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Off-farm labor supply and correlated shocks: New theoretical insights and evidence from Malawi

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Abstract: We offer new conceptual insights into the understanding of occupational choice in uncertain rural environments, with a focus on its ex ante (before a shock) and ex post (after a shock) consequences for farmers belonging to different portions of the asset distribution. We model theoretically the choice between relatively safe subsistence farming, higher return but higher risk cash crop activities, and off-farm labor—conditional on preexisting asset allocation—and look at the general equilibrium labor market implications of correlated shocks. Our results, backed by evidence from Malawi, challenge some stylized perceptions in the literature on consumption smoothing via off-farm labor supply.

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Off-Farm Labor Supply and Correlated Shocks: New Theoretical Insights and Evidence from Malawi

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I. Introduction

A large part of the rural landscape of developing countries is dominated by subsistence farmers, operating on small or marginal plots of land. In the absence of insurance markets, they take recourse to a number of coping strategies to protect themselves from various risks. Some engage in specialization that involves adoption of production techniques that are resistant to pests, droughts, and other environmental risk factors. For instance, pearl millet, an extremely sturdy cereal grown in sub-Saharan Africa, is known for adapting well to extreme evapotranspiration, poor sandy soils, and erratic rains. Others resort to consumption smoothing via diversification, some of which involves combining farm and off-farm activities within the same household.

The tendency of consumption-smoothing choices to either lift or further entrap small farmers into poverty has long intrigued economists, and prolific sets of literature have developed in several different analytical directions. On the one hand, stylized poverty trap models have focused on the tendency of asset-poor and hence risk-averse households residing close to the poverty

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threshold to opt for low-risk, low-return portfolios that presumably lower the risk of hunger but paradoxically push them down a spiral of even further destitution (Dercon 1998, 2005; Carter and Barrett 2006; Barrett, Carter, and Ikegami 2008). The main focus of this literature is on the choice between safer, although low return (subsistence), cropping activities and riskier, although higher return, livestock and cash crop production. On the other hand, portfolio diversification into nonfarm (e.g., off-farm labor) sources of income is typically seen as a strategy that stochastically dominates those relying on own-farm income alone (Barrett, Bezuneh, and Aboud 2001).

Indeed, the relatively more scarce literature on consumption smoothing via nonfarm employment agrees that the off-farm labor supply in poor rural settings tends to increase in the event of a shock, thus potentially providing a viable insurance in uncertain environments (Kochar 1999; Rose 2001; Cameron and Worswick 2003). While the central question here is whether—on average—a well-functioning rural market can serve as a poverty-alleviating escape option for farmers struck by idiosyncratic shocks, some of the broader literature on off-farm (and in particular nonagricultural) labor voices a concern over distributional issues and asks the question whether labor market barriers may preclude poorer farmers from effectively smoothing their consumption in a risky environment (Leones and Feldman 1998; van den Berg and Ruben 2001). The underlying policy implication is that removal of barriers to entry in the off-farm market should help with assuring frictionless consumption smoothing in rural environments fraught with uncertainty.

But is even a barrier-free factor market a panacea, and are those endowed with better ex ante control over resources always "the winners"? To the best of our knowledge, while the broader literature on off-farm labor considers distributional issues primarily on account of barriers to entry in the labor market, studies looking at consumption smoothing via off-farm labor supply focus exclusively on the effect of idiosyncratic shocks, possibly on account of the reasonable (and evidence backed) assumption that correlated shocks make perfect insurance impossible. This leaves out of focus the more intriguing case of correlated shocks that affect both poor and rich farmers simultaneously and its interesting general equilibrium dynamics, alongside situations in which obvious entry barriers to the off-farm labor market may not be present.

We contribute to the literature by first modeling theoretically the ex ante choices of farmers belonging to different portions of the asset distribution among relatively risk-free subsistence cropping, riskier although higher return cash cropping, and off-farm labor supply and consider the differential off-farm labor supply effect of correlated shocks on both smaller and larger farmers in a general equilibrium setting. We test some of the central predictions of the model with the use of data from the particularly interesting context of rural Malawi, characterized by dualistic agricultural structure, including large cash crop (mainly tobacco and groundnut) producing estates, alongside a vast smallholder sector, inhabited by predominantly subsistence farmers. Structural reforms in the 1990s attempted to dismantle the dualistic structure—a heritage of active 1970s–1990s government support for the development of the cash crop estate sector—by encouraging smallholder involvement in the production of exportable cash crops, like tobacco, groundnuts, and cotton. However, there is evidence supporting the persistence of the dualistic agricultural system in Malawi (Harishima 2008).

One of the most interesting and controversial phenomena in Malawi, consistent with the existence of a dualistic agricultural sector, is *ganyu*—low-skill off-farm labor, traditionally described as either a form of exploitation of the poor by the rich (Bryceson 2006) or a low-risk and low-return diversification strategy of poor subsistence farmers, which eventually drives them further into poverty (Whiteside 2000). If ganyu is indeed a poverty-entrapping strategy, we should see it prevail in times of need and primarily among poor households. However, data from the Second Integrated Survey of Malawi, collected by the Malawi government (2004), indicate that more than half of all rural households offer ganyu, and ganyu supply is spread across households and seasons. Furthermore, qualitative research indicates that ganyu may not be a result of subsistence constraints but may represent an important source of additional income (Orr, Mwale, and Saiti-Chitsonga 2009). This indicates that ganyu may be more complex than a simple survival (in fact, poverty enhancing) strategy of smallholders, bound by small land size, credit constraints, and labor and fertilizer shortages (Alwang and Siegel 1999; Orr 2000; Orr and Mwale 2001; Harrigan 2003). Testing the predictions of our model in the context of Malawi not only helps us throw fresh light on the controversial phenomenon of ganyu labor but also leads to more general and apparently counterintuitive findings that challenge some stylized perceptions of the broader literature on portfolio diversification in developing countries.

The rest of the article is organized as follows. The theoretical model is outlined in Section II. Section III discusses some relevant characteristics of rural Malawi and presents some descriptive statistics. Section IV discusses the empirical specification, and Section V presents the econometric estimation strategy and our empirical results. Section VI concludes.

II. The Ganyu Market: Theoretical Framework and Hypotheses

We consider a two-step cultivation process. In period 1 the farmer has to prepare the field, and in period 2 the farmer realizes the value from cultivation.

When preparing the field in period 1, the farmer has to use labor, and this labor requirement is determined by the decision taken by the farmer about the type of crop to produce in period 2 and the amount of land she has. We distinguish between two types of crops—a (safe) staple crop, denoted *S*, and the more risky commercial crop, denoted *M*. While the commercial crop cannot be consumed directly, it can be sold in the market, generating purchasing power for the farmer who can then buy subsistence goods from the market. Thus, while the staple provides direct subsistence, the commercial crop provides subsistence through a market exchange of the crop.

The other important element in our model is the timing of the realization of the risk. While the uncertainty regarding the commercial crop is not resolved in period 1, when farmers decide on the period 1 investment in land, the uncertainty is resolved at the beginning of period 2, or before the production of the commercial crop happens. In other words, once the uncertainty is resolved, the farmer has a choice of continuing with production or abandoning it and offering to be hired out in the labor market (becoming a ganyu laborer) rather than working on her own farm. In what follows, we examine (1) the production of the staple crop, (2) the production of the commercial crop, and (3) ganyu demand and supply in the aggregated economy.

A. Production of Staple Crop

Consider a farmer with T units of land and F units of family labor. There are two periods in the production process. In the first period, the land has to be prepared for production of the crop in period 2. Preparing the land uses l^S units of labor per unit of land. Thus, the total amount of labor used on T units of land in the first period is $L_1^S = l^S T$. Given that the land has been prepared, the second-period output of the staple crop S is given by the function

$$S(L_2^S,\ T) = (L_2^S)^{\alpha} T^{1-\alpha}. \tag{1}$$

We normalize the price of the staple crop to be 1. If the land has been prepared in period 1 for the staple crop, then in the second period the farmer has to choose the optimal amount of labor to maximize the net value of the staple crop. Thus, the farmer chooses L_2^S to maximize $(L_2^S)^{\alpha} T^{1-\alpha} - w_2 L_2^S$, where w_2 is the wage rate in period 2. From the first-order condition, it is easy to show that the net income from the staple is maximized at

$$L_2^S = T\left(\frac{\alpha}{w_2}\right)^{1/(1-\alpha)}. \tag{2}$$

While the farmer knows what the wage in period 2 is when deciding to use labor in period 2, this wage is outside her control, and, hence, she takes it as given. The period 2 wage can take two possible values, w^H and w^L, with $w^H > w^L > 0$. Obviously from (2), for this farmer, the period 2 labor used will be higher when the corresponding wage is lower.

The labor used on one's land can be a mix of hired and family labor. Family labor can work on the farm or hire itself out at the market wage. The opportunity cost of family labor is, therefore, the market wage. We make the assumption that a farmer exhausts family labor before hiring labor if the opportunity cost of the family labor is the same as the cost of hired labor.

The profit, or in our case the rent from land, is the net value of the staple crop—revenue minus the labor cost. Both the revenue and the labor cost are a mix of market and imputed values. The crop can be consumed at home or sold, and the market price (which is 1 as assumed) is the opportunity cost of a unit of home consumption. Moreover, as mentioned above, the cost of family labor is the forgone wage in the ganyu market. Suppose the high-wage state and low-wage state are denoted H and L, respectively, and their respective probabilities of happening are p and $1 - p$, with $0 < p < 1$. Then, if i denotes the state ($i = H, L$), the period 2 net income from the staple crop using equation (2) is

$$Y_i^S = (1 - \alpha)T\left(\frac{\alpha}{w_2^i}\right)^{\alpha/(1-\alpha)}. \tag{3}$$

Finally, note two things. First, in period 1, there is no cash inflow from family labor on one's own farm but a cash outflow for hired labor. For simplicity, we will assume that the farmer has enough liquidity to pay for hired labor in period 1. This is consistent with our assumption that family labor is preferred to hired labor. Also note that the labor demand for preparing the land in period 1 is an increasing function of land. Therefore, it is only the large farmers who will hire labor in period 1; our assumption simply states that larger farmers have enough liquidity. Second, since we are calculating the net income in period 2, the family labor component always gets "paid" (i.e., is subtracted as other wage-related cost). To compensate for this, the second-period income is the net income plus the wages of family labor.

When the farmer decides to grow the staple on her land, she expects to earn over the two periods a value given by

$$EY^S = w_1(F - l^S T) + p\left[w_2^H F + Y_H^S\right] + (1 - p)\left[w_2^L F + Y_L^S\right]. \tag{4}$$

For ease in notation, let us define the following terms:

$$\sigma^H \equiv (1 - \alpha)\left(\frac{\alpha}{w_2^H}\right)^{\alpha/(1-\alpha)},$$

and

$$\sigma^L \equiv (1-\alpha)\left(\frac{\alpha}{w_2^L}\right)^{\alpha/(1-\alpha)}.$$

Using these definitions, we can write (4) as

$$EY^S = w_1(F - l^S T) + p\left[w_2^H F + \sigma^H T\right] + (1-p)\left[w_2^L F + \sigma^L T\right]. \quad (4*)$$

For completeness, we need to make one more observation. An obvious alternative for the farmer is not to produce any crop on the land and earn labor income only in the two periods equal to $w_1 F + p[w_2^H F] + (1-p)[w_2^L F]$. Observe that (4) collapses to this value for all landless laborers in the village ($T = 0$). We would want to be able to say that owning land is always at least as good as not owning land and, hence,

$$EY^S \geq w_1 F + p\left[w_2^H F\right] + (1-p)\left[w_2^L F\right] \quad \text{for all } T \geq 0. \quad (5)$$

B. *Production of Commercial Crop*

There are two major differences between the staple crop and the commercial crop. First, the commercial crop technology is more sophisticated than the staple crop technology. We assume that this is observed in the preparation of the land. More specifically, for a given plot of land, the greater the intensity of labor use on the land in period 1, the greater the productivity in period 2. Preparation of the land can be interpreted as investment in land. For the staple crop, this is a simple technology for which the investment in labor required per unit of land is constant. For the commercial crop, greater investment can give greater second-period productivity. There is, therefore, a period 1 output that is nontransferable and has no immediate monetary value but has a positive impact on the period 2 output. Formally, this productivity is denoted I, and

$$I = aT\left(L_1^M\right)^\gamma; \quad a > 0 \text{ and } 0 < \gamma < 1. \quad (6)$$

Recall that the productivity of the period 2 staple land has also been implicitly defined. For the staple crop, this productivity is an indicator function taking the values 1 or 0. Any labor intensity less than l^S gives zero productivity; anything above l^S gives a productivity of 1.

The second way in which the commercial crop differs from the staple crop is the uncertainty of the activity. As stated above, the commercial crop can be hit by a shock such as droughts, floods, or crop disease. To keep matters simple, we add some structure to this shock, but as will be evident the qualitative results will be unaffected by greater generalizations.

The risk of a shock, denoted $\tilde{A}$, generates two possible states: high return ($\tilde{A} = A > 1$) or zero return (crop failure). Risk $\tilde{A} = A$ with probability p, and $\tilde{A} = 0$ with probability $1-p$. The important thing about this risk is that farmers in the beginning of period 2 can observe a perfect signal about what the state will be. What this implies is that on receiving the signal about the low state, the farmers have to abandon their decision to produce the commercial crop. This means that their entire family must enter the labor market, as their earnings from commercial crop production are zero and they cannot produce any staple because they have not prepared their land for staple production.

For the positive situation of $\tilde{A} = A$, the commercial crop production value for the farmer is given by

$$M\left(L_2^M,\ T\right) = IA\left(L_2^M\right)^{\beta} T^{1-\beta},\ \text{with } 1 > \gamma + \beta, \tag{7}$$

and this happens with probability p. The restriction on $\gamma + \beta$ ensures that the interaction of first-period labor with second-period labor keeps the second-period production technology concave in first-period labor (see eq. [12] below). With probability $1 - p$, the farmer gets nothing because her seedlings are destroyed by drought, floods, or pests. However, she can earn w_2F by using her family labor in the ganyu market.

If the shock is good, the commercial farmer maximizes the following expression at the beginning of period 2 and decides on the second-period labor demand, L_2^M:

$$IA\left(L_2^M\right)^{\beta} T^{1-\beta} - w_2^H L_2^M, \tag{8}$$

yielding a labor demand

$$L_2^M = T\left(\frac{IA\beta}{w_2^H}\right)^{1/(1-\beta)}. \tag{9}$$

As in equation (3), this yields a net income from the commercial crop in period 2 of

$$Y_H^M = (1-\beta)T(IA)^{1/(1-\beta)}\left(\frac{\beta}{w_2^H}\right)^{\beta/(1-\beta)}, \quad \text{and } Y_L^M = 0. \tag{10}$$

The period 2 earnings of the commercial farmer thus take on two possible values: no negative shock gives her Y_H^M with probability p, and a negative shock gives her $w_2^L F$ with probability $1-p$.

Corresponding to equation (4), the second-period income for a commercial farmer is given by

$$EY^M = w_1\left(F - L_1^M\right) + p\left[w_2^H F + Y_H^M\right] + (1-p)\left[w_2^L F\right], \qquad (11)$$

where L_2^M is given by (9). As we did for equation (4), we can write

$$\begin{aligned} EY^M &= w_1\left(F - L_1^M\right) + p\left[w_2^H F + \mu^H T(I)^{1/(1-\beta)}\right] + (1-p)\left[w_2^L F\right] \\ &= w_1\left(F - L_1^M\right) + p\left[\mu^H T(I)^{1/(1-\beta)}\right] + R, \end{aligned} \qquad (11*)$$

where

$$\mu^H \equiv (1-\beta)(A)^{1/(1-\beta)}\left(\frac{\beta}{w_2^H}\right)^{\beta/(1-\beta)}$$

and

$$R \equiv \left(1-q\right)\left[w_2^L F\right] + p w_2^H F.$$

Observe that μ^H and R are both independent of L_1^M. The difference from the staple production is that now the farmer must also nontrivially decide on the amount of period 1 labor to use on each unit of land. For the staple crop, this was given by technology; for the commercial farmer, this is an endogenous choice. In other words, the commercial farmer will choose L_1^M to maximize the right-hand side of equation (11) (or eq. [11*]), which is the same thing as maximizing $w_1\left(F - L_1^M\right) + p\left[\mu^H T(I)^{1/(1-\beta)}\right]$. Substituting equation (6) into this expression, the solution for the first-period labor demand for commercial production is given by

$$\begin{aligned} L_1^M &= Q(T)^{(2-\beta)/(1-\beta-\gamma)}, \\ \text{where } Q &\equiv \left\{\frac{[\gamma/(1-\beta)](p\mu^H)(a)^{1/(1-\beta)}}{w_1}\right\}^{(1-\beta)/(1-\beta-\gamma)}. \end{aligned} \qquad (12)$$

Plugging this value of L_1^M into the expression being maximized, and recalling (6), we get

$$w_1 F + p\left\{\mu^H T\left[aT\left(L_1^M\right)^\gamma\right]^{1/(1-\beta)}\right\} - w_1 L_1^M,$$

which, on simplification yields

$$\left[Z(Q)^{\gamma/(1-\beta)} - w_1(Q)^{(1-\beta-\gamma)/(1-\beta)}\right] T^{(2-\beta)/(1-\beta-\gamma)}, \quad \text{where } Z \equiv p\mu^H\left(a^{1/(1-\beta)}\right). \tag{12*}$$

The important thing to note here is that the maximized value of (11*) is increasing at an increasing rate in T, while (4*) is linear in T. Therefore, comparing (4*) and (12*), we know that there exists a value T^* of land such that $EY^M \geq EY^S$ if and only if $T \geq T^* \geq 0$, or that the larger farmer will opt for the commercial crop while the smaller farmer will stay with the staple crop.

C. The Aggregated Economy

Any region will have a distribution of farmers distinguished from each other by the amount of land they hold. Given the productivity of land in the region, the prices, the wages, and the technology, farmers make their decisions. We are interested in the impact of the equilibrating farmer decisions on the off-farm regional labor market.

First, observe that staple-growing farmers with landholding less than F/l^S will have family labor available for the labor market of an amount $F - l^S T$. Similarly, from equation (12), we can get a value of T for the commercial farmers such that all farmers below this amount of landholding will supply labor in the first-period labor market. More formally, for all T less than or equal to $(F/Q)^{(1-\beta-\gamma)/(2-\beta)}$ (but greater than T^* since otherwise she would be a staple producer), commercial farmers will be providing labor to the first-period labor market.

Let $T^S \equiv \min[(F/l^S), T^*]$, $T^M \equiv \max\left[(F/Q)^{(1-\beta-\gamma)/(2-\beta)}, T^*\right]$, and $G(T)$ be the distribution of land in the region. Then the first-period ganyu supply from the staple-growing farmers, N_1^S, will be given by

$$N_1^S = \int_0^{T^S} F - l^S T dG(T),$$

and the first-period ganyu supply from commercial farmers, N_1^M, is given by

$$N_1^M = \begin{cases} 0 & \text{if } T^M \leq T^* \\ \displaystyle\int_{T^*}^{T^M} F - Q(T)^{(2-\beta)/(1-\beta-\gamma)}\, dG(T) & \text{if } T^M > T^* \end{cases}.$$

First-period labor demand by staple growers will similarly be given by

$$D_1^S = \begin{cases} 0 & \text{if } T^S \geq T^* \\ \int_{F/l^S}^{T^*} l^S T - F dG(T) & \text{if } T^S < T^* \end{cases}$$

and for commercial farmers by

$$D_1^M = \int_{T \geq T^M} Q(T)^{(2-\beta)/(1-\beta-\gamma)} - F dG(T).$$

The first-period labor market will clear when $N_1 \equiv N_1^S + N_1^M = D_1^S + D_1^M \equiv D_1$. Observe that Q contains the first-period-equilibrating w_1 that will ensure that the first-period labor market clears since it is immediate that the supply of labor for both types of farmers is increasing in w_1 while their demands for labor are decreasing in w_1.

This statement is valid only if w_2^H is correctly anticipated by the farmers. The only thing that affects the second-period wage is the signal. Thus, all farmers can successfully predict the wage once they observe the signal, and this prediction will be self-fulfilling in equilibrium. Thus, all farmers know what the second-period market-clearing wage is once they observe the signal.

To see this more clearly, let us calculate the demands and supplies of second-period labor. Suppose the signal is good (i.e., there is no shock). Then all commercial farmers will demand L_2^M as given by equation (9), which depends only w_2^H and is increasing in T. The aggregate demand for labor by a commercial farmer is given by $L_2^M = T\left(IA\beta/w_2^H\right)^{1/(1-\beta)} = T\Omega$ (see eq. [9]), where $\Omega \equiv \left(IA\beta/w_2^H\right)^{1/(1-\beta)}$. Therefore, if $T\Omega \leq F$ or $T \leq F/\Omega$ and $T^* < F/\Omega$, farmers will supply labor in the second period; otherwise they will demand labor. Hence, the supply of second-period labor in the market by commercial farmers, $N_2^M(H)$, with H denoting a positive signal, is given by

$$N_2^M(H) = \begin{cases} \int_{T^*}^{F/\Omega} F - T\Omega \, dG(T) & \text{if } T^* < F/\Omega \\ 0 & \text{otherwise} \end{cases}.$$

In equation (2), we stated the amount of labor used by the staple grower as a function of the second-period wage. If the correlated shock is good, the second-period wage is denoted w_2^H, and we can write equation (2) as $L_2^S = T\left(\alpha/w_2^H\right)^{1/(1-\alpha)} = T\Phi^H$, where $\Phi^H \equiv \left(\alpha/w_2^H\right)^{1/(1-\alpha)}$. Thus,

$$N_2^S(H) = \int_0^{\tau^H} F - T\Phi^H \, dG(T),$$

where $\tau^H = \min(T^*, F/\Phi^H)$. Observe that both Ω and Φ^H are decreasing functions of the second-period (high) wage, and hence the two supply curves are upward sloping, giving a positively sloped aggregate second-period labor supply when the signal is good.

Correspondingly, the demand for second-period labor by commercial farmers is

$$D_2^M(H) = \begin{cases} \int_{F/\Omega} T\Omega - FdG(T) & \text{if } T^* < F/\Omega \\ \int_{T^*} T\Omega - FdG(T) & \text{if } T^* \geq F/\Omega \end{cases}$$

and

$$D_2^S(H) = \begin{cases} \int_{F/\Phi^H}^{T^*} T\Phi^H - FdG(T) & \text{if } \mathrm{T}^* \geq \mathrm{F}/\Phi^{\mathrm{H}} \\ 0 & \text{otherwise} \end{cases}.$$

Observe that both demand curves are negatively sloped in w_2^H; hence, as in the first-period labor market, the high-signal wage will equilibrate

$$N_2(H) \equiv N_2^S(H) + N_2^M(H) = D_2^S(H) + D_2^M(H) \equiv D_2(H).$$

When the signal about the shock is bad or low, then all commercial farmers will offer their entire family labor to the market. Then if $\Phi^L \equiv \left(\alpha/w_2^L\right)^{1/(1-\alpha)}$, then $N_2^M(L) = \int_{T^*} F\, dG(T)$ and $N_2^S(L) = \int_0^{\tau^L} F - T\Phi^L\, dG(T)$, where $\tau^L = \min(T^*, F/\Phi^L)$. While $N_2^M(L)$ is invariant with respect to w_2^L, the staple labor supply is increasing in w_2^L, once again giving us a positively sloped second-period supply curve of labor when the signal is bad.

In the low-signal case, there will be no demand for period 2 labor by commercial farmers, and only the staple growers will demand labor. Thus,

$$D_2^M(L) = 0,$$

and

$$D_2^S(L) = \begin{cases} \int_{F/\Phi^L}^{T^*} T\Phi^L - FdG(T) & \text{if } T^* \geq F/\Phi^L \\ 0 & \text{otherwise} \end{cases}.$$

Observe that $\Phi^L \to \infty$ as $w_2^L \to 0$, and, hence, there will always be a positive second-period low wage at which the market clears (i.e., $D_2^S(L) > 0$).

Note that the second-period low-wage equilibrium, which happens when the shock is bad, implies that staple growers, or the small farmers, will demand more ganyu than the large farmers (who demand no labor and supply all their family labor to the market). Since family labor is preferred to hired labor, this means that smaller farmers will be using all their labor on the farm, while larger farmers will be entering the supply side of the labor market when wages are low. It is as if the low wage (bad signal case) squeezes out the smaller farmers from the labor market.

We can summarize the most relevant conclusions from our model as follows:

1. Overall ganyu supply will increase in the event of a negative shock.
2. This effect is driven by commercial farmers abandoning their production and making use of ganyu as their fall-back option. These commercial farmers are those farmers with larger land size.
3. Conversely, small farmers tend to stay with the riskless staple food production, so that shocks only indirectly affect their ganyu supply. In equilibrium they should supply less rather than more ganyu in the event of a shock.
4. In good states of nature (no negative shocks), ganyu will be supplied primarily by poor farmers (simply because they need less of their family labor on their own land), whereas large farmers will demand ganyu.

III. Ganyu Labor in Rural Malawi: Context and Descriptive Statistics

To test the hypotheses of our model in the context of rural Malawi, we use the Second Integrated Household Survey 2004, available upon request from the World Bank. Data were collected between March 2004 and March 2005. The survey covers a stratified random sample of 11,280 households (including a total of 52,702 individuals, or 0.42% of the Malawi population), over the whole area of the country. As ganyu is predominantly a rural phenomenon and occupational decisions by urban households tend to be based on different considerations (with additional options for off-farm labor supply), we restrict our sample to agricultural households, namely, households engaged in agricultural production during the reference period. These represent approximately 89% of the sample, the size of which is reduced to 10,032 observations. After accounting for missing values, we are left with 9,994 observations for our empirical analysis.

To set the stage, we first take a look at the land distribution and cash crop choices among farmers in rural Malawi. Figure 1*A* highlights the average land size across quintiles in the land distribution, while figure 1*B* shows the pro-

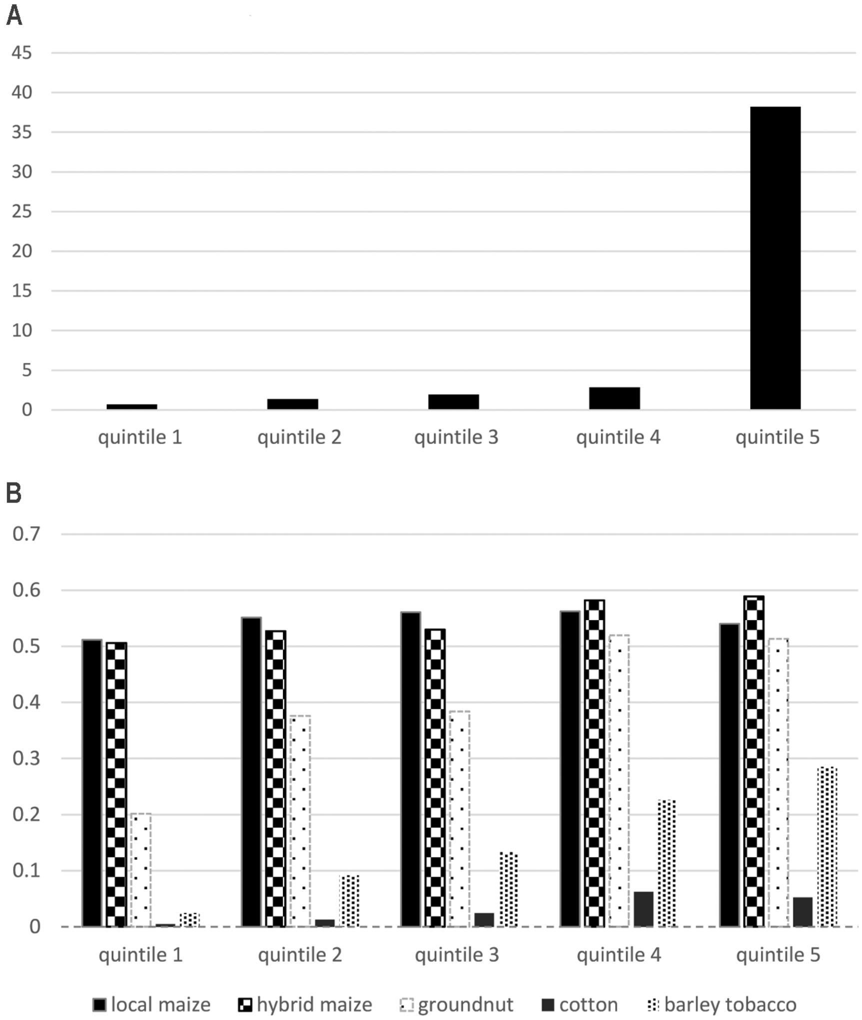

Figure 1. *A*, Average land size (hectares) per quintile of the land distribution. *B*, Share of households producing different crops, by quintile of the land size distribution; quintile 1 represents the smallest plot area, and quintile 5 the largest plot area. Source: Authors' calculations, based on the Second Integrated Household Survey of Malawi.

portions of different types of crops, produced by farmers belonging to these quintiles. Taken together, these statistics are consistent with the evidence on Malawi, presented at the outset of the article, as well as with the dynamics of the model outlined in Section II. The highly skewed land distribution, whereby land is concentrated among the top 20% of the farmers while 80% of the smallholders operate land plots on average not exceeding 2 hectares, is consistent with the evidence of a continued dualistic agricultural market structure. Furthermore, the production of barley tobacco, groundnuts, and cotton, the key cash crops in Malawi, is much more prevalent among the largest farmers belonging to quintile 5 than among the small households in quintile 1 and increases relatively steadily in between. Hence, without loss of generality, and in keeping with our theoretical model, we conduct our empirical estimations separately for the samples of "large" farmers, belonging to quintile 5, and "small" farmers, belonging to quintiles 1–4.[1]

To further verify the realism of the model's assumptions in the context of Malawi, we take a look at the probability of demand and supply of ganyu labor—captured by the proportions of farmers supplying and demanding ganyu—separately for large farmers (belonging to quintile 5 of the land size distribution) and small farmers (belonging to quintiles 1–4 of the land size distribution) in the event of a shock and in the event of no shock (see fig. 2). Shocks related to droughts, floods, or crop diseases, that is, the types of shocks that are key to our analysis, are referred to as "village shocks" since they are correlated across households. The diagram also highlights the average regional wages for the different states of nature.

Once again, the statistics are consistent with the logic of our model. We observe that the model's dynamics is indeed driven by the behavior of large farmers who appear to enter the market on the supply side and exit the market on the demand side in the event of shock compared to the state of no shock, while the probability of either entering or exiting the ganyu market remains roughly unchanged for small farmers. The statistics are also consistent with the model in that under "normal conditions" the supply side of the market is dominated by smallholders while large farmers are more likely to demand ganyu labor, as well as with the fact that while smallholders "belong" to the market, the shock-based dynamics is driven by large farmers whose probability to enter on the supply side and probability to exit on the demand side increases. While these statistics reflect probabilities, a further look at the data indicates that the average days of labor supplied by smallholders decreases in the event of a correlated shock, especially one characterized by pests and crop diseases, consistent with the general equilibrium dynamics of the model. Finally, the general equilibrium dynamics is confirmed by the 10% lower regional wage in the event of a correlated shock compared to the situation of no shock.

[1] We also performed estimations separately for all five quintiles. These results, available upon request, are consistent with our model and overall story. Given the better fit of our estimates for two sets of farmers—large and small—with the model, we prefer to keep only these results in the article.

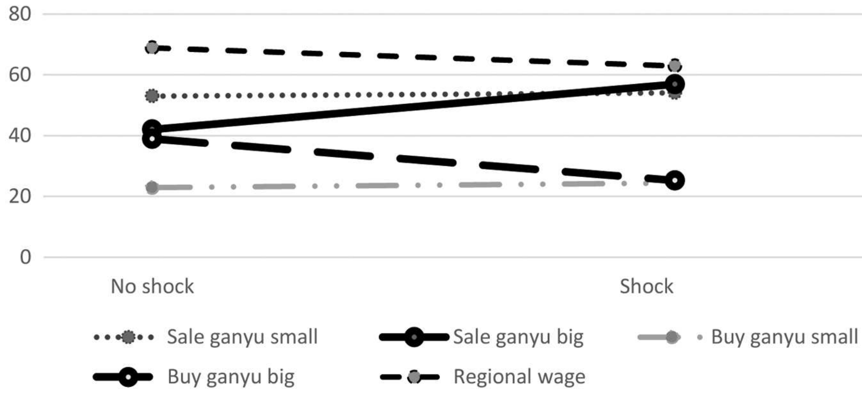

Figure 2. Ganyu buying and selling behavior of small and large farmers. Source: Authors' calculations, based on the Second Integrated Household Survey of Malawi.

Since our main empirical focus is on ganyu labor, we are interested in identifying key covariates of ganyu labor over and above the village shocks. Table 1 highlights the prevalence of ganyu in Malawi and shows the characteristics of the households participating in the ganyu labor market. The first row shows that ganyu is a wide-spread phenomenon. During the year of the survey, more than half of the rural households in Malawi (44% + 9%) supplied some ganyu, and about one-quarter (16% + 9%) recruited ganyu. A noticeable 9% of the households even engage in both supply and demand of ganyu, which is also consistent with our model.

The following rows in table 1 provide some information on the well-being of households, household structure, as well as land and production characteristics. While poverty is widely spread across all groups, on average, ganyu-recruiting households are significantly better off than ganyu-supplying households.

Table 1 further shows that on average, ganyu-supplying households are slightly smaller, much more often headed by females (which may be another, more indirect indicator of destitution; see Green and Baden 1994; Devereux 1999; Bryceson 2006), and considerably less educated than ganyu-recruiting households. As expected, they tend to own smaller plots and grow cash crops less frequently.

Table 1 also shows the share of households that reported the occurrence of different types of shocks. Aside from the above-mentioned "village shocks," we show statistics (and later control for) two idiosyncratic—death/sickness and theft/damage—shocks, included as a matter of comparison. These shocks should not influence the ganyu market as a whole but might still influence individual households' ganyu supply and demand decisions (much like the

TABLE 1

CHARACTERISTICS OF AGRICULTURAL 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	43.69%	16.10%	8.57%	31.64%
	[42.06%–45.34%]	[14.97%–17.29%]	[7.89%–9.29%]	[30.09%–33.24%]
Share of households below the poverty line*	25.68%	3.78%	9.94%	16.63%
	[23.61%–27.74%]	[2.88%–4.68%]	[7.69%–12.19%]	[14.74%–18.52%]
Share of severely underweight children under 5 years (weight for age, −3 SD)	8.67%	4.87%	6.06%	7.59%
	[7.39%–9.99%]	[3.49%–6.24%]	[4.15%–7.97%]	[6.02%–9.16%]
Share of households with iron roof	8.10%	51.03%	28.64%	17.66%
	[7.12%–9.08%]	[47.36%–54.69%]	[24.64%–32.63%]	[15.75%–19.58%]
Average number of household members	4.65	4.87	5.22	4.26
	[4.57–4.73]	[4.73–5.01]	[5.06–5.38]	[4.16–4.36]
Average number of adults in the household	2.29	2.44	2.61	2.06
	[2.25–2.32]	[2.37–2.52]	[2.52–2.70]	[2.01–2.11]
Share of female headed households	26.82%	15.37%	17.83%	25.58%
	[25.43%–28.21%]	[13.53%–17.21%]	[15.00%–20.65%]	[23.89%–27.26%]
Average education of household head (years of schooling; range 0–19)	3.37	6.90	5.08	4.10
	[3.24–3.49]	[6.59–7.21]	[4.79–5.37]	[3.93–4.27]
Average land size of household (hectares)	8.96	7.51	8.30	9.05
	[1.19–16.72]	[3.41–11.62]	[2.27–14.32]	[1.90–16.21]
Share of households with small plots (<.5 hectares)	34.89%	22.91%	24.54%	32.55%
	[32.77%–37.00%]	[20.24%–25.59%]	[21.38%–27.69%]	[30.09%–35.01%]

Share of households growing maize	96.17%	98.39%	98.71%	93.78%
	[95.26%–97.07%]	[97.68%–99.10%]	[97.99%–99.44%]	[92.57%–94.99%]
Share of households growing cash crops (tobacco, cotton, and groundnuts)	43.00%	53.57%	54.49%	43.48%
	[40.33%–45.68%]	[50.03%–57.11%]	[50.40%–58.58%]	[40.83%–46.13%]
Average number of different crops (rainy season)	3.22	3.50	3.58	3.04
	[3.13–3.32]	[3.35–3.66]	[3.41–3.76]	[2.94–3.14]
Share of land uncultivated	26.19%	19.45%	25.99%	24.27%
	[24.05%–28.34%]	[17.11%–21.80%]	[22.81%–29.17%]	[21.78%–26.75%]
Share of households experiencing a village shock	17.55%	14.05%	19.54%	14.57%
	[15.57%–19.52%]	[11.87%–16.23%]	[16.34%–22.75%]	[12.32%–16.83%]
Share of households experiencing a personal shock (death/sickness)	17.37%	15.71%	18.14%	16.41%
	[15.88%–18.85%]	[13.56%–17.86%]	[15.48%–20.80%]	[14.72%–18.11%]
Share of households experiencing a property shock (theft/damage)	15.21%	16.95%	18.00%	14.50%
	[13.76%–16.67%]	[14.93%–18.97%]	[15.03%–20.97%]	[12.86%–16.15%]

Note. 95% confidence intervals in brackets. All population estimates take into account the stratified sample structure as well as household weights (using STATA survey data commands).

* Poverty line is 16,165 Malawi kwacha (MK) per person per year, or 44.3 MK per person per day (corresponding to US$0.42 at 2004 exchange rate).

indicators of poverty or the indicator of household labor resources already mentioned above). In keeping with our model, the group that both demands and supplies ganyu (the one that according to our model is likely to move from the demand to the supply side of the market) reports the greatest incidence of shocks, especially those of a correlated nature.

Let us conclude our overview of ganyu in Malawi by looking at the regional and seasonal spread of the phenomenon. While geographical and seasonal aspects are not captured by our theoretical framework, they may hide relevant cultural and production-related factors for which we might need to control in the following econometric analysis. Figure 3 presents the share of households involved in hiring ganyu by season and district. As a seasonal differentiation is not available for supply, we use the hiring data to reflect the overall prevalence of ganyu. Households in urban districts are included if they are engaged in agricultural activities.[2]

Figure 3 shows considerable differences in the prevalence of ganyu across regions. Generally, ganyu is less prevalent in the northern part of Malawi. As ethnic groups in Malawi are regionally located, 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, who 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). These and other cultural or religious characteristics of different groups may introduce social barriers to ganyu in some cases and a more open attitude in others.

In addition, it is clear that ganyu is much more relevant in the rainy than in the dry season. This may be related to a stronger need of workers during the rainy season but also to the fact that the end of the rainy season (January to March) corresponds to the period of greatest difficulty to meet consumption needs. The main harvest takes place during the dry season (March to October) and generally ensures at least a minimum level of consumption. As far as the possibility to produce during the dry season is related to geographical factors, this may also explain some of the regional differences discussed above. Overall, the descriptive statistics are consistent with both the theoretical model and our understanding of the characteristics of ganyu labor in Malawi.

IV. Empirical Specification

To recapitulate, we distinguish between hypotheses related to (A) times of shock and (B) normal times, that is, once the event of negative shocks is controlled for:

[2] Agricultural but "urban" households constitute 6.3% of the households in our sample.

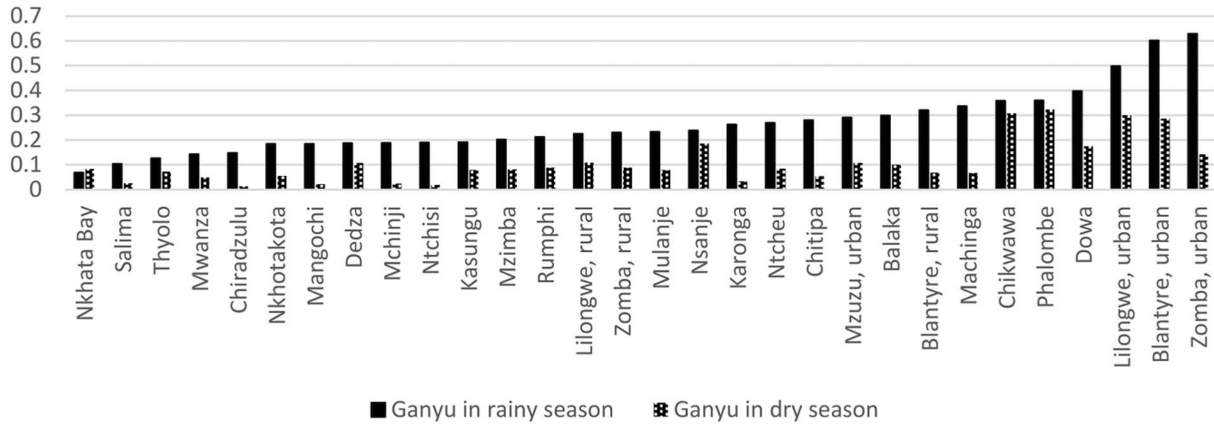

Figure 3. Share of households involved in ganyu by season and district. Source: Authors' calculations, based on the Second Integrated Household Survey of Malawi

A. Hypotheses related to times of shock

- H1. Ganyu supply will rise in the event of correlated shocks.
- H2. This effect is driven by the effect of the shock on large farmers.
- H3. Small farmers will be indirectly affected and tend to reduce their ganyu supply.

B. Hypothesis related to normal times

- H4. In normal times, ganyu is supplied primarily by small farmers. To test these hypotheses, we perform the empirical analysis first for the full sample, focusing on the characteristics of ganyu in general and on whether ganyu is primarily supplied by small farmers (hypothesis B), and then separately for small and large farmers (hypotheses A).

We proxy our dependent variable with the total number of days of ganyu labor supplied by each household during the reference year. Our measure of correlated shocks is based on the household's positive response to a question related to the incidence of droughts, flood, or crop pests, which, we assume, will affect numerous households in a given village at the same time. This correlated nature of the shock is important in the context of our theoretical model because idiosyncratic shocks—while potentially severe for any individual household—should not have significant repercussions for the labor market as a whole.

In order to show this contrast within our empirical model, we introduce idiosyncratic (household level) shocks as control variables, notably a dummy variable for household personal shocks due to accidents, illness, or death of working-age members of the household and another dummy variable for household property shocks due to damage or theft, including theft of livestock. To test our hypotheses on the effect of shocks on large relative to small farmers in our initial full sample analysis, we introduce a "small plot" variable, indicating that a household owns less than 0.5 hectares of land, which makes it practically landless (Green and Baden 1994). In terms of our quintiles, this critical threshold coincides approximately with the cutoff between quintile 1 and quintile 2.

Apart from these main variables capturing the central predictions of our theoretical model, we consider a number of controls, which mainly reflect the farmer's agricultural productivity, wealth characteristics, and geographic characteristics. While at the individual farmer's level the model identifies the comparison between on-farm productivity and wages as a determinant of ganyu supply, wages are endogenous to the correlated shock variable, and hence the effect of wages is implicitly captured by the dynamics of labor supply in the face of correlated shocks.

While aside from land size, own-farm productivity is likely to vary with the use of fertilizer and other inputs to the production function, such variables are likely to be endogenous. In addition to land size, we thus include only a variable for production during the dry season (which is only possible in certain locations). Neither of these two variables is likely to change in the short run.

As an additional determinant of own-farm productivity, we consider human capital. Two types of measures of human capital have been used in household-level labor supply equations, namely, either education and age (or experience) of the household head or the average levels of education and age (or experience) of all household members. Since the human capital characteristics of household members are typically highly correlated and the measures for the household head are less likely to be endogenous (Rizov and Swinnen 2004), we give preference to the former and define our educational indicator as the years of education and the experience indicator as the age of the household head.

Available family labor is proxied with the number of adults age 15–64. Conversely, children under 15 and elderly people will be considered as dependents whose proportion is used as an indicator for poverty, along with a dummy variable for a female household head. We also include a dummy for family homes with an iron roof to reflect household wealth.

Finally, we introduce some geographic and cultural controls. Malawi is divided into the three regions: north, center, and south. On the basis of the statistics presented in figure 3, we expect ganyu to be much less prevalent in the north. We thus include a dummy variable for the northern region. In addition, we include dummy variables for the most important ethnic groups, the Chewa, mainly in central Malawi, and the Lomwe and Yao in the south (see, e.g., CIA 2012; Malawi Government 2014). In multiethnic households, the measure refers to the household head. These variables are meant to control for different traditions in different parts of the country that could also affect ganyu supply. A detailed description of all variables can be found in table A1.

V. Econometric Estimation Strategy and Empirical Results

As the number of days of ganyu, supplied by the household, cannot be smaller than zero, our dependent variable is censored. For this reason, estimating the off-farm labor supply function with ordinary least squares would lead to biased results. Tobit and Heckman selection models are both potentially more appropriate (Cragg 1971; Heckman 1979). Our theoretical model does not suggest any structural difference between the decision to first enter the ganyu labor market and the decision of how much ganyu to supply. At least the direction of the expected effects should be the same for both decisions. This suggests the use of a Tobit model. To confirm that this is the case empirically, we perform likelihood ratio tests to discriminate between the two options. The chi-square statistics turn out to be well below the critical values, indicating that the decision to enter the ganyu market and the amount of labor supplied to this activity are (statistically) not two separate decisions. On the basis of these results, a Tobit model will be estimated. As we are not interested in the effect of our explanatory variables on a latent concept, such as the "preference for ganyu supply," but on the actual days of ganyu labor supplied, we do not directly present the coefficients of the Tobit equation. Instead, we present the marginal effects with respect to the expected number of days of ganyu supply, that is, for any explanatory variable x_j with coefficient β_j (Wooldridge 2002, 523):

$$\frac{\partial E(\text{ganyu days}|x)}{\partial x_j} = \Phi\left(\frac{x\beta}{\sigma}\right)\beta_j$$
$$= \Pr(\text{ganyu days} > 0|x)\beta_j.$$

Before we present the results, a few additional estimation problems need to be considered. First, our data are drawn from a stratified random sample, so that observations within strata may not be fully independent. This could lead to an underestimation of standard errors and thus an overconfidence in our regression results. Hence, we determine our standard errors through bootstrapping, which also allows us to take stratification into account.

Second, there may be concerns with respect to the possible endogeneity of some of our variables. As mentioned earlier, endogeneity may also be a problem with respect to different variables used to capture own-farm productivity. While, for precisely this reason, we have already been highly selective with the inclusion of these variables, some concerns may remain. To be sure, we carry out an endogeneity test for land area, dry season cultivation, and education, using the two-step procedure for Tobit models outlined by Wooldridge (2002). The instruments used are the regional share of small area farms and the ethnic background of the household head, respectively. We thereby cover geographical and cultural factors that should be truly exogenous and that are highly correlated with our variables of interest. Using these instruments for the above-mentioned test, we determine that the hypothesis of exogeneity of our initial variables cannot be rejected at any conventional level of significance.

Table 2 highlights our regression results for the sample as a whole. In regressions 1 and 2, we report the results using all variables related to farm productivity, wealth or poverty, household labor resources, and the dummy taking the value of 1 if the household resides in the northern part of the country.

TABLE 2

DETERMINANTS OF GANYU SUPPLY, FULL SAMPLE

	(1)	(2)	(3)	(4)
Shock:				
Household personal shock			2.90**	3.05**
			(.03)	(.04)
Household property shock			1.62	1.73
			(.34)	(.23)
Village shock			.99	1.14
			(.45)	(.37)
Wealth/poverty:				
Small plot	3.80***		3.78***	4.09***
	(.00)		(.00)	(.00)
Plot size		−.005		
		(.51)		
Iron roof	−22.15***	−22.03***	−22.18***	−22.06***
	(.00)	(.00)	(.00)	(.00)
Female household head	2.31	2.66*	2.23	1.87
	(.10)	(.08)	(.10)	(.18)
Dependents	4.49*	3.98	4.35*	4.25*
	(.07)	(.10)	(.10)	(.09)
Household labor resource:				
Adults	9.04***	8.78***	9.02***	8.82***
	(.00)	(.00)	(.00)	(.00)
Productivity:				
Dry season cultivation	−1.79	−2.11*	−1.75	−1.96*
	(.13)	(.05)	(.15)	(.06)
Education	−2.34***	−2.35***	−2.33***	−2.48***
	(.00)	(.00)	(.00)	(.00)
Age household head	−.38***	−.39***	−.38***	−.37***
	(.00)	(.00)	(.00)	(.00)
Regional control:				
North	−16.52***	−16.85***	−16.46***	−19.48***
	(.00)	(.00)	(.00)	(.00)
Chewa				−3.78**
				(.01)
Lomwe				−11.23***
				(.00)
Yao				−12.99***
				(.00)
Wald	$\chi^2(9) = 601.08$	$\chi^2(9) = 651.52$	$\chi^2(12) = 618.78$	$\chi^2(15) = 610.35$
	(.00)	(.00)	(.00)	(.00)

Note. Tobit estimated effects on *E*(ganyu days | ganyu days > 0). Marginal effects or discrete change of dummy variables from 0 to 1. *P*-values in parentheses. The stratified sample structure is taken into account in the estimation of standard errors using bootstrapping (200 replications). *N* = 9,770.

* $p < .1$.

** $p < .05$.

*** $p < .01$.

Regression 3 then introduces the shocks, and regression 4 provides a robustness check with a larger number of regional/cultural controls.

The results based on specifications 1 and 2 confirm the traditional finding that ganyu is primarily a strategy of poorer smallholder households. All poverty and wealth indicators have the expected signs and are generally significant. Only the female household head variable shows a less robust effect. The effect of land size is also consistent with our model-driven expectations: households with small plots of land tend to supply more ganyu. Only in regression 2, when the indicator variable for small plots is replaced by the continuous variable for land size, does it lose its significance. This suggests that land size does not enter the ganyu supply function in a linear way but rather in terms of relevant thresholds.

Farm productivity variables, too, are generally significant and show the expected sign: higher education, greater experience, and the ability to produce crops across seasons reduce the supply of labor in the ganyu market. Moreover, the coefficient of the variable capturing household labor resources is positive and significant, indicating that, at given levels of all other variables, large households supply more ganyu. The regional control for northern parts of the country also shows the expected negative sign. Overall, we find support for hypothesis 4.

The coefficients of all these variables remain largely unaffected when we introduce the shock variables in regressions 3 and 4, the general impact of which is also consistent with our expectations. In regression 3, we see that in keeping with hypothesis 1, when hit by droughts, floods, or crop disease, the average household supplies an additional 2.4 days of ganyu (4.8 days if hit by two of these). However, note that the average effect across all households is insignificant. This is consistent with our theoretical assumptions on a larger supply of ganyu in the event of a correlated shock simultaneously with a decrease in ganyu supply by smaller farmers.

Household personal shocks have a positive effect on ganyu supply by the individual agricultural household, although in this case, this cannot be induced by the failure of production but only by a significant income effect leading to a reallocation between leisure and labor (which is outside of our model). The effect of household property shocks is less clearly significant, possibly because they tend to be much less severe in nature. We do not expect these shocks to have a differential effect on smaller and larger farmers, something that we will verify in the forthcoming separate regressions for these two sets of farm households.

The addition of further cultural and regional variables shows that the three largest ethnic groups in Malawi (which are located predominantly in the center and the south) tend to supply less ganyu than smaller, southern groups (the comparison group). But the rest of the regression results remains unaffected, so we will not consider these factors in the following analysis.

We now turn to the (key to our analysis) comparison across different land sizes to examine whether we find the predicted differences between small and large farmers for the correlated shocks. Table 3 presents separate estimations for these two sets of households.

These results are consistent with the predictions of our model. Village shocks that account for droughts, floods, and crop pests have a negative (although statistically insignificant) effect on small farmers and the expected positive and

TABLE 3
DETERMINANTS OF GANYU SUPPLY FOR SMALL AND LARGE FARMERS

	Small Farmer	Large Farmer
Shock:		
Household personal shock	4.579	11.43
	(.21)	(.14)
Household property shock	2.285	2.159
	(.52)	(.76)
Village shock	−1.731	24.83***
	(.60)	(.00)
Productivity:		
Dry season cultivation	−.216	−20.16***
	(.94)	(.00)
Education	−4.886***	−5.981***
	(.00)	(.00)
Age household head	−.816***	−.829***
	(.00)	(.00)
Wealth:		
Iron roof	−55.70***	−55.20***
	(.00)	(.00)
Household characteristic:		
Adults	23.06***	12.02***
	(.00)	(.00)
Female household head	5.664	9.502
	(.12)	(.18)
Dependents	11.51*	5.446
	(.06)	(.67)
North	−40.36***	−49.64***
	(.00)	(.00)
Wald	$\chi^2(11) = 596.86$	$\chi^2(11) = 165.36$
	(.00)	(.00)
N	7,878	1,892

Note. Tobit estimated effects on *E*(ganyu days | ganyu days > 0). Marginal effects or discrete change of dummy variables from 0 to 1. *P*-values in parentheses. The stratified sample structure is taken into account in the estimation of standard errors using bootstrapping (500 replications). Constant term not presented here.
* $p < .1$.
*** $p < .01$.

statistically significant effect on large farmers. In line with our theoretical expectations, we do not observe this relationship across land sizes for the idiosyncratic household-level shocks.

Table 4 provides further details on the village-level shock by disaggregating this shock variable into its two components, that is, shocks related to droughts or floods, on the one hand, and shocks related to crop disease or pests, on the other hand. The estimation shows that it is primarily the event of natural disasters such as droughts and floods that drives the results with the combined

TABLE 4

DETERMINANTS OF GANYU SUPPLY FOR SMALL AND LARGE FARMERS WITH DISAGGREGATED CORRELATED SHOCKS

	Small Farmer	Large Farmer
Shock:		
Household personal shock	4.273	11.55
	(.28)	(.13)
Household property shock	2.142	2.347
	(.54)	(.70)
Village shock 1—crop disease/pests	−22.30***	−8.474
	(.00)	(.57)
Village shock 2—drought or floods	3.165	29.47***
	(.37)	(.00)
Productivity:		
Dry season cultivation	.0704	−19.60***
	(.98)	(.00)
Education	−4.893***	−5.955***
	(.00)	(.00)
Age household head	−.821***	−.843***
	(.00)	(.00)
Wealth:		
Iron roof	−55.64***	−54.66***
	(.00)	(.00)
Household characteristic:		
Adults	23.03***	11.99***
	(.00)	(.00)
Female household head	5.671*	9.244
	(.07)	(.21)
Dependents	11.24*	5.960
	(.06)	(.67)
North	−40.59***	−49.63***
	(.00)	(.00)
Wald	$\chi^2(12) = 556.30$	$\chi^2(12) = 202.88$
	(.00)	(.00)
N	7,878	1,892

Note. Tobit estimated effects on *E*(ganyu days | ganyu days > 0). Marginal effects or discrete change of dummy variables from 0 to 1. *P*-values in parentheses. The stratified sample structure is taken into account in the estimation of standard errors (using the Huber-White sandwich estimator for probit and bootstrapping [500 replications] for Tobit). Constant term not presented here.
* $p < .1$.
*** $p < .01$.

village shock presented before. For this subcategory of the village-level shock, we find a strongly significantly positive effect on ganyu supply among larger farmers. The effect is also quantitatively substantial, with the experience of such a shock being associated, on average, with about 29 days of additional ganyu labor. By contrast, we obtain the expected negative and significant coefficient of the crop disease shock for small farmers. The results based on the shock disaggregation thus grant support to hypotheses 2 and 3, even though the effects are significant only for small farmers in the case of crop disease and for large farmers in the case of droughts or floods.

VI. Concluding Remarks

The occupational portfolio choice of small farmers in uncertainty ridden rural environments is among the most interesting and high profile areas of research and policy debate in development economics. The largest proportion of studies in this area has traditionally focused on the choice between relatively risk-free—though low return—activities such as subsistence farming and higher-return and higher-risk activities like livestock and cash crop production and agreed that relatively asset-poor and risk-averse households are likely to opt for the latter, thus potentially going down the slope of further destitution. By contrast, the literature on consumption smoothing via off-farm labor supply has focused on the ability of the market to absorb excess labor in the event of idiosyncratic production shocks, as well as on distributional issues linked to asset-based entry barriers for poor farmers in this market. This has left out of focus the intriguing case of labor market dynamics in the face of correlated shocks, as well as the interesting from a policy point of view situation of poverty exacerbation even when obvious entry barriers to factor markets are not present.

We contribute to the literature by bringing these two stylized paradigms together in a unified theoretical framework and exploring the general equilibrium dynamics of demand and supply of off-farm labor by relatively asset-poor and relatively asset-rich households in the face of correlated shocks. We observe that while in keeping with stylized theoretical assumptions asset-rich households are in a better ex ante position to opt for larger-return high-value agricultural activities, the more rewarding ex ante choices increase their ex post vulnerability to correlated shocks. The increased ex post propensity of large farmers to decrease labor demand and supply more off-farm labor in the event of a correlated shock can have potentially large implications for the off-farm labor market as a whole.

The hypotheses emanating from our theoretical model are supported by empirical evidence from rural Malawi, which contradicts traditional views of off-farm (ganyu) labor as a consumption-smoothing activity that either traps poor farmers into poverty or perpetuates the exploitation of the poor by the rich. Our model sees ganyu as a rational choice of poorer and richer farmers alike and as a buffer for both sets of farmers from either genuine destitution or shorter-term negative shocks. Our conceptual results, backed by evidence from Malawi, provide at least some grounds for rethinking policy advice. One implicit message of the microeconomics literature on poverty traps is that the (politically difficult) agenda of wealth redistribution may help pull those who are permanently destitute on account of insufficient ex ante wealth out of the trap. Although looking closely into this issue is well beyond the scope of our article, we do not find clear indicators that successful asset reallocation (even if it were possible) would necessarily help resolve the poverty entrapment problems of contexts such as that of rural Malawi.

More importantly (and more closely linked to the evidence in this article), much of the focus of the off-farm labor literature is on dismantling barriers to entry in the off-farm market. This may indeed be a viable priority in contexts where clearly superior and constrained entry niches of the labor market coexist with less profitable labor market opportunities. However, we do find that the ability of the off-farm labor market to provide successful consumption smoothing and poverty-alleviating occupational alternatives to poor farmers may be limited even when barriers to entry may not be present. In such conditions, direct intervention as in the case of the National Rural Employment Guarantee Act in India could perhaps be a more viable policy agenda.

Appendix

TABLE A1

VARIABLE DEFINITIONS AND DESCRIPTIVE STATISTICS

Variable	Definition	Mean	SD	Min	Max
Ganyu days	No. of days a household supplies ganyu labor (per year; >0 for 52% of all households)	36.42	72.04	0	1,249
Household personal shock	= 1 if household head died or a working member turned ill/had an accident in this year, 0 otherwise	.167	.373	0	1
Household property shock	= 1 if household experienced a shock for livestock died or stolen, other theft, or dwelling damaged in this year, 0 otherwise	.155	.362	0	1
Village shock	= village shock 1 + village shock 2	1.08	.45	0	3
Village shock 1—crop disease/pests	= 1 if village experienced crop disease or crop pest, 0 otherwise	.03	.16	0	1
Village shock 2—drought or floods	= 1 if village experienced droughts or floods, 0 otherwise	.13	.34	0	1
Small plot	= 1 if household's farm land is smaller than 0.5 hectares, 0 otherwise	.31	.46	0	1
Plot size	Size of farm land in acres	8.69	167.07	0	9,800
Plot size quintile 1–5	Plot size quintiles with 1 lowest and 5 highest			0	1
Dry season cultivation	= 1 if household cultivates any type of subsistence crop in the dry season, 0 otherwise	.36	.48	0	1
Education	Years of schooling of household head	4.30	3.97	0	19
Age household head	Age of household head	43.38	16.48	15	103
Iron roof	= 1 if household's roof is made of iron sheets, clay tiles, or concrete, 0 otherwise	.19	.39	0	1
Adults	No. of individuals age 15–64 per household	2.27	1.22	0	11
Female household head	= 1 if household head is female, 0 otherwise	.23	.42	0	1
Share of dependents	No. of children (0–14 years) and elderly (over 64 years) divided by no. of total household members	.46	.24	0	1
North	= 1 if household lives in the north region, 0 otherwise	.10	.30	0	1
Chewa	= 1 if household head speaks the language Chewa, 0 otherwise	.58	.49	0	1
Lomwe	= 1 if household head speaks the language Lomwe, 0 otherwise	.04	.20	0	1
Yao	= 1 if household head speaks the language Yao, 0 otherwise	.10	.30	0	1

Note. Stratified sample structure and weights are taken into account in the descriptive statistics.

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