Received: 6 April 2018 | Accepted: 23 December 2022

DOI: 10.1111/ajae.12371

ARTICLE

Economic impact of giving land to refugees

Heng Zhu[1] | Anubhab Gupta[2] | Mateusz Filipski[3] | Jaakko Valli[4] | Ernesto Gonzalez-Estrada[5] | J. Edward Taylor[6]

[1]United Nations World Food Programme (WFP), Kampala, Uganda

[2]Department of Agricultural and Applied Economics, Virginia Tech, Blacksburg, Virginia, USA

[3]Department of Agricultural and Applied Economics, University of Georgia, Athens, Georgia, USA

[4]Cash Based Transfers & SCOPE at the WFP, Juba, South Sudan

[5]WFP East and Central Africa Regional Bureau, Nairobi, Kenya

[6]Department of Agricultural and Resource Economics, University of California (UC) Davis, Davis, California, USA

Correspondence
J. Edward Taylor, Department of Agricultural and Resource Economics, University of California (UC) Davis, Davis, CA, USA.
Email: jetaylor@ucdavis.edu

Abstract

This paper adds to a sparse but growing literature on the economic costs and benefits of hosting refugees, including a unique policy of providing refugees with access to cultivable land. We construct a general equilibrium model from microsurvey data to simulate the spillover effects of giving land to refugees on income and production in the host-country economy surrounding a refugee settlement in Uganda. Reduced-form econometric analysis of land allocations at the refugee settlement, robust to several specifications, confirms the simulation finding that providing refugees with agricultural land significantly improves their welfare and self-reliance. Simulations reveal that refugee aid and land allocations generate positive income spillovers in the local economy out to a 15-km radius around the refugee settlement. Host-country households benefit significantly from the income spillovers that refugee assistance creates, and host-country agriculture is the largest beneficiary among production sectors.

KEYWORDS

general equilibrium, immigration, land, refugees, spillovers, Uganda

JEL CLASSIFICATION

D58, I32, O12

1 | INTRODUCTION

A dramatic increase in the number of global refugees in recent years has triggered academic and policy debates on the economic implications of hosting displaced populations. Conventional wisdom holds that a large influx of refugees may create competition for scarce resources, driving up prices of food and other items, and negatively affecting the welfare of host country populations around refugee settlements. However, recent studies suggest that refugees and the aid they receive have the potential to create real-income spillovers in a variety of market settings (Alix-Garcia et al., 2018; Alloush et al., 2017; Taylor et al., 2016). Given the opportunity, refugees engage in productive and entrepreneurial activities, gaining self-reliance and creating a web of linkages with host country farms, businesses, and households (Omata and Kaplan, 2013).

We study the local general equilibrium (GE) impacts of a unique hosting policy that includes giving refugees access to land. Uganda, which has recently become home to by far the largest refugee population in Africa, is often held up as the most progressive and generous country in the world in terms of refugee policy (World Bank Group, 2016).[1] Besides receiving cash or food aid from United Nations agencies, refugees enjoy freedom of movement, have access to educational resources, and, perhaps most innovatively, they receive parcels of cultivable land if available at the time of their assignment to a refugee settlement.

Provision of land helps foster self-sustainable livelihoods for refugees by improving their productive capacity. Most refugees in Western Uganda are from agrarian backgrounds; thus, land is potentially one of the most important resources enabling them to participate in local economies. Strengthening the productive capacity of refugee households can increase economic interactions between the displaced and host communities, potentially creating larger spillover effects for local producers and consumers. However, it also can create competition with host country producers in local product and factor markets.

Research on land transfers shows that access to land in poor countries is important for poverty reduction (Birdsall & Londoño, 1997; Deininger, 2003; Jayne et al., 2003) while shaping poverty persistence and dynamics (Barrett et al., 2001; Carter & Barrett, 2006). Keswell and Carter (2014), exploiting exogenous variation in South Africa's land redistribution program, estimated that land transfers boosted consumption by an average of around 25% in beneficiary households. Larger plots of land were generally associated with higher welfare gains, but providing households with moderately sized parcels still had sizable impacts. Finan et al. (2005), using semiparametric methods with PROGRESA data from Mexico, found that the marginal welfare value of land was very high for smallholders (with less than 1 hectare of land). They also found that household characteristics and external market circumstances influenced the welfare potential of land. Marginal productivity of plots was higher in households with more productive members and assets, whereas imperfect markets dampened potential gains from land access.

To our knowledge, no study examines the economic impacts of giving land to refugees or GE effects of land transfers. The impacts of land transfers to refugees are difficult to ascertain *ex ante*, given the complex ways in which refugees interact with local economies; thus, an empirical approach is needed. Despite the potentially important economic and policy implications of understanding both refugee welfare and income spillovers from refugee assistance, a lack of data as well as political and ethical impediments to randomizing refugee treatments have hindered research in this area.

We construct a GE simulation model econometrically, using microdata from surveys in and around a refugee settlement in Uganda, and exploit the quasirandom nature of land allocations to validate some of the findings from simulations using the model. Experimental or quasi-experimental validation of GE simulation results is very rare. Our findings offer evidence that providing land to refugees significantly increases refugee welfare as well as total income spillovers in the local economy, which for this study includes the refugee settlement plus the 15 km radius band surrounding it. The government authorities in Uganda assured us that land is allotted randomly to refugees upon arrival at refugee settlements, conditional on availability of land and the arrival time of the refugees. Leveraging the authorities' stated quasirandom land allocation policy, and supported by a range of

[1]As of mid-2022, the United Nations High Commissioner for Refugees (UNHCR, 2021) reports that Uganda hosted a refugee population of 1.53 million, about 22% of all refugees in Africa. The next largest refugee hosting countries in Africa are Ethiopia and Sudan. (Source: UNHCR [2021] and author's calculations)

reduced-form econometric specifications for robustness, we find evidence supporting the simulation findings that providing refugee households with parcels of land improves their income, consumption, and self-reliance. Experimental estimates of spillovers from refugees or from giving land to refugees are not possible; however, we use the simulation model to predict these spillovers. Our GE simulations suggest that hosting refugees creates positive and significant spillover effects for the local host country economy by stimulating demand for goods and services.

We estimate that the total impact of an additional refugee household on annual real income in the local economy is around USD 1106 if the household receives food aid in cash and USD 866 if it receives in-kind food aid. Both easily exceed the cost of UN World Food Program (WFP) refugee assistance. Adjusting for households that did not receive and cultivate plots, the annual direct and indirect impacts of providing land to refugees adds another 170 to 205 USD to this impact. GE simulation results match quasi-experimental estimates for refugee households, lending support to the GE modeling approach. Confidence bounds around simulation results, using the Monte Carlo method proposed by Taylor and Filipski (2014), reveal that our findings are robust to errors in model parameter estimates. The methodology and findings presented here contribute toward understanding the economic impacts of refugee assistance policies, specifically land transfers, on the welfare of refugee as well as host country populations.

2 | BACKGROUND AND OVERVIEW

Past research produced mixed findings regarding the economic impacts of hosting refugees, but until recently study of this subject has been hamstrung by data and methodological limitations. Though theoretically possible, it is not politically or logistically feasible randomly to locate refugee settlements across a host country landscape. This creates fundamental identification challenges for studying refugee impacts.

Chambers (1986), using past evidence of refugee-hosting experiences from African countries, argued anecdotally that refugee programs ambiguously affect poorer hosts. He argued that there was overall economic development for poorer hosts, but host country households lost due to food shortages, high prices, cheap refugee labor, and exploitation of common property resources by refugees. Jacobsen's (1997) qualitative article argues that host country refugee integration—specifically, whether refugees live in camps or settlements and how well they are integrated with host communities—determines impacts on natural resources such as forests, soil, and water. In particular, she opined that a gradual integration of refugees into host communities is likely to have direct environmental benefits.

A large influx of refugees inevitably puts a burden on public and environmental resources in hosting regions, potentially depriving local populations of available resources and reducing their welfare. Leveraging geographical variation and exploiting a natural experiment in host communities during the refugee crisis in Tanzania, Baez (2011) used difference-in-difference methodologies and found empirical evidence of an adverse short-term effect of exposure to refugee influxes on local children. The impacts were in terms of health and educational outcomes, with the effects persisting 1.5 years after the shock.

On the other hand, hosting refugees can create economic opportunities for residents living near refugee settlements who are in a position to profit from an increased demand for goods, services, and labor to support displaced populations. Using commodity price data in the same region of Tanzania studied by Baez (2011), Alix-Garcia and Saah (2009) exploited variation in refugee population and food aid over time to examine the impacts of refugee camp proximity and aid on local food prices. They found that hosting refugees led to an increase in local food prices, with United Nations (UN) food aid dampening the price hike for specific aid items. Net sellers of food benefitted from the price increases, and their welfare, measured by asset holdings, increased. The opposite was true for net food buyers.

Maystadt and Verwimp (2014), using heterogeneity of refugee presence around hosting villages in Kagera region of northern Tanzania as an identification strategy, found a wide range of welfare effects, with host agricultural workers losing out due to increased competition with refugees, whereas agricultural employers benefited from cheap labor. Kreibaum (2016) reported that Ugandan households benefited from spillovers created by Congolese refugees, with implications for objective and subjective welfare. Adopting a difference-in-difference approach in Turkey during the Syrian refugee crisis, Akgündüz et al. (2015) found that housing and commodity prices increased, but aggregate local employment did not seem to be affected. However, a study in the same region by Ceritoglu et al. (2017), which disaggregated employment into formal and informal channels, found evidence of a reduction in employment for hosts who participated in informal wage work, as well as an increase in formal-channel employment among host populations, driven by increased social services in regions where refugee camps were established. How specific policies governing the hosting of refugees influence the size, direction, and distribution of spillover effects for local communities is largely unknown.

As of mid-2017, Uganda hosted more than 1.27 million refugees, mostly from South Sudan, Burundi, and the Democratic Republic of Congo, in 12 settlement locations distributed across rural regions in Northern and Western Uganda (UNHCR, 2017). We surveyed two of the largest refugee settlements and their surrounding host country economies in March and April of 2016. At Rwamwanja settlement, many refugee households received land upon arrival. We used the survey data econometrically to estimate a GE model to simulate local-economy impacts of this land-allocation policy. Both the likelihood of receiving land and the size of land allocations at Rwamwanja, we argue, are sufficiently random to enable us to validate GE simulations with quasi-experimental evidence of impacts on refugee households.[2]

2.1 | The land distribution process in Uganda

Understanding the refugee settlement and land allocation process is crucial if we wish to make statements about likely impacts. Refugees arriving at the Ugandan border are registered, processed, and transported to one of 12 refugee settlements based on space.[3] Upon arrival at the settlement, refugee households are provided with a ration card, an initial plot of homestead land, and, in certain settlements, cultivable land conditional on availability. The size and availability of cultivable plots for refugees vary widely, usually growing in times of reduced displacement and shrinking when there is an influx of refugees. Households arriving at roughly the same time may receive completely different sized plots.

Once refugees arrive at the border, they are first transported to sorting camps jointly administered by United Nations High Commissioner for Refugees (UNHCR) and WFP. At these sorting facilities, refugees receive temporary residence, food, and essential items such as blankets. Refugees are then registered with UNHCR (this generates their ration card) and sorted to various permanent settlements based on ethnicity, availability of space in each settlement, and personal preference should the refugees have one. The entire registration process typically takes no more than 2 weeks. Finally, once enough refugees are ready to move to the permanent refugee settlements, they are transported by bus in batches to the assigned settlement. At the assigned settlement, plots are distributed to the refugees based on availability.

Refugees in Uganda are allowed to move freely, and they often relocate to the capital city of Kampala, usually for work, resulting in a process that frees up previously allocated plots. A refugee

[2]By contrast, at another settlement, Adjumani, land allocations were scarce, small, and needs based. Conditional balance tests showed that education, gender of the household head, and number of dependents were significantly correlated with land allocations there, all with the expected sign given a needs-based criterion. Results for Adjumani settlement are available on request.

[3]The choice of settlement depends on refugees' ethnicity and the availability of space. Requests to transfer to a different settlement are considered on a case-by-case basis.

household loses rights over a plot once it leaves the settlement. Settlement management identifies free or idle plots through continuous monitoring exercises and puts them up for reallocation. The plots are demarcated only roughly, adding to the variation in allocated plot size. Displaced households receive only land-use rights; no official land title is conferred. With few exceptions, land allocated to refugees is public land that was previously idle. Some informal land rental/lease arrangements have also sprung up between refugees and locals.

Rwamwanja refugee settlement, located in Kamwenge district of southwestern Uganda, is administratively segmented into more than a dozen contiguous food distribution points (FDPs), often separated by a road or other form of demarcation. It has an active land allocation policy, providing newcomers with cultivable plots as long as idle land is available at their time of arrival. Within Rwamwanja, land becomes available when the existing refugee load is low or refugee households with cultivable plots leave the settlement. The probability of receiving land and the size of allocated plots depend upon the existing number of refugees and the influx of refugees every year. This is our basis for considering the land-allocation process as quasirandom.

A concern, however, remains of whether refugee agencies and the local government allocate land randomly regardless of whether land was randomly available or not. Conversations with officials of refugee agencies and the government operating in Rwamwanja suggest that land allocations to incoming refugees were indeed random, perceived as a condition for fairness. Nevertheless, we consider the potential for endogeneity in land allocation in our econometric analysis. If land allocations were in fact endogenous, they would depend on factors like the existing number and influx of new refugees at any point in time along with refugee-household characteristics. Households with male heads, higher education, lower dependency, a lower proportion of women, and so on may influence decisions on which household receives land or not.

We present the average treatment effect (ATE) of land on refugee incomes and welfare by first considering the treatment as exogenous/quasirandom, as per the local government's claim. Then we compare outcomes of the exogenous land treatment to results from an inverse-probability weight (IPW) treatment effects model that estimates the ATE of land assignment on outcome variables. Under the IPW treatment effects model, land treatment is assumed independent of the potential outcomes, after conditioning on all covariates (household characteristics, availability of land inversely proxied by the number of existing refugees, and the influx of new refugees). The magnitudes of the parameter estimates from the ordinary least squares (OLS) model of exogenous treatment tend to slightly overestimate the impact of land treatment when compared to the IPW treatment effects model; however, the size of the bias on the main outcome variables of interest is very small. Both models, as well as a series of robustness checks presented in Appendix A4, suggest that receipt of land has a significant and positive impact on refugee-welfare outcomes.

The WFP provides a monthly aid package to all new arrivals during their first 5 years. At the time of this study, most refugees received food aid (maize, sorghum, corn, soy blend and occasionally oil). Some were given the option of switching to cash assistance. Eligibility for cash aid is determined by refugees' arrival year, with different settlements having their own cutoff dates for eligibility. The WFP aid package phases out over the course of 5 years after refugees' first arrival to a refugee settlement. In the first 3 years, each member of the household receives full assistance, but this support drops to 50% in the last 2 years and then terminates once refugees exceed the 5-year aid limit. Extremely vulnerable individual (EVI) households, identified through annual assessments on income-earning ability by the UNHCR and other assisting agencies, receive full rations regardless of their duration of stay.

3 | MODELING INCOME SPILLOVERS FROM REFUGEE ASSISTANCE

By "treating" refugees with food, cash, and/or land, refugee assistance potentially creates income spillovers in and around refugee settlements. Without random placement of refugee settlements and baseline data prior to a refugee influx, it is not possible to estimate impacts of refugees or refugee assistance econometrically. Taylor et al. (2016) find evidence of positive income spillovers around two Congolese refugee camps in Rwanda using an applied GE simulation model. Alix-Garcia et al. (2018) find econometric evidence of income spillovers around a refugee camp in Kenya by correlating refugee-camp growth with nighttime luminosity from satellite data.

Uganda's refugee policies create opportunities for refugees and nearby host populations to interact economically for mutual benefit. Refugees are free to enter and exit the settlement at will, and transact in local markets (including labor markets) as buyers or sellers. Aid transfers to refugee households generate increased demand for food and other goods. Refugees spend most of the cash they receive in and around the settlement, including neighboring villages. Many refugees invest in agricultural or livestock production on allocated plots. This, along with the in-kind food aid that some refugees receive, increases the supply of food in the local economy and puts downward pressure on food prices, which might harm other households as producers but possibly benefit them as consumers (Singh et al., 1986; Taylor & Adelman, 2003). The same household might either benefit or lose if seasonal price variations favor producers or consumers, respectively, at different times of the year.

An influx of refugee labor into the local economy can be a stimulus to host country businesses and production activities, but it can also put downward pressure on local wages, which may adversely affect local workers. Provision of land to refugees creates an additional layer of influence from which spillovers can occur. Cultivable land allows refugees to be producers as well as consumers in local commodity markets, increasing the local food supply as well as demand for labor and other inputs.

An experimental approach to evaluate impacts of refugee land allocations on local economies would require having baseline and follow-up data on refugee and non-refugee households at a sufficiently large number of randomly selected "land treatment" and control sites. For practical and political reasons, such a research design is not compatible with the way in which UN agencies and country governments administer refugee assistance, including land provision, in response to crises. Understanding and evaluating the impacts of refugees on nearby host economies requires an alternative approach.

We used data from the household and business surveys econometrically to estimate micro models of refugee and host country agricultural households (AHs) interacting within a GE model of the local economy. We used this model to simulate the impacts of refugees, refugee aid, and refugee land allocations on the economy within 15 km around the settlement, including income and production spillovers. A Monte Carlo method, outlined in Taylor and Filipski (2014), makes it possible to conduct a sensitivity analysis simultaneously with regard to all model parameters and construct an analogue to confidence bounds around simulated impacts. Because this is a structural model, the simulation results shed light on the likely pathways through which refugee assistance, including land allocations, affect local economies, including income and production spillovers to host country households.

3.1 | Theoretical model

We begin by presenting a simple theoretical model to illustrate the ways in which providing land to refugees might affect local economies. Refugee (R) and local host country (H) households are simultaneously producers and consumers of a locally traded good, x_l, which has an endogenous price $\tilde{p}$. Price endogeneity at the level of the local economy implies imperfect integration between the local economy and outside markets, typical of many food crops in rural areas with high transaction costs, limited transportation, and marketing infrastructure, as well as non-tradable items like prepared foods and many services. However, within the local economy, households are price takers. For simplicity of exposition, assume that households produce the locally traded good with two inputs: land

and labor. Land is assumed fixed and non-tradable, and any increase to the refugee household's plot size is exogenous.

We represent the production technology by a production function $q^i = f^i\left(L^i, \overline{T}^i\right)$ with the usual concavity assumptions. In this function, q^i is defined as the agricultural output of household i; L^i represents the total labor input; and $\overline{T}^i$ is the fixed plot size. A household's full income is the value of its labor endowment, $w \cdot \overline{L}$, plus profits from production, $\tilde{p} \cdot f^i\left(L^i, \overline{T}^i\right) - w \cdot L^i$. The full income of representative household i is

$$y^i = \tilde{p} \cdot f\left(L^i, \overline{T}^i\right) - w \cdot L^i + w \cdot \overline{L} \tag{1}$$

The household as consumer demands quantities of the local good, x_l, and a globally tradable good, x_g, to maximize utility $u(\cdot)$. The utility function is assumed to be strictly quasiconcave, yielding an interior solution. The globally tradable good has an exogenous price, which for simplicity we normalize to one. The optimization problem for a given household (host country or refugee) can be formalized as

$$\text{Maximize}\, u\left(x_l^i, x_g^i\right)\ s.t\, y^i \leq \tilde{p} \cdot f^i\left(L^i, \overline{T}^i\right) - w \cdot L^i + w\overline{L}, i \in \{R, H\} \tag{2}$$

Maximizing the objective function in (2) yields the following set of standard first order conditions, with λ denoting the shadow value of household full income:

$$\partial u / \partial x_l^i = \lambda \cdot \tilde{p};\ \ \partial u / \partial x_g^i = \lambda;\ \ \tilde{p} \cdot \partial f^i / \partial L^i = w.$$

Summing demand and production across refugee and host country households, the market clearing condition, in equilibrium, implicitly defines the price of the locally tradable good

$$\sum_{i \in \{R,L\}} x_l^i\left(\tilde{p}, w, y^i\right) = \sum_{i \in \{R,L\}} f^i\left(L^i\left(\tilde{p}, w, \overline{T}^i\right), \overline{T}^i\right) \tag{3}$$

In the analytical model, we assume a perfectly elastic supply of labor, consistent with a high-unemployment economy (Lewis, 1954). Modeling the local wage as endogenous creates two simultaneous equations resulting in comparative static results that are unhelpful. We discuss the importance of this assumption in a later section and conduct a sensitivity analysis in our simulations.

3.2 | Price effects

Giving more land to refugees has ambiguous effects on the direction of price changes. An increase in land allocation increases the supply of the local good, and this exerts downward pressure on prices. However, agents in our AH model, both locals and refugees, are simultaneously consumers and producers; thus, it is possible for the price of the local good to rise under certain conditions. Without any loss of generality, we assume a representative agent for refugee and local households respectively, and totally differentiate both sides of the market clearing equation with respect to refugee landholdings, $\overline{T}^R$. Without expanding each derivative term, we transform (3) to obtain Expression (4):

$$d\tilde{p}/d\overline{T}^R = \frac{\frac{df^R}{d\overline{T}^R} - \left(\frac{dx_l^R}{dy^R}\frac{dy^R}{d\overline{T}^R} + \frac{dx_l^H}{dy^H}\frac{dy^H}{d\overline{T}^H}\right)}{\frac{dx_l^R}{d\tilde{p}} + \frac{dx_l^H}{d\tilde{p}}} \tag{4}$$

The term in the denominator, $\frac{dx_l^R}{d\tilde{p}} + \frac{dx_l^H}{d\tilde{p}}$, is the total change in demand for the locally produced good in response to a change in its price. If the locally produced good is normal, the denominator is negative. The numerator of (4) is comprised of two parts: $\frac{df^R}{d\overline{T}^R}$, the total increase in refugee production of the local good from an increase in landholdings; and $\left(\frac{dx_l^R}{dy^R}\frac{dy^R}{d\overline{T}^R} + \frac{dx_l^H}{dy^H}\frac{dy^H}{d\overline{T}^H}\right)$, the increase in demand for the local good from increased refugee and host country incomes. The sign of the numerator is ambiguous, depending on the increase in local production (by the refugee household) and changes to demand through income effects.

We can glean further information into price effects by expanding the second term in the numerator. Expanding full income terms in (1) to solve for $\frac{dy^R}{d\overline{T}^R}$ and $\frac{dy^H}{d\overline{T}^H}$, we obtain expressions for changes in refugee and host incomes:

$$\frac{dy^R}{d\overline{T}^R} = \frac{\partial\tilde{p}}{\partial\overline{T}^R}f^R + \tilde{p}\frac{\partial f^R}{\partial\overline{T}^R}$$

$$\frac{dy^H}{d\overline{T}^H} = \frac{\partial\tilde{p}}{\partial\overline{T}^H}f^H$$

Refugee households receive a direct benefit from land transfers through expansion in production, $\tilde{p}\frac{\partial f^R}{\partial\overline{T}^R}$, and they are indirectly affected by price changes in the local good, $\frac{\partial\tilde{p}}{\partial\overline{T}^R}f^R$. Host counterparts' income is affected only indirectly, through changes in prices $\frac{\partial\tilde{p}}{\partial\overline{T}^H}f^H$. Thus, if the net effect of land transfers is to decrease the price of the local good, host households unequivocally lose through a reduction in income.

In sum, when local aggregate demand for the good rises less than the bump in supply arising from the increased refugee land endowment, local prices fall to clear the market. The opposite happens in the special case where one household group is a net buyer of the local good and has a sufficiently large income elasticity of demand. Intuitively, the direction of the price change for the local good depends on the relative increase or decrease in local demand vis-à-vis local supply. The effects depend on household expenditure and production functions, which we estimate from microdata to construct our GE model.

3.3 | Welfare and productive impacts

Inasmuch as host country households do not receive the land transfer, providing land to refugee households can affect host country households' welfare only through GE price effects. To illustrate, we derive expressions for the welfare change of a given household type from an increase in land endowment to refugee households. For refugees, the welfare shift for a change in refugee land endowment is:

$$dV^R/dT^R = \left(\frac{\partial u^R}{\partial x_l^R}\frac{\partial x_l^R}{\partial \tilde{p}} + \frac{\partial u^R}{\partial x_g^R}\frac{\partial x_g^R}{\partial \tilde{p}}\right)\frac{\partial \tilde{p}}{\partial T^R} + \left(\frac{\partial \tilde{p}}{\partial T^R}\cdot f^R + \tilde{p}\cdot\frac{\partial f^R}{\partial T^R} - w\cdot\frac{\partial L^R}{\partial T^R}\right)\left(\frac{\partial u^R}{\partial x_l^R}\frac{\partial x_l^R}{\partial y^R} + \frac{\partial u^R}{\partial x_g^R}\frac{\partial x_g^R}{\partial y^R}\right)$$

Refugee households that are beneficiaries of land transfers experience direct changes in full income $\left(\frac{\partial \tilde{p}}{\partial T^R}\cdot f^R + \tilde{p}\cdot\frac{\partial f^R}{\partial T^R} - w\cdot\frac{\partial L^R}{\partial T^R}\right)$ and indirect changes in prices $\left(\frac{\partial \tilde{p}}{\partial T^R}\right)$. If the GE solution results in a lower price for the local good, refugees unambiguously gain as consumers but could lose out as producers due to reduced output prices. The change to host country welfare, reflecting spillover impacts of giving land to refugees, is:

$$dV^H/dT^R = \frac{\partial \tilde{p}}{\partial T^R}\left[\left(\frac{\partial u^H}{\partial x_l^H}\cdot\frac{\partial x_l^H}{\partial \tilde{p}} + \frac{\partial u^H}{\partial x_g^H}\cdot\frac{\partial x_g^H}{\partial \tilde{p}}\right) + \left(\frac{\partial u^H}{\partial x_l^L}\frac{\partial x_l^H}{\partial y^H} + \frac{\partial u^H}{\partial x_G^H}\frac{\partial x_g^H}{\partial y^H}\right)\cdot f^R\right]$$

As with refugee households, a decrease in the equilibrium price of the locally produced good benefits host households as consumers; however, the net effect of the land transfer on host households' nominal income is unambiguously negative due to falling prices.

Using this model, we can predict the net impact of providing land to refugee households on productive activities of both refugee and local households. Because host households are affected indirectly through GE price effects, the net production impact for them is negative (from the first order conditions associated with maximizing (2)). Assuming that land and labor are complements in production, refugee production is likely to increase, although it could fall if the reduction in price is large enough.

Treating wages as endogenous in the above model would add an additional layer of complexity with regard to how increased refugee land allocations affect the welfare of refugee and local households. Analogous to the welfare implications for net crop buying and selling households, increases in wages due to rising labor demand affect households heterogeneously, depending on whether they are net suppliers or purchasers of labor. Households that obtain income primarily through employment (net sellers of labor) would stand to benefit, whereas households that hire labor would lose. This could translate into a change in the distribution of benefits between host country households and refugees. Assuming refugees are net suppliers of labor, a local wage more sensitive to increases in labor demand could shift more of the benefits to refugee households. Increases in the local wage would also dampen the increase in local production from increasing refugee land endowments by discouraging hired labor demand.

This simplified analytical presentation reveals the importance of household and market behavior in shaping local-economy outcomes. In real life, both host country and refugee households interact in multiple product and factor markets, and there are multiple aid regimes, causing analytical models to quickly become intractable. As mentioned earlier, while most refugees receive food aid, a smaller proportion have the option of switching to cash aid. From a local economy perspective, cash transfers can increase spillovers by stimulating demand, production, and input purchases; however, if the local supply of goods is inelastic, there could be inflationary effects (Taylor et al., 2016). To address this issue in GE simulations, we use microdata to estimate response functions separately for cash and food aid households, making it possible to simulate the impact of providing land to refugees under the two aid distribution regimes.

In summary, the GE effect of providing more land to refugees is analytically ambiguous. It depends on several key aspects of the local economy: first, the amount of net trade among and between refugee and host country households, with larger levels of trade contributing to more potential spillover effects from price changes; second, the consumption and production behavior of both household groups; and third, the size of the refugee population relative to the local host country population. Although theory is useful as a guide to gain an intuitive understanding of pathways of influence, a simulation model constructed from household-level microdata can uncover the likely spillover effects of land transfers to refugees. In what follows, we first use the quasi-experimental land allocation to estimate direct impacts of providing refugees with land. We then use a simulation model to reveal the associated economy-wide impacts on both refugees and hosts.

4 | DATA

Rwamwanja settlement, with a refugee population of 103,000, is situated in the southwestern part of Uganda and mainly hosts refugees from the Democratic Republic of Congo (DRC). It has eight zones that consist of 25 villages (FDPs) where the refugees live. This settlement receives two rain cycles per year, and thus it has two agricultural seasons.[4] A team of researchers, with assistance from the WFP and local guides, administered surveys to a stratified random sample of refugees, local households, and businesses inside and outside this settlement between March and April of 2016. The surveys gathered detailed information on individual demographics, household production and income activities during the 12 months prior to the survey, and consumption (7 day, 30 days, or annual recall, depending on the item).

WFP provided a full list of the population of refugee households, sorted into cash and food aid recipients. A random sample was drawn from the population of refugees for each recipient type. We first randomly selected 12 FDPs (or administrative subsettlements) from a total of 26, and within each FDP, we randomly selected around 30 households on average (in larger FDPs, proportionally more refugees were surveyed) for our survey. Local households were sampled from 12 villages within a 15 km radius of the settlement. Village rosters were used to randomly select around 25 households per village. The final data set contains 620 households, including 335 refugee households and 285 host country households. It includes information on household businesses, collected as part of the household survey, as well as a targeted business survey (for businesses not picked up by the household surveys), for a total sample of 279 businesses. Of these, 183 businesses are from the household surveys, which included a business module identical to the one used in the targeted business surveys. Lacking a master list of local businesses, an n^{th} business sampling strategy was used to ensure representativeness. Summary statistics of household characteristics and average household incomes (for both refugees and locals) appear in Appendix A1 (see Appendix Tables A1-1 and A1-2).

The authorities of the local government (Office of the Prime Minister), as well as international agencies such as UNHCR and WFP, claim that the Ugandan government's land distribution policy to refugees is random and depends on availability of land as well as the influx of refugees. If indeed land allotment to refugees is purely random, it creates a pseudorandom natural experiment wherein a refugee household's initial land endowment (at time of arrival) is largely exogenous to household characteristics, conditional on arrival year and land availability. Factors that may determine land availability include the existing number of refugees and size of refugee influx in a given period. As a result, the amount of land a refugee household receives should be independent of household characteristics if we control for the size of the refugee population, additional refugee influx, time of arrival, and geographical location (or FDP) to which the refugee household is assigned. We estimate the effect of the land "treatment" on refugee welfare by considering land distribution as exogenous. However, if land allocation depends on household characteristics at the time of refugee arrival, for instance if land is more likely to be allotted to households with male heads, higher education, lower dependency, or a lower proportion of women, then considering land allocation as random will likely overestimate the ATE of giving land to refugees.

[4]The region around Rwamwanja settlement is described as having "soils with productivity greater than average." See http://www.yieldgap.org/uganda

Because, as researchers, we do not actually observe the land allocation process, we estimate an IPW treatment effects model in which land treatment is assumed to be independent of the potential outcomes after conditioning on a vector of refugee-household-level covariates. Later, in Appendix A4, we show a range of robustness checks by estimating IPW with regression adjustment, treatment effects with propensity score matching (PSM), and nearest-neighbor matching (NNM) models. Our findings on the impacts of land distribution on refugee welfare are robust to these specifications.

Conditional balance tests are not possible in experimental or quasi-experimental evaluations without baseline data prior to the treatment, except for variables that are unlikely to change as a result of the treatment or for which one can ascertain likely pretreatment values. We impute household characteristics at the time of arrival for time-varying variables such as the age of the household head, average age of male and female members, dependency ratio, and household size.[5,6] We combine these time-varying variables with available time-invariant variables, like the education of the household head and other household members, and an indicator of whether the household head is female, to perform conditional balance tests. A pair of conditional balance tests, with receipt of land and the amount of initial land received (L_i) as treatments, was carried out as specified in equation (5):

$$Z_{ic} = \alpha_0 + X'_{ic}\gamma + \sum_t \delta_t T_i + \theta_1 R_{12\_13,ic} + \theta_2 \dot{R}_{13\_14,ic} + \varepsilon_{ic} \tag{5}$$

$Z_{ic} = \{D_{ic}, L_{ic}\}$ consists of a dummy variable, D_{ic}, indicating whether refugee household i received a cultivatable plot upon arrival and assignment to cluster c, and the size of the allocated plot, L_{ic}, conditional on receipt. A vector of characteristics of household i in cluster c, X_{ic}, should be largely uncorrelated with the pair of initial land measures under a quasirandom land allocation process. Other control variables include T_i, a set of dummy variables indicating the year in which the household arrived at the settlement; $R_{12\_13,ic}$, the number of existing refugees by FDP clusters in 2012–2013; and $\dot{R}_{13\_14,ic}$, the additional influx of refugees in 2013–2014. Administrative data on refugee population and influx are available for 2012–2013 and the following year, respectively, which we use for the conditional balance tests. Specification (5) does not include FDP fixed effects in order to avoid collinearity with $R_{12\_13,ic}$, the existing number of refugees in 2012–2013, which accounts for roughly 75% of the total number of refugees in 2016 based on our sample. Even if the initial land allocation is exogenous, systematic differences in cohorts over time may create spurious correlations between household characteristics and the land treatment, necessitating use of year dummies to control for such effects. Conditional on a refugee household's arrival time, existing refugees, and the additional influx of refugees at an FDP location, *ex ante* we expect γ to be insignificant for both the probability of receiving plots and plot size—that is, land allocations are independent of household characteristics.

Table 1 reports the results from estimation of Specification (5). The first column reports the probit model with household receipt of "land treatment" as the dependent variable. The second column uses an OLS regression with the size of land (in hectares) as the dependent variable. The standard errors in both models are clustered at the FDP level. We adjust for the small number of twelve FDP-clusters by using a wild cluster-restricted bootstrapping method as suggested by

[5]Imputation of household characteristics at the time of arrival is done using reported age of each individual member of the household. For example, if a refugee household arrived at the settlement 3 years ago and have a child aged 2 years old, the imputed household size equals their current household size, minus one (the child who was not born yet).

[6]Appendix A3 provides details on refugee arrivals (Table A3-1) and summary statistics of characteristics of refugee households with and without land (Table A3-2). In Table A3-2, Panel (a) summarizes the variables at the time of the survey whereas Panel (b) summarizes the same variables by inferring their values at the time of refugee arrival. We test for differences in sample means by regressing the baseline variables on our "land treatment" dummy after adjusting for cluster robust standard errors. Clustered standard errors adjust for a small number of clusters using wild cluster-restricted bootstrap (see Wu, 1986), as adapted by Cameron, Gelbach and Miller (2008) for estimates with clustered standard errors and few clusters.

TABLE 1 Conditional balance test using variables at the "time of arrival"

Variables	Probability of receiving land	Allocated plot size
HH size	0.031 (0.731)	0.023 (0.739)
HH head education	−0.012 (−0.323)	0.032* (1.824)
HH head age	−0.0003 (−0.077)	0.006 (0.959)
HH head female	−0.205 (−1.113)	0.030 (0.325)
Average male age	−0.003 (0.665)	−0.001 (−0.177)
Average female age	0.002 (0.338)	−0.003 (−1.398)
Average male educ	0.041 (0.923)	−0.030** (−2.023)
Average female educ	0.042* (2.027)	0.006 (0.443)
Dependency ratio	−0.766 (−0.946)	0.683 (1.166)
Proportion of female	−0.093 (−0.124)	−0.091 (−0.998)
Constant	−0.617 (−0.449)	0.206 (0.106)
N	333	209
LR χ^2 (10)	13.86	-
Pseudo R^2	0.032	-
F-statistic (12, 196)	-	1.40
R^2	-	0.099

Note: The first regression uses a probit model where the dependent variable is whether the household received the "land treatment." The second uses an OLS regression with the size of land (in hectares) as the dependent variable, conditional on refugee households receiving land. Each regression controls for the total number of refugees by FDP cluster in 2012–2013 and the entry of additional refugees in 2013–2014. The standard errors are adjusted for FDP clusters. The z-score and t-score for each regressor appear in the parenthesis, respectively, for the probit and OLS regressions. The z-scores are obtained using 499 replications of "score bootstrap" (see Kline and Santos, 2012) for the probit model and the t-scores are obtained using 499 replications of wild bootstrap (see Cameron et al., 2008) for the OLS model, respectively, adjusting for the small number of clusters.
Abbreviations: FDP, food distribution points; HH, household; LR, likelihood ratio; OLS, ordinary least squares.
*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$.

TABLE 2 Landholding and agricultural output of refugee and host-country households

Location	Receiving cultivable land upon arrival (refugees only)	Share cultivating land	Agricultural output (in UGX)	Average land size (in hectares)
Host country	-	0.78 (0.41)	556,753 (620,773)	1.87 (1.95)
Refugee	0.65 (0.48)	0.73 (0.44)	318,909 (326,838)	0.52 (0.61)

Note: The first column measures initial receipt of land; a significant portion of refugee households who did not receive an initial plot later rented/borrowed/sharecropped in land. Standard deviations of sample mean in parentheses. Agricultural output is computed only using households that actively grow crops on their land. Average agricultural output for refugee households contains households who are yet to fully harvest crops at the time of survey, thus is likely to be a lower bound estimate of true average annual agricultural output.

Cameron et al. (2011) for linear models, and a score bootstrapping method (Kline & Santos, 2012) for nonlinear models. Controlling for arrival year and existing and arriving refugees by FDP location to which refugees are initially assigned, household characteristics are largely uncorrelated with the probability of receiving land upon arrival or the allocated plot size conditional on receiving land. The one exception is average female education, which has a quantitatively small positive correlation with the probability of getting land (10% level of significance). However, universal access to UNHCR schools within the settlements raises the possibility that refugee education is not time invariant. We observe a small but significantly negative correlation between average male education in the household and the allocated plot size at the time of arrival. In the subsequent OLS regression specifications where land assignment is assumed to be random, we add a vector of household characteristics as control variables, aiming to address any lingering issues due to slight differences in baseline characteristics between refugee households that did or did not receive land upon arrival.

TABLE 3 Agricultural output and labor input of refugee and host-country households

Location	Average output value per unit of land (in UGX/hectare)	Labor input per hectare (in person-days)	Share hiring labor	Share selling crops
Host country	635,067 (901,607)	0.02 (0.02)	0.19 (0.39)	0.57 (0.49)
Refugee	1,936,686 (4,507,155)	0.15 (0.38)	0.20 (0.40)	0.64 (0.48)

Note: Only households who reported positive crop output used in computing above statistics.

Tables 2 and 3 summarize selected characteristics of refugee and host households at the settlement site, including initial land distribution, land use, and output. About two-thirds of the refugee households received a plot of cultivable land upon arrival. At the time of our survey, some refugee households were able to rent in, borrow, or sharecrop in plots of land, and, as a result, more refugee households participated in agricultural production (about 73%) than initially received parcels of cultivable land.

On average, refugee households received a plot roughly 0.52 hectares in size. Refugees had less land than nearby host country farmers (1.87 hectares). Refugees outnumber their local hosts, whose population within the 15 km belt around the settlement was 15,700 at the time of our survey. Because of this, the total amount of agricultural output that refugees supply is high relative to that of the local host population, despite smaller plot sizes per refugee household. On average, a local host country household produces more agricultural output (in value), about UGX 556,753, than a refugee household, UGX 318,909 (Table 2).

The composition of crops grown is different between refugee and host country households. Most households, both refugees and nationals, cultivate mainly maize. Refugees are significantly more productive per unit of land than host country farmers; on average, they produce UGX 1.3 million (p-value of 0.003) more per hectare (see Column (1) of Table 3). Differences in unit-land productivity, reported in Table 3, persist even when we compare households cultivating the same crops. This discrepancy in yields is driven largely by the amount of extra labor refugees use on their plots. An inverse relationship among land size, yields, and labor input may signal that refugees face barriers to entry into other economic activities, depressing the shadow value of their labor.[7]

5 | IMPACTS OF LAND ON REFUGEE OUTCOMES

There are no existing estimates of the welfare and income impacts of land transfers to refugee households. The general literature on land transfers gives reason to expect positive effects, consistent with the impacts of land in non-refugee settings. To estimate the impact of land receipt and the size of land on refugee income and welfare outcomes, we first leverage the arguably quasirandom nature of land allocations to refugees and estimate equation (6):

$$Y_{ic} = \beta_0 + \beta_1 D_{ic} + X'_{ic}\gamma + \sum_t \delta_t T_i + \theta_1 R_{12\_13,ic} + \theta_2 \dot{R}_{13\_14,ic} + \epsilon_{ic} \quad (6)$$

where Y_{ic} is a set of income and welfare outcomes; D_{ic}, as before, is the treatment dummy that takes a value of one if the refugee household was initially allotted a cultivable parcel of any size; and T_i is the set of dummies for year of arrival.[8] X_{ic} is a vector of household control variables including age, gender, education, arrival year of the household head, family size, dependency ratio, an asset index,

[7]A stochastic frontier analysis testing for efficiency differences between refugee and host country producers failed to reject the null hypothesis of no difference (results not presented here but available upon request).

[8]The treatment variable is initial land allocation and does not include parcels of land acquired later through rental or sharecropping arrangements.

and a dummy variable indexing whether the refugee household received cash or food aid. We also control for the existing number of refugees and additional influx in an FDP location (variables $R_{12\_13,ic}$ and $\dot{R}_{13\_14,ic}$, respectively). Building on (6), we estimate Equation (7), which includes the size of the plot allotted to refugee household i at time of arrival in cluster c (L_{ic}), to assess the impact of land size on income and welfare outcomes:

$$Y_{ic} = \beta_0 + \beta_1 D_{ic} + \beta_2 D_{ic} L_{ic} + X'_{ic}\gamma + \sum_t \delta_t T_i + \theta_1 R_{12\_13,ic} + \theta_2 \dot{R}_{13\_14,ic} + \epsilon_{ic} \tag{7}$$

The outcome variables we use as measures of household welfare include earned income, the share of household income that is not aid, a food security index, log consumption levels in the past 2 weeks, and dietary diversity, measured as the number of categories of different food types consumed by members of the household in the week prior to the survey. Consumption generally is more reliable than income as a measure of welfare, given the possibility of smoothing via borrowing and savings (Deaton, 1997). The food security index is constructed using principal component analysis on six questions regarding the extent to which food security was compromised in the past week. Its magnitude increases with food security. To capture a multidimensional measure of welfare, we constructed an index consisting of dwelling characteristics (number of rooms, type of toilet used, material for roofing, etc.) using polychoric principal component methods. Detailed descriptions of the components of these food security and dwelling indices, together with the distributions of these indices, appear in Appendix Tables A2-1 and A2-2.

Panel (a) of Table 4 reports OLS estimates of Equation (6), treating land assignment as exogenous while controlling for household characteristics X_{ic}, time of refugee-household arrival T_i, existing number of refugees in 2012–2013 $R_{12\_13,ic}$, and additional influx of refugees $\dot{R}_{13\_14,ic}$. Results from the OLS model assume that land allocation is quasirandom. The results in Panel (b) take into account the fact that land assignment may not necessarily be random and possibly is influenced by household characteristics at the time of refugee arrival. In Panel (b), we present the inverse probability weights (IPW) treatment effects model that estimates the ATE of land assignment on the income and welfare outcome variables. The land assignment is assumed independent of the potential outcomes after conditioning for the household covariates at the baseline. It is possible that unobserved sources of endogeneity exist, in which case results from the IPW model represent our best attempt to estimate a treatment effect that we can compare with our GE model predictions.

The results from both Panels (a) and (b) suggest that land distributions have a significant and positive impact on most refugee income and welfare outcomes. The OLS model (Panel (a)) yields slightly higher parameter estimates compared with the IPW treatment effects model (Panel (b)). If there were any "selection" in land allocation based on refugee characteristics at baseline, the OLS model would overstate the effect of land on refugee outcomes. A comparison of the two panels shows that the magnitude of bias (if any) in OLS is small: the estimated coefficients are 0.45 in OLS and 0.40 in IPW for household income, 0.11 in OLS compared to 0.09 in IPW for % earned income, and so forth. Both the OLS (Panel (a)) and the IPW (Panel (b)) yield results indicating that refugee household welfare increases significantly with receipt of land.

Household total income is approximately 57% higher in households that initially receive cultivable land based on the OLS model (quasirandom land assignment), and 49% higher based on the IPW model (land assignment conditional upon household characteristics).[9] Around 9% more households earned income when they received land. The treatment effect on the log of income from agriculture is 8.08 and highly significant.[10] We do not find a significant impact of land provision on households' participation in business or on welfare outcomes (except consumption diversity in the

[9]We obtain 57% (OLS) and 49% (IPW), respectively, by using Halvorsen and Palmquist (1980) correction. Note $100 * (e^{0.45} - 1) \approx 57$ and $100 * (e^{0.40} - 1) \approx 49$.

[10]This represents a 2500% (OLS) and 1800% (IPW) increase in income from agriculture. We see this huge treatment effect on agricultural income because, without land, income from agriculture is negligible, and at the margin the treatment effect is exponential.

TABLE 4 Estimated impacts of land access on refugee outcomes

	Income and activities				Welfare			
Panel (a): OLS with quasirandom land treatment	**Log of household income**	**% earned income**	**Log income from agriculture**	**Business dummy**	**Dwelling index**	**Food security index**	**Log of per capita consumption**	**Consumption diversity**
Land	0.45*** (5.50)	0.11*** (4.22)	8.08*** (15.07)	−0.01 (−0.27)	0.20*** (3.98)	0.06 (0.82)	0.04 (0.75)	0.24 (1.01)
N	333	320	333	333	333	333	333	333
R-squared	0.33	0.26	0.50	0.13	0.23	0.16	0.13	0.10
Panel (b): Inverse probability weight treatment effects model								
ATE of land	0.40*** (3.64)	0.09*** (5.76)	5.21*** (15.51)	0.03* (1.82)	0.09 (1.57)	0.03 (0.05)	−0.05 (−0.62)	0.63*** (4.60)
Potential-outcome mean without land	14.21*** (140.58)	0.08*** (8.09)	0.84*** (5.10)	0.04 (3.88)	−0.33*** (−8.78)	−1.51*** (−3.63)	14.20*** (205.19)	3.53*** (46.17)
N	893	868	893	893	893	893	893	893

Note: All regressions in panel (a) control for the following variables at refugee household's time of arrival: HH size, HH head education, HH head age, HH head female, average male age, average female age, average male educ, average female educ, dependency ratio, proportion of female, HH time of arrival, the squares of the above control variables for any quadratic effects, and the number of refugees by FDPs in 2012–2013, and additional influx of refugees in 2013–2014 by FDPs. Panel (a) assumes that land treatment is exogenous, and we use ordinary least squares estimation. The standard errors are adjusted for FDP clusters. The *t*-scores, reported in parentheses in panel (a), are obtained using 499 replications of wild bootstrap (see Cameron et al. 2008) for the OLS model that adjusts for the small number of clusters. Panel (b) presents the results from the inverse probability weights treatment effects (logistic) model, which estimates the ATE of land assignment on the outcome variables. The land treatment is assumed to be independent of the potential outcomes after conditioning for the covariates. The covariates used for Panel (b) estimations are the same as the variables controlled in Panel (a). The *z*-scores appear in parenthesis in Panel (b). Appendix Tables A4-1 and A4-2 report IPW with regression adjustment, treatment effect model with propensity score match (PSM), treatment effects with nearest neighbor match (NNM) as robustness checks to Panels (a) and (b) in Table 4.
Abbreviations: ATE, average treatment effect; FDP, food distribution points; OLS, ordinary least squares.
*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$.

IPW model), despite the expected positive sign on the D_{ic} coefficient. We carry out several robustness checks to the OLS and IPW results; they are presented in Appendix Tables A4-1 and A4-2. The robustness specifications include IPW with regression adjustment (doubly robust estimation) (Cattaneo, 2010) (Panel (a) of Table A4-1), treatment effect with propensity score match (Panel (b) of Table A4-1.), and NNM with matches 1–5 (Abadie & Imbens, 2006, 2011) (Table A4-2.). All the robustness checks confirm the main result of a positive and significant impact of land assignment on refugee incomes.

Table 5 reports the results of Equation (7), which includes plot size. The marginal effect of land evaluated at the mean land size is $\widehat{\beta}_1 + \widehat{\beta}_2 \overline{L}$, where $\overline{\mathrm{L}}$ is the average land size. The proportion of total income derived from household activities (excluding WFP aid, remittances, and transfer income) increases by roughly 57% at the average land size.[11] We also find positive impacts on log total agricultural (crop) income but not on whether or not the refugee household currently owns a business. These findings suggest that, overall, larger plots allow refugees to be less dependent on aid.

The effects of initial land endowment size on food security are positive but not significant, likely reflecting the influence of WFP food aid on food security. Refugee households receiving larger plots of cultivable land scored higher on the index of dwelling characteristics: an additional hectare raises the index by more than one-third of a standard deviation. The land-treatment impacts on the share of income earned, business startup, and dwelling quality appear to operate mostly through the intensive margin. The effects on welfare indicators including per-capita expenditure on consumption items are positive but not statistically significant.

Given the various econometric specifications we employ, from the government's stated random land allocation (OLS) to IPW, PSM, and NNM (Appendix A4), we treat these estimates as ATEs of providing cultivable land on treated refugee households' welfare outcomes. We find evidence that the provision of cultivable parcels of land significantly improves refugee households' ability to generate income. Positive impacts of land allocations on refugee-household income open up the possibility that giving land to refugees generates economic spillovers in local economies, comprised of both refugee and host country households. Providing refugees with cultivable land fundamentally changes refugees' relationship with nearby local households, including AHs that both consume and supply food to local markets.

6 | THE APPLIED GE MODEL

Microsurvey data were used to econometrically parameterize a series of AH models (Filipski et al., 2022; Gupta et al., 2018; Singh et al., 1986; Taylor & Adelman, 2003). The AH models were then nested within a GE model of the economy in and around the settlement, following the methodology presented in Taylor and Filipski (2014) and used by Taylor et al. (2016) to study refugee impacts in a setting without land allocations. This is the first attempt to simulate the GE impacts of providing land to refugees. In this model, prices transmit impacts from the refugees who are direct beneficiaries of land allocations to others inside and outside of the settlement.

6.1 | Households, activities, and model calibration

The AH models describe each group's productive activities, income sources, and expenditure patterns. Household groups participate in multiple activities, including crop, livestock, and

[11]The marginal impact on log of income at the average amount of land provided to refugees is 0.45. As before, we obtain 57% by using Halvorsen and Palmquist (1980) correction, that is, $100 * \left(e^{0.45} - 1\right) \approx 57$.

TABLE 5 Estimated impacts of land on refugee outcomes

	Income and activities				Welfare			
OLS with quasirandom land treatment	Log of household income	% earned income	Log income from agriculture	Business dummy	Dwelling index	Food security index	Log of per capita consumption	Consumption diversity
Land	0.44*** (6.24)	0.08** (2.46)	7.81*** (15.23)	−0.02 (−0.64)	0.08 (1.43)	0.01 (0.11)	0.06 (0.70)	0.11 (0.72)
Land size	0.04 (0.30)	0.15** (3.75)	1.12 (1.64)	0.04 (0.59)	0.48 (2.73)	0.19 (1.98)	−0.07 (−0.38)	0.52 (0.37)
Marginal impact of land evaluated at mean land size	0.45*** (5.76)	0.10*** (3.74)	8.01*** (15.08)	−0.01 (−0.36)	0.16*** (3.45)	0.04 (0.62)	0.05 (0.76)	0.20 (0.84)
N	333	320	333	333	333	333	333	333
R-squared	0.33	0.29	0.50	0.13	0.26	0.17	0.13	0.10

Note: All regressions control for the following variables at refugee household's time of arrival: HH size, HH head education, HH head age, HH head female, average male age, average female age, average male educ, average female educ, dependency ratio, proportion of female, HH time of arrival, the squares of the above control variables for any quadratic effects, and the number of refugees by FDPs in 2012–2013, and additional influx of refugees in 2013–2014 by FDPs. The standard errors are adjusted for FDP clusters. The t-scores, reported in parentheses, are obtained using 499 replications of wild bootstrap (see Cameron et al. 2008) for the OLS model, which adjust for the small number of clusters. Marginal effect of land, evaluated at mean landholding of 0.176 hectares, is obtained using the lincom command in Stata 16.1.
Abbreviations: FDP, food distribution points; OLS, ordinary least squares.
$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

TABLE 6 Production function estimates by activity and household groups

Dependent variable	Refugee Crop production function estimation a. Total value of crop harvest (in UGX)	Host country	Refugee Livestock production function estimation b. Total value of livestock (in UGX)	Host country
Inputs	0.11	0.09	0.14	0.10
	(0.03)	(0.03)	(0.04)	(0.07)
Land	0.60	0.26	0.16	0.14
	(0.01)	(0.12)	(0.05)	(0.10)
Labor	0.25	0.60	0.49	0.33
	(0.08)	(0.12)	(0.07)	(0.08)
Capital	0.04	0.05	0.21	0.43
	(0.03)	(0.02)	(0.05)	(0.09)
Constant	10.42	8.87	8.17	6.03
	(0.51)	(0.60)	(0.57)	(0.78)
N	138	98	135	155
Dependent variable	**Retail production function estimation c. Total value of business profit in retail (in UGX)**		**Services production function estimation d. Total value of business profit in services (in UGX)**	
Inputs	0.32	0.37	0.12	0.34
	(0.12)	(0.09)	(0.10)	(0.06)
Labor	0.58	0.45	0.72	0.32
	(0.11)	(0.08)	(0.19)	(0.10)
Capital	0.09	0.18	0.16	0.35
	(0.10)	(0.08)	(0.15)	(0.09)
Constant	2.32	1.75	3.40	0.51
	(0.71)	(0.65)	(1.35)	(0.81)
N	44	88	35	82

Note: All variables are transformed using inverse hyperbolic sine transformation. Robust standard errors reported in parentheses. All the production functions are constant returns to scale, that is, the sum of coefficients constrained to one, estimated using a seemingly unrelated regression (SUR) model.

non-agricultural businesses (retail, service, and other nonagricultural).[12] All activities use factors (labor, land, capital) sourced inside the 15 km radius (often from the household itself), as well as intermediate inputs that are likely to be sourced outside the radius (e.g., purchased inputs for agriculture and merchandise for local shops). The transformation of factors into value added is described by activity-specific Cobb–Douglas production functions, whereas intermediate input demands are modeled with Leontief coefficients. To calculate the total value of output and the inputs used for each production activity by a household group, we use prices at the settlement level for refugees and at the village level for host country households, together with quantities reported in the household and business surveys. The production functions assume constant returns to scale (unconstrained Cobb–Douglas estimation yielded similar results). These assumptions suggest a relatively competitive economy around the settlement, which aligns with other studies of refugee settings in Uganda and East Africa. The proximity of weekly and daily markets limits the extent to which businesses can

[12]Retail includes village or town stores, which obtain much of their merchandise from wholesalers outside the local economy. Services include a variety of activities ranging from haircuts to construction, maintenance services, and transportation. Local production includes a variety of nonagricultural, nonservice activities, including home produced crafts, firewood, food processing, home breweries, and workshops.

TABLE 7 Household expenditure function estimates

Dependent variable	Refugee Cash	Refugee Food	Host country
Crops	0.59	0.67	0.29
	(0.09)	(0.06)	(0.04)
Livestock	0.17	0.10	0.19
	(0.06)	(0.03)	(0.03)
Retail	0.12	0.08	0.12
	(0.04)	(0.02)	(0.03)
Services	0.02	0.04	0.12
	(0.01)	(0.01)	(0.03)
Rest of world	0.05	0.03	0.09
	(0.15)	(0.05)	(0.16)
N	184	129	210

Note: Expenditure functions are estimated using Tobit model specification. Dependent variable is the expenditure on each category (crops, livestock, retail, and services). The parameter estimates are on total expenditure with estimates on constant not reported in the table. The estimates are budget shares for one UGX increase in expenditure for each household group. Robust standard errors presented in parentheses.

exert market power and affect prices. Considering the cases of Rwandan and Burundian refugees in Tanzania and Congolese refugees in Rwanda, Whitaker (2002) and Alloush et al. (2017), respectively, argue that the influx of refugees effectively moved markets closer to the local villages around refugee camps where markets evolved.

The four panels of Table 6 report the production function estimates for crop, livestock, retail, and services for refugee- and host-country households, respectively. In all the constant returns to scale (CRS) Cobb–Douglas specifications in Table 6, we transformed the variables using inverse hyperbolic sine (IHS/arcsinh) transformations. Our choice of arcsinh–arcsinh transformation over log–log is due to the well-known fact that log transformations should be applied only to strictly positive values, inasmuch as adding arbitrarily small positive numbers to variables with zero values can change the original structure of the data. The advantage of using IHS over log transformation is that there is no need for arbitrary manipulation of the original data, and IHS allows for a similar interpretation of regression results like that of log transformation with appropriate choice of measurement unit (Aihounton & Henningsen, 2021; Bellemare & Wichman, 2020). Bellemare and Wichman (2020) provide a practical guide applicable in cases where an arcsinh–arcsinh transformation of left- and right-hand side variables is used; the estimated elasticity approximates the estimated parameter for "large enough average values" of dependent and independent variables.[13]

The labor value-added share in crop production is 0.25 for refugees, lower than for host country farmers (0.60). Conversely, the land share is higher for refugees. Host country farms around the settlement have a higher share of capital in livestock production than refugee households.[14]

Households supply wage labor to local production activities, and they purchase goods and services inside the settlement, in markets within the 15 km band, as well as outside the local economy. Consumption demands are modeled as household-specific linear expenditure systems (LES), implying Stone-Geary utility. Trade in goods, services, and factors link household groups within the local

[13]Appendix Table A7 summarizes the variables used in the production function estimations, which are over an average value of 10 (as suggested by Bellemare & Wichman, 2020).

[14]Differences in production function parameters between the two groups may reflect differences in technologies used to produce the same crops as well as differences in crop mixes. The data do not permit further disaggregation by crop. Prices to value output and inputs are identical for all households in and around the settlement.

economy as well as to the rest of Uganda. Weaker interactions with outside markets generally imply fewer leakages, making it more likely to detect impacts within the local economy.

We used the survey data to estimate expenditure functions separately for refugee households receiving cash and food aid using a Tobit specification to account for zero expenditures on specific categories of items. The results, reported in Table 7, reveal that refugee households receiving aid in cash spend more than UGX 0.5 on locally grown food for every UGX of total expenditure. Food expenditures are not significantly different between refugee households receiving in-kind or food aid. Host country households have a marginal budget share for food of less than 0.30. Refugee households' expenditure shares on livestock products are 0.10–0.17, depending on the aid type. The livestock share for host country households around the camp is 0.19. Retail shares range from 0.08–0.12 for refugees. The retail share is the same for host and cash-recipient refugee households (0.12). Refugee households spend a smaller share of their income on services (0.02–0.04) than host households (0.12).

The survey provides the data to estimate these production and expenditure functions as well as initial values for all variables in the model. The initial values, together with the model parameters and standard errors, are organized into a data input spreadsheet designed to interface with GAMS, wherein the GE model resides.[15]

6.2 | Model closure

For each good and factor, closure rules determine where markets clear, and prices or wages are determined. A challenge in GE analysis is that we usually do not know with certainty where prices are determined. Changes in exogenous prices set outside of an economy may be transmitted into the economy via trade.

Transaction costs limit poor farmers' access to markets outside the region. Thus, the interaction of local supply and demand determines the prices of agricultural and livestock goods as well as the value-added price of retail and other services.[16] If the local supply of goods is elastic, demand shifts will have a minimal impact on prices and may potentially have a large real impact on local production and incomes. Otherwise, outward shifts in local demand may be inflationary. We do not know price impacts *ex ante*; we must simulate them simultaneously with other outcomes of interest.

We assume that household capital and land endowments are fixed and neither capital nor land can be reallocated between activities. These are reasonable assumptions, particularly in the short run, given our choice of activity aggregation. For example, crop cultivation implements are of little use in livestock or service activities, especially when markets are thin.[17] Thus, the rental rates on capital and land are household-specific shadow values. Labor is tradable within the local economy, but considering high transaction costs, the local economy cannot freely "import" or "export" wage workers with other parts of the country; thus, wages are endogenous. Impacts of labor-demand shocks may be muted if there is an elastic supply of labor, as is likely the case in rural Uganda, where un- and underemployment rates are high. Labor supply elasticity's are rare in the literature (Hill et al., 2021) and cannot be estimated with available data. We assume a nearly perfectly elastic labor supply (100) then test the sensitivity of our simulation results to this assumption.[18]

[15]The GE model and the data-input spreadsheet are available in Data S1 as a GAMS text and excel input file, respectively.

[16]The retail sector primarily sells goods procured outside the local economy at an exogenous wholesale price. Retail value added is the difference between gross sales, valued at the local retail price, and the cost of merchandise purchases. The retail price is influenced by the wholesale price but depends on local supply and demand, as in any local economy.

[17]This also means that tradables do not compete with nontradables for capital, which we believe is an acceptable simplification. Alternatives offer little appeal. Perfectly re-allocable capital would overinflate supply responses. Imperfectly elastic land reallocation *a la* Jonasson et al. (2014) would have required for us to guess at elasticity's of transformation, for little gain.

[18]This reflects excess labor supply in rural Uganda. Excess labor supply can be expected to lower inflationary pressures by limiting wage increases. It does not remove inflationary pressures, however, because land and capital constraints continue to limit the local supply response.

All other goods in the model are assumed tradable, with prices determined outside the 15-km radius. Thus, the model distinguishes among three levels of market closure: the household, the local market, and the rest of the country (or world). Monte Carlo simulations (Taylor & Filipski, 2014) and sensitivity analyses were used to test the sensitivity of our simulation results to alternative labor supply elasticity estimates (see Appendix A6). Appendix A5 summarizes the sets, accounts, variables, parameters, equation definitions, and equations in the model, including production and input demand functions; expenditure functions for each household group; and local market-clearing conditions, which determine prices for nontradable or, for tradable, net trade with the rest of the country at exogenous prices.

7 | GE SIMULATIONS

The GE methodology was designed to simulate and predict direct and indirect impacts of exogenous shocks (from projects, policies, markets, etc.) within local economies. We defined the local economy as the settlement plus the donut-shaped area around it out to a 15 km radius. We used the GE model first to simulate the impacts of an additional refugee household with given aid packages (cash or food) but without land. Besides offering insights into the local economy-wide impacts of refugees and refugee assistance, these simulations serve as baselines for the land-allocation simulations that follow.

We performed two simulations adding land into the model, one in which the refugee household farms with certainty and another taking into account the observed probability that the household participates in agriculture. To simulate the marginal impact of land, we increased the amount of land allotted to refugee households by the average size of plots received by refugee households, 0.52 hectares (see Table 2). Because the land was previously idle public land, this does not reduce cultivable land for host country households.

Refugees benefitting from the land allocation increase production and input purchases, as determined by first-order conditions for utility maximization. This leads to local GE price and quantity adjustments and changes in trade with the rest of Uganda, shaped by market-clearing conditions. By comparing the new equilibrium to the baseline, we obtain estimates of the marginal impacts of land allocations on refugee and host country income, production, and other outcomes, including spillovers. Econometric estimation of model parameters makes it possible to construct 95% confidence bounds around simulated impacts using the Monte Carlo method described in Taylor and Filipski (2014). The confidence bounds are reported in parentheses for selected outcomes in the tables that follow.

7.1 | Baseline simulations

Table 8 reports the baseline simulation results. An additional refugee household results in a net real-income boost to the local economy that significantly exceeds the cost of food aid, regardless of the assistance regime. An average refugee household receiving cash assistance increases annual local real income by UGX 3.8 million ($1106). The average cash assistance cost at this settlement, UGX 1.5 million per household, lies well below the 95% confidence interval for this real-income impact. The impact of refugees receiving aid in food instead of cash is lower but still substantial: UGX 3.0 million ($866), significantly higher than the cost of food assistance.

The difference between the total real income effect and assistance cost represents the real income spillover created by an additional refugee household. Panel (b) of Table 8 reports the distribution of real income spillovers across the three categories of households. A substantial share of income spillovers accrues to host country households within the 15-km belt around the settlement. Host country households receive UGX 0.95 million (41%, or 270 USD) of the UGX 2.32 million of real income

TABLE 8 Local economy impacts of an additional refugee household, by assistance regime (without land)

Panel (a): Total local real income effect without land (million UGX)	Cash	Food
WFP assistance	1.5	1.5
Spillover	2.32	1.49
Total effect	3.82	2.99
95% CI on total effect	(3.32, 4.53)	(2.54, 3.52)
Panel (b): Breakdown of net total real income effect (spillovers in million UGX)	**Cash**	**Food**
Cash aid refugees	0.49	0.43
Food aid refugees	0.88	0.40
Locals	0.95	0.67
Panel (c): Total change in production activities (million UGX)	**Cash**	**Food**
Crop production	1.74	1.37
Livestock production	0.72	0.50
Retail businesses	0.58	0.39
Services businesses	0.28	0.23

Abbreviation: WFP, UN World Food Program.

TABLE 9 Local economy impacts of refugee assistance (with land)

Panel (a): Total local real income effect with land (million UGX)	Cash	Food
Spillover	3.31	2.26
Total effect	4.81	3.76
95% CI	(4.34, 5.27)	(3.23, 4.28)
Panel (b): Breakdown of net total real income effect (spillover in million UGX)	**Cash**	**Food**
Cash aid refugees	1.74	0.42
Food aid refugees	0.75	1.25
Locals	0.82	0.59
Panel (c): Total change in production activities (million UGX)	**Cash**	**Food**
Crop production	2.66	2.15
Livestock production	0.84	0.53
Retail businesses	0.67	0.43
Services businesses	0.25	0.24

spillover from cash and UGX 0.67 million (45%, or 190 USD) of the UGX 1.49 million spillover from food aid.

Income spillovers reflect impacts of refugee and host country household demands on locally supplied goods and services. Panel (c) of Table 8 reports the effects of an additional refugee household on output by activity. The largest impacts are on agricultural and livestock production, followed by retail. Host country households carry out most local production and, thus, logically are the largest beneficiaries of income spillovers created by refugees and refugee assistance.

7.2 | Impact of land transfers

We simulate the impact of land allocations to refugees by increasing each refugee household group's land endowment by an amount equal to the average allocation. Initially, we assume that the

TABLE 10 Net local economy impacts of land (adjusting for idle landholdings)

Expected net income effect from land	Cash	Food
In million UGX	0.71	0.59
In USD	204.8	171.8

Note: The estimates are the net effect of land transferred to an additional refugee household. The estimate is obtained as follows: first, net impact of land provision = total, income effect with land − total income effect without land; then expected net impact of land provision = net impact of land provision × proportion of refugees that farm.

additional refugee household actively farms the plot with certainty, but later we test the robustness of findings to this assumption. Table 9 presents total real income impacts as well as a breakdown of spillovers to different household groups.

Land allocations increase the total real income effect significantly. The total income spillover, net of WFP aid cost from an additional refugee household receiving cash and an average-sized parcel of land, is UGX 3.3 million (956 USD)—higher than the spillover without land (UGX 2.3 million, or 671 USD). Access to land also increases the total income spillovers created by refugees receiving food aid (to UGX 2.3 million, or 667 USD). Panel (b) of Table 9 presents a breakdown of spillover effects across different household groups, and the bottom panel, across production activities. Not surprisingly, giving land to refugees substantially increases agricultural production by refugee households. However, indirect price effects reduce impacts on host country production compared with Table 8.

The largest beneficiaries of the land transfer, not surprisingly, are the refugees themselves. Access to land allows refugee households to increase their participation in agricultural production, raising their income levels. The transfer of land also affects the distribution of spillover impacts, raising them for refugee households and decreasing them slightly for nearby host country households. This is largely due to increased agricultural production by refugee households reducing the demand for crops produced by local farmers and generating GE price effects. Increases in agricultural output enter local markets and reduce the price of food that both refugee and host country farmers produce. Although the spillover effects to host country households decrease, they remain positive, and the total spillover effects increase dramatically.

Not all refugee households farm the plots they are given: 65% received land, but 73% of land beneficiaries grew crops (Table 2). About 65% of the refugee households received land, and 73% of those who received land farmed their land allotted to them (Table 2). To account for this, we weighted the average plot size by the sample probability of participating in farming. We then re-ran the model and compared the results to the baseline. The estimated impacts are in Table 10.

Once the proportion of refugees actively farming is considered, the net total income effect of giving refugees land ranges from 0.59 million UGX (171.8 USD) for in-kind households to 0.71 million UGX (204.8 USD) for cash-aid households. The adjusted estimates in Table 10 are conservative when compared with the quasi-experimental estimates reported in Table 4.[19]

Lacking empirical estimates for the wage elasticity of labor, our GE simulations assume a highly elastic local labor supply. This is a reasonable assumption given high unemployment levels in rural Uganda. We nonetheless checked the robustness of our estimates by iterating our previous results over a range of labor market elasticity's. The results, shown in Appendix A6, demonstrate that our findings are quite robust with respect to labor supply elasticity.

8 | CONCLUSIONS

Three major findings emerge from our local economy GE study of the impacts of giving land to refugees:

[19]Average (full) income for Rwamwanja refugee households is around 2.2 million UGX annually. From the OLS point estimate on the land dummy (0.45), we approximate that the expected increase in refugee household income is 57% ($e^{0.45}$), around 1.25 million UGX or US $337. Using the IPW estimate, we find the effect to be around 49% ($e^{0.40}$), around 1,1 million UGX or US $296 So, the estimates from the simulation model are conservative when compared to calculations from the econometric models.

First, Uganda's unique policy of providing refugees with access to land has a positive impact on refugee incomes, consumption, and welfare. Refugees' ability to utilize land for productive activities improves their self-reliance, which translates into higher and more diverse food consumption. Our GE simulations reveal that impacts on beneficiaries are potentially large, and our econometric analysis, which exploits the quasirandomness of land allocation, confirms this.

Second, refugees have positive impacts on local economies in and around the settlement in which they live. The GE simulation extends our analysis to outcomes not possible to evaluate using quasi-experimental methods. By stimulating local agricultural and nonagricultural activities, refugees bring about an increase in total income within a 15 km radius of the settlement that easily exceeds the cost of WFP food aid. The income gain is large when compared with average income in host country households around the settlement. Refugees create income spillovers by demanding locally supplied goods and services. This, in turn, stimulates local production and generates positive production and income spillovers. Ugandan households near the settlement carry out crop and noncrop production, and capture most of the spillovers that refugees create. A sizeable number of refugees set up businesses that purchase inputs from host country businesses and households, and many sell their labor to businesses inside or outside the settlements. As local incomes rise, so does demand, and this generates multiple rounds of impacts in the local economy while stimulating trade that transmits benefits to other parts of the country.

Third, providing land to refugees adds significantly to refugees' positive impact on income in local economies. We find that refugees farm their land intensively. They purchase seed, fertilizer, and other inputs from local businesses and sometimes hire labor from local households. The food refugees produce on their plots is an important source of nutrition for refugee households. Refugees sell some of this food in local markets to raise cash, most of which, in turn, they spend locally, creating new income spillovers. There is some tradeoff between increasing refugees' self-reliance by giving them access to land, on one hand, and creating income spillovers for the nearby host country population, on the other. However, our simulations reveal that this tradeoff is quantitatively small. Refugee assistance with or without land creates large and significant spillovers for host country as well as refugee households.

We focus on the impact of food aid and land allocations; however, refugee assistance is likely to have other impacts beyond the scope of our study. Infrastructure development is ongoing inside and near refugee settlements, with funding from UNHCR and other agencies. The construction of tarmacked roads, schools, and clinic facilities (which local hosts are allowed to access) potentially adds to the impacts of refugee assistance on host country welfare over time.

Uganda's experience offers lessons for other refugee-hosting countries. It reinforces findings from recent studies showing that refugees can create significant economic benefits for the countries that host them, and these benefits increase the more refugees are able to engage in host country markets. It suggests that total production and income impacts are larger when refugees receive assistance in the form of cash spent on locally supplied goods and services, and when they are given access to land. The potential economic benefits are also larger when governments locate refugee settlements in places where local farmers and other producers can supply refugees' demands and where there is a potential for refugees to supplement their income by working or establishing businesses, generating stronger local linkages (Taylor, 2016). Carefully designed refugee assistance policies have the potential to accomplish the dual goal of assisting displaced people while generating economic benefits for people living in or around refugee settlements.

FUNDING INFORMATION

The project was funded by the WFP and UC Davis Temporary Migration Cluster. The authors thank the editor and two anonymous referees for their valuable comments. The paper benefitted from seminar participants at AAEA 2018, FAO Rome, WFP Rome, Virginia Tech, and UC Davis. We are greatly indebted to Lucy Auma, Siddharth Krishnaswamy, Beatrice Nabuzale, Nelson Okao, Moses Oryema, Hamidu Tusiime, Edgar Wabyona, and Olivia Woldemikael for their excellent assistance in the field. We thank M&E Unit of WFP in Kampala, Samaritans Purse, and World Vision field offices for helping with the logistics during fieldwork. We also extend our appreciation to the Office of the Prime Minister (OPM), United Nations High Commission for Refugees (UNHCR) and subcounty offices of UNHCR and WFP for their support in gathering supplemental data for this study. The authors declare that they have no relevant or material financial interests that relate to the research described in this paper.

REFERENCES

Abadie, A., and G. W. Imbens. 2006. "Large Sample Properties of Matching Estimators for Average Treatment Effects." *Econometrica* 74(1): 235–67.

Abadie, A., and G. W. Imbens. 2011. "Bias-Corrected Matching Estimators for Average Treatment Effects." *Journal of Business & Economic Statistics* 29(1): 1–11.

Aihounton, Ghislain B. D., and Arne Henningsen. 2021. "Units of Measurement and the Inverse Hyperbolic Sine Transformation." *Econometrics Journal* 24(2): 334–51.

Akgündüz, Yusuf, Marcel van den Berg, and Wolter H. J. Hassink. 2015. "The Impact of Refugee Crises on Host Labor Markets: The Case of the Syrian Refugee Crisis in Turkey." (2015) IZA Discussion Paper No. 8841 March 24, 2018. https://ssrn.com/abstract=2564974

Alix-Garcia, Jennifer, Sarah Walker, Anne Bartlett, Harun Onder, and Apurva Sanghi. 2018. "Do Refugee Camps Help or Hurt Hosts? The Case of Kakuma, Kenya." *Journal of Development Economics* 130: 66–83.

Alix-Garcia, Jennifer, and David Saah. 2009. "The Effect of Refugee Inflows on Host Communities: Evidence from Tanzania." *World Bank Economic Review* 24(1): 148–70.

Alloush, Mohamad, J. Edward Taylor, Anubhab Gupta, Ruben Irvin Rojas Valdes, and Ernesto Gonzalez-Estrada. 2017. "Economic Life in Refugee Camps." *World Development* 95: 334–47.

Baez, Javier E. 2011. "Civil Wars beyond their Borders: The Human Capital and Health Consequences of Hosting Refugees." *Journal of Development Economics* 96(2): 391–408.

Barrett, Christopher B., Thomas Reardon, and Patrick Webb. 2001. "Nonfarm Income Diversification and Household Livelihood Strategies in Rural Africa: Concepts, Dynamics, and Policy Implications." *Food Policy* 26(4): 315–31.

Bellemare, Marc F., and Casey J. Wichman. 2020. "Elasticities and the Inverse Hyperbolic Sine Transformation." *Oxford Bulletin of Economics and Statistics* 82(1): 50–61.

Birdsall, Nancy, and Juan Luis Londoño. 1997. "Asset Inequality Matters: An Assessment of the World Bank's Approach to Poverty Reduction." *American Economic Review* 87(2): 32–7.

Cameron, A. Colin, Jonah B. Gelbach, and Douglas L. Miller. 2011. "Robust Inference with Multiway Clustering." *Journal of Business & Economic Statistics* 29: 238–49.

Carter, Michael R., and Christopher B. Barrett. 2006. "The Economics of Poverty Traps and Persistent Poverty: An Asset-Based Approach." *Journal of Development Studies* 42(2): 178–99.

Cattaneo, M. D. 2010. "Efficient Semiparametric Estimation of Multi-Valued Treatment Effects under Ignorability." *Journal of Econometrics* 155(2): 138–54.

Ceritoglu, Evren, H. Burcu Gurcihan Yunculer, Huzeyfe Torun, and Semih Tumen. 2017. "The Impact of Syrian Refugees on Natives' Labor Market Outcomes in Turkey: Evidence from a Quasi-Experimental Design." *IZA Journal of Labor Policy* 6(1): 5.

Chambers, Robert. 1986. "Hidden Losers? The Impact of Rural Refugees and Refugee Programs on Poorer Hosts." *International Migration Review* 20(2): 245–63.

Deaton, Angus. 1997. *The Analysis of Household Surveys: A Microeconometric Approach to Development Policy*. Washington DC: World Bank Publications.

Deininger, Klaus W. 2003. *Land Policies for Growth and Poverty Reduction*. Washington DC: World Bank and Oxford University Press.

Filipski, Mateusz, Anubhab Gupta, Justin Kagin, Arif Husain, Alejandro Grinspun, Oscar Maria Caccavale, Silvio Daidone, et al. 2022. "A Local General-Equilibrium Emergency Response Modeling Approach for Sub-Saharan Africa." *Agricultural Economics* 53(1): 72–89.

Finan, Frederico, Elisabeth Sadoulet, and Alain De Janvry. 2005. "Measuring the Poverty Reduction Potential of Land in Rural Mexico." *Journal of Development Economic* 77(1): 27–51.

Gupta, Anubhab, J. Justin Kagin, Edward Taylor, Mateusz Filipski, Lindi Hlanze, and James Foster. 2018. "Is Technology Change Good for Cotton Farmers? A Local-Economy Analysis from the Tanzania Lake Zone." *European Review of Agricultural Economics* 45(1): 27–56.

Halvorsen, Robert, and Raymond Palmquist. 1980. "The Interpretation of Dummy Variables in Semilogarithmic Equations." *American Economic Review* 70(3): 474–5.

Hill, A. E., I. Ornelas, and J. E. Taylor. 2021. "Agricultural Labor Supply." *Annual Review of Resource Economics* 13: 39–64.

Jacobsen, Karen. 1997. "Refugees' Environmental Impact: The Effect of Patterns of Settlement." *Journal of Refugee Studies* 10(1): 19–36.

Jayne, David, Niels Rasmussen, Konrad Andrassy, Paul Bacon, Jan Willem Cohen Tervaert, Jolanta Dadonienė, Agneta Ekstrand, et al. 2003. "A Randomized Trial of Maintenance Therapy for Vasculitis Associated with Antineutrophil Cytoplasmic Autoantibodies." *New England Journal of Medicine* 349(1): 36–44.

Jonasson, Erik, Mateusz Filipski, Jonathan Brooks, and J. Edward Taylor. 2014. "Modeling the welfare impacts of agricultural policies in developing countries." *Journal of Policy Modeling* 36(1): 63–82.

Keswell, Malcolm, and Michael R. Carter. 2014. "Poverty and Land Redistribution." *Journal of Development Economics* 110: 250–61.

Kline, Patrick, and Andres Santos. 2012. "A Score Based Approach to Wild Bootstrap Inference." *Journal of Econometric Methods* 1(1): 23–41.

Kreibaum, Merle. 2016. "Their Suffering, our Burden? How Congolese Refugees Affect the Ugandan Population." *World Development* 78: 262–87.

Lewis, W. Arthur. 1954. "Economic Development with Unlimited Supplies of Labour." *Manchester School* 22(2): 139–91.

Maystadt, Jean-François, and Philip Verwimp. 2014. "Winners and Losers among a Refugee-Hosting Population." *Economic Development and Cultural Change* 62(4): 769–809.

Omata, N., and J. Kaplan 2013. Refugee Livelihoods in Kampala, Nakivale and Kyangwali Refugee Settlements. Refugee Studies Center (95), Working Paper (2013). University of Oxford March 24, 2018. https://www.rsc.ox.ac.uk/files/files-1/wp95-refugee-livelihoods-kampala-nakivale-kyangwali-2013.pdf

Singh, Inderjit, Lyn Squire, and John Strauss. 1986. *Agricultural Household Models: Extensions, Applications, and Policy*. Washington, DC: The World Bank.

Taylor, J., Mateusz Filipski Edward, Mohamad Alloush, Anubhab Gupta, Irvin Rojas, and Ernesto Gonzalez. 2016. "Economic Impact of Refugees." *PNAS—Proceedings of the National Academy of Sciences* 113(27): 7449–53.

Taylor, J. Edward. 2016. "Research: Refugees Can Bolster a Region's Economy." *Harvard Business Review*. hbr-refugees-can-bolster-a-regions-economy-1.pdf (calpnetwork.org).

Taylor, J. Edward, and Mateusz Filipski. 2014. *Beyond Experiments in Development Economics: Local Economy-Wide Impact Evaluation*. Oxford: Oxford University Press.

Taylor, J. Edward, and Irma Adelman. 2003. "Agricultural Household Models: Genesis, Evolution, and Extensions." *Review of Economics of the Household* 1(1): 33–58.

UNHCR. 2017. UNHCR's Refugee Population Statistics Database. March 24, 2018. http://www.unhcr.org/en-us/. December 6, 2018. http://popstats.unhcr.org/en/demographics

UNHCR. 2021. Global Trends Report August 3, 2022. https://www.unhcr.org/62a9d1494/global-trends-report-2021

Whitaker, Beth Elise. 2002. "Refugees in Western Tanzania: The Distribution of Burdens and Benefits among Local Hosts." *Journal of Refugee Studies* 15(4): 339–58.

World Bank Group. 2016. *An Assessment of Uganda's Progressive Approach to Refugee Management*. Washington, DC: World Bank.

Wu, Chien-Fu Jeff. 1986. "Jackknife, Bootstrap and Other Resampling Methods in Regression Analysis." *Annals of Statistics* 14(4): 1261–95.

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

How to cite this article: Zhu, Heng, Anubhab Gupta, Mateusz Filipski, Jaakko Valli, Ernesto Gonzalez-Estrada, and J. Edward Taylor. 2023. "Economic Impact of Giving Land to Refugees." *American Journal of Agricultural Economics* 1–26. https://doi.org/10.1111/ajae.12371