy variables for infrastructure capture whether the cellule (the smallest administrative unit in Rwanda) has a regular market, a year-round passable road, and whether more individuals arrived in the area than departed during the past five years, indicating economic opportunities. As the EICV household survey does not contain suitable variables for welfare weights, instead intra-household position variables are used, as it is likely that these correlate with a person's bargaining power within the household. In order to differentiate between male-headed and widow-headed households, a dummy indicating a widow-headed household is interacted with all human capital and household composition variables in the estimation of equation 1. Summary statistics of variables used in the empirical analysis are provided in Table 4 below.

In the second step of the Fafchamps and Quisumbing (2003) framework, individual-level labor shares are defined as:

$$S_a^i = \frac{L_a^i}{L_a} \tag{3}$$

where the labor share, *S,* of individual, *i,* on activity, *a,* is defined as an individual's labor supply out of the total household labor supply allocated to an activity. In other words, *S* measures the intensity of a person's engagement. The aim of the individual-level estimations is to test for the impact of gender roles and household hierarchy on individual time allocation across household types.

In estimating individual labor shares empirically, the same set of human capital, composition, productive assets, wealth, and community characteristics is used as in the household labor supply regression, with some variables defined in a slightly different way. Human capital variables are now defined in relative terms as the difference between a person's human capital endowments and the average endowments of household members of the same gender. Household composition is captured with dummy variables, taking the value one if a person is the head, wife, teenage girl etc.[6] Additionally, sex ratios are included (see next section).

[6] This is a departure from the Fafchamps and Quisumbing (2003) approach, which proposes another parameterization for household composition when estimating individual labor shares. Yet their second

Again, human capital and household composition variables are interacted with a dummy for widow-headed households.

A number of households and individuals do not engage in any activity (see next section) at all. Zeros in the dependent variable are interpreted as behavioral choices to not work in a particular activity, while the remaining observations with positive hours worked are continuously distributed. A two-part (or hurdle) model is used to estimate both household-level and individual-level time allocation. In the first part of the estimation, the determinants of engaging in an activity are estimated with probit. The second part of the estimation draws on the sample of uncensored observations, using OLS. A joint log-likelihood value is derived from both parts. The two-part model is advantaged in that homoskedasticity and normality are not required to obtain consistent estimators (Cameron and Trivedi 2009: p. 541). Moreover, it allows different mechanisms to determine participation in an activity and intensity of participation.[7]

Given that households were interviewed at different stages in the agricultural cycle, the impact of the timing of interviews on time allocation is tested. As expected, households spend significantly less total time farming between May and September, the low season. Nevertheless, very few month dummies are significant in the individual labor share estimations and none of the other variables of interest change substantially in magnitude or level of significance. There is hence no evidence that the intra-household division of labor varies systematically across seasons.

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parameterization term is complex and requires non-linear estimation methods, which makes it unable to include additional covariates. The choice in the following analysis is to use less precise dummy variables as proxies for composition categories and resort to linear estimation techniques that facilitate the interpretation of estimated coefficients.

[7] Equations 1 and 3 were also estimated using tobit as a robustness check (data not shown), although the normality assumptions tobit crucially relies on are violated. The tobit estimations produce very similar results in terms of levels of significance and magnitude of coefficients compared to the two-part model.

5 Data

Data from the latest Rwandan national household survey, the *Enquête Intégrale sur les Conditions de Vie de Ménage* (EICV) (National Institute of Statistics Rwanda 2005) is used.[8] The EICV is a sample of 6,900 households that collects information on household demographics, education, health, agricultural production, employment, income and expenditures, migration, credit and savings, and time use. The survey is a stratified two-stage sample design and provides representative data at national and provincial levels during the 2005/2006 agricultural cycle.

Data on time use was collected through a stylized list of activities in various modules of the questionnaire. Respondents were asked to recall the frequency and duration of time they spent on selected, pre-coded, activities over a short and a long reference period. The paper only draws on the former, given that more detailed information is available for the short reference period, namely the hours spent per day and number of days worked during the seven days prior to the interview in domestic and income-generating activities.

Domestic work covered in the survey comprises of gathering wood, fetching water, buying everyday supplies at the market, cooking, and an aggregate of other household chores that includes cleaning, laundry and childcare. In the following, domestic activities are grouped into those taking place inside the homestead (that is, not visible to others) and those conducted outside the homestead. In terms of income-generating activities, the original survey captures wage work, self-employment and unpaid work, each in the farm and non-farm sector. For the purpose of analysis, these income-generating activities are aggregated into (1) farming on the household's own land; (2) non-farm market activities, such as trading and public sector employment; and (3) farm wage work outside the household's fields. Each of these domestic and income-generating activities includes the travel time from the household and back. Time spent on social activities, leisure, resting, and sleeping is not recorded in the survey. Therefore, the hours spent on domestic tasks and income-generating activities included in the survey do not add up to 24 hours a day.

[8] Household survey data on time use is only available for 2000 and 2005. A direct comparison of time allocation patterns and gender roles in the pre-genocide and post-genocide period is therefore not possible.

In the analysis of time allocation, the sample is restricted to rural areas because livelihoods are less diverse in the urban sector and there are markets (at least to some extent) for some domestic tasks, which reduces the number of activities observed. Moreover, community-level information on infrastructure and access to markets is only collected in rural areas. Given that intra-household labor divisions are a key focus of the analysis, only households with at least two active members are used in the analysis. This leaves a sample of 4,648 rural households (of which 1,041 are widow-headed) and 11,607 economically active individuals (of which 997 are widows). A small number of individuals (less than half a percent of the sample) have suspiciously high numbers of aggregated hours worked over the seven days prior to their interview, which appears to be the result of interviewer error. A maximum of 18 hours of work per day is imposed on those cases.

One drawback of the EICV is that data on remuneration is rather weak. For the majority of surveyed wage laborers, information on earnings is missing, which is often paid in kind. Also, income derived from joint activities of household members, such as working on the family farm, cannot be disaggregated into the hourly earnings of each household member.

Sex ratios are taken from an additional data source, the 2002 census (Ministry of Finance and Economic Planning, et al. 2002). In order to account for regional differences in conflict intensity and male mortality, sex ratios are considered at provincial level. Moreover, sex ratios were calculated for each cohort, based on the typical age difference between spouses in Rwanda. For men, the average was taken from the sex ratio in a man's 5-year birth cohort, two younger birth cohorts and one older birth cohort. For women, sex ratios in a woman's birth cohort, one younger birth cohort and two older birth cohorts were averaged. These provincial, cohort-specific sex ratios are the closest approximation to the local marriage market possible with publicly available data.

6 Results and discussion

6.1 Descriptive statistics

Table 1 depicts individuals' mean hours worked in various domestic and income-generating activities during the week prior to the interview, differentiated by a person's position within the household hierarchy. Note that only individuals who engaged in an activity are included in

this calculation; the mean over all individuals is lower. The figures suggest that there is a pronounced division of labor along gender lines in rural households, corresponding to a female caregiver and male breadwinner divide. For instance, a male head works about 18 hours per week less than his wife in domestic tasks within the homestead, but 14 and seven hours more in non-farm market activities and farm wage work, respectively. The exception is farming on the household's own land, largely for the purpose of meeting the food requirements of the household, to which all members contribute a similar amount of time. Beyond gender, an individual's position within the household hierarchy makes a difference. For instance, teenage sons and daughters have higher workloads in domestic tasks outside the household, market work, and farm wage work than persons of the same gender but of a different relation to the head of the household.

Time allocation patterns of male-headed and widow-headed households are compared in Table 2. Interestingly, male heads and widow heads of households allocate their time differently. Male heads work about eight hours per week longer in income-generating activities than widow heads, while the latter spent almost half of the time surveyed in reproductive tasks. It seems that widow heads follow the typical time patterns of wives, both in terms of absolute work burdens and the division of labor in the domestic and market spheres. Considering the aggregated time spent on all activities, female household members work on average 10 hours more per week than male members. This contrasts with evidence from developed countries, where the total time spent in reproductive and productive activities is balanced across gender (Burda et al. 2007). Still, the gendered division of labor is less pronounced in widow-headed households, which contrasts with results from Mexico where men in female-headed households work harder in order to compensate for the gender wage gap (Cunningham 2001). This line of argument assumes that a female head earns less than a male head; as a consequence, a male member in a female-headed household is required to help as a secondary laborer.

Table 3 indicates that male-headed and widow-headed households also differ in some socio-economic characteristics. Three results are of particular interest. First, it appears that household composition in terms of total household size and the ratio of female to male members varies significantly across both types of household. This underlines the necessity of carefully incorporating household size and composition in the regression analysis. Second, widow-headed households have a higher incidence of poverty and extreme poverty when

compared to male-headed households, which correlates with lower endowments of physical and human capital assets. Third, widow heads are engaged in a significantly lower number of market activities than male heads, in both the long and short term. This may be due to lack of opportunities.

To conclude, while the unconditional analysis points towards major differences in time allocation across gender, a person's position within the household hierarchy, and household type, it does not reveal whether these patterns are driven by social roles, differences in human capital endowments, or wealth. Results from multivariate analysis that control for initial endowments are used in the next section to test the three hypotheses outlined above.

6.2 Multivariate results

Table 5 displays two-part model estimations of total household labor supply in five different activities (equation 1): domestic work inside the homestead, domestic work outside the homestead, farming on the household's land, non-farm market activities, and farm wage work. The dependent variables in the household-level estimations are defined as the natural logarithm of total hours per household spent on an activity. As the sharing of tasks is the focus of this analysis, Table 5 only reports coefficients of the second part OLS estimation based on uncensored observations. Joint log-likelihood values are calculated from the first and second part estimation and range between -3,800 and -6,100. R-squares are around 0.14 for all regressions. The mean of the predicted values from both censored and uncensored cases differ from the actual sample mean by 0.8 to 8.2 percent. Overall, these statistics indicate a good fit of the household-level regressions.

The same two-part model approach is used to explore the determinants of individual labor shares (Table 6). The dependent variables measure the proportion of individuals' time out of total household time spent on each activity of the same five activities, again transformed into natural logarithms. Censoring now occurs both at the lower and upper ends of the distribution, indicating people doing no activity at all and people specializing completely in one activity, respectively. Again, the joint log-likelihood value of the first and second part estimations are displayed in Table 6. The regression fit of the second-part model varies with the proportion of censored households, with R-squares of 0.46 for domestic tasks within the household and between 0.1 and 0.14 in all other activities.

Tests on the equality of male-headed and widow-headed households are conducted following both household-level and individual-level regressions (reported at the bottom of Table 5 and Table 6). In the household-level analysis, the hypothesis that male-headed and widow-headed households are the same is rejected for all activities except for farming in the first part estimation and for domestic tasks outside the homestead in the second part estimation. Similarly, at the individual level, tests strongly reject the hypothesis that individuals living in male-headed and widow-headed households are equal. It is therefore statistically valid to distinguish between those two household types.

a) Gender roles across household types

As theory predicts, human capital strong influences the determinants of household labor supply in male-headed households (Table 5). Households with better educated members (CLASM and CLASF) spend significantly more time on non-farm income-generating activities and significantly less time on farming and domestic chores outside the household. Health problems (DAYSICKM and DAYSICKF) reduce household labor supply to income-generating tasks and increase time spent on caring-related tasks within the homestead. Many variables regarding intra-household position are individually significant after controlling for household size, human capital endowments, household wealth and community infrastructure. Females, irrespective of their position within the household hierarchy, contribute significantly more time to domestic work and farming and significantly less time to other income-generating activities than male adults, the reference category.

F-tests, shown at the bottom of Table 5, reject the hypothesis that all adult members and all female members are the same as far as almost all activities are concerned. This suggests that both gender and a person's position within each gender group are binding constraints in male-headed households. Moreover, male-headed households benefit from economies of scale in all tasks except farm wage work, as an additional household member increases household time in these activities less than proportionally (HHSIZEL). All other significant covariates have the expected signs.

The determinants of individual labor shares in male-headed households are presented in Table 6. Again, many of the household composition variables are individually significant with the sign and magnitude of significant coefficients confirming a strict division of labor along

gender lines after controlling for human capital endowments, household assets, and community infrastructure. For instance, the wife of the head contributes more than twice as much to internal housework than any adult males, but 31 percent less to market work. Equality of a male head and his wife is strongly rejected for every activity in pairwise F-tests.

In contrast, household composition barely contributes to explaining household labor supply in a widow-headed household (Table 5). Very few household composition proxies are individually significant. Testing whether all adults are the same in widow-headed households reveals that this can only be rejected for domestic tasks outside the homestead, while the equality of female members cannot be rejected at all. Therefore, patterns of gender and household hierarchy do not pose a binding constraint in widow-headed households. Interestingly, human capital also plays less of a role in explaining the determinants of household time allocation in widow-headed households. Additional years of education of male or female members (CLASM and CLASF) have no significant impact on household labor supply to income-generating activities.

When considering the share of labor for individuals living in widow-headed households, the role of widow heads (WIDHEAD) stands out (Table 6). Widow household heads engage significantly more intensely in domestic tasks and farming on own land but significantly less intensely in farm wage work than adult male members, the reference group. Overall, fewer composition variables are individually significant compared to male-headed households. F-tests reject the equality of adult work shares and female work shares in all activities except non-farm market work. This sector is a valuable source of income because returns are generally higher than in farming and because market work is not affected by agricultural shocks. Given that widow-headed households, on average, have fewer adult male members who can carry out non-farm market work, following culturally defined gender norms in this activity comes at a high economic cost.

F-tests on pairwise comparisons of widow heads to other family status categories suggest that widow heads do not differ significantly from wives in male-headed households in domestic tasks, such as cooking, childcare, cleaning, and doing laundry. This suggests a universal caregiver role that the leading woman of the household assumes, irrespective of the presence of a male breadwinner. Yet the labor intensity of a widow head differs not only from other women in her own household, but also from a male head and a wife in male-headed

households in almost all income-generating activities. This result may be interpreted in the light of the social status of widows: They may have more freedom than other (potentially younger, childless and unmarried) women but are still subject to gender norms that constrain them to a smaller range of income-generating activities than men. Pairwise comparisons of male and female teenagers provide evidence for the continued impact of gender roles in either type of household. Equality of male and female teenagers is strongly rejected for domestic tasks (but cannot be rejected for income-generating activities), which indicates that gendered behavior is learned from childhood onwards.

b) Gender roles in public and contained activities

If an individual's reputation and standing in the community is shaped by the extent that they conform to their gender role, we would expect gender roles to have a stronger impact on activities that take place in public than those carried out inside the homestead. This hypothesis is tested by focusing on three activities that do not require much experience or skill and may be easily shifted among household members. Domestic tasks taking place outside the household, including fetching water, collecting firewood, and buying everyday supplies at the market are considered as a publicly visible activity. Contained activities include farming on the household's own fields that typically encircle the homestead in rural Rwanda and internal domestic tasks, such as cooking and cleaning. F-tests (Table 6) strongly reject the equality of adults' work shares in both public and contained activities in either household type. Moreover, pairwise comparisons of a male head to a wife and a male head to a widow head strongly reject the null hypothesis that there is no difference in their labor shares in public activities and contained activities. Then again, the hypothesis that other adult women contribute equally to an activity as compared to a wife is rejected in four out of five activities. This indicates that the housework/market work division is not a matter of preferences that all women share. Rather, a woman's standing within the household and her marital status also shape the role a woman performs in the household.

c) The impact of sex ratios

Columns (2), (4), (6), (8), and (9) of Table 6 report the same individual labor-share regressions as discussed above, but now include cohort and province-specific sex ratios.

SEXRATIO captures the average effect of sex ratios on males irrespective of their exact status within the household, while its impact on different female roles is differentiated by interacting SEXRATIO with widow head, wife, teenage girl, and adult woman. Note that in these interaction terms, females are not distinguished by the type of household they live in. An increase in SEXRATIO (corresponding to a move towards a balanced ratio of men to women) significantly increases male work burdens in domestic tasks outside the household and farming. This finding is in line with the hypothesis that more potential competitors on the provincial marriage market may lead men to enhance their standing by signaling their cooperativeness in the sharing of intra-household work burdens.

An alternative explanation is that the higher relative number of men in a given province increases competition in wage work and self-employment, which in turn may lead men to revert to farming out of economic stress. This interpretation implies that SEXRATIO significantly reduces male labor shares in non-farm market work and farm wage work, which was not found in the data.

In contrast, the work intensity of adult women, teenage girls, and widow heads is negatively correlated with sex ratios in a given region. A decrease in SEXRATIO significantly increases the workloads of adult women and widow heads in domestic tasks outside the homestead, keeping household wealth and community infrastructure constant. Similarly, a drop in SEXRATIO significantly augments the labor shares of adult women and teenage girls in farming. In contrast to expectations, no significant effect is found for wives. The significant coefficient of widow heads in market activities should be interpreted with caution as very few widows engage in market work at all. Interestingly, about 86 percent of the adult women – most of them are daughters of the head – are unmarried. The effect of sex ratios is hence strongest for unmarried women (ADULTWOM and TEENGIRL) who are potential candidates on the marriage market and will eventually leave the household.

7 Conclusion

This paper examines the determinants of intra-household time allocation in post-war rural Rwanda. The analysis accounted for the unusual war-related distribution of household size and composition that leaves different scope for dividing tasks among household members. Three issues have been revealed.

First, the intra-household division of labor is driven by different factors in different household types. In male-headed households, tasks are allocated based on both gender and family status and on comparative advantage, measured by education, experience, and health status. The gendered division of labor is very strict, assigning females to reproductive and males to productive tasks. In contrast, in widow-headed households, the division of tasks along gender lines is less pronounced. The role of the widow head in particular contrasts with the typical role of women of a similar age. Roles and responsibilities within widow-headed households appear to have been rearranged to cope with the absence of the male breadwinner. The triggers of change in gender roles seem to be strongly linked with exposure to violence and male death. There is no evidence that women per se benefit from a more flexible division of labor.

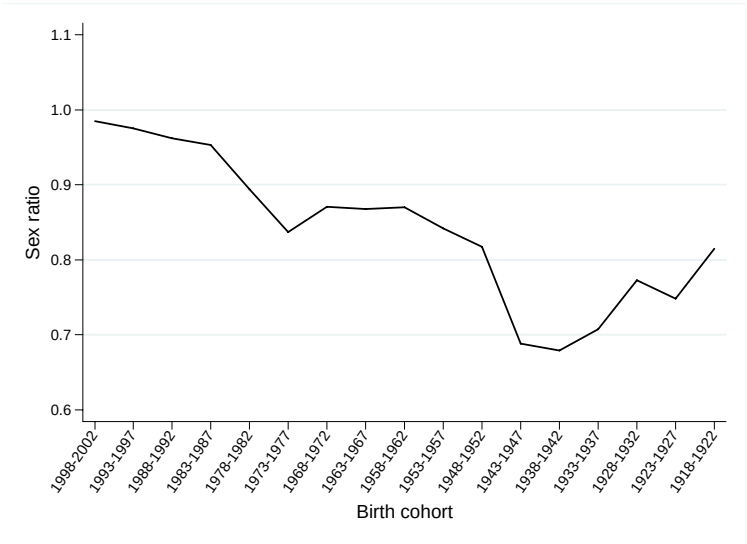
Second, there is no empirical support for the hypothesis that activities that are less visible to neighbors and community members are characterized by a less strict gendered division of labor. This in turn points towards little flexibility towards negotiating responsibilities within the household.

Third, the local marriage market, proxied by provincial, cohort-specific sex ratios has an impact on the division of labor. In particular, young, unmarried women engage more intensely in typical female activities when the shortage of men is severe. Conforming to the female gender role may be a strategy to improve their chances of getting married. These patterns are likely to persist until the cohort of individuals born after the genocide (in which sex ratios are balanced) reaches marriageable age.

Several policy implications can be derived from the results. Given the high proportion of female-headed households in Rwanda, reducing gender-related constraints in the access to economic opportunities has repercussions for making advances in poverty reduction. Women would benefit from lowering the entry barriers to non-agricultural income-generating activities, such as petty trading and artisanry. Providing training to acquire new skills and access to microfinance may be fields of intervention. Lastly, the analysis makes an argument for the provision of basic infrastructures in rural areas. Improved access to water and the provision of alternative energy sources to replace firewood as cooking fuel reduces the time individuals (particularly women) spend on arduous domestic tasks.

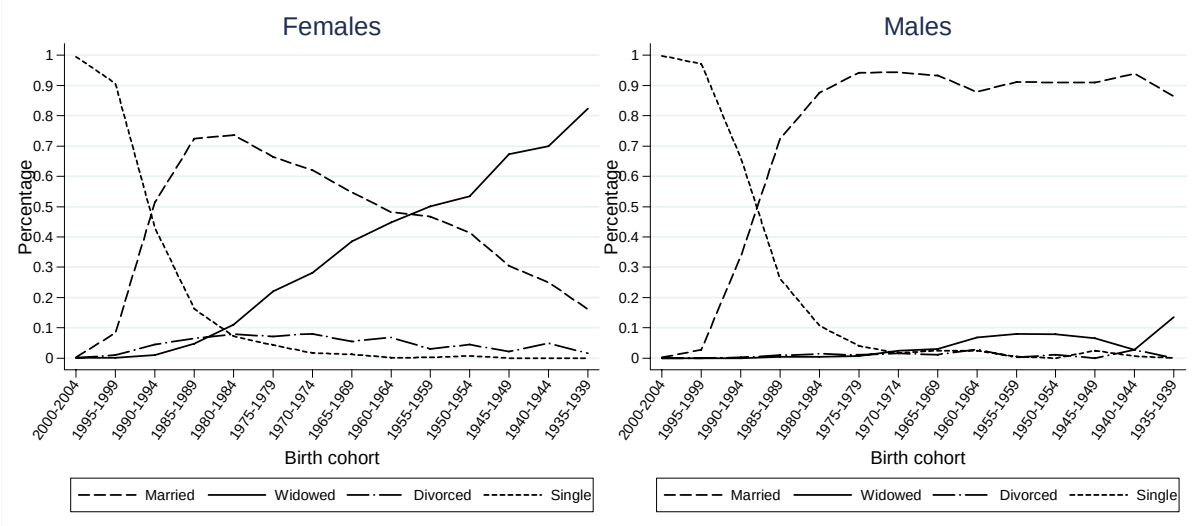
Appendix

Fig. 1: Sex ratio by birth cohort in Rwanda.



Source: 2002 census.

Fig. 2: Distribution of marital status among females and males, by birth cohort



Source: EICV. Population weights were used.

Table 1 Time use by household position

	Hours in domestic tasks		Hours in income-generating activities			Hours in all activities	Sample size
	Inside the homestead	Outside the homestead	Farming on own land	Non-farm market work	Farm wage work		
Male head	6.46	5.68	21.62	35.25	22.23	36.11	3,410
Widow head	16.56	6.47	20.73	20.22	17.77	43.75	997
Wife of head	24.33	8.04	22.37	21.71	15.69	53.93	3,328
Other adult man	6.63	6.91	23.51	42.23	33.63	40.71	1,356
Other adult woman	17.06	8.12	21.56	31.24	19.60	48.91	1,460
Teenage boy	8.60	8.37	24.03	42.91	41.49	40.12	523
Teenage girl	17.05	10.03	20.51	34.40	18.33	46.73	533
Average	17.86	7.41	21.96	33.46	22.69	44.80	-

Source: EICV. Hours spent in an activity during last seven days. Sample: Economically active individuals living in rural areas. Zeros are excluded in the calculation of mean hours worked. Population weights were used.

Table 2 Time use by household type

	Hours in domestic tasks	Hours in income-generating activities	Hours in all activities	Sample size
Male head	7.66	32.16	36.11	3,413
Widow head	21.16	24.71	43.75	997
Male member in male-headed household	12.27	35.62	41.73	1,207
Male member in widow-headed household	9.98	33.46	38.40	669
Female member in male-headed household	29.44	25.87	52.57	4,592
Female member in widow-headed household	23.03	27.10	47.29	729

Source: EICV. Hours spent in an activity during last seven days. Sample: Economically active individuals living in rural areas. Zeros are excluded in the calculation of mean hours worked. Population weights were used.

Table 3 Socio-economic characteristics by household type

	Mean		t-statistic on differences in means
	Male-headed households	Widow-headed households	
Age of head of household	42.19	54.32	26.21***
Number of school classes completed by head	3.56	1.62	-19.97***
Number of days the head was sick during last 2 weeks	1.00	1.67	6.02***
Household size	5.33	4.22	-17.24***
Dependency ratio	1.26	1.22	-1.12
Ratio of female to male members	1.23	1.91	16.07***
Size of cultivated land per capita (in hectare)	0.17	0.18	0.96
Number of livestock (in tropical livestock units)	1.13	0.71	-2.86***
Proportion of households under poverty line	0.58	0.61	1.76*
Proportion of households under extreme poverty line	0.36	0.41	3.24**
Number of income-generating activities done by head, short term	1.32	1.24	-5.18***
Number of income-generating activities done by head, long term	1.65	1.41	-11.55***

Source: EICV. Sample: Rural households. Population weights were used.

Table 4 Summary statistics

Variable	Definition	Mean	SD	Min	Max
Dependent variables (household-level regression)					
DOMINHOURHH	Total hours spent per household on domestic tasks inside the homestead over last 7 days†	39.40	24.86	0	268
DOMOUTHOURHH	Total hours spent per household on domestic tasks outside the homestead over last 7 days†	26.34	20.98	0	293
SUBHOURHH	Total hours spent per household on farming on the household's own land over last 7 days†	46.06	34.82	0	320
MARKETNFHOURHH	Total hours spent per household on non-farm market activities (self-employment and wage work) over last 7 days†	18.27	31.46	0	313
WAGEFHOURHH	Total hours spent per household in farm wage work over last 7 days†	8.71	19.57	0	330
Dependent variables (individual-level regression)					
DOMINHOURI	Individual's hours spent on domestic tasks inside the household as proportion of total household time in these tasks over last 7 days†	0.33	0.36	0	1
DOMOUTHOURI	Individual's hours spent on domestic tasks outside the household as proportion of total household time in these tasks over last 7 days†	0.25	0.28	0	1
SUBHOURI	Individual's hours spent on farming on the households' own land as proportion of total household time in this activity over last 7 days†	0.37	0.31	0	1
MARKETNFHOURI	Individual's hours spent on non-farm market activities as proportion of total household time in these activities over last 7 days†	0.14	0.32	0	1
WAGEFHOURI	Individual's hours spent on farm wage work as proportion of total household time in this activity over last 7 days†	0.10	0.28	0	1
Household composition					
HHSIZE	Household size†	6.12	2.14	2	16
WIDHEAD	Widow-headed household (d)	0.19	0.42	0	1
HEAD	Individual is head (d)	0.29	0.46	0	1
TEENBOY	Individual is teenage boy (12-17 years) (d)	0.04	0.21	0	1
ADULTMAN	Individual is adult man (d)	0.11	0.32	0	1
WIFE	Individual is wife of head (d)	0.28	0.45	0	1
TEENGIRL	Individual is teenage girl (12-17 years) (d)	0.04	0.21	0	1
ADULTWOM	Individual is adult woman (d)	0.12	0.33	0	1
HEADSHARE	Share of head of household size	0.14	0.12	0.06	0.50
TEENBOYSHARE	Share of teenage boys (12-17 years) of household size	0.07	0.12	0	0.66
ADULTMANSHARE	Share of adult men of household size	0.07	0.16	0	0.80
WIFESHARE	Share of wife of head of household size	0.14	0.12	0	0.50
TEENGIRLSHARE	Share of teenage girls (12-17 years) of household size	0.07	0.12	0	0.66
ADULTWOMSHARE	Share of adult women of household size	0.07	0.15	0	0.80
CHILDSHARE	Share of children (0-11 years) of household size	0.36	0.22	0	0.86
Human capital of male members					
AGEM	Mean age	21.38	12.70	0	97
AGEDIFFM	Individual's difference in age from mean age of male household members	4.66	10.96	-35.00	59.60
CLASM	Mean number of classes completed	3.16	3.01	0	23
CLASDIFFM	Individual's difference in number of classes from mean education of male household members	0.14	1.61	-14.38	14.00
DAYSICKM	Mean number of days individual was immobilized due to health problems in last 2 weeks	0.75	1.87	0	14
HEALTHDIFFM	Individual's difference in health status from mean number of sick days for male household members	0.01	1.20	-8.00	11.67
Human capital of female members					
AGEF	Mean age	22.88	13.05	0	91
AGEDIFFF	Individual's difference in age from mean age of female household members	5.13	11.25	-38.33	54.22
CLASF	Mean number of classes completed	2.81	2.53	0	18
CLASDIFFF	Individual's difference in number of classes from mean education of female household members	0.13	1.60	-10.67	13.20
DAYSICKF	Mean number of days individual was immobilized due to health problems in last 2 weeks	0.90	2.09	0	14
HEALTHDIFFF	Individual's difference in health status from mean number of sick days for female household members	0.05	1.42	-8.75	12.44
Household characteristics					
LAND	Land cultivated by household in hectare†	0.94	1.47	0	49.51
AGRIASSET	Current value of agricultural assets in Rwandan Franc†	3,812.2	4,190.8	0	32,700
LIVESTOCK	Livestock owned by household in tropical livestock units†	1.36	7.30	0	310.20
UNEARNEDY	Unearned income (transformed into terciles in regression)	21,562.6	56,505.8	0	1.5 mio
Community characteristics					
MARKET	Cellule has a daily or weekly market (d)	0.14	0.36	0	1
ROAD	Cellule has a road that is passable the whole year (d)	0.66	0.48	0	1
CLUSTERMIG	More individuals arrived than departed from cellule in last 5 years (d)	0.51	0.50	0	1
SEXRATIO	Sex ratio in an individual's cohort of potential partners per province	0.78	0.08	0.57	1

Source: EICV. Sample: Households with at least two active members and engaging for at least one hour each per week in domestic and income-generating activities in rural Rwanda. Population weights were used. (d) indicates dummy variables; † natural logarithm used in regression.

Table 5 Determinants of household time allocation (two-part model)

			Total hours per household spent on				
			Domestic work (inside homestead)	Domestic work (outside homestead)	Farming on own-land	Non-farm market activities	Farm wage work
			(1)	(2)	(3)	(4)	(5)
Male-headed households	Composition	HHSIZEL	0.38***	0.83***	0.36*	0.49*	1.02***
		HEADSHARE	-0.33	1.35**	-0.86	-0.38	2.47*
		TEENBOYSHARE	0.18	0.94***	-0.23	-0.72*	-0.88**
		WIFESHARE	0.72***	-0.45*	0.99***	-0.66	-1.20**
		TEENGIRLSHARE	0.65***	0.47**	-0.17	-0.89**	-1.28***
		ADULTWOMSHARE	0.43**	0.14	0.61**	-0.28	-0.71*
		CHILDSHARE	0.16	0.26*	-0.67***	-1.41***	-1.55***
	Human capital	AGEM	-0.00	0.02***	0.01*	-0.02**	0.00
		AGEM2	0.00	-0.00***	-0.00**	0.00**	-0.00
		AGEF	-0.01***	0.02***	0.00	-0.03**	-0.01
		AGEF2	0.00***	-0.00***	-0.00	0.00**	0.00
		CLASM	0.01	-0.03***	-0.01**	0.02***	-0.01
		CLASF	0.01**	-0.02***	-0.03***	0.04***	0.01
		DAYSICKM	0.02***	0.01*	0.00	-0.02	-0.05***
		DAYSICKF	0.01**	0.01	-0.03***	0.02	0.01
Widow-headed households	Composition	WIDHEAD	0.08	-0.12	-0.38	-0.80	0.93
		HHSIZEL†	-0.12	0.15	0.67**	1.07*	-1.12*
		HEADSHARE†	-0.08	1.83*	1.50	3.07	-3.13
		TEENBOYSHARE†	-0.06	-0.62**	-0.47	0.44	0.27
		TEENGIRLSHARE†	-0.11	0.02	-0.10	0.07	0.64
		ADULTWOMSHARE†	-0.31	-0.16	0.24	-0.06	0.74
		CHILDSHARE†	0.06	0.10	-0.06	0.34	0.69
	Human capital	AGEM†	0.00	-0.02*	0.02	0.02	0.02
		AGEM2†	-0.00	0.00	-0.00	0.00	-0.00
		AGEF†	0.01	-0.00	-0.01	0.01	-0.02
		AGEF2†	-0.00	0.00	0.00	-0.00	0.00*
		CLASM†	-0.00	0.02**	-0.00	-0.03	0.00
		CLASF†	-0.01	0.02	-0.03	0.01	0.02
		DAYSICKM†	-0.02*	-0.01	-0.00	0.06	0.01
		DAYSICKF†	-0.00	0.02	-0.00	-0.06	0.03
Household wealth		LAND	0.03***	0.01	0.04**	-0.04**	-0.04**
		AGRIASSET	0.04***	-0.00	0.06***	-0.00	-0.10***
		LIVESTOCK	0.05**	0.06**	0.15***	0.03	0.14**
		UNEARNYLOW	-0.06**	-0.09**	-0.11**	0.01	0.06
		UNEARNYHIGH	0.05*	-0.03	-0.09**	-0.00	0.06
Comm-unity		MARKET	0.01	-0.10*	0.01	-0.05	0.01
		ROAD	-0.06**	-0.02	-0.06	0.07	0.01
		CLUSTERMIG	0.01	-0.02	0.06	0.08	-0.07
Constant			2.49***	0.82*	2.76***	3.93***	2.73***
R-squared			0.14	0.18	0.14	0.13	0.14
Joint log-likelihood (1st and 2nd part)			-4122	-5236	-6161	-4895	-3822
N total			4648	4648	4648	4648	4648
N left-censored			4	15	297	3017	3457
N uncensored (2nd part)			4644	4633	4351	1631	1191
Test on equality of household types (widow-headed = male-headed households)							
1st part, likelihood ratio test			16.99 [0.000]***	10.47 [0.063]*	15.71 [0.401]	42.08 [0.000]***	28.33 [0.019]**
2nd part, F-test			0.74 [0.744]	2.93 [0.000]***	1.04 [0.415]	0.95 [0.505]	1.11 [0.342]
Male-headed households (2nd part, F-test)							
All adults are the same			4.34 [0.000] ***	7.03 [0.000]***	4.55 [0.000]***	1.41 [0.220]	2.73 [0.019]**
All females are the same			6.21 [0.000] ***	3.83 [0.010]**	5.61 [0.000]***	2.10 [0.099]*	3.52 [0.015]**
Widow-headed households (2nd part, F-test)							
All adults are the same			0.37 [0.827]	2.41 [0.049]**	1.25 [0.288]	0.73 [0.573]	0.78 [0.537]
All females are the same			0.46 [0.709]	1.22 [0.300]	0.84 [0.473]	0.71 [0.544]	1.04 [0.373]

Source: EICV. Sample: Rural households with at least two active members and engaging for at least one hour each per week in domestic and income-generating activities. As an estimation approach, a two-part model was applied, with left-censored observations estimated with probit in the first part and uncensored observations estimated with OLS in the second part. Only estimated coefficients in the second part and robust standard errors with * p<0.1, ** p<0.05, *** p<0.01 (not shown for coefficients) are displayed. Other adult men are the reference category in household composition and zero unearned income is the reference category for unearned income received. † indicates that a variable is interacted with a widow-headed household dummy (WIDHEAD).

Table 6 Determinants of individual time allocation (two-part model)

		Individual time shares spent on									
		Domestic work inside homestead		Domestic work outside homestead		Farming on own land		Non-farm market activities		Farm wage work	
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Male-headed households	Composition										
	HEAD	0.15*	0.20**	0.44***	0.53***	0.46***	0.51***	0.29***	0.27**	0.17**	0.17**
	TEENBOY	0.18**	0.13	0.05	-0.04	0.00	-0.05	0.15	0.16	-0.20**	-0.21**
	WIFE	2.02***	2.10***	0.89***	1.02***	0.56***	0.64***	-0.31***	-0.33***	-0.07	-0.06
	TEENGIRL	1.23***	1.33***	0.27***	0.35***	0.02	0.22**	-0.05	0.12	-0.25**	-0.34
	ADULTWOM	1.27***	1.32***	0.19***	0.32***	0.07*	0.14***	-0.15*	-0.16*	-0.25***	-0.23***
	Human capital										
	AGEDIFFM	-0.01**	-0.01*	-0.02***	-0.02***	-0.01***	-0.00***	-0.00	-0.01	-0.00	-0.00
	AGEDIFFF	-0.02***	-0.02***	-0.03***	-0.03***	-0.01***	-0.00***	0.01*	0.01*	-0.01**	-0.01**
	CLASDIFFM	-0.06***	-0.06***	-0.03***	-0.03***	0.00	0.00	-0.02***	-0.02***	0.01	0.01
	CLASDIFFF	0.01*	0.01	-0.01	-0.01*	0.01	0.00	-0.01	-0.02	0.01	0.01
	HEALTHDIFFM	0.02	0.02	-0.01	-0.01	-0.02***	-0.02***	-0.03	-0.03	0.01	0.01
	HEALTHDIFFF	-0.01	-0.01	-0.03***	-0.03***	-0.02***	-0.02***	-0.04	-0.03	0.02**	0.02**
Widow-headed households	Composition										
	WIDHEAD	-0.10	-0.10	0.20**	0.18**	0.22***	0.21***	0.07	0.09	0.16*	0.15*
	HEAD†	1.83***	1.95***	0.44***	0.60***	0.32***	0.42***	-0.31	-0.14	-0.35***	-0.29**
	TEENBOY†	0.24	0.24	0.19*	0.19*	0.01	0.02	-0.02	-0.02	0.07	0.07
	TEENGIRL†	-0.15	-0.14	-0.19*	-0.18*	-0.14*	-0.14*	0.09	0.04	0.34**	0.34**
	ADULTWOM†	0.07	0.08	-0.15	-0.14	0.01	0.02	0.09	0.10	0.17	0.17
	Human capital										
	AGEDIFFM†	-0.01	-0.01	0.00	0.00	0.02***	0.02***	0.01	0.01	0.02*	0.02*
	AGEDIFFF†	0.00	-0.00	0.01***	0.01***	0.00	0.00	-0.00	0.00	0.02**	0.02**
	CLASDIFFM†	0.01	0.01	-0.03*	-0.03*	-0.02*	-0.02	0.01	0.01	-0.01	-0.01
	CLASDIFFF†	-0.00	0.00	0.03**	0.03**	-0.01	-0.01	0.02	0.03	-0.01	-0.01
	HEALTHDIFFM†	-0.00	-0.00	0.02	0.02	-0.01	-0.01	-0.11*	-0.11*	0.03	0.02
	HEALTHDIFFF†	0.00	0.00	-0.00	-0.00	0.01	0.01	-0.01	-0.00	-0.07***	-0.07***
Household wealth	LAND	-0.03***	-0.03***	-0.03***	-0.03***	-0.02***	-0.02***	0.03	0.02	0.00	0.00
	AGRIASSET	-0.07***	-0.07***	-0.06***	-0.06***	-0.04***	-0.04***	-0.07***	-0.07***	-0.03	-0.03
	LIVESTOCK	-0.02	-0.02	-0.05**	-0.05**	-0.06***	-0.06***	0.02	0.02	0.06*	0.06
	UNEARNYLOW	-0.01	-0.01	-0.01	-0.02	0.03*	0.03*	0.03	0.04	0.01	0.01
	UNEARNYHIGH	-0.04	-0.04	-0.01	-0.01	0.03	0.02	0.04	0.05	-0.05	-0.05
Comm-unity	MARKET	0.02	0.03	-0.03	-0.02	0.00	0.01	0.03	0.03	0.06	0.06
	ROAD	0.03	0.03	0.00	0.00	0.01	0.01	0.02	0.02	0.01	0.01
	CLUSTERMIG	-0.02	-0.02	-0.03	-0.03	-0.02*	-0.03**	-0.07*	-0.07*	0.07**	0.07**
Sex ratios	SEXRATIO		0.73		1.53***		0.82***		-0.14		0.10
	HEAD†‡		0.20		-1.34**		-0.46		4.43*		0.45
	WIFE‡		0.07		-0.39		0.28		0.28		-0.33
	TEENGIRL‡		-1.25		-1.17		-2.39**		-1.80		1.12
	ADULTWOM‡		-0.65		-2.45***		-1.38***		0.23		-0.92
Constant		-1.78***	-2.42***	-1.23***	-2.56***	-0.98***	-1.70***	-0.45**	-0.33	-0.65***	-0.74*
R-squared		0.46	0.46	0.13	0.14	0.14	0.15	0.10	0.11	0.12	0.12
Joint log-likelihood (1st and 2nd part)		-14136	-14126	-17411	-17382	-14489	-14450	-9544	-9542	-7787	-7786
N total		11607		11607		11607		11607		11607	
N left-censored		4071		3222		2727		9435		863	
N right-censored		1243		490		1309		1208		801	
N uncensored (2nd part)		6293		7895		7571		964		863	
Test on equality of household types (widow-headed = male-headed households)											
1st part, likelihood ratio test		520.72		191.77		314.30		76.47		36.76	
		[0.000]***		[0.000]***		[0.000]***		[0.000]***		[0.000]***	
1st part, likelihood ratio test		343.93		82.20		471.31		35.40		28.07	
		[0.000]***		[0.000]***		[0.000]***		[0.000]***		[0.003]***	
2nd part, F-test		83.25		17.81		14.53		1.59		3.07	
		[0.000]***		[0.000]***		[0.000]***		[0.102]		[0.000]***	
Male-headed households (2nd part, F-test)											
All adults are the same		394.05		107.36		81.03		6.51		6.86	
		[0.000]***		[0.000]***		[0.000]***		[0.000]***		[0.000]***	
All females are the same		353.21		157.19		110.45		3.67		3.92	
		[0.000]***		[0.000]***		[0.000]***		[0.013]**		[0.009]***	
Wife = other woman		356.62		312.08		235.06		2.22		3.78	
		[0.000]***		[0.000]***		[0.000]***		[0.137]		[0.053]*	
Wife = male head		888.31		100.82		14.26		23.56		11.45	
		[0.000]***		[0.000]***		[0.000]***		[0.000]***		[0.000]***	
Teenage girl = teenage boy		157.10		11.17		0.13		2.46		0.15	
		[0.000]***		[0.000]***		[0.718]		[0.118]		[0.701]	
Widow-headed households (2nd part, F-test)											
All adults are the same		154.30		11.39		9.32		0.36		3.14	
		[0.000]***		[0.000]***		[0.000]***		[0.838]		[0.015]**	
All females are the same		205.44		14.48		12.44		0.47		4.20	
		[0.000]***		[0.000]***		[0.000]***		[0.703]		[0.006]***	
Widow head = other woman		403.09		35.68		21.91		1.41		9.27	
		[0.000]***		[0.000]***		[0.000]***		[0.236]		[0.002]***	
Widow head = wife		2.72		18.71		13.59		0.00		3.77	
		[0.100]		[0.000]***		[0.000]***		[0.988]		[0.053]*	
Widow head = male head		155.90		0.00		4.94		3.27		13.34	
		[0.000]***		[0.960]		[0.026]**		[0.071]*		[0.000]***	
Teenage girl = teenage boy		6.99		13.12		2.22		0.26		1.65	
		[0.008]***		[0.000]***		[0.137]		[0.611]		[0.199]	

Source: EICV. Sample: Economically active individuals 12 years and older living in rural households with at least two active members and engaging for at least one hour per week each in domestic and income-generating activities. As an estimation approach, a two-part model was applied, with left-censored and right-censored observations estimated separately with probit in the first part and uncensored observations estimated with OLS in the second part. Only estimated coefficients in the second part and robust standard errors with * p<0.1, ** p<0.05, *** p<0.01 (not shown for coefficients) are displayed. Other adult men are the reference category in household composition and zero unearned income is the reference category for unearned income received. † indicates that a variable is interacted with a widow-headed household dummy (WIDHEAD). ‡ indicates that a variable is interacted with SEXRATIO.

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