

# Left Behind to Farm?

## Women's Labor Re-Allocation in Rural China

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## Abstract

The transformation of work during China's rapid economic development is associated with a substantial but little noticed re-allocation of traditional farm labor among women, with some doing much less and some much more. This paper studies how the work, time allocation, and health of non-migrant women are affected by the out-migration of others in their household. The

analysis finds that the women left behind are doing more farm work than would have otherwise been the case. There is also evidence that this is a persistent effect, and not just temporary re-allocation. For some types of women (notably older women), the labor re-allocation response comes out of their leisure.

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This paper—a product of the Human Development and Public Services Team, Development Research Group—is part of a larger effort in the department to better understand labor rural markets. Policy Research Working Papers are also posted on the Web at <http://econ.worldbank.org>. The author may be contacted at [dvandewalle@worldbank.org](mailto:dvandewalle@worldbank.org).

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# Left Behind to Farm? Women's Labor Re-Allocation in Rural China

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## 1. Introduction

As the economics profession has come to seriously question income-pooling models of the household based on empirical evidence, the possibility arises that many aspects of overall economic development may come with distributional effects within households, with likely gender dimensions.<sup>1</sup> A case in point is migration during the process of structural transformation of a largely rural-based agricultural economy to a more urban-based economy. Typically, only some members of the rural household migrate, leaving others behind. While the literature on migration has traditionally had a lot to say about the impacts on the total income of rural households — notably through remittances — the rejection of an income pooling model and the importance of non-income factors to welfare suggest a need to examine the welfare impacts on those left behind in rural areas. This is in keeping with the recent new literature on migration emphasizing intra-household behavioral responses (reviewed later).

In this paper, we focus on non-migrant women and how their work, time allocation and health are affected by living in a migrant household. The equity arguments are often related to women's empowerment and neglect other aspects of welfare, such as the type of work and time for leisure. Left-behind women may be more empowered but at the expense of being over-worked, with direct implications for their well-being, including their leisure and health. Household income may increase with migrants' remittances, but women's well-being may not.

The setting for our study is rural China. In trying to evaluate women's welfare changes resulting from current migration patterns in rural China, we first focus on the effects on women's total working hours and (hence) their leisure, which is assumed to be an important determinant of welfare. We also explore impacts on labor time allocation across productive activities including on and off the farm, both in terms of participation and hours. As China transitions out of agriculture, a key question is whether some groups are being held back in farm work, which could limit their social and economic mobility. Health is another important dimension of welfare that may be impacted — being left behind as well as possibly bearing a larger work burden may increase women's

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<sup>1</sup> Bourguignon etc (1993), Browning and Chiappori (1998) provide theories of non-unitary household models. Examples of empirical rejections of the income pooling assumption in developing countries are Thomas (1994) and Duflo (2003).

stress and fatigue, and lead to potential health problems. Finally, we look at whether there is any evidence of female empowerment through increased managerial responsibilities for household productive activities. This too could affect well-being and possibly balance out other negative effects of being left-behind.

Understanding the welfare of left-behind rural women has important implications for aggregate growth and for policy. Improvements in the public provision of child and elderly care or support may help alleviate the burden of household production on the women staying behind. Extension services are particularly important as many non-migrant women have lower education and knowledge about farming. There may also be a role for public policy and anti-poverty reduction strategies to help the left-behind women through better services in health care, credit, non-farm employment and safety nets. However, since the left-behind phenomenon changes the population structure of rural areas, and is caused partly by distortions and policy failures in the migration destination market (notably through China's household registration system discussed below), correcting these distortions and failures may be a more effective and long-lasting solution.

We find evidence of significant re-allocation across labor force activities, with substantially more hours worked in agriculture by left-behind women and fewer worked in wage or family business activities. These effects differ across age cohorts, some of whom also suffer a consequent reduction in leisure. In general, these time allocation effects are associated primarily with the migration of offspring as opposed to husbands and are not reversed when migrants return, with seemingly permanent consequences. We find little sign of effects on health or empowerment.

The next section briefly reviews the relevant literature and identifies the contributions of this paper. Section 3 then describes the data. This is followed in Section 4 by some descriptive tables and figures documenting recent trends in rural labor force participation in various activities and in rural to urban migration by gender. The covariates of female migration for the period 1997 through 2006 are also examined. Section 5 then turns to the impacts on non-migrant women of living in migrant households. Section 6 concludes.

## 2. Literature review

The sweeping economic changes experienced by China in recent decades have transformed the division of labor by both occupation and gender. Since the introduction of agricultural and other reforms in the late 1970s, labor markets and the nature of labor force participation have changed significantly in rural areas. With the gradual relaxation of restrictions on rural to urban migration, the country experienced one of the largest flows of labor out of agriculture in world history. Rapidly increasing migration throughout the economic reform period has been associated with economic growth (for example, see Liang and Ma, 2004; Fan, 2008).

For reasons elaborated on below, much of this migration remains temporary with rural households retaining members and agricultural land in their ancestral villages. The existing division of labor by gender, informal rules and gender norms in intra-household decision-making suggest that the propensity for migration in China will differ by gender (Murphy 2004). There was a rapid increase in the migration of men of all ages to jobs in urban areas (Zhao 2002). Some women followed suit, but their overall participation in migrant labor markets has lagged behind men's (Fan 2003, de Brauw et al. 2008). In the last decade or so, more women have joined in the rural to urban migration. However, as confirmed by our data, this is true particularly for young, single women (Du, Park and Wang 2005, de Brauw et al 2008). For most rural women, marriage is synonymous with the termination of migrant work and return to the village (Fan 2004). Older, married women continue to stay behind in rural areas.

Lagging female migration is thought to be due in part to women's occupational options as migrants tending to be inferior to men's (Fan 2003, Liang and Chen 2004). In addition, the gender trends reflect various constraints on opportunities that stem from market and governmental failures that are more binding for women. For example, China's Hukou or household registration system has helped keep migration an impermanent event. Severe obstacles to switching one's registration from rural to urban areas prevent entire families from moving to cities since access to urban health and education services and social safety nets is linked to registration (World Bank, 2009). It is not surprising that women are more likely than men to stay behind in rural areas with

their families.<sup>2</sup> Other constraints tied up with insecure land tenure — whereby agricultural land holdings are subject to administrative re-allocation that can be triggered by absence or leaving the land temporarily uncultivated — may also be playing an important role.<sup>3</sup> Such constraints, and the induced migration patterns, could well produce a distorted gender division of labor — with women taking responsibility for looking after children, elderly parents and the farm — and excessively gender-differentiated labor markets, at a cost to both equity and efficiency.

Much of the migration literature for China and elsewhere has focused on the income effects of migration on those left behind. Migrants typically send back remittances. These are expected to have an income effect on the recipient households and may lead to a decline in left-behind women's labor supply.<sup>4</sup> A counter-balancing effect may be felt through the costs of migration and the need to compensate for the loss of household labor and the associated foregone income. Missing land rental markets may prevent leasing out land and also dampen the income effect on women's welfare. Supervision and other transaction costs limit the scope for substituting hired labor. Left-behind women are often solely responsible for child rearing which is more compatible with farm and household production than off-farm work (for this argument in the context of rural China, see Short et al. 2002). Thus out-migration of household members may well increase women's time in household and farm production despite the income effect of remittances.

Thus, how women's time allocation, leisure and labor force participation are affected by the out-migration of household members is an empirical issue. Studies for Albania (Mendola and Carletto 2009), the Philippines (Rodriguez and Tionson 2001), Mexico (Amuedo-Dorantes and Pozo 2006) and Nepal (Lokshin and Glinskaya 2008) have found the net effect to be a decline in labor force participation as well as in hours of

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<sup>2</sup> The policy regime underlying these constraints is changing over time. Registration is becoming easier to obtain for rural migrants. A potentially important change in 1998 is that children born from mothers with rural registrations living in urban areas can be given urban registration. Individuals with rural *hukou* status can now purchase non-agricultural *hukou* status from urban governments, yet in many cases the system continues to work against more permanent migration flows (Fan, 2008).

<sup>3</sup> A law introduced in 2002, the Rural Land Contract Law (RLCL), guarantees farmers' land tenure security for at least 30 years during which no land reallocation is occur. However implementation is decentralized and varies across villages (Deininger and Jin, forthcoming)

<sup>4</sup> Research has also shown that migrant remittances can help households overcome credit constraints to invest in productive activities (e.g. Woodruff and Zenteno, 2007) or in the human capital of the next generation (e.g. Beine, Docquier, and Rapoport, 2008; Yang, 2008).

paid work by female members of sending households. This issue has not been analyzed in the rural China context to our knowledge.<sup>5</sup>

It is generally believed that China's recent labor market changes have increased mean national income and mean household welfare. For example, de Brauw and Giles (2008) carefully document the positive impacts of migrants on household living standards in rural China. However, there is an ongoing debate about how these trends have affected women's welfare, both absolutely and relative to men. Some contributions focus on the new economic opportunities that rural to urban migration provides for women (Zhang et al. 2004), while others emphasize the multiple disadvantages faced by female migrants who are typically young, single and uneducated: segregated jobs, lower wages and discrimination (Fan 2003).

But as already pointed out and confirmed in Section 4, female migration lags behind that of men. Of more relevance to our concerns in this paper is the literature concerning impacts on the women who are left behind while their husbands or children migrate. Here too there is disagreement. Some argue that left behind women's welfare has risen as a result of increased autonomy and new decision making powers as household heads (Davin 1999). Improvements in farm efficiency are seen as enhancing the welfare of those who now manage and work the farms (Zhang et al. 2004, de Brauw et al. 2008). In addition, greater access to local off-farm work and to higher wages is claimed to have raised women's welfare.

Against that, the increased division of labor, with women typically holding down the low status, low value farm and household production work in rural areas is posited to have reinforced gender segregation and low status (Fan 2003). There has also been much debate about claims of a feminization of agriculture. However, careful examination of the evidence has conclusively shown these fears to be unfounded at least through the year 2000 (de Brauw et al. 2008). The evidence points to a large reduction in the hours worked in agriculture by both men and women since the reforms began as well as significant increases in off-farm work. On average, a smaller share of rural Chinese men and women now work on the farm (de Brauw et al. 2008).

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<sup>5</sup> Chen touches upon them in her analysis of bargaining within the household (2006a, 2006b). Using a sample of households with children aged 6 to 16 and co-resident parents she is interested in testing whether household resource allocation is cooperative. She finds that wives work less and consume more leisure when husbands migrate (2006b).

Our contributions to the debates in the literature are two-fold. Our primary contribution to this literature is to analyze the impacts of migration on left behind women but extending the usual examination of aggregate effects of migration on labor force participation to differentiate those effects by age cohort, and also by whether the migration is of husbands, children, or other household members and finally by whether the effects of return migration are symmetric with those of out-migration. In the process we also extend the documentation of recent trends in allocation to labor force activities, including work-related migration, by gender and age-cohort over time up through 2006. Most recently published analyses only take the trends up through 2000 (de Brauw et al., 2008). Some of the more recent trends are suggestive of a developing gender gap in farm work for middle aged women. We identify signs of changing patterns including potential increases in the participation of women in agricultural work.

### **3. Data**

The main data used for the analysis are from the China Health and Nutrition Survey (CHNS), conducted by the University of North Carolina at Chapel Hill.<sup>6</sup> This is a longitudinal survey that interviewed the same households in 1989, 1991, 1993, 1997, 2000, 2004, and 2006 in nine provinces: Guangxi, Guizhou, Henan, Hubei, Hunan, Jiangsu, Shandong, Liaoning and Heilongjiang. These provinces substantially differ geographically and with respect to their level of economic development. Attrition at the household level is less than 5% between waves, and some rotation of households began after 1993. The data for rural households are partly from the rural villages on the outskirts of county towns and partly from much more rural villages. We use the complete rural CHNS sample of about 3,800 households covering approximately 16,000 individuals.

The sample for each province followed a multistage, random cluster process whereby counties were stratified by income and a weighted sampling scheme was used to randomly select four in each province. Rural villages and rural suburban neighborhoods were selected randomly. The sample is made up of 36 suburban neighborhoods and 108 villages.

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<sup>6</sup> See <http://www.cpc.unc.edu/projects/china> for details.

The CHNS collects detailed information on household demographics, education, health and nutrition, occupations and labor force participation, housing and asset ownership, time use, and incomes. One major advantage of the CHNS is that it contains detailed information on individual hours spent on various activities. For example, it records how many hours per day, days per week, and months per year each individual worked in the garden (vegetable plots near the house), on crop production, livestock, and fisheries; it asks about hours worked in wage labor, handicraft and small commercial household businesses. These questions about labor time allocation all refer to "the past year." We will however, refer to individuals' activities by the year of the survey round.<sup>7</sup> In terms of domestic activities, the CHNS collects time allocation during the preceding week to various "household chores" in which are included buying and preparing food, doing laundry, getting water, and cleaning house; hours spent in child and elderly care are also recorded separately.

The detailed information on time allocation across market, farm and household production allows us to map out women's behavioral responses to a household members' out-migration. However, time allocation information is not collected by means of complete time diaries so that measurement errors can arise in calculating leisure. A priori, there is no reason to believe that any existing measurement error is systematically related to a household member's migration status.

The CHNS was not originally conceived to study migration. The migration status of household members in CHNS must be built up from the household roster. If an individual who was in a previous round of the CHNS is not in the current round of the survey, a question is asked regarding the location of this individual. However, it is only from the 1997 survey round on that the reason for being absent was also recorded. This allows us to distinguish "labor" migrants who left to seek work from individuals who left for reasons such as marriage and schooling. For this reason we use the 1997 and later rounds only. We will consider any individual who has left the home county for work reasons between two waves to be a migrant. Another drawback of the CHNS is that we are unable to tell whether the migration is to an urban or other rural area. Although most migration of rural Chinese is to urban areas, some could well be to rural destinations.

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<sup>7</sup> For example, if an individual reported in the 1997 survey round that she worked in a family business during the past year, we will refer to this as working in a family business in 1997.

Another potential problem with the CHNS is that we may underestimate the migration rate because migrants in between surveys cannot be identified, and hence we may underestimate the impact of a household member's out-migration on women's behavioral adjustment.

As its name implies, the CHNS provides multiple measurements of health. We take advantage of some of these, and analyze how different facets of a woman's health — body mass index (BMI), self-reported health, and stress as measured by blood pressure and alcohol consumption — are affected by household member migration status. The available health measures are not ideal for our purposes and we will not be able to conclusively say whether and how health is affected. The surveys also include questions about which household member has the primary responsibility for the farm, and any fishing and gardening activities. We use this as one of our outcome variables as well to test whether women in migrant households are more likely to report being in charge.

It should be noted that some important variables are less well measured in the CHNS. For example, operated land amounts are often missing. We expect this to be a key covariate but can only control for whether households report having land or not.

#### **4. Labor allocation, women's migration and the left behind**

As a background to our analysis of the impacts on women of living in migrant households, we describe labor force participation rates and allocation across activities by gender and their evolution over time. We also examine women's migration and its determinants, and women's non-migration. A key result of the section is that more women are in fact being left behind.

##### **4.1. Gender differences in labor allocation**

Using the four survey rounds of the CHNS as a pooled cross-section we categorize respondents aged 16-70 into four sectors of activity at each date: "migrant" employment (for which migration is necessary), rural agricultural self-employment, rural off-farm self-employment (family business) and rural local wage employment.<sup>8</sup> Table 1 also presents overall labor force participation rates for men and women in this age group as well as mean age and years of education for those involved in each activity for 1997,

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<sup>8</sup> Labor migration can be to other rural areas although the bulk of employment for which migration is necessary is urban.

2000, 2004 and 2006. Participation is defined as one if an individual reported being engaged in the activity in either their primary or secondary occupations and is expressed in percentages.<sup>9</sup>

As can be seen in Table 1, the labor force participation rates of rural individuals aged 16 through 70 fell from 89 to 82% for men, and from 86 to 73% for women between 1997 and 2006.<sup>10</sup> Work-related migration increased substantially for both men and women. The male migration rate tripled from 7.8 to 24.5%. However, despite a similar threefold increase (5.6 to 14.9%), the female migration rate remains much lower than men's. The unconditional gender gap in the migration rate increased over time from about 2% in 1997 to almost 10% nine years later.

The percent of men and women engaging in agricultural self-employment are similar on average. Both declined from around 76 to around 56% over the period. The percentages working locally for a wage declined somewhat between the late 1990s and mid 2000s to 23% for men and 16% for women. There appears to be a slight increasing trend in the percent of women employed in family businesses — from 10% in 1997 to about 12% in 2006.

Migrants are the youngest among the four labor categories, and female migrants are on average younger than male migrants. Those self-employed in agriculture are the oldest and least educated workers while those employed in local wage work have the highest levels of education. It is also clear that women have less education than men across all employment categories. The profile of workers across activities is consistent with that found in other studies based on different data sources (for example, Zhao 1999).

Averages across men and women as presented in Table 1 mask the fact that gender differences in labor allocation to activities vary substantially across age groups. These are also changing over time. As shown in Figure 1, the very youngest women have, at least since 1996, had a higher migration rate than the youngest men. But women in general are less likely to migrate than men, and the gender gap in migration widens

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<sup>9</sup> There is no minimum time requirement for being recorded as a participant and participation in on-farm and off-farm rural employment activities are not mutually exclusive. As a result, participation across the four activities does not add up to one hundred percent for each year.

<sup>10</sup> These trends are confirmed in the census. Based on the 0.966% sample of the 2005 Chinese Census, the rural labor force participation rate in 2005 is 84.2% for men (aged 16-70) and 71.3% for women (aged 16-70). According to the 1‰ sample of 2000 Chinese Census, the rate is 87.7% for men and 76.7% for women in 2000. We thank Meiyang Wang in IPLE-CASS for providing the information.

significantly over time.<sup>11</sup> This reflects the fact that although more women are migrating over time, more men are also doing so at an increasing rate. Women under 45 work in agriculture at about the same rate as men before 2006, echoing the findings of de Brauw et al. (2008). However, a gap emerges in the 2006 data with women from their 30s more likely to be employed in agriculture than men in the same age groups (Figure 1b).<sup>12</sup> Women at older ages continue to be less likely to work in agriculture. Women's participation in local non-farm work (whether wage or off-farm family businesses) has also lagged behind men but shows signs of catching up over time, especially at younger ages.

We conclude from the above descriptive information that, with the exception of the very youngest, women are indeed lagging behind in leaving farms and seeking migrant employment opportunities. This gender gap is not closing but widening over time. Parallel to this trend, a higher percentage of women are staying behind in rural areas to run the farms and engage in local off-farm employment.

#### **4.2 Women's migration**

Although women in most age groups are being left behind, some still migrate. What factors affect whether a rural woman migrates for work? The panel and the repeated observations over time on rural individuals allow us to identify non-migrant women — here defined as women aged 7 to 52 in 1997 (16 to 61 in 2006) who report no migration experience during the CHNS panel survey period — and women in the same age group who do. Among the 2592 observations with non-missing values for key variables, 563 (22%) ever migrated in the subsequent years. Using probit models and graphical techniques, we explored what initial 1997 individual, household and geographic/village characteristics are associated with a higher probability of subsequent migration. Since the specific probit values are not the main concern of the paper, we limit discussion to a brief summary of the results here and illustrate some of the more striking effects in Figure 2. (The probit is given in Appendix Table 2.)

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<sup>11</sup> These are non-parametric regressions of locally weighted smoothed scatter plots.

<sup>12</sup> An OLS regression suggests that, conditional on province fixed effects, women in this group are 8% more likely than men to work in agriculture. This gender difference is statistically significant at the 5% level. The increase in the gender difference is also statistically significant at the 5% level compared to 1997 when women in the same age group are only 1.5% more likely to work in agriculture.

Age is a key correlate. Migration is highest for the youngest women and drops continuously with age. All other covariates interact with age, exerting their most pronounced effect on migration probabilities among the young and with effects that are much attenuated with age. This can readily be seen in the figures: typically the curves converge as age rises, showing off the non-linear interactions with the various correlates (Figures 2 a) to g)).

Among young women, the relatively better educated are more likely to be migrants. However, the more educated the household head (typically their husband or father), the less likely the migration (Figure 2 a) and b)). Controlling for age, marital status is not an important determinant. The only important household compositional factor appears to be the number of males aged between 7 and 60 which is positively associated with young women's migration (Figure 2 c)). The value of household assets per capita has a significant negative effect — young women in better-off households are less likely to migrate (Figure 2 d)).<sup>13</sup> This suggests a push factor.<sup>14</sup> The presence of other migrants in the household also exerts a positive effect on female migration, presumably reducing the individual's costs of migration (Figure 2 e)). Among village characteristics, the migration network as measured by the percentage of inhabitants who were migrants in 1997, is positively related to young women's migration (Figure 2 f)); better local labor market conditions as measured by the percent of villagers working in large enterprises (more than 20 employees) in 1997 has a negative effect (Figure 2 g)). Finally young women in the more rural villages have a greater probability of migration than those in the hinterland of county towns probably also reflecting differences in local job opportunities and the presence of a senior middle school in the village reduces their migration.

Whether women migrate is clearly a household decision, which is unsurprisingly influenced by individual characteristics but also by household and village characteristics. This suggests that the welfare of non-migrant women will be affected by other household members' migration.

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<sup>13</sup> The value of assets aggregates the value of owned productive and consumption assets: tricycles, bicycles, motorcycles, cars, tractors, walking tractors, animal carts, draft animals, irrigation equipment, power threshers, water pumps, livestock, professional equipment, fishing equipment, radios, VCRs, black and white TVs, washing machines, refrigerators, air conditioners, sewing machines, fans, wall clocks, cameras, microwaves, cooking pots, pressure cookers, and other cooking utensils. It does not include land assets.

<sup>14</sup> This echoes the findings of Zhao (1999) for a much earlier period.

### **4.3 *Non-migrant women in migrant households***

What proportion of non-migrant women live in households with migrant members during the period covered by the surveys? Using information from the household roster, supplemented with the matched parent-child identification data provided by the CHNS, we can link migration information of parents, husbands, and children with non-migrant women resident in the same households. Table 2 gives, by age cohort and by survey years, the percentages of women who were not themselves migrants at the time of each survey round but lived in households with migrant members. For the 16 to 20 age group, Table 2 reports parents' and siblings' migration status, while it shows husbands' and children's migration for the older groups.

In all age groups, an increasing percent of non-migrant women live in migrant households over time. About 11% of the youngest women did so in 1997, while 37% did in 2006. Both the incidences of having parents and siblings who migrate for work increase substantially over the nine year period from 5 to 17% and 5 to 21%, respectively.

Around 85% of non-migrant women in the 21 to 35 age group are married. Pooling the married and unmarried, we see that the share of women living in migrant households in this age cohort increases from 6 to 21%. Conditional on being married, 13% live in a migrant household and 10% have a migrant husband in 2006 — a share that increased significantly from 3% in 1997. Note that the sample size for this age group declines from 649 to 186, which reflects the higher attrition of young women both through migration and marriage.

Women aged 36 to 50 and 51 to 60 are far more likely to live in a migrant household than younger women. Although the husband migration rate increases steadily from 3 to 12% and 1 to 7% over time, the migration of children is the dominant phenomenon. It rises from around 15 to 40% for both groups. Although it continues to increase over time, spousal migration for non-migrant women in the 51-60 age group decreases significantly when compared to that for the younger cohorts. Having a migrant husband is far less common for women aged 61 and above (2.5% in 2006) — consistent with the fact that men's migration declines with age — as is having migrant children

(25% in 2006).<sup>15</sup> The distinct age profiles that emerge from Table 2 suggest that young women are more likely to be affected by a husband's absence and older women by a child's.

## **5. Impacts of living in households with migrants**

We examine how living in a migrant household affects women's labor force participation, time allocation and welfare. Controlling for other household and individual factors, how does life compare for non-migrant women who are left behind by household members versus those that are not? Do left behind women devote more time to working on the farm and on household chores including child and elderly care? The data allow us to explore these questions convincingly with respect to time allocation both in terms of participation in different activities and the number of hours spent in those activities. Ultimately, we would like to know how welfare is affected. But welfare is hard to measure and in common with most surveys and studies, we are unable to compute a broad individual level welfare measure. Instead, we can look at a number of aspects of welfare including leisure, a number of physical and psycho-social health measures that may be suggestive of heightened stress or undernourishment (BMI, self-reported health status, alcohol consumption and high blood pressure diagnosis) and one measure of empowerment given by whether women hold primary management responsibilities for running the farm. Davin (1999) and Zhang et al. (2004) have argued that through becoming decision-makers and managers of productive activities women who are left behind may be empowered and hence better off. Again, we are unable to judge whether such responsibilities enhance welfare, but we can examine whether such management responsibilities do increase for left-behind women.

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<sup>15</sup> This reflects negative age effect on the migration of children. In addition, it may reflect adult children coming back to take care of elderly parents. This explanation is consistent with the findings in Giles and Mu (2007) that adult children are less likely to migrate when elderly parents are in poor health. Note that since no information is available for children who don't live in the surveyed households, child migration rates from the CHNS could both over- or under-estimate children's actual migration rate. If living with parents facilitates out-migration, then migration rates based on resident children will over-estimate the actual rate. If co-residence instead reflects care for parents, then resident children's migration will be an under-estimate.

### 5.1 Empirical strategy

To evaluate how a household member's migration affects the time use and other outcomes of the left-behind women, one might choose a reduced form regression across all non-migrant women of outcome measure  $Y_{ijt}$  for individual woman  $i$  in household  $j$  at time  $t$ :

$$Y_{ijt} = \alpha_0 + \alpha_1 M_{jt} + X'_{ijt} \alpha_3 + H'_{jt} \alpha_4 + D_{p \times t} + v_i + \varepsilon_{ijt} \quad (2)$$

The time use outcome measures include women's total working hours, and their component parts: working hours on the farm, off-the farm including in wage labor and in a family business, and on household chores.  $Y_{ijt}$  can also be a binary variable equal to 1 if woman  $i$  participates in the above activities and zero otherwise.<sup>16</sup>  $M_{jt}$  is a binary variable equal to 1 if household  $j$  has at least one member who is away for work reasons at time  $t$  and so is 'a migrant household' in our terminology. (Below we distinguish impacts by who migrates.)  $X_{ijt}$  and  $H_{jt}$  are vectors of individual and household characteristics, respectively, that affect individual  $i$ 's outcomes for example through preferences or ability to work on or off the farm locally. The vector  $X_{ijt}$  includes individual  $i$ 's age, years of schooling and marital status. Included in  $H_{jt}$  are household size and demographic composition, characteristics of the household head, and welfare status as measured by the log of household income per capita. The individual fixed factors in  $v_i$  influence labor and time allocation constantly over time. A vector of province and time dummy variables,  $D_{p \times t}$  controls for province-specific macroeconomic shocks that may affect labor market demand. Lastly,  $\varepsilon_{ijt}$  is an idiosyncratic error term. Since our interest is in the population of women who do not migrate, the sample for estimating this equation is confined to women who are present in all rounds of the data. Note also that since we are interested in drawing conclusions about this population there are no selection problems at this level.

The objective of our analysis is to derive an unbiased estimate of  $\alpha_1$ , which gives the impact of a household member's migration on non-migrant women's time allocation.

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<sup>16</sup> Since practically all women participate in household chores, we exclude this activity from the participation regressions.

One concern with the above specification is simultaneity bias — the fact that the migration of household members may reflect joint decisions with a woman’s labor allocation. For example, women’s participation in agricultural work may facilitate a member’s out-migration.<sup>17</sup> Another concern is that household and individual characteristics in  $X_{ijt}$  and  $H_{jt}$  (such as marital status, fertility decisions, and elderly parents’ living arrangements) may also be jointly determined with women’s time allocation. To address these concerns, we use lagged migrant status and only include the initial value of individual and household characteristics ( $X_{ij0}$  and  $H_{j0}$ ) and other covariates that are predetermined at time  $t$ . Furthermore, we use the panel structure of the data and apply first-differences to wipe out omitted variables that are time-invariant. The first-differenced specification is

$$\Delta Y_{ijt} = \alpha_0 + \alpha_1 \Delta M_{jt-1} + X'_{ij0} \alpha_2 + H'_{j0} \alpha_3 + \Delta D_{p \times t} + \Delta \varepsilon_{ijt} \quad (3)$$

The identifying assumption needed for obtaining an unbiased estimate of  $\alpha_1$  in the above specification is that lagged changes in migration status are exogenous to currently observed changes in outcomes conditional on the controls. While this seems a reasonable assumption, the only reason to question the assumption is if shocks that affect the change in household members’ migration in previous survey rounds (2 to 4 years ago) have independent impacts on current changes in labor allocation. Demographic and weather shocks that affect the harvest are the most relevant types of shocks for rural households. However, our regressions include detailed demographic controls and a dummy for lagged health shocks to household members, and weather shocks have contemporaneous effects which lagging should deal with. So, the combination of fixed effects, the controls and the lagging, suggest that our estimates should not suffer from serious bias.

Note that this specification requires at least three repeated observations for each non-migrant woman. In this, and all subsequent regressions, we take account of potential serial correlation within villages by using clustered standard errors.

The migration of a household member can be measured in different ways. First, we define a “migrant household” to be one that has at least one migrant and estimate an encompassing model where migration is treated as a yes or no and does not distinguish

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<sup>17</sup> The reference period for the labor time allocation questions is “last year”, which exacerbates the reverse causality problem in the specification.

who, or how many migrate. We then examine children's, husband's and other members' migration separately, allowing the impacts to differ according to who migrates. For example, it could be that children remit less as they are saving more for their own futures whereas husbands plan to come back. Although we are unable to investigate this issue with our data, we can ascertain whether effects differ according to who migrates.

In the first specification, the change in a household members' migration status ( $\Delta M_{jt-1}$ ) can take three values: +1 denotes that a household has no migrant at time t-2 but has at least one at time t-1 (we label this scenario as having a new migrant(s)); 0 denotes the case of no change in the household's migration status between time t-2 and t-1; and -1 the case where the household has a migrant member(s) at time t-2, but none at time t-1 (we term this situation as having a return migrant(s)). The above specification assumes that having a new migrant(s) has the equivalent reverse impact on left behind women's outcomes as having a return migrant(s). That is, outcomes such as labor allocation are fully adjustable in response to a household member's migration. However, the impacts of new migration and return migration may well be asymmetric, for example if inter-household labor allocation arrangements are made once when out-migration occurs but not remade upon return migration. If migration is a long-term arrangement, and return migration is often short-term, one would also expect left-behind women's labor allocation to be more responsive to new out-migration than to return migration. To test whether there are asymmetric impacts of new and return migration, we modify the specification in equation (3) and estimate the following:

$$\Delta Y_{ijt} = \beta_0 + \beta_1 I(\Delta M_{jt-1}) + \beta_2 I(-\Delta M_{jt-1}) + X'_{ij0} \beta_3 + H'_{jt0} \beta_4 + \Delta D_{p \times t} + \Delta \varepsilon_{ijt} \quad (4)$$

where  $I(x)$  is the indicator function, such that  $I(x) = 1$  if  $x > 0$  and  $I(x) = 0$  otherwise.

Given the importance of age in labor allocation as evidenced in the results in Section 4, we estimate the impacts of migration using both the total sample and subsamples stratified by age cohort.

## 5.2 Results

Tables 3 through 6 examine the impacts of living in a migrant household on the participation of non-migrant women in various activities and Tables 7 to 10 report on the impacts on the hours worked in those activities, for the encompassing model given in

equation (3) and its various refinements. All regressions control for the same set of detailed household and individual characteristics although we report the coefficient estimates on the covariates only for the all-encompassing model (Tables 3 and 7).<sup>18</sup> The others report the estimated coefficients on the migration status variables only since these are our main interest.

Controlling for household and individual characteristics, we find positive impacts on the participation of non-migrant women in agricultural work, and these effects are significant at the 1% level (Table 3). The probability of working on the farm is 7% higher for left-behind women. There are no signs of effects on participation in non-agricultural work. Disaggregating to look at this relationship by age cohorts and controlling for the same covariates, reveals that the impact on farm work is statistically significant only for the cohort of women aged 36 to 50 (Table 4). The estimated effects for the age cohorts 21 to 35, and 51 to 60 are not significantly different from that for women aged 36 to 50 but they are imprecisely estimated reflecting the smaller sample sizes for those cohorts.

When we allow impacts to differ according to who migrates, we find that increased participation in farm work is due entirely to children's migration (Table 5). The migration of offspring significantly raises the probability that women engage in farm work — by 9% in the overall sample, 7% for women aged 36 to 50, 10% for those aged 51 to 60 and by a high but less precisely estimated 25% for those aged 61 to 70.<sup>19</sup> This specification also suggests that a husband's migration vastly reduces participation in farm labor for the oldest cohort, and reduces participation in wage labor by 10% for the 21 to 35 age cohort.

Finally, the results in Table 6 suggest that the impacts of being left-behind are not reversed once migrant household members return. In particular, it is out migration that results in a statistically significant increase in the probability of working on the farm of 5% in the overall sample and for the 36 to 50 age group. By contrast, return migration has no impact, positive or negative, on the participation in agriculture. Given that this effect appears to come solely from the migration of children, this result is not unexpected

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<sup>18</sup> We report the summary statistics for the explanatory variables in Appendix Table 1. The sample means of time allocation and labor force participation are reported in Appendix Tables 3 and 4, respectively.

<sup>19</sup> Note, however, that the sample size for this last cohort is small at 177 women.

as many children are likely to return to the household only temporarily before setting up their own households. When the return is permanent, returnees may not go back to farming, such that the previously left-behind women simply continue handling the farm work.

Suggestively, return migration is found to have a negative effect on non-migrant women's participation in family businesses — reducing the probability of partaking by 5% in the overall sample (significant only at the 10% level) and by 15% for women in the 51 to 60 age cohort. This suggests that return migrants may aspire to off-farm self-employment, and supplant left-behind women's labor in family businesses.

Whether one participates in an activity or not is a rather blunt measure and we expect to see more response in the hours devoted to various activities. Tables 7 through 10 present the results with respect to hours worked, again for the various specifications.<sup>20</sup> Turning first to the regressions on the entire sample of non-migrant women, we find no sign of impacts on total hours worked or on the time spent doing chores (Table 7). On average, left-behind women do not appear to have longer work days or reduced leisure as a result of household adult members going away for work. Conversely, there are no signs that leisure time has increased.

However, left-behind women may well be doing more strenuous work during those working hours. We find evidence of significant re-allocation effects across labor force activities. In particular, living in a migrant household has a statistically significant impact of 149 more hours worked in agriculture a year. Conversely, it reduces the hours worked off the farm: 39 hours less on wage work and 93 fewer hours on the family business.

Unpacking these impacts, we find that the effects on the distribution of working hours across activities are most pronounced for the 36 to 50 age cohort reinforcing our results in the case of participation (Table 8). This group sees a 129 hour increase in time spent working on the farm and a reduction of 179 hours on non-agricultural work. However, women in the next cohort (age 51 to 60) see an even larger increase of 179 in hours devoted to farm work. The results on overall working hours for this group suggest that these hours are entirely additional and not just due to a re-allocation to compensate

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<sup>20</sup> We have not logged the dependent variable for these estimations due to the many zero hours.

for a household member's absence. Thus, for left-behind women aged 51 to 60 the results are suggestive of a high and significant drop in leisure time.

In Table 9, the results are presented according to who in the household migrated. In line with our previous results on participation, positive and statistically significant impacts on the time devoted to farm work are primarily associated with the migration of children. Again, they are positive and statistically significant for women in the 36 to 60 age group. There is also a mildly statistically significant effect of husband's migration on farm work hours for the cohort aged 21 to 35 who are for the most part still too young to have migrant children. Echoing our previous results, there are signs of reduced leisure time for older women linked to the migration of children. We find large though imprecisely estimated impacts on total hours worked by the 51 and above age groups. Significant negative impacts on the hours worked outside agriculture are due both to husband's and children's migration. These effects are particularly large for wage labor.

Table 10 shows again that the effects of out and return migration are quite consistently not symmetric. When considering the entire sample, it is out-migration that results in hours re-allocated from non-farm activities to farm work. The patterns are a little less clear when we look at individual age cohorts.

We find that the left-behind women increase their labor allocation to household agricultural production, but do they also gain status in the process by becoming the household's primary managers and decision makers in these activities? Using the same reduced form models we examine whether they are more likely to hold primary responsibility for household farming, fishing and livestock activities as a result of living in a migrant household. We find no impacts in this regard (Table 11).<sup>21</sup>

Finally, we also look at health outcomes as described above. We find no impacts on the consumption of alcohol or on blood pressure. There is no sign either that self-reported health status worsens as a result of a household member's migration. Instead, migration is related to a slight increase in the body mass index among the 36-50 age group (Table 12).

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<sup>21</sup> These results may indicate that women prefer not to incur increased decision making responsibilities to avoid potential blame for failed tasks as some sociological studies have emphasized (Nelson 1992, Murphy 2004). However, they may well also indicate resistance on the part of male household members in relegating such responsibilities.

## **6. Conclusions**

Our study reveals the complexities and ambiguities behind the dramatic labor market transition that China has been going through stemming from effects on work allocation within households. The transformation of China's economy is creating new non-farm work opportunities for some women in rural China, notably those who migrate. But this is not an unambiguous process whereby all rural women transit out of farming. Indeed, we have found that the non-migrant women left behind in rural areas, while other household members migrate, are doing more farm work than would have otherwise been the case. The aggregate transformation of work during China's rapid economic development is being associated with a substantial re-allocation of traditional farm labor among women — the young doing much less and older women much more. Moreover, our results suggest that the re-allocation of left-behind women's time resulting from the migration of household members entails more hours in farm work at the cost of fewer hours in local off-farm work, with no sign of increasing decision-making responsibilities over the household's farming activities. In other words, this is not a simple process of labor re-allocation away from farming; instead, some women (the migrants) are doing less farm work while others (the left-behind) are doing more. For some types of women (notably older non-migrant women) the labor re-allocation response comes out of their leisure with potentially adverse welfare impacts despite the higher household income. We also find evidence that this is a persistent effect, and not just a temporary re-allocation.

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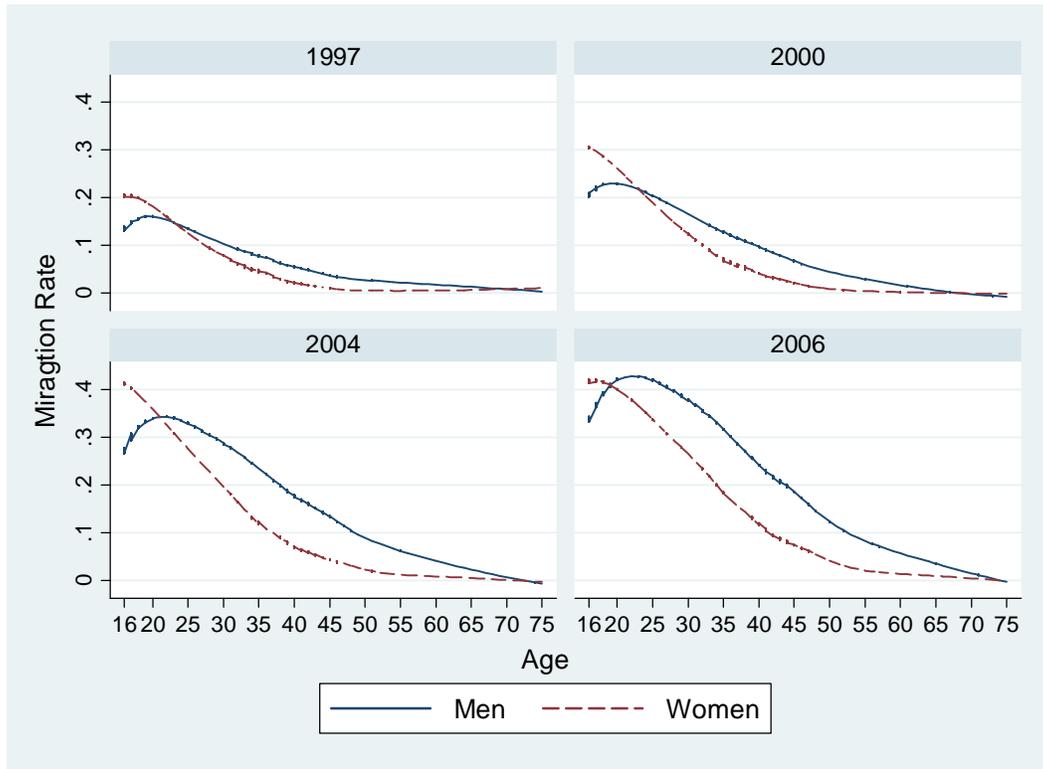
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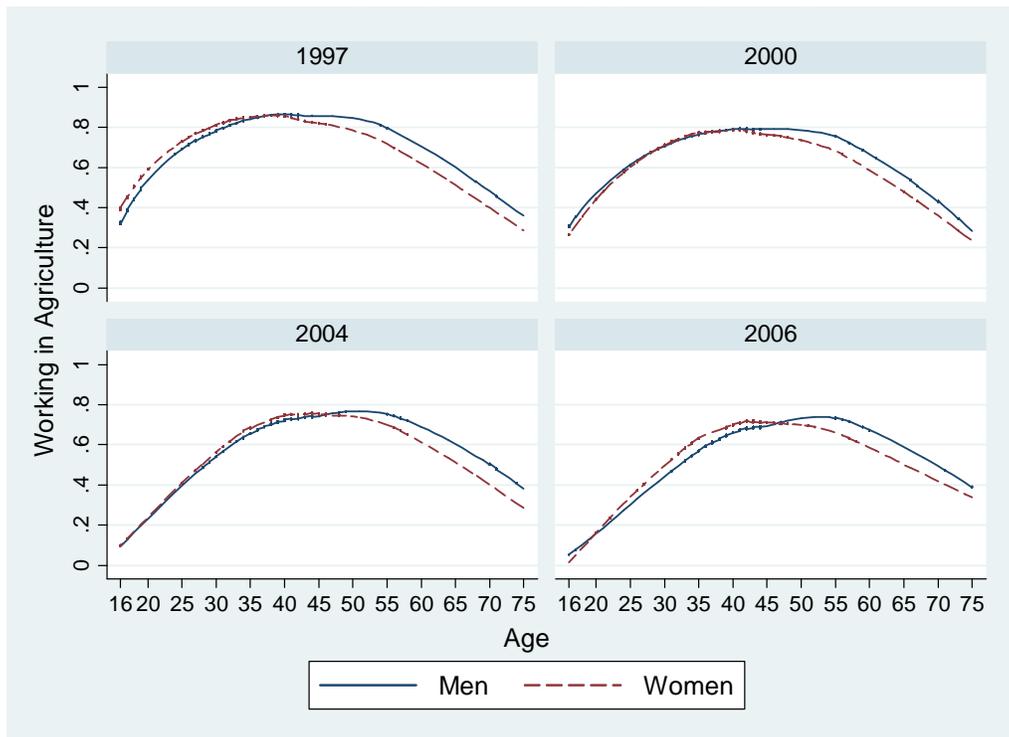
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**Figure 1: Allocation of labor across activities by gender and age.**

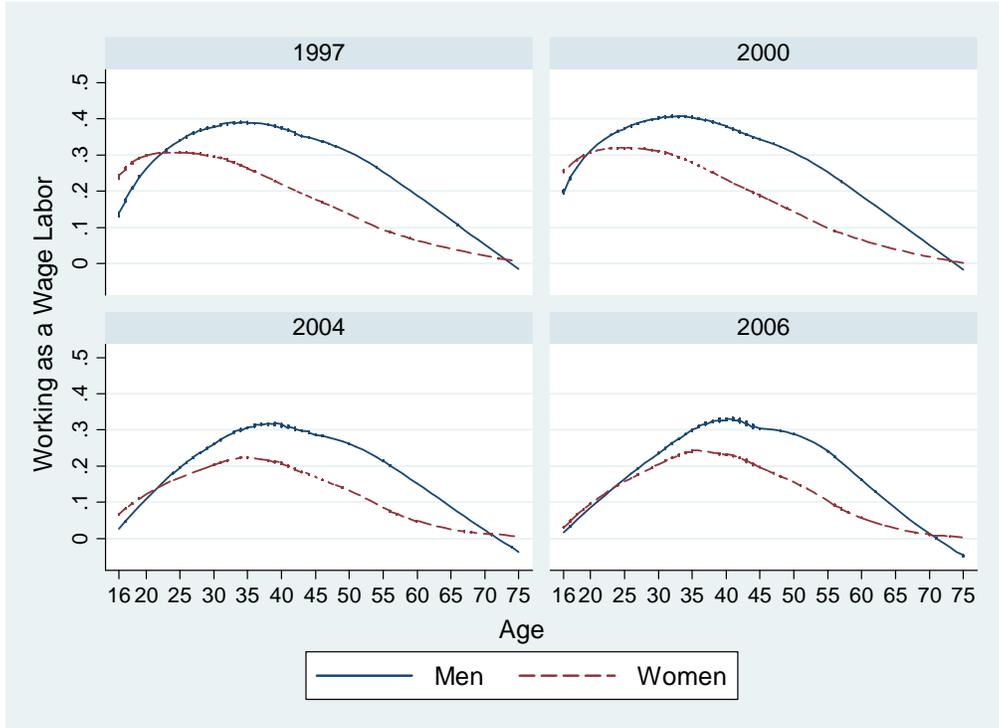
**a) Migration rate by year, age and gender**



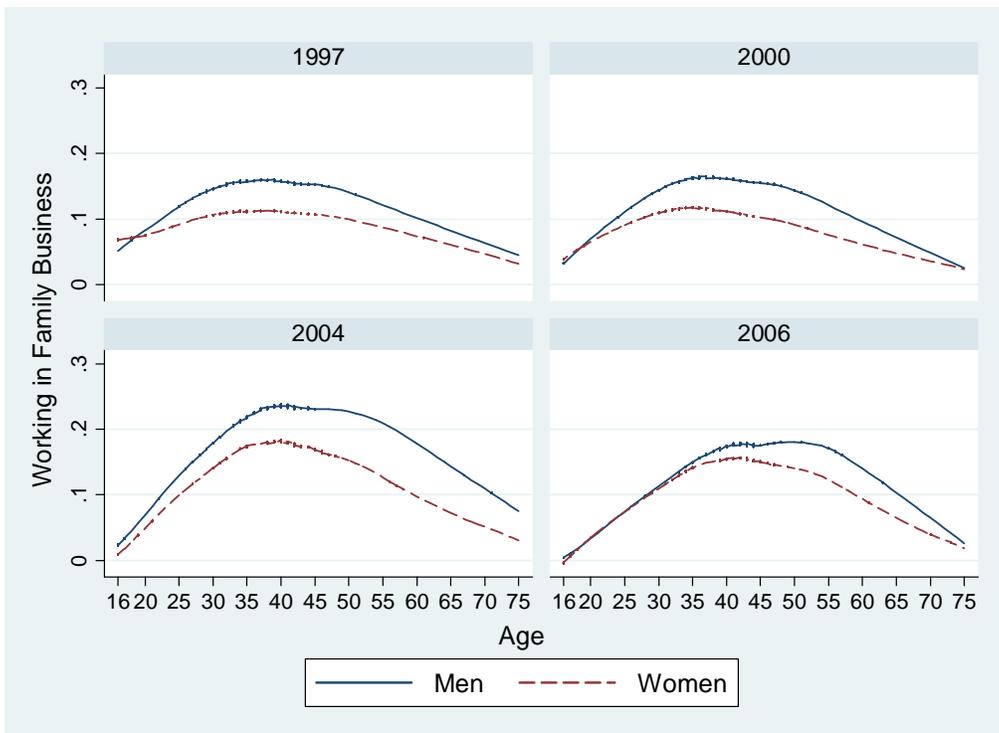
**b) Share of labor force working in agriculture by year, age and gender**



**c) Share of labor force in local wage labor by year, age and gender**

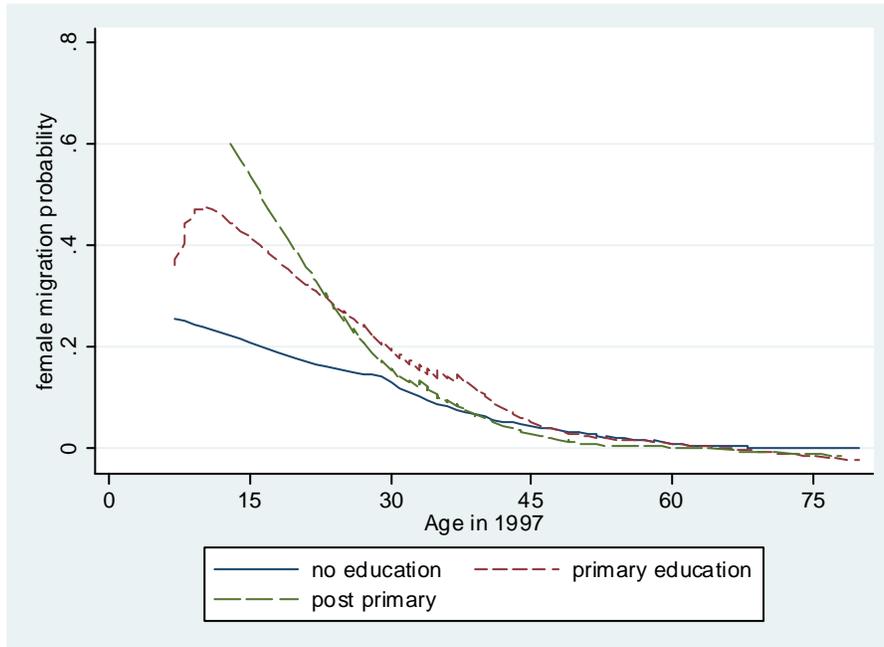


**d) Share of labor force in family business by year and gender**

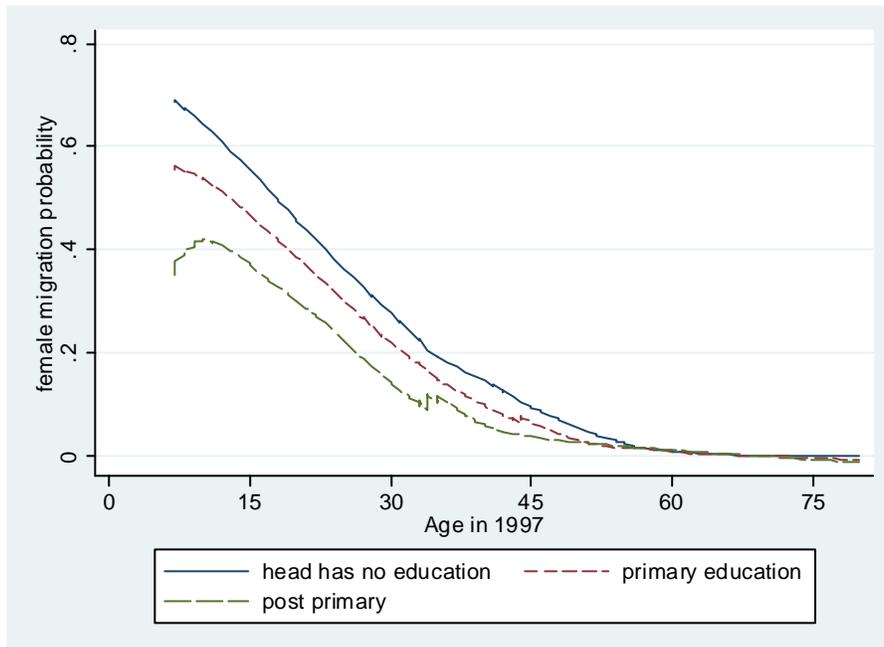


**Figure 2: Determinants of female work related migration**

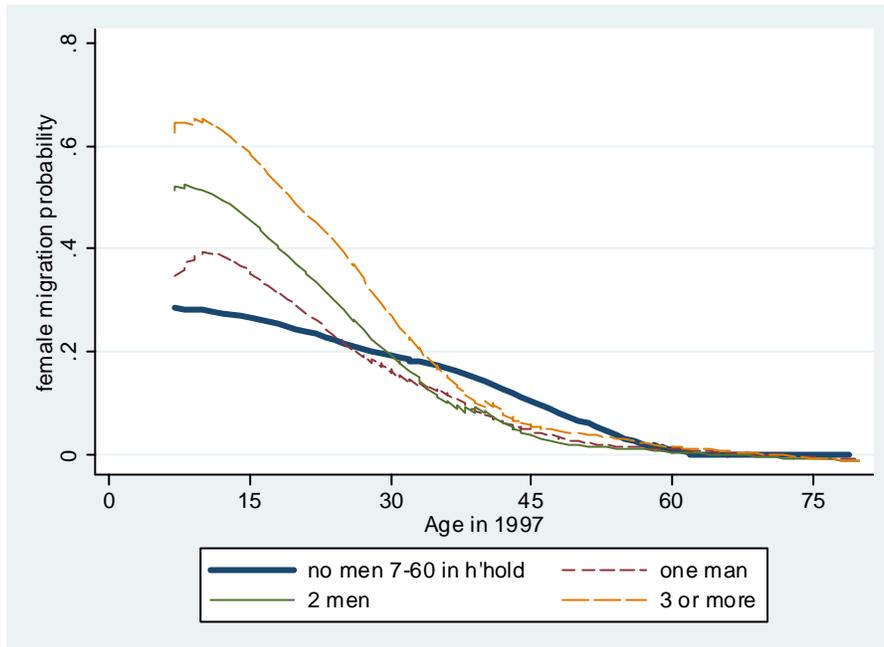
**a) Own education**



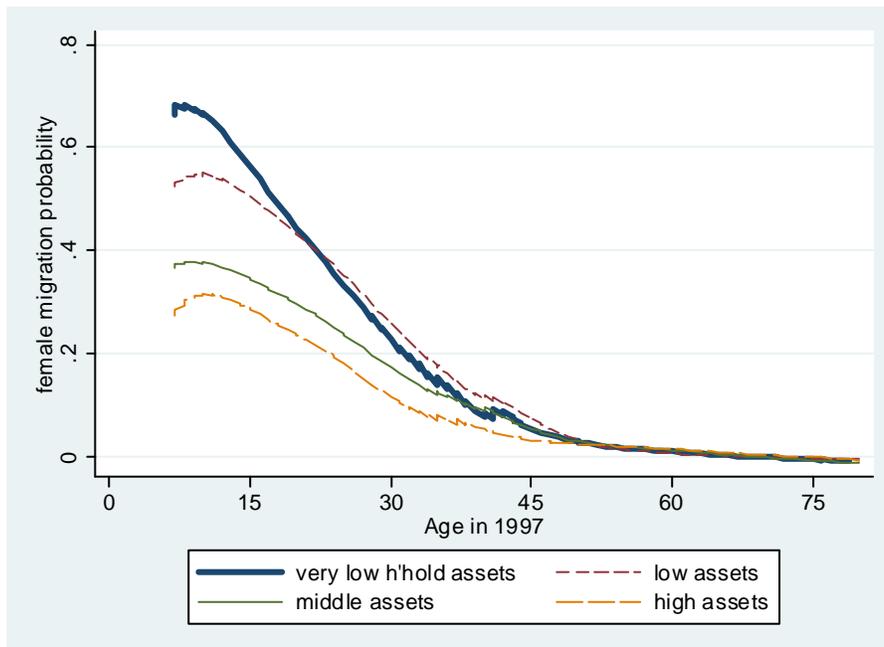
**b) Household head's education**



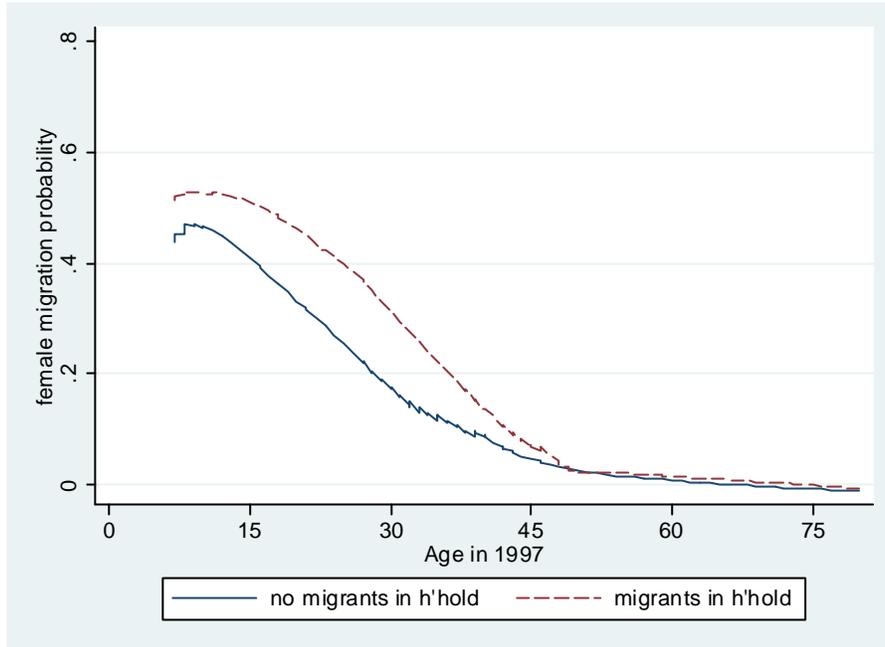
**c) Number of men in household**



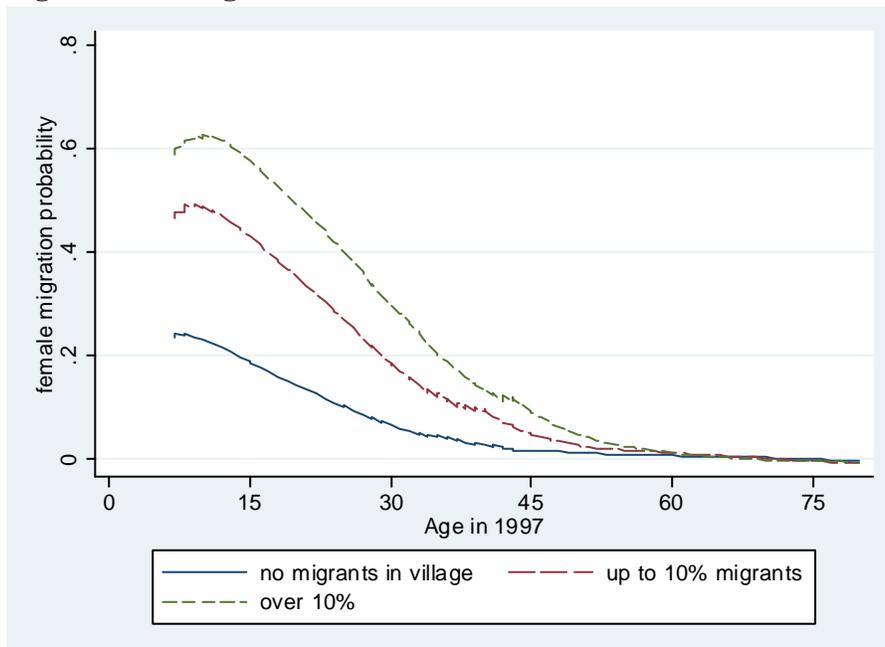
**d) Level of household assets:**



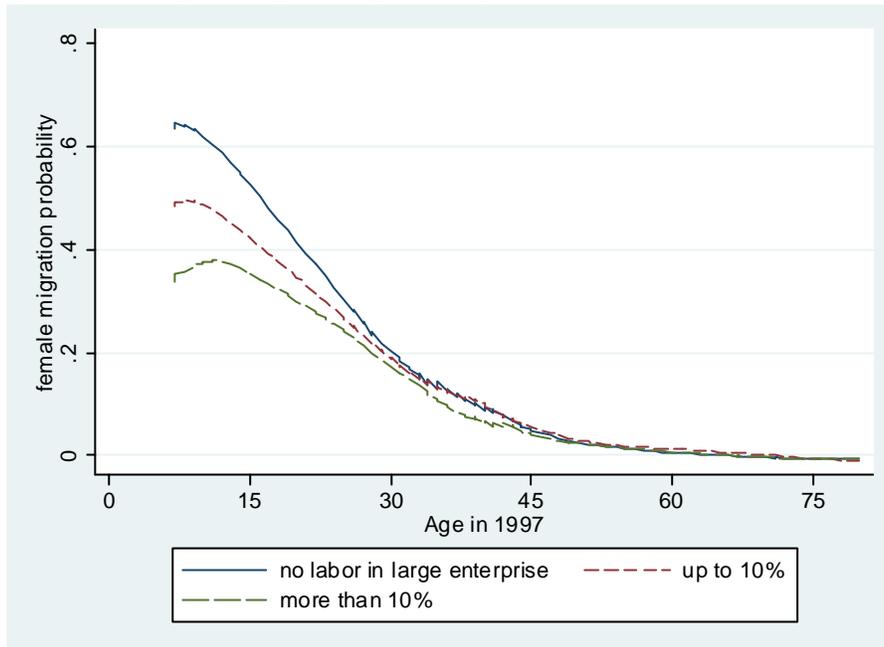
**e) Other migrants in household**



**f) Other migrants in village**



**g) % villagers working in large village enterprises**



**Table 1: Labor force participation and distribution across activities of rural men and women aged 16 to 70, from 1997 to 2006**

|                     |                  | 1997 | 2000 | 2004 | 2006 |
|---------------------|------------------|------|------|------|------|
| <b>Rural men:</b>   |                  |      |      |      |      |
| Working             | %                | 89.0 | 87.8 | 82.4 | 82.1 |
|                     | age              | 38.2 | 38.7 | 40.5 | 40.8 |
|                     | education        | 7.4  | 7.8  | 7.8  | 7.9  |
| Migrants            | % of labor force | 7.8  | 11.6 | 19.0 | 24.5 |
|                     | age              | 27.8 | 28.4 | 30.2 | 30.8 |
|                     | education        | 7.9  | 8.4  | 8.2  | 8.1  |
| Agriculture         | % of labor force | 76.6 | 70.7 | 60.9 | 55.3 |
|                     | age              | 38.9 | 39.7 | 43.6 | 45.2 |
|                     | education        | 7.3  | 7.7  | 7.7  | 7.9  |
| Local wage          | % of labor force | 32.3 | 34.1 | 23.5 | 23.5 |
|                     | age              | 36.2 | 36.2 | 40.1 | 41.5 |
|                     | education        | 8.8  | 8.9  | 9.1  | 9.2  |
| Family business     | % of labor force | 13.3 | 13.3 | 18.6 | 13.5 |
|                     | age              | 38.5 | 39.3 | 42.5 | 44.4 |
|                     | education        | 8.2  | 8.3  | 8.0  | 7.9  |
| Obs. Number         |                  | 3582 | 4026 | 4023 | 4273 |
| <b>Rural women:</b> |                  |      |      |      |      |
| Working             | %                | 85.9 | 82.1 | 75.1 | 73.4 |
|                     | age              | 38.0 | 38.8 | 40.8 | 41.1 |
|                     | education        | 5.6  | 6.2  | 6.1  | 6.4  |
| Migrants            | % of labor force | 5.6  | 8.2  | 11.6 | 14.9 |
|                     | age              | 23.1 | 23.6 | 25.1 | 26.9 |
|                     | education        | 7.8  | 8.4  | 7.7  | 7.8  |
| Agriculture         | % of labor force | 76.0 | 68.4 | 61.3 | 56.4 |
|                     | age              | 38.5 | 39.9 | 43.6 | 44.7 |
|                     | education        | 5.5  | 6.0  | 5.8  | 6.0  |
| Local wage          | % of labor force | 21.7 | 22.3 | 15.0 | 15.8 |
|                     | age              | 32.1 | 32.6 | 36.8 | 38.3 |
|                     | education        | 8.4  | 8.6  | 8.7  | 8.8  |
| Family business     | % of labor force | 9.8  | 9.5  | 13.4 | 11.5 |
|                     | age              | 38.3 | 38.3 | 41.8 | 43.4 |
|                     | education        | 6.6  | 7.2  | 6.7  | 7.1  |
| Obs. Number         |                  | 3445 | 3891 | 3849 | 4012 |

Note: CHNS rural sample of men and women aged 16 to 70 years.

**Table 2: Non-migrant women in migrant households (%)**

|                             | 1997 |        | 2000 |        | 2004 |        | 2006 |        |
|-----------------------------|------|--------|------|--------|------|--------|------|--------|
| <b>age 16-20</b>            |      |        |      |        |      |        |      |        |
| living in migrant household | 11.1 | (31.6) | 14.4 | (35.2) | 26.9 | (44.5) | 36.8 | (48.4) |
| parent(s) migrated          | 5.3  | (22.5) | 7.2  | (26.0) | 11.7 | (32.2) | 16.8 | (37.5) |
| sibling(s) migrated         | 5.4  | (22.6) | 6.1  | (24.1) | 9.8  | (29.9) | 21.2 | (41.0) |
| obs.                        | 117  |        | 153  |        | 130  |        | 155  |        |
| <b>age 21-35</b>            |      |        |      |        |      |        |      |        |
| living in migrant household | 6.3  | (24.3) | 12.4 | (33.0) | 15.3 | (36.1) | 21.0 | (40.8) |
| husband migrated            | 3.4  | (18.1) | 7.5  | (26.5) | 10.1 | (30.2) | 8.7  | (28.3) |
| child(ren) migrated         | 0.2  | (4.3)  | 0.0  | 0.0    | 0.6  | (7.9)  | 0.0  | 0.0    |
| obs.                        | 649  |        | 466  |        | 248  |        | 186  |        |
| <b>age 36-50</b>            |      |        |      |        |      |        |      |        |
| living in migrant household | 18.3 | (38.7) | 26.9 | (44.4) | 40.5 | (49.1) | 43.6 | (49.6) |
| husband migrated            | 3.1  | (17.4) | 5.4  | (22.6) | 10.9 | (31.2) | 11.8 | (32.2) |
| child(ren) migrated         | 15.4 | (36.1) | 24.3 | (42.9) | 35.0 | (47.7) | 39.4 | (48.9) |
| obs.                        | 821  |        | 840  |        | 716  |        | 635  |        |
| <b>age 51-60</b>            |      |        |      |        |      |        |      |        |
| living in migrant household | 18.8 | (39.1) | 26.6 | (44.2) | 35.3 | (47.9) | 44.1 | (49.7) |
| husband migrated            | 1.2  | (11.0) | 1.0  | (10.2) | 3.2  | (17.6) | 6.6  | (24.8) |
| child(ren) migrated         | 17.1 | (37.7) | 23.9 | (42.7) | 32.6 | (46.9) | 39.4 | (48.9) |
| obs.                        | 336  |        | 399  |        | 447  |        | 497  |        |
| <b>age &gt;61</b>           |      |        |      |        |      |        |      |        |
| living in migrant household | 7.3  | (26.1) | 12.1 | (32.7) | 24.8 | (43.3) | 30.4 | (46.1) |
| husband migrated            | 0.9  | (9.6)  | 0.4  | (6.5)  | 0.4  | (6.6)  | 2.5  | (15.6) |
| child(ren) migrated         | 4.1  | (20.0) | 9.2  | (29.0) | 21.3 | (41.0) | 24.7 | (43.2) |
| obs.                        | 219  |        | 240  |        | 250  |        | 270  |        |

Notes: Standard deviations in parentheses. The total rural sample is used. Non-migrant women are defined as women who were present at the time of each specific survey round

**Table 3: First difference estimates of labor force participation in various activities**

|   | Participation<br>in agr. | Participation<br>in non-agr. | Participation<br>in wage labor | Participation<br>in family<br>business |
|---|--------------------------|------------------------------|--------------------------------|--|
| Migrant household status (lagged)             | 0.066***<br>(0.021)      | -0.004<br>(0.029)            | -0.005<br>(0.011)              | 0.001<br>(0.028)                       |
| Household member has bad health<br>(lagged)   | -0.044*<br>(0.026)       | 0.080**<br>(0.034)           | 0.008<br>(0.015)               | 0.064*<br>(0.033)                      |
| Age 16-20 in initial year                     | -0.016<br>(0.083)        | -0.009<br>(0.083)            | -0.001<br>(0.042)              | -0.003<br>(0.079)                      |
| Age 21-25 in initial year                     | 0.082<br>(0.074)         | 0.003<br>(0.060)             | -0.026<br>(0.035)              | 0.033<br>(0.056)                       |
| Age 26-30 in initial year                     | 0.176***<br>(0.058)      | -0.008<br>(0.050)            | -0.014<br>(0.024)              | 0.006<br>(0.050)                       |
| Age 31-35 in initial year                     | 0.215***<br>(0.054)      | -0.000<br>(0.051)            | 0.002<br>(0.027)               | 0.007<br>(0.048)                       |
| Age 36-40 in initial year                     | 0.235***<br>(0.059)      | 0.045<br>(0.048)             | 0.030<br>(0.021)               | 0.017<br>(0.047)                       |
| Age 41-45 in initial year                     | 0.222***<br>(0.054)      | 0.045<br>(0.046)             | 0.018<br>(0.017)               | 0.047<br>(0.045)                       |
| Age 46-50 in initial year                     | 0.206***<br>(0.050)      | 0.023<br>(0.049)             | -0.002<br>(0.016)              | 0.038<br>(0.048)                       |
| Age 51-55 in initial year                     | 0.134**<br>(0.056)       | -0.008<br>(0.046)            | 0.002<br>(0.016)               | -0.007<br>(0.048)                      |
| Age 56-60 in initial year                     | 0.060<br>(0.049)         | 0.098*<br>(0.052)            | 0.024<br>(0.019)               | 0.092*<br>(0.054)                      |
| Years of schooling in initial year            | 0.002<br>(0.003)         | 0.003<br>(0.003)             | 0.003**<br>(0.001)             | 0.000<br>(0.003)                       |
| Years of schooling squared in initial<br>year | -0.000*<br>(0.000)       | -0.000<br>(0.000)            | -0.000***<br>(0.000)           | 0.000<br>(0.000)                       |
| Years of schooling of head in initial<br>year | -0.005*<br>(0.002)       | -0.004<br>(0.003)            | -0.001<br>(0.002)              | -0.003<br>(0.003)                      |
| Age of household head in initial year         | -0.004***<br>(0.001)     | -0.002<br>(0.001)            | -0.001<br>(0.001)              | -0.001<br>(0.001)                      |
| Minority household                            | 0.094**<br>(0.042)       | -0.032<br>(0.040)            | -0.027<br>(0.032)              | -0.013<br>(0.033)                      |
| Household size in initial year                | -0.007**<br>(0.003)      | -0.004<br>(0.004)            | -0.001<br>(0.001)              | -0.003<br>(0.004)                      |
| Number of girls 0-6 in initial year           | 0.013<br>(0.022)         | 0.035<br>(0.031)             | 0.007<br>(0.015)               | 0.033<br>(0.032)                       |
| Number of boys 0-6 in initial year            | 0.016<br>(0.022)         | 0.039<br>(0.024)             | -0.002<br>(0.016)              | 0.040*<br>(0.022)                      |

|  |                      |                   |                   |                   |
|--|----------------------|-------------------|-------------------|-------------------|
| Number of girls 7-15 in initial year     | 0.015<br>(0.013)     | 0.017<br>(0.015)  | 0.002<br>(0.008)  | 0.011<br>(0.014)  |
| Number of boys 7-15 in initial year      | 0.004<br>(0.016)     | 0.028<br>(0.017)  | 0.016*<br>(0.008) | 0.020<br>(0.016)  |
| Number of elderly female in initial year | 0.026<br>(0.024)     | 0.028<br>(0.026)  | -0.000<br>(0.015) | 0.029<br>(0.029)  |
| Number of elderly male in initial year   | -0.012<br>(0.031)    | -0.038<br>(0.029) | -0.007<br>(0.014) | -0.027<br>(0.033) |
| Never married in initial year            | -0.127***<br>(0.045) | -0.064<br>(0.060) | 0.015<br>(0.031)  | -0.065<br>(0.052) |
| (log) Income per capita in initial year  | -0.043***<br>(0.011) | 0.016<br>(0.010)  | -0.004<br>(0.004) | 0.017*<br>(0.010) |
| Constant                                 | 1.240***<br>(0.128)  | -0.060<br>(0.127) | 0.084*<br>(0.047) | -0.106<br>(0.120) |
| Number of observations                   | 3,401                | 3,401             | 3,401             | 3,401             |
| R2                                       | 0.148                | 0.047             | 0.028             | 0.047             |

Notes: The sample consists of all women who are present in all survey rounds. Participation in a labor force activity is a binary variable equal to 1 if the respondent reported being engaged or having positive working hours in the activity and 0 otherwise. Province/year interactions are also included in the regressions but not reported. Standard errors are clustered at the village level. \* denotes significance at 10% level; \*\* denotes significance at 5% level; and \*\*\* denotes significance at 1% level.

**Table 4: First difference estimates of labor force participation by initial age cohort**

|                                  | Age16-20         | Age 21-35         | Age 36-50           | Age 51-60        | Age 61 -70        |
|----------------------------------|------------------|-------------------|---------------------|------------------|-------------------|
| Participation in agriculture     | 0.042<br>(0.159) | 0.077<br>(0.050)  | 0.063***<br>(0.023) | 0.067<br>(0.046) | 0.081<br>(0.149)  |
| Obs. No                          | 187              | 843               | 1,502               | 692              | 177               |
| Participation in non-agriculture | 0.063<br>(0.190) | 0.021<br>(0.061)  | -0.025<br>(0.037)   | 0.038<br>(0.050) | 0.018<br>(0.142)  |
| Obs. No                          | 187              | 843               | 1,502               | 692              | 177               |
| Participation in wage labor      | 0.041<br>(0.120) | -0.044<br>(0.032) | -0.007<br>(0.015)   | 0.013<br>(0.016) | -0.039<br>(0.039) |
| Obs. No                          | 187              | 843               | 1,502               | 692              | 177               |
| Participation in family business | 0.006<br>(0.141) | 0.048<br>(0.065)  | -0.024<br>(0.033)   | 0.048<br>(0.048) | 0.018<br>(0.142)  |
| Obs. No                          | 187              | 843               | 1,920               | 692              | 177               |

Notes: The sample consists of all women who are present in all survey rounds. Coefficients on household migration status (lagged) are reported. Other variables included but not reported are the same as are given in Table 3 along with province/year interactions. Standard errors are clustered at the village level. \* denotes significance at 10% level; \*\* denotes significance at 5% level; and \*\*\* denotes significance at 1% level.

**Table 5: Impacts of different household members' migration on labor participation**

|                     | Participation<br>in agr. | Participation in<br>non-agr. | Participation<br>in wage labor | Participation in<br>family business |
|---------------------|--------------------------|------------------------------|--------------------------------|-------------------------------------|
| <b>Total Sample</b> |                          |                              |                                |                                     |
| Children migrated   | 0.092***<br>(0.023)      | -0.007<br>(0.031)            | 0.007<br>(0.013)               | -0.007<br>(0.030)                   |
| Husband migrated    | 0.021<br>(0.038)         | -0.019<br>(0.048)            | -0.051*<br>(0.027)             | 0.018<br>(0.047)                    |
| Other migrated      | 0.020<br>(0.061)         | 0.031<br>(0.073)             | 0.029<br>(0.029)               | -0.011<br>(0.071)                   |
| <b>Age 16-20</b>    |                          |                              |                                |                                     |
| Other migrated      | 0.042<br>(0.159)         | 0.063<br>(0.190)             | 0.041<br>(0.120)               | 0.006<br>(0.141)                    |
| <b>Age 21-35</b>    |                          |                              |                                |                                     |
| Husband migrated    | 0.075<br>(0.056)         | -0.036<br>(0.082)            | -0.104**<br>(0.052)            | 0.056<br>(0.085)                    |
| Other migrated      | 0.080<br>(0.086)         | 0.078<br>(0.087)             | 0.017<br>(0.039)               | 0.040<br>(0.094)                    |
| <b>Age 36-50</b>    |                          |                              |                                |                                     |
| Children migrated   | 0.071***<br>(0.025)      | -0.016<br>(0.043)            | 0.004<br>(0.016)               | -0.027<br>(0.039)                   |
| Husband migrated    | 0.014<br>(0.038)         | -0.035<br>(0.055)            | -0.022<br>(0.030)              | -0.020<br>(0.046)                   |
| Other migrated      | 0.028<br>(0.121)         | -0.124<br>(0.116)            | 0.017<br>(0.021)               | -0.045<br>(0.081)                   |
| <b>Age 51-60</b>    |                          |                              |                                |                                     |
| Children migrated   | 0.102**<br>(0.045)       | 0.042<br>(0.053)             | 0.024<br>(0.015)               | 0.042<br>(0.051)                    |
| Husband migrated    | -0.212<br>(0.227)        | 0.055<br>(0.249)             | -0.158<br>(0.125)              | 0.203<br>(0.198)                    |
| Other migrated      | 0.032<br>(0.127)         | -0.056<br>(0.176)            | 0.015<br>(0.013)               | -0.062<br>(0.175)                   |
| <b>Age 61-70</b>    |                          |                              |                                |                                     |
| Children migrated   | 0.245*<br>(0.132)        | 0.102<br>(0.132)             | -0.033<br>(0.034)              | 0.102<br>(0.132)                    |
| Husband migrated    | -0.755***<br>(0.184)     | 0.307<br>(0.222)             | -0.034<br>(0.034)              | 0.307<br>(0.222)                    |
| Other migrated      | -0.313<br>(0.445)        | -0.314<br>(0.215)            | 0.032<br>(0.035)               | -0.314<br>(0.215)                   |

Notes: The sample consists of all women who are present in all survey rounds. Migration variables are valued at one period lag. Other variables included but not reported are the same as are given in Table 3 along with province/year interactions. Standard errors are clustered at the village level. \* denotes significance at 10% level; \*\* denotes significance at 5% level; and \*\*\* denotes significance at 1% level.

**Table 6: Impacts of out versus return migration on labor participation**

|                   | Participation in agr. | Participation in non-agr. | Participation in wage labor | Participation in family business |
|-------------------|-----------------------|---------------------------|-----------------------------|----------------------------------|
| <b>Total</b>      |                       |                           |                             |                                  |
| Return migration  | 0.004<br>(0.018)      | -0.032<br>(0.029)         | 0.003<br>(0.014)            | -0.045*<br>(0.027)               |
| Out migration     | 0.046*<br>(0.027)     | -0.016<br>(0.036)         | 0.014<br>(0.016)            | -0.020<br>(0.036)                |
| <b>Age 16-20</b>  |                       |                           |                             |                                  |
| Return migration  | -0.155<br>(0.126)     | 0.084<br>(0.169)          | -0.010<br>(0.129)           | 0.082<br>(0.121)                 |
| Out migration     | 0.007<br>(0.234)      | 0.194<br>(0.327)          | 0.151<br>(0.175)            | 0.017<br>(0.260)                 |
| <b>Age 21-35</b>  |                       |                           |                             |                                  |
| Return migration  | 0.037<br>(0.047)      | -0.028<br>(0.067)         | 0.019<br>(0.042)            | -0.062<br>(0.061)                |
| Out migration     | 0.082<br>(0.059)      | -0.020<br>(0.075)         | -0.003<br>(0.029)           | -0.016<br>(0.085)                |
| <b>Age 36-50</b>  |                       |                           |                             |                                  |
| Return migration  | 0.017<br>(0.021)      | -0.006<br>(0.036)         | 0.011<br>(0.015)            | -0.018<br>(0.033)                |
| Out migration     | 0.054*<br>(0.030)     | -0.006<br>(0.052)         | 0.016<br>(0.024)            | -0.019<br>(0.045)                |
| <b>Age 51-60</b>  |                       |                           |                             |                                  |
| Return migration  | -0.059<br>(0.048)     | -0.130**<br>(0.066)       | -0.021<br>(0.027)           | -0.153**<br>(0.067)              |
| Out migration     | 0.033<br>(0.052)      | -0.052<br>(0.059)         | 0.020<br>(0.026)            | -0.057<br>(0.057)                |
| <b>Age 61 -70</b> |                       |                           |                             |                                  |
| Return migration  | 0.042<br>(0.097)      | 0.002<br>(0.122)          | 0.013<br>(0.012)            | 0.002<br>(0.122)                 |
| Out migration     | 0.059<br>(0.218)      | -0.001<br>(0.280)         | -0.110<br>(0.103)           | -0.001<br>(0.280)                |

Notes: The sample consists of all women who are present in all survey rounds. Migration variables are valued at one period lagged. Out migration is defined as 1 if at least one household member has migrated out for work from time t-1 to time t, and 0 otherwise. Return migration is defined as 1 if at least one household member has returned from work-related migration from time t-1 to time t. Other variables included in the regressions but not reported are the same as are given in Table 3 along with province/year interactions. Standard errors are clustered at the village level. \* denotes significance at 10% level; \*\* denotes significance at 5% level; and \*\*\* denotes significance at 1% level.

**Table 7: First difference estimates of yearly working hours on various activities**

|  | <b>Total hours worked</b> | <b>Hours worked in agr.</b> | <b>Hours worked in non-agr.</b> | <b>Hours worked in wage labor</b> | <b>Hours worked in family business</b> | <b>Hours in household chores (weekly)</b> |
|--|---------------------------|-----------------------------|---------------------------------|-----------------------------------|--|---|
| Migrant household (lagged)                 | 24.028<br>(62.273)        | 148.771***<br>(42.680)      | -134.794***<br>(36.866)         | -38.958*<br>(22.428)              | -93.027***<br>(28.484)                 | 0.351<br>(0.671)                          |
| Household member has bad health (lagged)   | -86.719<br>(78.730)       | -36.997<br>(53.483)         | 3.115<br>(43.962)               | 9.212<br>(37.629)                 | 1.475<br>(32.218)                      | -0.803<br>(0.829)                         |
| Age 16-20 in initial year                  | 142.353<br>(255.884)      | 103.920<br>(147.424)        | 162.543<br>(132.290)            | 56.092<br>(87.020)                | 132.963<br>(106.924)                   | -4.405**<br>(2.171)                       |
| Age 21-25 in initial year                  | 854.433***<br>(207.884)   | 269.238*<br>(138.363)       | 265.871**<br>(120.608)          | 121.922<br>(90.511)               | 179.460**<br>(83.558)                  | 2.122<br>(1.932)                          |
| Age 26-30 in initial year                  | 806.274***<br>(186.917)   | 376.566***<br>(141.756)     | 326.565***<br>(120.613)         | 206.122**<br>(89.802)             | 120.997<br>(76.354)                    | -0.487<br>(1.790)                         |
| Age 31-35 in initial year                  | 625.402***<br>(171.713)   | 324.375**<br>(126.303)      | 334.235***<br>(113.155)         | 206.747***<br>(73.740)            | 149.252<br>(95.367)                    | -1.688<br>(1.376)                         |
| Age 36-40 in initial year                  | 616.715***<br>(155.939)   | 353.845***<br>(105.588)     | 281.165***<br>(107.992)         | 176.045**<br>(72.061)             | 140.002<br>(89.989)                    | -0.713<br>(1.350)                         |
| Age 41-45 in initial year                  | 613.403***<br>(156.816)   | 400.247***<br>(116.381)     | 270.580***<br>(93.600)          | 170.063***<br>(61.638)            | 112.588<br>(71.428)                    | -1.606<br>(1.377)                         |
| Age 46-50 in initial year                  | 600.249***<br>(144.200)   | 452.464***<br>(105.231)     | 112.833<br>(78.217)             | 78.309*<br>(45.807)               | 50.272<br>(65.800)                     | 0.605<br>(1.271)                          |
| Age 51-55 in initial year                  | 339.785**<br>(154.461)    | 402.718***<br>(111.438)     | -51.716<br>(76.748)             | -15.855<br>(50.463)               | -17.178<br>(60.701)                    | -0.193<br>(1.558)                         |
| Age 56-60 in initial year                  | 229.645*<br>(136.215)     | 208.756**<br>(91.678)       | 7.298<br>(85.804)               | 28.194<br>(52.881)                | 2.274<br>(64.227)                      | 0.679<br>(1.340)                          |
| Years of schooling in initial year         | -11.218<br>(9.024)        | 9.833<br>(6.187)            | -19.971***<br>(6.013)           | -21.052***<br>(5.030)             | 1.101<br>(3.990)                       | -0.013<br>(0.073)                         |
| Years of schooling in initial year squared | 0.369<br>(0.364)          | -0.944***<br>(0.209)        | 1.270***<br>(0.272)             | 1.269***<br>(0.243)               | 0.004<br>(0.167)                       | -0.000<br>(0.003)                         |
| Years of schooling of head in initial year | -7.912<br>(8.562)         | -16.966***<br>(5.875)       | 10.488*<br>(5.815)              | 6.092*<br>(3.320)                 | 3.961<br>(5.117)                       | -0.027<br>(0.065)                         |
| Age of household head in initial year      | -3.267                    | -9.201***                   | 4.897**                         | -0.445                            | 4.906**                                | -0.034                                    |

|  |              |              |               |            |             |           |
|--|--------------|--------------|---------------|------------|-------------|-----------|
|  | (3.979)      | (3.236)      | (2.472)       | (2.009)    | (1.973)     | (0.033)   |
| Minority household                       | 225.384*     | 319.613***   | -116.189**    | -38.112    | -84.635     | 0.947     |
|  | (121.485)    | (114.939)    | (57.644)      | (32.087)   | (52.724)    | (0.916)   |
| Household size in initial year           | 11.821       | -5.120       | 0.244         | 0.148      | -0.042      | 0.284**   |
|  | (11.164)     | (6.242)      | (5.317)       | (4.233)    | (3.308)     | (0.144)   |
| Number of girls 0-6 in initial year      | 28.791       | -16.514      | -92.690**     | -22.374    | -77.067***  | 3.025***  |
|  | (80.550)     | (52.295)     | (41.499)      | (31.404)   | (28.373)    | (0.880)   |
| Number of boys 0-6 in initial year       | 38.558       | -27.432      | 46.908        | 29.509     | 19.951      | 0.980     |
|  | (80.579)     | (43.896)     | (47.756)      | (33.236)   | (42.477)    | (0.919)   |
| Number of girls 7-15 in initial year     | 43.012       | 47.081*      | 23.471        | -18.744    | 38.441      | -0.369    |
|  | (52.183)     | (27.566)     | (39.270)      | (26.372)   | (34.272)    | (0.390)   |
| Number of boys 7-15 in initial year      | 35.246       | 103.194***   | -56.610*      | -81.965*** | 19.536      | -0.274    |
|  | (44.375)     | (34.737)     | (33.054)      | (22.767)   | (26.570)    | (0.362)   |
| Number of elderly female in initial year | 98.626       | 121.469      | 13.655        | 70.770     | -33.009     | -0.534    |
|  | (88.949)     | (80.223)     | (62.392)      | (56.596)   | (34.858)    | (0.735)   |
| Number of elderly male in initial year   | -168.939**   | -6.608       | -64.558       | -38.104    | -31.306     | -1.148    |
|  | (77.477)     | (56.259)     | (43.850)      | (35.459)   | (34.240)    | (0.840)   |
| Never married in initial year            | -432.687***  | -116.981     | -117.647      | -1.647     | -127.180**  | -6.072*** |
|  | (153.553)    | (84.017)     | (81.825)      | (58.079)   | (61.395)    | (1.220)   |
| (log) Income per capita in initial year  | 35.460       | -86.935***   | 134.474***    | 51.328***  | 83.442***   | -0.425    |
|  | (32.381)     | (26.555)     | (19.863)      | (14.823)   | (13.202)    | (0.262)   |
| Constant                                 | 1,264.901*** | 1,499.362*** | -1,315.527*** | -343.526*  | -911.420*** | 24.461*** |
|  | (360.041)    | (269.790)    | (253.072)     | (203.897)  | (189.376)   | (2.988)   |
| Number of observations                   | 3,050        | 3,366        | 3,353         | 3,389      | 3,369       | 3,128     |
| R2                                       | 0.089        | 0.199        | 0.120         | 0.127      | 0.044       | 0.091     |

Notes: The sample consists of all women who are present in all survey rounds. Total hours worked equal the sum of hours worked in agriculture (including time spent farming, home gardening, raising livestock/poultry, and fishing.), non-agriculture (including hours in wage labor and family business) and household chores (including buying and preparing food, doing laundry, and child care). Wage labor is defined as work that generates regular wage income in either primary and/or secondary occupations. Family business includes time spent on small handicraft and commercial household businesses. Yearly working hours are calculated by multiplying weekly days of work, daily working hours and months worked. 4.3 weeks in a month is assumed. When converting hours worked in household chores into a yearly value, 52 weeks are assumed. Province/year interactions are also included in the regressions but not reported. Standard errors are clustered at the village level. \* denotes significance at 10% level; \*\* denotes significance at 5% level; and \*\*\* denotes significance at 1% level.

**Table 8: First difference estimates of working hours by initial age cohort**

|                                  | Age16-20              | Age 21-35             | Age 36-50               | Age 51-60             | Age 61-70            |
|----------------------------------|-----------------------|-----------------------|-------------------------|-----------------------|----------------------|
| Total hours worked               | -418.687<br>(408.993) | 75.810<br>(195.233)   | -69.398<br>(79.501)     | 177.460*<br>(107.630) | 260.972<br>(246.344) |
| Obs. No                          | 124                   | 715                   | 1,413                   | 635                   | 163                  |
| Hours worked in agriculture      | -97.926*<br>(50.657)  | 113.047<br>(85.464)   | 129.093**<br>(61.629)   | 178.802**<br>(74.761) | 117.222<br>(183.553) |
| Obs. No                          | 187                   | 833                   | 1,487                   | 683                   | 176                  |
| Hours worked in non-agriculture  | -188.047<br>(225.276) | -102.646<br>(117.523) | -178.804***<br>(53.994) | -64.266<br>(44.719)   | -32.685<br>(127.749) |
| Obs. No                          | 185                   | 822                   | 1,479                   | 690                   | 177                  |
| Hours worked in wage labor       | -77.162<br>(203.039)  | -65.618<br>(93.489)   | -69.130**<br>(34.976)   | -6.857<br>(4.615)     | 85.267<br>(85.393)   |
| Obs. No                          | 187                   | 836                   | 1,497                   | 692                   | 177                  |
| Hours worked in family business  | -103.999*<br>(58.432) | -59.498<br>(77.474)   | -96.317**<br>(42.251)   | -57.292<br>(44.515)   | -117.952<br>(94.324) |
| Obs. No                          | 185                   | 831                   | 1,486                   | 690                   | 177                  |
| Hours worked on household chores | -1.445<br>(3.589)     | 1.552<br>(2.301)      | -0.278<br>(0.747)       | 1.520<br>(1.318)      | 3.044<br>(4.238)     |
| Obs. No                          | 125                   | 744                   | 1,450                   | 645                   | 164                  |

Notes: See notes for Table 7. Coefficients on household migration status (lagged) are reported. Other included but unreported variables are the same as are include in Table 7 and province/year interactions. Standard errors are clustered at the village level. \* denotes significance at 10% level; \*\* denotes significance at 5% level; and \*\*\* denotes significance at 1% level.

**Table 9: Impacts of different household members' migration on yearly hours worked across activities**

|                         | <b>Total hours worked</b> | <b>Hours worked in agr.</b> | <b>Hours worked in non-agr.</b> | <b>Hours worked in wage labor</b> | <b>Hours worked in family business</b> | <b>Hours worked in household chores (weekly)</b> |
|-------------------------|---------------------------|-----------------------------|---------------------------------|-----------------------------------|--|--|
| <b>Total</b>            |                           |                             |                                 |                                   |  |  |
| Children migrated       | 54.740<br>(62.992)        | 217.113***<br>(49.866)      | -146.556***<br>(40.821)         | -57.960**<br>(24.358)             | -89.217***<br>(33.205)                 | 0.070<br>(0.696)                                 |
| Husband migrated        | -35.929<br>(188.425)      | 136.484<br>(107.867)        | -161.052*<br>(96.364)           | -149.779***<br>(51.182)           | -17.996<br>(85.878)                    | 0.696<br>(2.212)                                 |
| Other migrated          | -16.887<br>(122.929)      | -37.483<br>(73.712)         | -63.027<br>(71.308)             | 46.560<br>(60.880)                | -96.341**<br>(42.103)                  | 1.315<br>(1.235)                                 |
| <b>Age 16-20</b>        |                           |                             |                                 |                                   |  |  |
| Other migrated          | -418.687<br>(408.993)     | -97.926*<br>(50.657)        | -188.047<br>(225.276)           | -77.162<br>(203.039)              | -103.999*<br>(58.432)                  | -1.445<br>(3.589)                                |
| <b>Age 21-35</b>        |                           |                             |                                 |                                   |  |  |
| Husband migrated        | 21.130<br>(282.460)       | 213.469*<br>(115.152)       | -187.993<br>(155.619)           | -219.454***<br>(84.302)           | 32.642<br>(136.851)                    | 0.818<br>(3.349)                                 |
| Other migrated          | 125.201<br>(239.978)      | 13.964<br>(126.395)         | -15.589<br>(164.150)            | 87.256<br>(141.296)               | -152.466*<br>(78.390)                  | 2.193<br>(2.869)                                 |
| <b>Age 36-50</b>        |                           |                             |                                 |                                   |  |  |
| Children migrated       | -70.198<br>(74.291)       | 161.299**<br>(63.270)       | -192.216***<br>(58.826)         | -105.639***<br>(36.648)           | -86.720*<br>(45.058)                   | -0.504<br>(0.752)                                |
| Husband migrated        | 432.004<br>(267.183)      | 498.265<br>(344.061)        | -301.028***<br>(108.830)        | -215.854***<br>(65.288)           | -77.334<br>(121.100)                   | 5.313<br>(4.898)                                 |
| Other migrated          | -42.094<br>(163.449)      | -47.344<br>(108.646)        | -43.488<br>(105.816)            | 58.039<br>(94.397)                | -55.075<br>(75.578)                    | 0.657<br>(1.527)                                 |
| <b>Age 51-60</b>        |                           |                             |                                 |                                   |  |  |
| Children migrated       | 213.788*<br>(111.066)     | 214.798**<br>(84.588)       | -73.358*<br>(44.261)            | -4.335<br>(3.835)                 | -68.931<br>(44.259)                    | 1.556<br>(1.372)                                 |
| Husband migrated        | -105.577<br>(479.903)     | -29.295<br>(181.815)        | 7.717<br>(175.618)              | -25.746<br>(18.718)               | 33.609<br>(171.804)                    | -0.150<br>(3.859)                                |
| Other migrated          | 197.761<br>(367.204)      | 43.072<br>(354.476)         | 34.872<br>(167.537)             | -0.196<br>(12.556)                | 35.328<br>(167.824)                    | 2.365<br>(3.075)                                 |
| <b>Age 61 and above</b> |                           |                             |                                 |                                   |  |  |
| Children migrated       | 447.978*<br>(253.564)     | 259.797<br>(163.164)        | -61.971<br>(120.874)            | 71.551<br>(73.263)                | -133.522<br>(94.901)                   | 5.414<br>(3.992)                                 |
| Husband migrated        | -623.473<br>(1,068.477)   | 33.147<br>(826.197)         | 174.190<br>(195.997)            | -69.453<br>(75.592)               | 243.643<br>(177.501)                   | -15.102*<br>(9.007)                              |
| Other migrated          | -483.022<br>(417.992)     | -350.153**<br>(166.462)     | -357.405<br>(306.039)           | 73.729<br>(72.612)                | -431.134<br>(296.289)                  | 5.476<br>(4.315)                                 |

Notes: See notes for Table 7. Migration variables are valued at one period lagged. Other included but unreported variables are as given in Table 7 along with province/year interactions. Standard errors are clustered at the village level. \* denotes significance at 10% level; \*\* denotes significance at 5% level; and \*\*\* denotes significance at 1% level.

**Table 10: Impacts of out versus return migration on yearly hours worked across activities**

|                   | <b>Total<br/>hours<br/>worked</b> | <b>Hours<br/>worked in<br/>agr.</b> | <b>Hours<br/>worked in<br/>non-agr.</b> | <b>Hours<br/>worked in<br/>wage labor</b> | <b>Hours<br/>worked in<br/>family<br/>business</b> | <b>Hours<br/>worked in<br/>household<br/>chores<br/>(weekly)</b> |
|-------------------|-----------------------------------|-------------------------------------|---|---|--|--|
| <b>Total</b>      |                                   |                                     |   |   |  |  |
| Return migration  | 3.985<br>(68.567)                 | 47.903<br>(42.843)                  | -65.071<br>(47.915)                     | -21.130<br>(28.530)                       | -48.215<br>(36.182)                                | 0.689<br>(0.644)   |
| Out migration     | 60.706<br>(76.696)                | 132.233**<br>(54.180)               | -119.231***<br>(38.700)                 | -61.299**<br>(29.041)                     | -66.093*<br>(35.118)                               | 0.129<br>(0.874)   |
| <b>Age 16-20</b>  |                                   |                                     |   |   |  |  |
| Return migration  | 207.877<br>(532.058)              | -205.933<br>(172.977)               | -54.736<br>(168.134)                    | -19.375<br>(156.917)                      | -27.816<br>(70.656)                                | 8.566**<br>(3.397)   |
| Out migration     | -871.195**<br>(389.426)           | -103.988<br>(86.567)                | -457.783**<br>(207.947)                 | -308.314*<br>(164.525)                    | -136.825<br>(112.297)                              | -4.429<br>(2.839)  |
| <b>Age 21-35</b>  |                                   |                                     |   |   |  |  |
| Return migration  | -1.407<br>(153.704)               | 188.458*<br>(112.519)               | -241.420**<br>(109.758)                 | -14.112<br>(104.329)                      | -231.007***<br>(51.643)                            | 2.297<br>(1.435)   |
| Out migration     | 386.149*<br>(218.736)             | 198.496<br>(122.942)                | 13.485<br>(175.745)                     | -66.178<br>(138.413)                      | 52.143<br>(131.565)                                | 1.884<br>(2.772)   |
| <b>Age 36-50</b>  |                                   |                                     |   |   |  |  |
| Return migration  | -78.624<br>(78.604)               | 21.671<br>(45.228)                  | -93.707<br>(58.205)                     | -47.761*<br>(27.810)                      | -56.103<br>(47.477)                                | -0.187<br>(0.712)  |
| Out migration     | -77.634<br>(118.784)              | 67.694<br>(80.186)                  | -195.739***<br>(66.566)                 | -119.285***<br>(44.119)                   | -84.138<br>(53.811)                                | 0.261<br>(1.037)   |
| <b>Age 51-60</b>  |                                   |                                     |   |   |  |  |
| Return migration  | 170.748<br>(139.830)              | 31.068<br>(82.722)                  | 162.773*<br>(90.887)                    | 10.660<br>(13.059)                        | 152.056*<br>(89.733)                               | 0.307<br>(1.867)   |
| Out migration     | 82.018<br>(150.153)               | 216.776**<br>(98.326)               | -71.930<br>(47.135)                     | -9.903<br>(6.659)                         | -61.859<br>(46.587)                                | -1.474<br>(1.673)  |
| <b>Age 61 -70</b> |                                   |                                     |   |   |  |  |
| Return migration  | -188.993<br>(282.174)             | -178.871<br>(128.067)               | -14.122<br>(167.076)                    | -27.162<br>(26.832)                       | 13.039<br>(162.523)                                | 0.156<br>(4.185)   |
| Out migration     | 460.508<br>(433.675)              | -68.876<br>(246.860)                | 152.588<br>(253.275)                    | 238.615<br>(222.542)                      | -86.027<br>(94.925)                                | 6.163<br>(5.727)   |

Notes: See notes for Table 7. Migration variables are valued at one period lag. Out migration is defined as 1 if at least one household member has migrated for work out from time t-1 to time t, and 0 otherwise. Return migration is defined as 1 if at least one household member has returned from work-related migration from time t-1 to time t. Other included but unreported variables are as given in Table 7 along with province/year interactions. Standard errors are clustered at the village level. \* denotes significance at 10% level; \*\* denotes significance at 5% level; and \*\*\* denotes significance at 1% level.

**Table 11: First difference estimates of impacts on having primary responsibility for household agriculture activities**

|                                | <b>Total</b>      | <b>Age16-20</b>   | <b>Age 21-35</b>  | <b>Age 36-50</b>  | <b>Age 51-60</b>  | <b>Age 61-70</b>  |
|--------------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| In charge of farming           | -0.015<br>(0.025) | 0.018<br>(0.014)  | 0.025<br>(0.063)  | -0.029<br>(0.040) | -0.015<br>(0.043) | -0.004<br>(0.075) |
| In charge of fishing           | 0.001<br>(0.004)  |                   | -0.007<br>(0.004) | 0.001<br>(0.006)  | 0.009<br>(0.013)  |                   |
| In charge of raising livestock | -0.004<br>(0.022) | -0.024<br>(0.047) | 0.040<br>(0.063)  | -0.008<br>(0.036) | -0.012<br>(0.055) | -0.063<br>(0.171) |

Notes: Coefficients on household migration status (lagged) are reported. Other included but unreported variables are the same as are included in Table 7. Standard errors are clustered at the village level. \* denotes significance at 10% level; \*\* denotes significance at 5% level; and \*\*\* denotes significance at 1% level.

**Table 12: First difference estimates of health outcomes and behavior**

|                         | <b>Total</b>      | <b>Age16-20</b>   | <b>Age 21-35</b>  | <b>Age 36-50</b>   | <b>Age 51-60</b>  | <b>Age 61-70</b>  |
|-------------------------|-------------------|-------------------|-------------------|--------------------|-------------------|-------------------|
| Worsening health status | -0.003<br>(0.018) | 0.063<br>(0.059)  | -0.077<br>(0.048) | 0.006<br>(0.022)   | -0.001<br>(0.037) | 0.103<br>(0.094)  |
| High blood pressure     | -0.004<br>(0.009) |                   | -0.010<br>(0.009) | 0.002<br>(0.012)   | -0.018<br>(0.030) | -0.028<br>(0.109) |
| BMI                     | 0.173<br>(0.115)  | -0.581<br>(0.690) | -0.262<br>(0.279) | 0.294**<br>(0.135) | 0.109<br>(0.278)  | -0.084<br>(0.782) |
| Drinking                | -0.008<br>(0.006) |                   | -0.009<br>(0.008) | -0.014*<br>(0.007) | 0.007<br>(0.016)  | -0.027<br>(0.072) |

Notes: Worsening health status is defined as 1 if self-reported health status is worse than reported in the previous survey round. There are four choices for the self-reported health status: excellent, good, fair and bad. High blood pressure is equal to 1 if the individual is diagnosed with high blood pressure, 0 otherwise. Drinking is a dummy variable equal to 1 if the respondent drinks alcohol. Coefficients on household migration status (lagged) are reported. Other included but unreported variables are the same as are included in Table 7. Standard errors are clustered at the village level. \* denotes significance at 10% level; \*\* denotes significance at 5% level; and \*\*\* denotes significance at 1% level

**Appendix Table 1: Descriptive statistics of initial year characteristics of women in migrant and non-migrant households**

|  | total  |          | migrant households |         | non-migrant households |          |
|--|--------|----------|--------------------|---------|------------------------|----------|
| aged 16-20                               | 0.075  | (0.264)  | 0.062              | (0.241) | 0.08                   | (0.272)  |
| aged 21-25                               | 0.072  | (0.258)  | 0.034              | (0.181) | 0.083                  | (0.276)  |
| aged 26-30                               | 0.103  | (0.304)  | 0.04               | (0.196) | 0.123                  | (0.328)  |
| aged 31-35                               | 0.124  | (0.330)  | 0.104              | (0.306) | 0.132                  | (0.339)  |
| aged 36-40                               | 0.113  | (0.316)  | 0.128              | (0.335) | 0.108                  | (0.310)  |
| aged 41-45                               | 0.132  | (0.338)  | 0.198              | (0.399) | 0.108                  | (0.310)  |
| aged 46-50                               | 0.138  | (0.345)  | 0.196              | (0.397) | 0.118                  | (0.322)  |
| aged 51-55                               | 0.113  | (0.316)  | 0.13               | (0.337) | 0.107                  | (0.310)  |
| aged 56-60                               | 0.084  | (0.278)  | 0.07               | (0.256) | 0.091                  | (0.288)  |
| aged 61-64                               | 0.046  | (0.209)  | 0.037              | (0.190) | 0.05                   | (0.217)  |
| years of schooling                       | 6.747  | (3.556)  | 6.729              | (3.331) | 6.736                  | (3.675)  |
| years of schooling of head               | 6.821  | (3.486)  | 6.771              | (3.184) | 6.817                  | (3.613)  |
| age of head                              | 47.302 | (10.659) | 46.923             | (8.865) | 47.45                  | (11.291) |
| ethnic minority household head           | 0.136  | (0.343)  | 0.162              | (0.369) | 0.127                  | (0.333)  |
| household size                           | 4.292  | (2.145)  | 4.691              | (2.293) | 4.117                  | (2.062)  |
| number of female children younger than 6 | 0.102  | (0.318)  | 0.071              | (0.283) | 0.114                  | (0.329)  |
| number of male children younger than 6   | 0.133  | (0.371)  | 0.094              | (0.309) | 0.146                  | (0.390)  |
| number of female children aged 7-15      | 0.308  | (0.571)  | 0.47               | (0.677) | 0.248                  | (0.514)  |
| number of male children aged 7-15        | 0.354  | (0.579)  | 0.52               | (0.664) | 0.292                  | (0.530)  |
| number of working age men (16-60)        | 1.556  | (0.784)  | 1.682              | (0.841) | 1.515                  | (0.757)  |
| number of working age women (16-60)      | 1.509  | (0.865)  | 1.528              | (0.798) | 1.518                  | (0.885)  |
| number of elderly women (60 or older)    | 0.136  | (0.350)  | 0.133              | (0.342) | 0.139                  | (0.355)  |
| number of elderly men (60 or older)      | 0.117  | (0.324)  | 0.087              | (0.282) | 0.131                  | (0.340)  |
| married                                  | 0.787  | (0.410)  | 0.826              | (0.379) | 0.775                  | (0.418)  |
| single                                   | 0.17   | (0.376)  | 0.128              | (0.334) | 0.183                  | (0.387)  |
| household real income per capita (log)   | 7.937  | (1.084)  | 7.777              | (1.114) | 8.012                  | (1.062)  |
| household member has bad health          | 0.088  | (0.283)  | 0.111              | (0.314) | 0.08                   | (0.271)  |
| Liaoning                                 | 0.052  | (0.222)  | 0.041              | (0.198) | 0.057                  | (0.231)  |
| Heilongjiang                             | 0.117  | (0.322)  | 0.031              | (0.174) | 0.153                  | (0.360)  |
| Jiangsu                                  | 0.092  | (0.289)  | 0.098              | (0.298) | 0.089                  | (0.285)  |
| Shandong                                 | 0.138  | (0.345)  | 0.087              | (0.282) | 0.158                  | (0.365)  |
| Henan                                    | 0.113  | (0.316)  | 0.127              | (0.333) | 0.108                  | (0.310)  |
| Hubei                                    | 0.114  | (0.318)  | 0.172              | (0.377) | 0.09                   | (0.286)  |
| Hunan                                    | 0.107  | (0.310)  | 0.116              | (0.321) | 0.105                  | (0.306)  |
| Guangxi                                  | 0.143  | (0.350)  | 0.189              | (0.392) | 0.122                  | (0.328)  |
| Guizhou                                  | 0.124  | (0.330)  | 0.139              | (0.346) | 0.118                  | (0.323)  |
| obs.                                     | 3401   |          | 1252               |         | 2149                   |          |

**Appendix Table 2: Probit of women's migration 2000-2006**

|  | coef      | se    |
|--|-----------|-------|
| Aged 7-16 in 1997                                | 0.606***  | 0.098 |
| Aged 17-23 in 1997                               | 0.538***  | 0.125 |
| Aged 24-30 in 1997                               | 0.459***  | 0.117 |
| Aged 31-35 in 1997                               | 0.321***  | 0.107 |
| Aged 36-52 in 1997                               | 0.133**   | 0.063 |
| Years of schooling in 1997                       | 0.020***  | 0.007 |
| Years of schooling in 1997 squared               | -0.001*   | 0.000 |
| Age interaction with years of schooling          | -0.000**  | 0.000 |
| Was married                                      | -0.042    | 0.027 |
| Had child(ren) in 1997                           | -0.013    | 0.017 |
| Head's years of schooling in 1997                | -0.006*** | 0.001 |
| Number of girls less than 6 in 1997              | -0.011    | 0.013 |
| Number of boys less than 6 in 1997               | 0.003     | 0.010 |
| Number of girls aged 7-15 in 1997                | 0.001     | 0.006 |
| Number of boys aged 7-15 in 1997                 | 0.017**   | 0.008 |
| Number of working age women (16-60) in 1997      | -0.002    | 0.008 |
| Number of working age men (16-60) in 1997        | 0.027***  | 0.007 |
| Number of women 60 + in 1997                     | 0.002     | 0.012 |
| Number of men 60 + in 1997                       | -0.012    | 0.015 |
| Father/father-in-law alive in 1997               | 0.015     | 0.013 |
| Mother/mother-in-law alive in 1997               | -0.028    | 0.019 |
| Household assets per capita in 1997 (log)        | 0.045*    | 0.026 |
| Assets squared                                   | -0.004**  | 0.002 |
| % of people in the village migrated in 1997      | 0.003**   | 0.001 |
| Migration *education                             | 0.000     | 0.000 |
| Village had a primary school in 1997             | 0.024**   | 0.009 |
| Village had a junior middle school in 1997       | 0.015     | 0.016 |
| Village had a senior middle school in 1997       | -0.033**  | 0.013 |
| % villagers working in large enterprises in 1997 | -0.001**  | 0.000 |
| % villagers working in small enterprises in 1997 | -0.001**  | 0.000 |

|  |           |       |
|--|-----------|-------|
| Distance to the nearest bus stop in 1997           | 0.003     | 0.002 |
| Distance(km) to nearest public bath                | 0.001**   | 0.000 |
| Telephone service available in the village in 1997 | 0.019     | 0.012 |
| Guizhou  | -0.000    | 0.018 |
| Heilongjiang                                       | -0.068*** | 0.010 |
| Jiangsu  | 0.026     | 0.025 |
| Shandong   | -0.003    | 0.018 |
| Hubei  | 0.042*    | 0.025 |
| Hunan  | -0.016    | 0.016 |
| Guangxi  | -0.009    | 0.021 |
| Number of observations                             | 3,301     |       |
| Pseudo R <sup>2</sup>                              | 0.359     |       |

Note: Estimated probit coefficients are transformed into marginal impacts, evaluated at the mean of the dependent variable. Robust t statistics (corrected for serial correlation within village and arbitrary heteroskedasticity) in parentheses. \* denotes significance at 10% level; \*\* denotes significance at 5% level; and \*\*\* denotes significance at 1% level.

**Appendix Table 3: Sample means of working hours**

|  | 1997    | 2000    | 2004    | 2006    |
|--|---------|---------|---------|---------|
| Total working hours (yearly)               | 2164.32 | 1854.94 | 1819.17 | 1722.57 |
| ___ Initial age 16-20                      | 1453.5  | 709.3   | 703.49  | 1583.49 |
| ___ Initial age 21-35                      | 2275.42 | 2036.58 | 2056.06 | 2003.35 |
| ___ Initial age 36-50                      | 2383.29 | 2068.61 | 1873.53 | 1748.85 |
| ___ Initial age 51-60                      | 2011.72 | 1672.67 | 1478.3  | 1275.61 |
| ___ Initial age 61-70                      | 1764.49 | 1360.02 | 1103.03 | 1005.22 |
| Working hours in agriculture (yearly)      | 916.72  | 669.91  | 518.19  | 458.73  |
| ___ Initial age 16-20                      | 107.58  | 164.08  | 191.72  | 61.73   |
| ___ Initial age 21-35                      | 822.64  | 635.71  | 518.54  | 455.36  |
| ___ Initial age 36-50                      | 1127.1  | 822.72  | 651.66  | 577.52  |
| ___ Initial age 51-60                      | 889.38  | 660.43  | 462.47  | 357.5   |
| ___ Initial age 61-70                      | 759.29  | 515.51  | 256.58  | 186.82  |
| Working hours in non-agriculture (yearly)  | 415.13  | 388.23  | 348.66  | 365.79  |
| ___ Initial age 16-20                      | 240.15  | 280.73  | 196.66  | 309.54  |
| ___ Initial age 21-35                      | 548.27  | 544.16  | 523.76  | 594.7   |
| ___ Initial age 36-50                      | 463.73  | 410.1   | 337.55  | 338.97  |
| ___ Initial age 51-60                      | 206.33  | 147.73  | 152.01  | 71.82   |
| ___ Initial age 61-70                      | 84.44   | 71.28   | 16.14   | 7.69    |
| Working hours in family business (yearly)  | 174.45  | 172.36  | 174.83  | 189.8   |
| ___ Initial age 16-20                      | 69.57   | 108.36  | 32.34   | 114.16  |
| ___ Initial age 21-35                      | 188.31  | 193.73  | 243.63  | 276.4   |
| ___ Initial age 36-50                      | 206.37  | 199.62  | 164.67  | 194.1   |
| ___ Initial age 51-60                      | 142.17  | 118.7   | 147.08  | 66.44   |
| ___ Initial age 61-70                      | 84.44   | 71.28   | 13.3    | 7.69    |
| Working hours in wage labor (yearly)       | 244.99  | 220.36  | 176.42  | 183.06  |
| ___ Initial age 16-20                      | 167.86  | 171.56  | 164.32  | 195.38  |
| ___ Initial age 21-35                      | 374.52  | 349.46  | 284.16  | 329.93  |
| ___ Initial age 36-50                      | 255.85  | 221.57  | 174.98  | 150.29  |
| ___ Initial age 51-60                      | 64.16   | 28.9    | 4.91    | 5.33    |
| ___ Initial age 61-70                      | 0       | 0       | 2.84    | 0       |
| Working hours in household chores (weekly) | 18.62   | 16.66   | 17.9    | 16.99   |
| ___ Initial age 16-20                      | 11.25   | 4.5     | 5.81    | 12.14   |
| ___ Initial age 21-35                      | 20.9    | 18.42   | 18.48   | 16.89   |
| ___ Initial age 36-50                      | 18.16   | 17.26   | 18.32   | 17.48   |
| ___ Initial age 51-60                      | 19.09   | 17.4    | 17.32   | 16.66   |
| ___ Initial age 61-70                      | 19.68   | 16.77   | 15.67   | 15.34   |

Notes: Means are reported for the non-migrant women who have been in the survey for at least three consecutive rounds. The number of observations for 1997, 2000, 2004 and 2006 is 2114, 2689, 2689 and 2354 respectively. The number of observations for non-missing working hours for these four years is 1836, 2420, 2136 and 1971 respectively.

**Appendix Table 4: Sample means of labor participation**

|                                   | 1997 | 2000 | 2004 | 2006 |
|-----------------------------------|------|------|------|------|
| Participation in agriculture      | 0.74 | 0.64 | 0.57 | 0.58 |
| ___ Initial age 16-20             | 0.22 | 0.35 | 0.36 | 0.23 |
| ___ Initial age 21-35             | 0.79 | 0.72 | 0.66 | 0.7  |
| ___ Initial age 36-50             | 0.82 | 0.7  | 0.67 | 0.65 |
| ___ Initial age 51-60             | 0.62 | 0.54 | 0.4  | 0.37 |
| ___ Initial age 61-70             | 0.53 | 0.38 | 0.25 | 0.19 |
| Participation in non-agriculture  | 0.76 | 0.67 | 0.48 | 0.46 |
| ___ Initial age 16-20             | 0.19 | 0.37 | 0.34 | 0.21 |
| ___ Initial age 21-35             | 0.82 | 0.75 | 0.56 | 0.57 |
| ___ Initial age 36-50             | 0.84 | 0.73 | 0.57 | 0.51 |
| ___ Initial age 51-60             | 0.65 | 0.55 | 0.3  | 0.25 |
| ___ Initial age 61-70             | 0.52 | 0.4  | 0.16 | 0.13 |
| Participation in family business  | 0.66 | 0.56 | 0.4  | 0.37 |
| ___ Initial age 16-20             | 0.1  | 0.26 | 0.27 | 0.1  |
| ___ Initial age 21-35             | 0.66 | 0.59 | 0.44 | 0.42 |
| ___ Initial age 36-50             | 0.75 | 0.64 | 0.49 | 0.45 |
| ___ Initial age 51-60             | 0.61 | 0.51 | 0.3  | 0.24 |
| ___ Initial age 61-70             | 0.52 | 0.39 | 0.16 | 0.13 |
| Participation in wage labor       | 0.12 | 0.12 | 0.09 | 0.1  |
| ___ Initial age 16-20             | 0.09 | 0.12 | 0.07 | 0.13 |
| ___ Initial age 21-35             | 0.18 | 0.19 | 0.15 | 0.18 |
| ___ Initial age 36-50             | 0.12 | 0.12 | 0.09 | 0.08 |
| ___ Initial age 51-60             | 0.04 | 0.05 | 0    | 0.01 |
| ___ Initial age 61-70             | 0.01 | 0.01 | 0.01 | 0    |
| Participation in household chores | 0.99 | 0.98 | 0.81 | 0.85 |
| ___ Initial age 16-20             | 0.91 | 0.93 | 0.96 | 0.91 |
| ___ Initial age 21-35             | 1    | 0.98 | 0.81 | 0.85 |
| ___ Initial age 36-50             | 1    | 0.99 | 0.91 | 0.93 |
| ___ Initial age 51-60             | 0.99 | 0.99 | 0.86 | 0.89 |
| ___ Initial age 61-70             | 1    | 0.99 | 0.79 | 0.85 |

Notes: Means are reported for the non-migrant women who have been in the survey for at least three consecutive rounds. The number of observations for 1997, 2000, 2004 and 2006 is 2114, 2689, 2689 and 2354 respectively.