Ganyu Labor in Malawi: Efficiency Problems and Determinants of Supply

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Abstract

Poor rural households in Malawi often chose to supplement their income through additional casual work on other farms ("ganyu" labor). Based on data from the Second Integrated Household Survey for 2004, we explore the potential objectives and determinants of ganyu supply. We find a confirmation of the neoclassical theoretical hypothesis whereby households use ganyu as a consumption smoothing option and supply ganyu in response to a higher marginal product of this particular type of labor as opposed to own farm labor. While our results therefore reject the alternative hypothesis of a backward bending labor supply curve, they reveal interesting insurance and cultural patterns of the allocation of labor across own farm and foreign farm activities in rural Malawi. Village level shocks increase the gross amount of ganyu supply across families that tend to supply labor and families that tend to demand ganyu labor. Women headed households appear to make a particularly strong use of ganyu as an insurance through social networks and for this purpose simultaneously supply and demand ganyu. And ganyu is particularly widely spread in ethno-cultural contexts with matrilineal systems, i.e. predominantly in the South and the Center of the country. However, enhanced education for individual peasants as well as for the community as a whole, encouragement of cash crop growing practices and crop diversification appear to open up some alternatives to traditional ganyu labor.

JEL Codes: O12, J22, J24

1. Introduction

In Malawi just as in many other developing countries, poor rural households have a certain choice to live from their own agricultural production or to supplement their income through additional casual work on other farms. In Malawi, the latter is called "ganyu" and is widely spread throughout the country. According to data from the Second Integrated Household Survey for 2004 (Malawi Government, 2004), overall, about 52% of all rural households offer ganyu.[1] And even within urban households ganyu appears to play a certain role.

Given that urban households only represent a small minority of about 11% of the total population, and that decision making processes for these households may be determined by other considerations, we will discard them from our analysis. In the Malawi context, for most rural households, we can safely assume that there is effectively no additional option but labor on one's own or on a foreign farm. This changes the situation examined here from the one typically analyzed in rural labor market models (for a review, see Lanjouw and Lanjouw, 1995). These models generally discuss the choice between labor and leisure, and beyond this, the choice between on- and off-farm labor. The crucial difference is that in such a context, exogenous shocks like a drought will directly affect only one market, reduce productivity there and thereby create incentives for a stronger supply of labor in the other market. If the labor options are limited to the agricultural sector alone, such exogenous shocks will, however, affect productivity everywhere simultaneously.

The problems induced by this kind of situation are first discussed in the Malawi context by Whiteside (2000). The author comes to the conclusion that ganyu is highly problematic because it (i) induces households to supply more ganyu the lower the wage (suggesting a perverse supply function), and (ii) leads households to neglect their own fields in order to be able to supply enough ganyu. These conclusions are reached predominantly on the basis of local observation of household behavior, either by the author himself, or by other authors he reviews.

In this paper, our intention is to follow up on the above observations, by providing a more systematic theoretical framework and survey based empirical tests. Moreover, we will discuss the different determinants of ganyu supply which turn out to be significant in the ganyu supply equation. In particular, we will examine the role of culture and ethnicity, but also of education and of agricultural diversification strategies. It is hoped that this will shed some light on what could be done to reduce rural households' vulnerability.

To set the scene, Section 2 provides the theoretical discussion about the conditions in which a situation such as described by Whiteside (2000) can actually arise. Section 3 presents some descriptive statistics based on the Second Integrated Household Survey to check the plausibility of these conditions in the context of rural Malawi. Section 4 provides our econometric estimation of the ganyu supply function and discusses the determinants of the households' ganyu supply decision. The conclusions are presented in Section 5.

[1] All population means are calculated taking into account the appropriate household weights (estimation using STATA survey data commands).

2. Why ganyu could be a problem: Some theoretical considerations

First of all, ganyu represents an additional option for rural households. As they are free to decide whether or not to supply ganyu, neoclassical economic theory would suggest that they can only be better off if this option exists (Polzin and MacDonald, 1971; Huffman, 1980; Rosenzweig, 1980). One would expect households' labor allocation decision to merely depend upon the productivity and respective wages in the two "sectors" home and foreign farming. Households would be expected to supply ganyu whenever the wage received on the foreign farm exceeds the (shadow) wage received for home production. This should lead to an overall efficient allocation of labor into the most productive activities and therefore also have a positive effect on the overall welfare of the rural community or region.

However, there may be exceptions to this rule for different reasons: First, there may be *inter-temporal productivity effects of labor*. In this case, spending time and effort on somebody else's farm through ganyu may lead to reduced productivity on one's own farm in the following period. Whiteside (2000) provides some examples for this, e.g. sowing takes place too late, or the plot is not properly prepared, so that the next harvest and even future land use may be negatively affected. The problem is that both at home and on the foreign farm, the period necessitating the highest labor input comes at the same time. Indeed, in Malawi, the peak agricultural labor period is from November to January, just at the same time of sowing. The consequences may *not be foreseeable* for the peasant when he engages in ganyu in the first place. He might thus think to make additional gains, while in fact, the opposite is true.

Nevertheless, while it is plausible to assume that expectations may sometimes differ from actual developments, it is less plausible that this should happen consistently over and over again. Rather, we would assume the household to form expectations about the overall impact of his allocation of labor which should be correct at least on average.

However, even if we assume full information, there may still be situations in which the household decides to supply ganyu even though this is inefficient from an overall productivity perspective. This can happen, in particular, when inter-temporal productivity effects coincide with *binding consumption constraints*. As the household has to ensure a certain minimum level of consumption in each period, supplying ganyu may be the only way to meet this requirement. If the household can reach the minimum consumption level with ganyu, but not without ganyu, this implies that *current wages* for ganyu are higher than the shadow wages for work on the household's own plot. Nevertheless, the positive productivity effect of work on the household's own plot on *shadow wages in the next period* might have more than outweighed this loss in the current period. In this event, only the consumption constraint would drive the household to supply ganyu and overall (inter-temporal) productivity will be reduced.

This kind of situation may be reinforced if there are *long-term relationships* between households supplying and households demanding ganyu. Whiteside (2000) notes that households sometimes supply ganyu even in periods in which they do not have to struggle to meet their consumption constraints and in which, at the same time, their labor would be highly productive at home. The authors explain this situation by the fact that in order to make sure to be allowed to provide ganyu in a period of need, poor rural households tend to sustain their ganyu relationship over time.

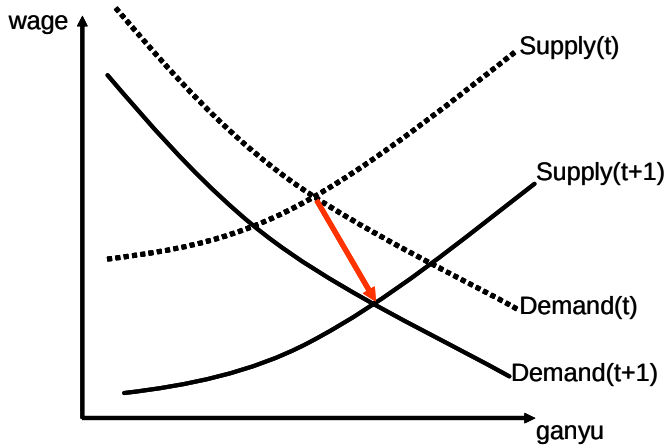
Assuming the usual concave production function in foreign farms, with marginal productivity of labor converging to zero or even becoming negative after some point, these farms will only be willing to employ a limited number of ganyu laborers. As droughts or other exogenous shocks tend to have a simultaneous negative impact on the agricultural production in a whole region, periods of need for any given household are positively correlated with periods of need of other households. Thus ganyu supply may substantially rise for many households at a time. Simultaneously, the same shock may depress the possibility of a productive use of these laborers on foreign farms. Therefore, there may indeed be a relevant risk of not finding employment in such periods of need. Long-term ganyu relations could work as some kind of an *insurance system* against this risk. Understanding ganyu as such kind of an insurance system could explain situations in which households provide ganyu *even if current productivity and wages are lower in the foreign than in their own farm.*

Overall, these theoretical arguments show that ganyu in Malawi may be essential for poor rural households' survival strategy, while, at the same time, it may indeed reduce their current and long-term productivity. What would be the policy implications of such a diagnostis? Obviously not to regulate or abolish ganyu, but rather to strive for policies reducing poor households' risk to fail to meet their minimum consumption requirements.

Conversely, a situation in which the economically optimal policy response would indeed include the regulation of the ganyu market, is the event of a *"perverse" supply function*, i.e. a situation in which lower wages lead to increased ganyu supply, so that the ganyu supply curve would be negatively rather than positively sloped. Such a situation may again arise out of binding consumption constraints. Whiteside (2000) seems to believe that this is the case in Malawi. In the event of a perverse supply curve, as the demand curve is negatively sloped as well, there is no guarantee for any equilibrium to be reached. As wages fall, labor supply will increase, and wages will continue to fall and thus lead to continuous impoverishment. The continuous fall can be blocked, for instance, through a fixed minimum wage.

While this kind of an extreme situation is conceptually possible, it is easily confounded with a different situation in which the observed negative relationship between wages and ganyu only reflects a simultaneous shift of demand and supply. This is the well-known problem to identify the demand and supply equation individually when actually only equilibrium values are observed. Figure 1 illustrates the problem for the event of a drought, i.e. an exogenous shock negatively affecting both ganyu demand and supply in t+1.

Figure 1: The possible effect of a drought on the equilibrium in the ganyu market



Here the supply curve has the usual positive slope, and nevertheless, we observe increased ganyu at lower wages in t+1. This observation alone is thus not necessarily problematic and also not necessarily related to any binding consumption restriction. Further empirical investigation is required to indicate which of the above theoretical frameworks characterize best the Malawi ganyu market. This analysis will be provided in Sections 3 and 4.

3. Who supplies and demands ganyu in Malawi? Data and initial descriptive statistics

To analyze the situation of ganyu in Malawi we use the Second Integrated Household Survey 2004 (Malawi Government, 2004). Data were collected between spring 2003 and spring 2004. The survey covers a stratified random sample of 11 280 households over the whole area of the country. Overall, 11 280 households and 52 702 individuals corresponding to 0.42% of the Malawi population are included in the sample. Table 1 presents some general household characteristics for the Malawi population.

Table 1: Characteristics of households in Malawi (population estimates)

	Ganyu supplying households (no demand)	Ganyu demanding households (no supply)	Households with both supply and demand of ganyu	Households with neither supply nor demand of ganyu
Share of households	41.3%	14.4%	7.6%	36.7%
	(0.008)	(0.005)	(0.003)	(0.008)
Share of households engaged in agriculture	94.3%	99.9%	99.9	76.9%
	(0.006)	(0.001)	(0.001)	(0.016)
Subjective income level, average (range 1-5)	1.48	2.24	1.86	1.78
	(0.015)	(0.029)	(0.034)	(0.025)
Share of underweight children under 5 years (weight for age, -2 sd)	24.2%	18.2%	17.3%	21.4%
	(0.009)	(0.012)	(0.015)	(0.011)
Share of households with electricity	0.5%	1.8%	0.4%	3.1%
	(0.001)	(0.002)	(0.001)	(0.004)
Average number of household members	4.61	4.88	5.22	4.13
	(0.040)	(0.070)	(0.082)	(0.045)
Share of female headed households	10.69%	2.21%	1.36%	7.64%
	(0.003)	(0.001)	(0.001)	(0.003)
Average education of household head (years of schooling; range 0-15)	3.53	6.82	5.06	5.08
	(0.066)	(0.146)	(0.129)	(0.129)
Share of households growing maize	90.8%	98.4%	98.7%	72.4%
	(0.007)	(0.004)	(0.004)	(0.016)
Share of households growing subsistence maize	59.9%	53.6%	61.2%	45.7%
	(0.012)	(0.016)	(0.021)	(0.014)
Share of households growing cash crops (tobacco, cotton or hybrid maize)	57.4	74.7%	70.4%	45.8%
	(0.012)	(0.013)	(0.018)	(0.014)
Average number of different crops (rainy season)	3.04	3.50	3.58	2.34
	(0.053)	(0.079)	(0.090)	(0.068)
Share of land uncultivated	26.2%	19.5%	26.0%	24.3%
	(0.011)	(0.012)	(0.016)	(0.013)

Note: Standard errors in parentheses. All population estimates take into account the stratified sample structure as well as household weights (using STATA survey data commands).

The first line shows the relevance of ganyu labor in the country. During the year of the survey, almost 50% (41.3%+7.6%) of Malawi households supplied some ganyu, and 22% (14.4%+7.6%) recruited some ganyu. 7.6% of these both supply and demand ganyu, a fact which might be partially explained by different agricultural activities in different periods of

the year (rainy season versus dry season). Only 36.7% did not engage in any ganyu either on the supply or on the demand side, and about one forth of these are urban households with no agricultural activities.

As shown in the second row, clearly ganyu is a predominantly rural phenomenon. While a few non-agricultural households also supply ganyu, ganyu demand comes almost necessarily from households engaged in agriculture. Generally, non agricultural households must be assumed to decide about the allocation of their labor resources in different ways and based on a different range of options than agricultural households. To avoid too much complexity, we will restrict the core of the analysis to agricultural households alone. This will reduce the sample size to 10 032 households.

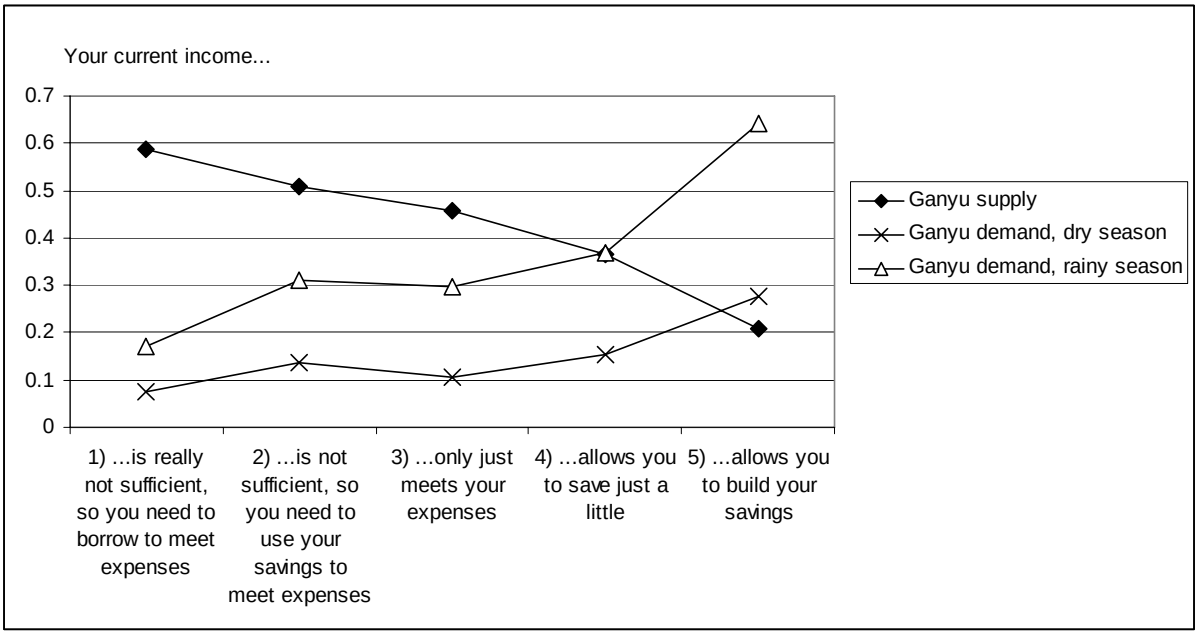
Rows 3-5 provide some information on the well-being of households. The first indicator represents the subjective statement of the household head who had to select any point on a scale from 1 (lowest) to 5 (highest) (see Figure 2 for the detailed categories). The second is based on the anthropometric measurement of malnutrition using the indicator 'weight for age'. Children under 5 are considered as undernourished if their weight falls 2 standard deviations or more under the standard reference weight provided by the WHO for the corresponding age group (WHO 2007). As opposed to anthropometric measures based on height, this indicator measures the impact of recent, rather than long-term, restrictions in nutritious intake (see e.g. Sahn and Stifel, 2002, p. 718). Finally, we consider whether the households have access to electricity.

For the whole population all of these indicators indicate wide-spread poverty. Subjective income in all groups is on average lower than would be just sufficient, malnutrition of young children ranges from 17%-24%, and access to electricity is extremely rare throughout. It is 3.1% at best, in the category for neither ganyu supply nor demand, i.e. the category with a relatively high number of urban households.

Comparing ganyu supplying to ganyu recruiting households indicates that on average and despite overall poverty, the latter are significantly better off than the former. This is true irrespective of the specific indicator selected and is consistent with the explanation of ganyu as an escape option in case of binding consumption constraints. However, for the explanation of the consumption constraint to be fully convincing, we should see a sharp increase in ganyu supply at a certain minimum income level. As shown in Figure 2, such a discontinuity cannot be observed in practice. Rather, ganyu supply – measured as the share of households providing ganyu – decreases rather smoothly from lower to higher income levels.

It is only for households hiring ganyu that we observe a certain kink associated with a strong increase of the share between income groups 4 and 5. Thus households in the highest income group have a substantially higher propensity to hire ganyu than households in the income group just below. At the same time, the data suggests that quite some households recruit ganyu labor, without being themselves able to meet their ends. This points to a mutual relationship of responsibility for one another within the community, and not just within the family, and to ganyu as being part of it. Clearly, ganyu is not a simple story of the 'rich' exploiting the 'poor'.

Figure 2: Share of households providing or hiring ganyu, by subjective income level



As far as general household statistics are concerned, ganyu supply and demand households also do not always differ much. With respect to household size, for instance, the differences are rather small. They are much stronger, however, between those households engaged in both ganyu supply and demand, and those households engaged in neither of the two. The relatively high average number of household members in households with both, ganyu supply and demand, suggests that big families might practice some kind of an exchange of family members, possibly to sustain some social networks on which they can count in times of need. For households with neither ganyu supply nor demand, the relatively small number of household members could be related to the partially urban background of these families.

As opposed to the number of household members, the share of female headed households is much higher for ganyu supplying (10.7%) than for ganyu demanding households (2.2%). This may be related to the particular neediness of households where the husband and father died or moved off (see also Green and Baden 1994, p. 16). Another explanation could be that female household heads tend to be stricter in sending their household members to work.

Strong differences can also be observed between ganyu demanding and supplying households with respect to education. Educational attainment of the household head is almost twice as high for the former as for the latter. While on average, ganyu supplying households do not even complete lower primary education (=4 years), ganyu demanding households reach almost 7 years of education.

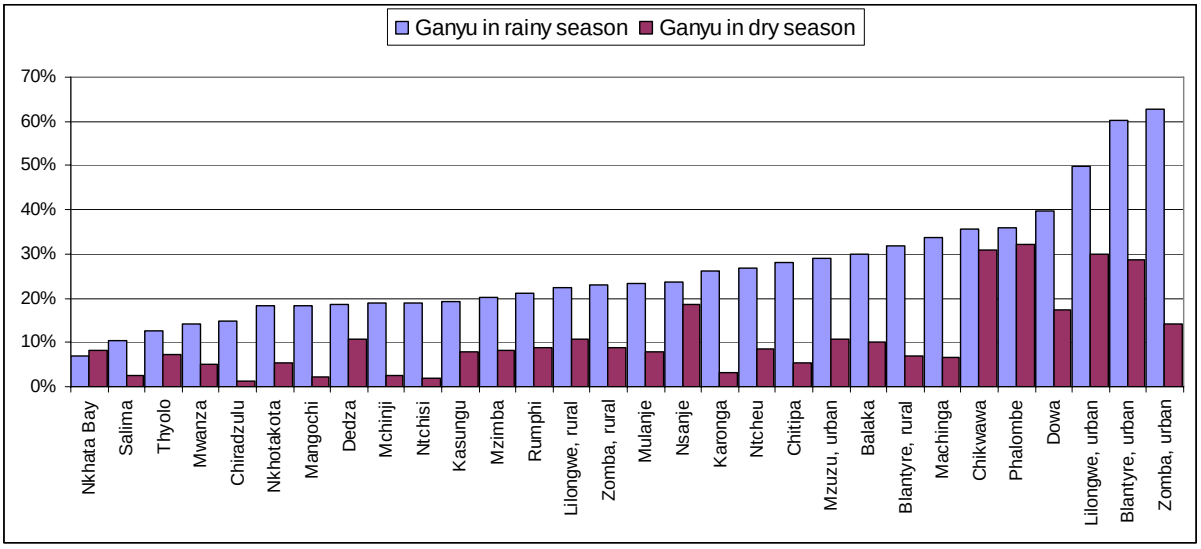
Finally, let us examine the crop composition of these two types of households. Ganyu demanding households tend to rely on a greater variety of crops and, quite obviously, a higher share of cash crops including tobacco, cotton, and hybrid maize. Table 1 also shows that almost all households grow some type of maize, whereby ganyu supplying households rely more heavily on traditional forms of subsistence maize. Reliance on unproductive varieties and single crop agriculture (strong dominance of maize), may in fact explain problems of food insecurity and malnutrition eventually leading to the necessity to obtain additional income through ganyu. The potential to considerably raise incomes through a switch from subsistence to hybrid maize was already discussed by Sahn et al. (1990, p. 14). It should be noted,

however, that over the last decade, some progress has been made in this respect. As shown in Table 1, the high yielding variety of hybrid maize has widely spread by now whereas in the early 1990s, hybrid maize was hardly used by local subsistence farmers at all (Green and Baden, 1994, p. 8).

Finally, we consider the plots left idle. While some plots can be expected to be always kept idle in order to increase future productivity, this is not a plausible explanation for the differences we observe between groups. Apparently, ganyu supplying households keep over one forth of their land uncultivated while the corresponding percentage for ganyu hiring households is only 19.5%. Note that this is consistent with Whiteside's (2000) argument that the supply of ganyu may lead to a neglect of one's own farming activities. In this case, the excess plots left idle are to be interpreted as the areas which the household had no time to prepare for the next season. Of course, an alternative explanation would be that households supplying ganyu possess land of lower quality soils which need to be left idle more often or which are so unproductive that work elsewhere simply yields higher benefits. The issue can not be fully clarified here.

Let us return to the argument of ganyu being some kind of an insurance system for which we already provided some suggestive evidence above. If ganyu works in this way, we expect long-term relationship whereby ganyu would also be supplied – at least to some extent – in periods of reduced need. The period of greatest difficulties to meet consumption needs falls between January and March, which is the end of the the rainy season and just before harvest. The main harvest then falls into the dry season (March to October) and generally ensures at least a minimum level of consumption. If ganyu is supplied only in response to acute food deficiencies as suggested by the consumption constraint argument, ganyu might be supplied only in the rainy season. As presented in Figure 3, this is not actually the case. While ganyu is substantially lower in the dry season, it is still relevant for a significant share of households. The shares are presented only for households hiring ganyu because information disaggregated by season is not available with respect to households supplying ganyu.

Figure 3: Share of households engaging ganyu, by season and district



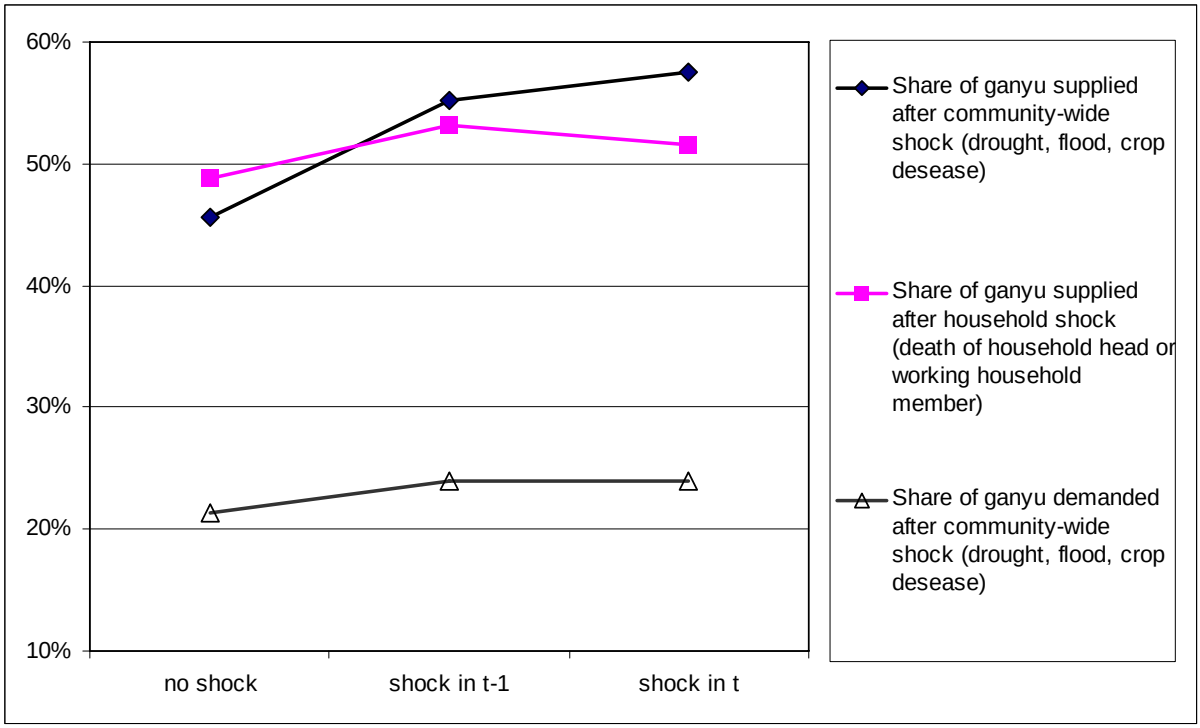
Note: Only for households engaged in agriculture.

Figure 3 also shows that there is significant regional variation. On the graph, districts are ordered according to the relevance of ganyu in the rainy season. All urban districts show a very high percentage of ganyu, but note that this only refers to households engaged in

agriculture in the first place, which is of course a rather small percentage in urban cities. More interestingly, the figure shows that the ranking of districts with respect to ganyu is quite different in the dry and in the rainy season. This appears to be related to the fact that dry season agriculture with a second harvest from September onwards, only exists in certain areas. Overall, it appears that ganyu effectively employed is strongly driven by changes in demand. This may also speak for a long-term relationship between ganyu employers and providers. At the same time, information on wages suggests that in order to employ ganyu workers during the dry period, employers' households also have to pay considerably higher wages than during the rainy period. Thus ganyu supply during the dry season may simply appear profitable and therefore not necessarily reflect the willingness to stabilize the social bands with the employer.

Another possibility to clarify this issue may be to look at shocks experienced by the household. While ganyu demand and supply curves can be expected to shift into the same direction from the dry to the rainy season (there is greater need to supply ganyu *and* there is greater need to hire ganyu), the event of a regional or community-wide shock should lead to an increased need to supply, but a reduced need to hire ganyu (as there will be less productive use for this labor). We clearly observe an increase in ganyu engaged in such a situation, i.e. in the new equilibrium, a higher number of households both supply and demand ganyu (see Figure 4. This shows that more households are ready to accept ganyu laborers in times of need. At the same time, this may of course also be reflected in a reduced wage (corresponding exactly to the situation illustrated in Figure 1).

Figure 4: Ganyu provided and hired in times of shocks



Due to the difficulty to distinguish between demand and supply side effects when only equilibrium values can be observed, it may be conceptually more interesting to look at shocks affecting only individual households. Their behavior should not have an impact on overall demand so that an increase in ganyu can clearly be attributed to the supply side effect in this case. Indeed the likelihood of ganyu labor increases which shows that additional labor gets

absorbed on the market. It may surprise that the effect is stronger one year after the shock than in the year of the shock itself. The reason might be that a shock during the year of the survey will typically be felt only during part of the overall period, i.e. from the time onwards when it actually occurred. Moreover, if the shock implies the death of the household head or another working member of the household (as defined here), this person may have supplied ganyu himself so that the immediate effect on ganyu supply may also be a negative one, despite increased need.

All in all, this section shows that ganyu is a highly complex phenomenon. First, demand and supply side are not distinct, so that some households simultaneously provide and hire ganyu. With respect to household characteristics such as income, there are tendencies, but there also remains a clear overlap between the two groups. This evidence suggests that ganyu is not primarily a device to punctually escape a binding consumption constraint. Moreover, with the evidence at hand, it is difficult to argue that it should be necessarily negative for the people engaged in it, even in the mid-term perspective. A possible interpretation consistent with the evidence presented so far, would be that ganyu is driven (i) by actual productivity differences reflected in profitable wages, and (ii) by implicit social contracts as some kind of a risk insurance system.

As social contracts like this must be expected to be highly dependent on cultural background, we will include this aspect in our detailed multivariate analysis of ganyu supply in the following section.

4. Empirical specification and regression results

4.1. Variable definitions and hypotheses

As indicated in Section 2, the primary determinants of labor supply by agricultural households outside their own farm must be expected to be the ganyu wage rate and the farm productivity or (shadow) wage received for home production. In analogy to the literature on on- and off-farm production (e.g. Huffman, 1980), we proxy the ganyu wage rate faced by ganyu supplying peasants with the regional wage rates, obtained by dividing the total amount paid by farmers hiring ganyu by the days of ganyu labor employed, and averaging this daily wage rate within the district (*ganyu_wage*).

As indicated in Section 2, it is difficult to disentangle the demand and supply impacts on equilibrium wages and therefore, simply including regional wage rates into our ganyu supply regressions may lead to an endogeneity bias. This is why we initially attempted to instrument these wages with the use of different village level instruments. Unfortunately, there is no strong theoretical motivation for the choice of any specific instruments, few variables can plausibly be considered as exogenous, and instrumentation using the latter leads to a poor fit of the instrumentation equation and overall poor labor supply results. We therefore have to rely on the assumption that even though aggregate ganyu supply is likely to have a significant impact on equilibrium wages, the impact of individual households is negligible. In this case, regional wages are exogenous in our household level ganyu supply regressions.

The neoclassical literature on off-farm labor supply postulates a positive relationship between the off-farm wage rate and both the decision of farmers to supply labor off-farm and the total amount of off-farm labor supplied. However, as indicated in Section 2, we may expect a reverse relation in at least two circumstances in our context. First, a binding consumption constraint may lead to a backward bending supply function. Second, an exogenous shock that simultaneously affects the demand and supply of ganyu labor may lead to a negative

association between equilibrium wages and the supply of ganyu labor observed even in the presence of the usual positively sloping supply curve. The direction of the relation between wages and ganyu supply is therefore a matter of empirical investigation.

It is common to proxy the shadow wage received from home production with determinants of the productivity of the household on its own farm (e.g. Rosenzweig, 1980; Jacoby, 1993; Huffman, 1980). An important candidate is typically the size of land used for agricultural production. In the Malawi context, it has been argued that land size smaller than 0.5 hectares is a good proxy for being practically landless and therefore facing a high probability of supplying ganyu labor (Green and Baden, 1994). We therefore include a dummy variable of land-holding of less or equal to 0.5 hectares (*smallarea*) as a proxy for land size in our ganyu supply regression and expect the coefficient of this variable to be positive.

Clearly, productivity is also, to a large extent, determined by the types of crops. As already noted above, the cultivation of subsistence maize is by far less productive than the cultivation of hybrid maize or other cash crops. Overall productivity should also be higher if the fields are used in both seasons, i.e. in other words, if any crops are grown during the dry season. Moreover, productivity should be enhanced, if monocultures are avoided. In particular, the planting of maize only appears to be a rather frequent phenomenon which at the same time leads to a rather unbalanced diet indirectly tightening the consumption constraint. Finally, we expect own farm productivity to positively depend on the use of fertilizer. We therefore specify the variables *propland_cash*, i.e. the proportion of land used for the cash crops tobacco, hybrid maize or cotton, *anycrops_dry*, a dummy for any own production during the dry season, *ncrops_rainy*, the number of different crops grown during the rainy season (as a measure of crop diversity), and the dummy variable *fertilizer* for the use of fertilizer. For all these indicators of productivity on one's own land we expect a negative coefficient in the ganyu supply regressions.

Another factor potentially relevant for productivity is human capital. Two types of measures of human capital have been used in household level labor supply equations, namely the education and age or experience of the head of household, or the average levels of education and age of the household members or any other proxy of the latter. Since the human capital characteristics of household members are typically highly correlated and the measures for the household head are less susceptible to be endogenous (Rizov and Swinnen, 2004), we give some preference to the former. Specifically, we define an educational indicator *education_head* ranging from 0 to 4 (no education, some lower primary, some upper primary, some secondary and some higher education), and a variable *age_head*, as a proxy of the age or experience of the head of household.

High levels of both of these characteristics are expected to increase the household's productivity on his farm and should thereby reduce the need to rely on ganyu. It should be noted that this expectation differs from the hypothesis of the on- versus off-farm literature (Huffman, 1980; Rizov and Swinnen, 2004), where off-farm work is generally assumed to be relatively high skill, which is not the case for ganyu.

We finally add an indicator of the general human capital level in the community (*highereduc_peer*) which indicates the share of people with at least some level of secondary education within the village. This is supposed to capture positive externalities of education, e.g. through peasants learning from each other (see e.g. Foster and Rosenzweig, 1995, p. 1194f. for India).

Given that we define ganyu by the absolute number of days provided by the household, household size and composition should also have an important impact on supply. To capture this effect we define two different variables: *adults* capturing the number of working age household members in the age range of 15-65 as a proxy of a pure scale effect in labor supply, and *propdependents* for children and youth under 15 as well as elderly people. To avoid including a large number of persons who actually contribute to labor despite their young (or old) age, we also create the alternative variable *children* for the number of children under five belonging to the household. Clearly, the impact of adults on ganyu labor supply should be positive, while the impact of the number of children or other dependents is less clear. On the one hand, they require time and attention therefore lowering the households overall time for agricultural labor. On the other hand, their presence increases the households consumption needs and may thus reinforce the consumption restriction thereby enhancing the necessity of ganyu supply.

Whiteside (2000) suggests that female headed households in Malawi are among the poorest and hence use a significantly higher proportion of their time for ganyu despite considerably lower pay. To capture this effect, we include a variable *female_head* taking the value of one if the head of household is a female and expect the effect of this variable on ganyu supply to be positive.

In addition, our theoretical framework as well as our descriptive statistics indicate a general relationship between ganyu and income or wealth. Unfortunately, the inclusion of either total income, or wealth proxies like the number of underweight children are likely to be endogenous in our ganyu supply equation. We therefore privilege indicators for wealth which can be supposed not to change very fast and/or to be externally provided. We thus define a dummy variable *electricity* taking the value of one if the household has access to electricity. Moreover, we define a variable *rooms*, as the size of the living area of the household divided by the number of household members. These variables are expected to be negatively correlated with ganyu supply.

Conversely, external shocks experienced by households are likely to decrease income and wealth and thus to increase ganyu supply. To capture these impacts we define two different shock variables, namely *shock_village(t-1)* for community-wide shocks such as drought, flood or crop desease, and *shock_household(t-1)* for household specific shocks, notably the death of the head of household or any other working age household member. Both variables are dummy variables taking the value of 1 if the household experienced a shock during the year preceding the survey. We could also use contemporaneous shocks but prefer to use the lagged specification because our descriptive statistics showed that this is the time where the effect comes out most clearly.

Finally, Sections 2 and 3 highlighted the existence of several interesting insurance and other cultural determinants of ganyu and the fact that that ganyu patterns vary considerably across the different regions in Malawi. As ethnic groups in Malawi are regionally allocated, these differences may capture different cultural determinants of ganyu supply. A point in case is the concentration of the *Ngoni*, *Ngonde* and *Tumbuka* ethnicities in the Northern region, which operate under patrilineal kinship systems as opposed to the *Chewa* and *Yao* ethnic groups in the Southern and Central regions, characterized by a matrilineal kinship systems (Green and Baden, 1994). There is evidence to suggest that the matrilineal systems of inheritance are on the decline, and due to declining land availability, land is increasingly being fragmented through family allocation (Dickerman and Bloch, 1991). This is likely to decrease the own farm productivity in the South and Central regions of Malawi and lead to a higher reliance on

ganyu labor for survival compared to the Northern region. Moreover, different ethinc and cultural groups may simply have developed different strategies to cope with production irregularities and the need to meet consumption needs on a regular basis. Ganyu may be part of this strategy in some groups more than in others. To analyze the empirical evidence on these questions, we include both the regional variable *north* and dummies for the major ethnic groups (*chewa, tonga, tumbuka, lomwe, yao, nyanja*) into some of our regression specifications.

4.2. Econometric specification and regression results

Based on these variables, we specify different econometric models. For censored variables such as ganyu for which we only observe variation above the threshold of zero, either a tobit model or a differentiated model with separate selection and allocation equations are appropriate choices and widely used in the off-farm labor supply literature (e.g. Rosenzweig, 1980; Rizov and Swinnen, 2004). The former supposes that the decision whether at all to supply ganyu, and the decision how much ganyu to supply are taken simultaneously or at least follow the same reasoning, i.e. depend in the same way on our explanatory variables. A priori, nothing suggests that this should not be the case. Nevertheless, Table 2 presents the tobit alongside with a probit model to separately depict the households' decision about participation in the ganyu market.

In addition, given the significant incidence of simultaneous supply and demand of ganyu labor by the same households in Malawi, we estimate an OLS model of net ganyu supply, where the dependent variable is the number of days of ganyu labor supplied net of the number of days of ganyu demanded. To the extent to which the gross ganyu supply concept incorporates the substitution of own farm labor by ganyu labor, the differences between the results from estimating the latter two models are likely to capture some of the insurance patterns in ganyu supply in Malawi discussed in the theoretical and descriptive statistics sections.

The results from the probit model on the likelihood of the household to supply any ganyu labor are reported in column 1 of Table 2, the results from our tobit estimates of the determinants of the (gross) amount of ganyu labor supplied by the household are reported in column 2, and the results from our OLS estimates on net ganyu supply are reported in column 3. Most of the results are consistent with the hypotheses highlighted in our theoretical section and illustrated by our descriptive statistics.

Starting first with the probit model estimates, we observe that the regional ganyu wage has a positive impact on the likelihood of the household to supply ganyu labor. In other words, the pattern of ganyu supply is consistent with neoclassical logic and contradicts the assumption of a backward bending supply curve characteristic of poor rural economies. Moreover, in keeping with our expectations, the likelihood of ganyu supply is a positive function of very small land holdings and a negative function of both the proportion of land devoted to cash crops and the use of fertilizers in own farm production.

The positive effect of crop diversity as well as the positive effect of dry-season production on the probability to supply ganyu is difficult to explain, however. A possible explanation could be some correlation with regional specificities not yet taken appropriately into account in this regression. We will return to this issue later with some more refined specifications.

Table 2: Initial regression results

	Likelihood of ganyu supply (probit)	Gross amount of ganyu supply (tobit)	Net amount of ganyu supply (ols)
constant	0.5851***	-2.8334	51.8288***
	(0.0937)	(8.6380)	(11.6353)
ganyu_wage	0.0019***	0.5536***	0.2315***
	(0.0007)	(0.0623)	(0.0833)
smallarea	0.1017***	7.9530***	9.7490***
	(0.0299)	(2.7993)	(3.7517)
propland_cash	-0.0755*	-5.4047	-1.4289
	(0.0404)	(3.7671)	(5.0937)
cropdiversity	0.0318***	2.2247***	0.9356
	(0.0086)	(0.8144)	(1.0862)
anycrops_dry	0.1503***	-2.1404	-3.1409
	(0.0429)	(3.9571)	(5.3902)
fertilizer	-0.1865***	-13.1659***	-11.0091***
	(0.0291)	(2.7062)	(3.6574)
education_head	-0.1976***	-19.3325***	-12.4675***
	(0.0147)	(1.3967)	(1.8386)
age_head	-0.0096***	-0.8076***	-0.2407**
	(0.0009)	(0.0868)	(0.1141)
adults	0.1028***	15.3844***	1.6393
	(0.0136)	(1.2797)	(1.6975)
female-head	0.1420***	5.6959*	1.4271
	(0.0341)	(3.1609)	(4.2556)
propdependents	-0.2073***	-8.9989	-17.9669**
	(0.0674)	(6.4497)	(8.3134)
electricity	-0.7409***	-88.7193***	-48.4459***
	(0.0907)	(9.4279)	(10.1811)
rooms	-0.2577***	-18.5153***	-11.8925***
	(0.0325)	(3.1512)	(3.8383)
north	-0.2759***	-33.2385***	-4.2462
	(0.0392)	(3.8951)	(4.9089)
shock_houshold(t-1)	0.0664	2.0250	1.3787
	(0.0677)	(6.2828)	(8.5177)
shock_village(t-1)	0.0423	6.9056**	1.4122
	(0.0287)	(2.6974)	(3.6275)
Adj Rsq	0.0666	0.0139	0.0144
N Obs	9771	9771	9771

Note: Standard errors in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

As expected, both higher education and higher experience of the household's head reduce the household's probability to supply labor in the ganyu market. In sum, household characteristics positively correlated with high levels of own farm productivity have a negative impact on ganyu supply. As such, our results support the perception of ganyu labor as a consumption smoothing mechanism, and are once again consistent with neoclassical logic.

Again as expected, we also observe that the likelihood of the household to supply ganyu labor is an increasing function of the number of adults in the family and is negatively associated with measures of wealth such as large living space and access to electricity. Female headed households appear to be more likely to participate in the ganyu labor market than male headed households, and a higher proportion of dependents in the family has a negative impact on ganyu supply in line with the hypothesis of a pull effect of dependency ratios on household labor supply. Finally, the coefficient of our dummy variable for the northern region of the

country is negative vis-à-vis the omitted category of South and Central indicating that patrilineal systems encourage ganyu supply to a lesser extent than matrilineal systems. However, none of the shocks has any impact on the likelihood of the household to participate in the ganyu labor market.

The results from the tobit model on gross ganyu labor supply are broadly consistent with those from our estimates of the household's likelihood to supply labor in the ganyu labor market. However, we observe that the proportion of land devoted to cash crops does no more show any significant impact on the amount of ganyu labor supplied. Moreover, unlike in the probit model, the variable capturing the proportion of dependents in the household is no longer significant. Finally, we observe that village level shocks have a strong positive impact on the gross amount of ganyu labor supplied. This is consistent with our expectations.

Finally looking at our third equation, i.e. the estimates of net ganyu supply (Table 2, column 3), we observe some interesting differences: The crop diversity, female head, adult, and northern region and village shock variables lose their significance vis-à-vis the respective gross labor supply estimates. These results are consistent with the interpretation that engaging in both ganyu supply and demand can be interpreted as the willingness to sustain existing social networks (e.g. for insurance purposes). In this context, comparing columns 2 and 3 would indicate that female headed households and households with many adult members have a particularly high propensity to use ganyu as part of such a networking and insurance system. The change in significance of crop diversity and the regional dummy, however, may again indicate some regional (or cultural) specificities with respect to this social networking mechanism.

All in all, it appears relevant to analyze these cultural aspects in some more detail. Moreover, the differences between the tobit and the probit estimation suggest, that after all, to some extent different decisions may be hidden between the selection into the ganyu market (supply or not supply) and the allocation of a specific amount of ganyu once the first decision has been positive. This suggests to use a Heckman model and to estimate a separate selection and allocation equation. Moreover, to be more prudent with the interpretation of significance levels, the complex structure of the data set (households nested within communities and strata) is now taken into account using the Huber-White sandwich estimator for the computation of the variance-covariance matrix.

Some changes are also made with respect to the variables. Apart from the addition of dummies for the major ethnic groups, the variable *propdependents* is exchanged against *children* and the potential externalities of education by other households in the community (*highereduc_peer*) are taken into account. Table 3 presents the results.

Table 3: Regression results in the Heckman model

	Selection equation	Allocation equation
ganyu_wage	0.01*** (0.00)	0.24*** (0.09)
anycrops_dry	0.06* (0.04)	-18.48*** (3.26)
propland_cash	-2.96*** (0.09)	
ncrops_rainy	-0.01 (0.01)	
education_head	-0.22*** (0.02)	-5.75*** (1.4)
highereduc_peer	-0.48* (0.29)	
age_head	-0.01*** (0.00)	
female_head	0.12*** (0.04)	
children	-0.01 (0.02)	
adults	0.11*** (0.01)	11.32*** (1.36)
electricity	-0.84*** (0.11)	-26.04*** (9.98)
rooms	-0.20*** (0.03)	
north	-0.45*** (0.09)	-4.91 (5.02)
chewa	-0.36*** (0.08)	25.65*** (4.71)
tumbuka	-0.26*** (0.09)	-13.41*** (4.75)
lomwe	-0.34*** (0.12)	28.56*** (10.22)
nyanja	-0.12 (0.10)	38.01*** (5.25)
tonga	-0.88*** (0.16)	
yao	-0.34*** (0.09)	
shock_household(t-1)	0.06 (0.08)	
shock_village(t-1)	0.06* (0.04)	
λ	-7.24***	
	F(10, 415)=17.57***	Strata: 30; PSU: 454
N Obs	9754	

Note: Standard errors in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

Again, regression results are overall quite consistent with earlier results. In particular, we again get the expected positive impact of ganyu wages as well as a generally negative effect of variables indicating productivity on one's own land.

Interestingly, the variable whether any production takes place in the dry season now clearly shows a difference between the selection and the allocation part of the analysis. As far as pure allocation of labor is concerned, we now get the expected negative and highly significant

effect. With respect to the question whether or not to supply ganyu in the first place, however, the coefficient is still positive. Possibly this could be a reflection of specific areas in which dry-season production takes place in general. In this case, the coefficient in the selection equation might be biased due to a demand-side effect (when there is dry-season production, there may be more demand for ganyu and thus indirectly, a higher probability for anybody to participate).

The new variable of higher educational attainment by others in the community has the expected negative effect on ganyu supply, although it is only weekly significant. The variable *children* remains insignificant.

Interestingly, the additional ethno-linguistic variables show that apart from a north-south divide (significant only in the selection equation once all the other variables are included), there are considerable differences between individual groups. In particular the Tonga, a small ethnic group in the North, show a considerably lower probability to participate in ganyu then any other group – over and above the lesser probability of northern groups in general. Conversely, the Njanja, a small group in the South, show a relatively high probability to participate in the ganyu market, and in addition, to supply very high amounts of ganyu labor, even more than the Chewa for which the coefficient in the allocation equation is also very high. The Chewa, the largest group in the country, is mainly based in the centre of Malawi.

5. Conclusion

Based on some theoretical investigation on potential effects of ganyu labor in Malawi as well as initial descriptive statistics suggesting the rather complex objectives of this agricultural labor strategy, we estimate the supply of ganyu in order to get more detailed insights into its determinants.

Overall, our regression results are consistent with both our theoretical framework and descriptive statistics. We find a confirmation of the neoclassical theoretical hypothesis whereby households use ganyu as a consumption smoothing option and supply ganyu in response to a higher marginal product of this particular type of labor as opposed to own farm labor. While our results therefore reject the alternative hypothesis of a backward bending labor supply curve, they reveal interesting insurance and cultural patterns of the allocation of labor across own farm and foreign farm activities in rural Malawi. Village level shocks increase the gross amount of ganyu supply across families that tend to supply labor and families that tend to demand ganyu labor. Women headed households appear to make a particularly strong use of social networks, and for this purpose, simultaneously supply and demand ganyu. And ganyu is particularly widely spread in ethno-cultural contexts with matrilineal systems.

Our results also indicate that land tenure systems have a significant influence on farm productivity and hence ganyu labor supply. To the extent to which ganyu labor is a low skill and low pay labor, used as a short run consumption smoothing mechanism leading to own farm productivity deterioration in the future, policies that improve the own farm productivities of farmers should be encouraged. A point in case is enhanced education for individual peasants, but also for the community as a whole, encouragement of cash crop growing practices and crop diversification, and land tenure systems which stimulate the productive allocation of land resources.

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