Smallholder farmers and contract farming in developing countries

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Edited by Arun Agrawal, University of Michigan, Ann Arbor, MI, and approved November 12, 2019 (received for review June 2, 2019)

Poverty is prevalent in the small-farm sector of many developing countries. A large literature suggests that contract farming—a preharvest agreement between farmers and buyers—can facilitate smallholder market participation, improve household welfare, and promote rural development. These findings have influenced the development policy debate, but the external validity of the extant evidence is limited. Available studies typically focus on a single contract scheme or on a small geographical area in one country. We generate evidence that is generalizable beyond a particular contract scheme, crop, or country, using nationally representative survey data from 6 countries. We focus on the implications of contract farming for household income and labor demand, finding that contract farmers obtain higher incomes than their counterparts without contracts only in some countries. Contract farmers in most countries exhibit increased demand for hired labor, which suggests that contract farming stimulates employment, yet we do not find evidence of spillover effects at the community level. Our results challenge the notion that contract farming unambiguously improves welfare. We discuss why our results may diverge from previous findings and propose research designs that yield greater internal and external validity. Implications for policy and research are relevant beyond contract farming.

contract farming | outgrower schemes | smallholder farmers | external validity

Smallholder farmers in developing countries are often trapped in a vicious cycle of low-intensity, subsistence-oriented farming, low yields, and insufficient profits to make beneficial investments. These factors contribute to high levels of poverty in many rural areas (1–3).

Linking poor farmers to markets is one option to break this vicious cycle, but it requires overcoming various barriers and market imperfections (3, 4). Smallholder farmers may face high risks while lacking the skills, technologies, and financial services to produce a marketable surplus—or to supply the quality, quantity, and types of commodities demanded by buyers (5).

Contract farming—a preharvest agreement between farmers and buyers—is commonly understood as a useful tool to mitigate prevalent market failures and to reduce the risks facing smallholder farmers (6–8). Contract farming is therefore promoted by policy makers and development agencies (9, 10). Contract farming is not a new phenomenon (8, 11); the globalization of agricultural trade and the rapid modernization of agricultural value chains in developing countries (5), however, has generated renewed interest in the topic.

Numerous studies analyze whether farm households benefit from contract farming, which is important in light of increasing policy support. Most studies focus on profits and household income (12–14); some explore implications for other dimensions of household welfare (15–17). Most studies find that contract farming improves welfare (6, 18–20). Contract farming may affect household welfare through different channels. For example, contracts that specify the price or quantity of products to be delivered can reduce transaction costs and uncertainty around prices and marketing options, thus facilitating planning and investments (7, 11, 16). Contract farming may also improve farmers' access to extension, financial services, and farm inputs, thereby enabling farmers to increase productivity, improve product quality, or adopt more-profitable crops (11, 21).

Although participating households are largely found to benefit, implications for their communities at large are less well understood (22–25). This is an important shortcoming, given that contract farming receives attention from policy makers precisely because of its expected contribution toward rural development. At least in the medium term, however, the general equilibrium effects of contract farming seem less clear.

On the one hand, participation in contract farming may have, as prerequisites, initial investments and ownership of land and other resources (12, 26), possibly leading to the exclusion and further marginalization of the poorest population segments in rural areas. A common concern is thus that contract farming may increase inequality (27). On the other hand, nonparticipating households may benefit indirectly via technology spillovers, investments in local infrastructure, or the creation of new jobs. The labor market implications of contract farming seem particularly important, given that employment options for the rural poor are typically limited. Evidence on labor market implications of contract farming is scarce, but a handful of studies suggest that contract farming contributes to the emergence of middle-class farmers, who typically rely on hired labor (28). Similarly, contract farming is often associated with the introduction of labor-intensive crops, technologies, or standards, which may lead to an increase in the demand for hired labor and in local wages (28–30). Yet changes in labor demand tend to be context-specific (12), and the

Significance

Achieving the United Nations' Sustainable Development Goals remains a challenge in many developing countries, and especially in rural areas. Smallholder farmers are often trapped in a vicious cycle of low-intensity farming, low yields, limited market access, and insufficient profits, all of which prevents beneficial investments. Contract farming is commonly seen as a suitable means of linking poor farmers to markets, improving household welfare, and promoting the modernization of the agricultural sector. The available evidence supports the notion that contract farming increases welfare, but external validity is limited. We address this gap using data from 6 developing countries and discuss implications for policy and research.

Author contributions: E.-M.M. and M.F.B. designed research; E.-M.M. performed research; E.-M.M. analyzed data; and E.-M.M. and M.F.B. wrote the paper.

The authors declare no competing interest.

This article is a PNAS Direct Submission.

Data deposition: Reproduction materials and do-files are available at Cornell's data repository, https://doi.org/10.6077/190x-1677.

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This article contains supporting information online at https://www.pnas.org/lookup/suppl/doi:10.1073/pnas.1909501116/-/DCSupplemental.

First published December 13, 2019.

overall number of jobs created may be limited, employment options seasonal, and working conditions precarious (31). Hence, implications for workers' total household income and welfare remain poorly understood. Spillover effects beyond those via local labor markets have received even less scientific attention.

Overall, the evidence on the effects of contract farming on participating and nonparticipating households is overwhelmingly case study-based. Most of these studies are based on cross-sectional observational data from a case study area, often covering a single contract scheme or small geographical area (exceptions include refs. 15, 32, and 33). Such study designs yield results that are not representative beyond a particular contract scheme or region. Relatedly, extant studies mainly focus on large, export-oriented contract schemes that are operated by private companies. More-informal, governmental, or domestic schemes are hardly covered and thus poorly represented in the literature. This is a serious gap, since such schemes may potentially include and affect more farmers than large, export-oriented schemes.

We contribute to the literature on contract farming by providing evidence that is generalizable beyond a particular contract scheme, type of contract, crop, region, or country. Our analysis is based on survey data provided by the Consultative Group to Assist the Poor (CGAP) (34–39). CGAP smallholder surveys cover a wide range of issues related to livelihoods and farming and were conducted with farmers and their households from 6 countries, namely, Bangladesh, Côte d'Ivoire, Mozambique, Nigeria, Tanzania, and Uganda. Data are nationally representative for smallholder farmers in the aforementioned countries (40, 41).

Unlike previous studies, we focus on welfare implications for both the farm households that participate in contract farming and those that do not. Our outcome variables of interest are household income and demand for hired labor. We are particularly interested in the question of whether contract farming increases incomes and demand for hired labor among participating households—and whether the prevalence of contract farming affects the incomes of nonparticipating households in the same communities.

Participation in contract farming is not randomly assigned. Better-off households with larger landholdings may self-select into contract farming (21, 33). Contract farming may also be more common in regions with favorable agroecological or institutional conditions (3, 33). To reduce bias due to self-selection of households and specific regions into contract farming, we take advantage of the hierarchical structure of the data, which cover countries, administrative units, clusters (i.e., communities), households, and individual household members. Location and, more importantly, household fixed effects allow us to control for various unobserved characteristics that may simultaneously affect the propensity to participate in contract farming and our outcomes of interest (i.e., labor demand and household income).

Results

Characteristics of Contract Farmers. Table 1 provides an overview of the sample, which includes 6 countries, 661 administrative units (Districts, Sous-Préfectures, or Local Governmental Areas), 1,255 clusters (small geographical units covering parts of villages or towns), 16,140 farm households, and 27,761 individual household members. Data are provided by CGAP (34–39), a think tank that seeks to improve smallholder farmers' access to financial services (40, 41). CGAP data are nationally representative for smallholder farmers (see *Materials and Methods*).

We define contract farmers as farmers who have a contract to sell their crop or livestock products. Similarly, we define households as contract households when at least 1 household member has a contract. Thus, our definition of contract farming captures a wide range of contractual arrangements, involving different products, buyers, pricing policies, degrees of formality, and services attached.

The prevalence of contract farming varies across countries (columns 2 and 4 of Table 1). While participation rates in Bangladesh are relatively low (3 to 4% of all sampled individuals and households participate in contract farming), they are relatively high in Tanzania (77 to 80% of all sampled individuals and households participate). High participation rates in Tanzania suggest that contractual arrangements are relatively common in some countries, also beyond large, formal, export-oriented contract schemes. Overall, however, figures displayed in Table 1 are in line with previous estimates suggesting that participation rates are typically below 15% (42).

In columns 6 and 8 of Table 1, we display the share of clusters and administrative units where at least one sampled household participates in contract farming. These figures suggest that contract farming is not geographically concentrated.

Several characteristics of individuals and their households are associated with participation in contract farming. Female-headed households (*SI Appendix*, Table S1) and female farmers (*SI Appendix*, Table S2) are significantly less likely to participate in contract farming. Compared to their counterparts without contracts, contract farmers and their households are more likely to own productive resources such as land and livestock, to use modern farm inputs, and to sell their products to wholesalers or processors. That said, access to resources, farm practices, and crop choices may be a precondition for or the outcome of contract farming.

Both contract and noncontract farmers are involved in multiple farming activities, involving crop farming and animal husbandry. On average, farmers grow about 5 different crops. Contract farmers are not necessarily specialized in traditional cash crops such as

Table 1. Sample size and prevalence of contract farming

	Individuals		Households		Clusters		Administrative units*	
	1	2	3	4†	5	6	7	8§
	N	Percent with contract	*N*	Percent with contract†	*N*	Percent with contract‡	*N*	Percent with contract§
Bangladesh	3,951	3.2	2,689	4.3	201	31.8	61	63.9
Côte d'Ivoire	5,354	10.5	2,912	15.0	210	73.3	151	79.5
Mozambique	3,979	4.2	2,331	5.7	206	36.9	11	90.9
Nigeria	4,532	13.2	2,737	15.9	214	66.4	199	68.3
Tanzania	4,742	77.3	2,706	80.8	209	99.5	135	100
Uganda	5,203	7	2,765	10.0	215	66.0	104	74.0
Total	27,761	19.8	16,140	22.2	1,255	62.6	661	78.2

*Districts in Bangladesh, Mozambique, Tanzania, and Uganda; Sous-Prefectures in Côte d'Ivoire; Local Governmental Areas in Nigeria.
†At least 1 household member has a contract.
‡At least 1 household within a cluster has a contract.
§At least 1 household within an administrative unit has a contract.

Table 2. Contract farming and household income

	1	2	3
	Country FEs	Admin. unit FEs	Cluster FEs
All countries (n = 14,573)	0.140**	0.116***	0.095***
	(0.044)	(0.031)	(0.026)
Bangladesh (n = 2,677)		−0.040	0.007
		(0.072)	(0.053)
Côte d'Ivoire (n = 2,686)		0.119**	0.077
		(0.060)	(0.054)
Mozambique (n = 1,443)		0.350*	0.268*
		(0.190)	(0.138)
Nigeria (n = 2,604)		0.007	0.006
		(0.049)	(0.049)
Tanzania (n = 2,621)		0.078	0.069
		(0.057)	(0.053)
Uganda (n = 2,542)		0.285***	0.252***
		(0.092)	(0.078)

This table provides an overview of regression results by country. Full regression outputs displaying the complete set of control variables can be found in *SI Appendix*, Table S3. The log of income per capita and day is regressed on a binary variable capturing participation in contract farming. SEs clustered at the country level (column 1), administrative (Admin.) unit level (column 2), or cluster level (column 3) are shown in parentheses. FEs, fixed effects. *P < 0.1, **P < 0.05, ***P < 0.01.

tobacco, cotton, or cocoa. Indeed, contract farmers name a wide variety of different crops as their most important crop (*SI Appendix*, Figs. S1 and S2).

Income and Poverty. On average, households with contracts have incomes that are about 10% higher than that of their counterparts without contracts. We focus on household income per capita and day (see also *Materials and Methods*). Table 2 provides an overview of regression results. We control for various household characteristics that may simultaneously determine participation in contract farming and household income. Full regression outputs can be found in *SI Appendix*, Table S3. We further include country, administrative unit, or cluster fixed effects (in columns 1, 2, and 3 of Table 2). Thus, we control for the unobserved heterogeneity (e.g., agroecological, geopolitical, or welfare differences) common to the households at those levels of aggregation across locations.

Results are robust to alternative specifications (*SI Appendix*, Tables S4–S6). Higher incomes also translate into lower levels of poverty among contract households (*SI Appendix*, Figs. S3 and S4 and Table S6). Yet regressions shown in the lower part of Table 2 suggest that income differences vary across countries. Income differences between households with and without contract are large in Mozambique (only significant at less than the 10% level) and Uganda (significant at less than the 1% level), but statistically insignificant in Bangladesh, Nigeria, and Tanzania.

As indicated, our definition of contract farming captures a wide range of contractual arrangements, whereas previous studies typically focused on large, export-oriented contract schemes. Do farmers benefit less from participation in more-informal, governmental, or domestic contract arrangements? Although this is a reasonable hypothesis, this does not have to be the case. Large buyers may have monopsonistic power, keeping farmers in exploitative contracts; not all large buyers offer inputs; and small, domestic buyers may be more trusted. Our data do not allow for a detailed analysis of the importance of such factors for contract outcomes. But we can proxy participation in more-formal contract arrangement by considering information on the type of buyer—and whether farmers receive inputs from these buyers. We find that farmers do not necessarily benefit more from contract farming when they enter into contracts with buyers such as wholesalers or processors, even when they obtain inputs from these buyers (see also *SI Appendix*, Tables S7–S10 and robustness checks in *SI Appendix*).

Demand for Hired Labor. Compared to their peers without contracts, contract households are about 10% more likely to hire laborers for an extended period of time, with some variation across countries. Fig. 1 provides an overview of the regression results at the household level.

Regression at the individual level supports these results (*SI Appendix*, Tables S11–S15), but as we control for more unobserved factors by including household fixed effects, the magnitude of the effect size decreases (*SI Appendix*, Table S11).

Community-Level Effects. Higher labor demand among contract farmers may generate new employment opportunities for the rural poor. The prevalence of contract farming may also affect nonparticipating households via various other pathways, including improved availability of farm inputs and services, technology spillovers, or investments in local infrastructure.

We explore whether the prevalence of contract farming is associated with higher incomes among those households that do not participate in contract farming, focusing on the subsample of noncontract farmers. We do not find robust evidence that the prevalence or presence of contract farming affects the incomes of nonparticipating households in the same communities. While coefficients are mostly positive and quite large for some countries, they are imprecisely estimated and are thus mostly insignificant (*SI Appendix*, Tables S16–S19).

Discussion

This study explores the welfare implications of contract farming for participating and nonparticipating smallholder farm households based on survey data from 6 developing countries. We find that contract farmers obtain, on average, about 10% higher incomes than their counterparts without contracts. Average income effects reported in previous studies are typically substantially larger (19, 20). Additionally, our results are driven by 2 countries (Uganda and Mozambique), meaning that, in 3 out of the 6 countries, income differences are marginal or insignificant. Thus, our results challenge previous findings and the notation that contract farming unambiguously improves household welfare. Exploring and explaining country-specific differences is beyond the scope of this paper due to data limitations—but it may be a fruitful and policy-relevant direction for future research.

We do not find robust evidence that contract farming generates spillover effects on nonparticipating farm households in the same communities. This is somewhat surprising, since our results suggest that contract farming increases demand for hired labor. One may expect that such labor market effects translate into higher incomes among nonparticipating households. Better understanding local and sector-wide effects is important from a policy perspective, but is currently very difficult due to data limitations. For instance, the data used here do not adequately capture nonagricultural households. Similarly, we also lack information on who within villages is actually employed (or influenced otherwise) by contract farmers. In the future, researchers and donors may want to design surveys that better capture possible spillover and network effects, to allow for more detailed analyses.

We conclude by discussing why our results on income effects of participating households may diverge from previous results. We propose different explanations, while also highlighting directions for future research.

One potential explanation relates to methodological differences. While most studies employ matching or instrumental variable approaches to deal with selection bias, our approach is

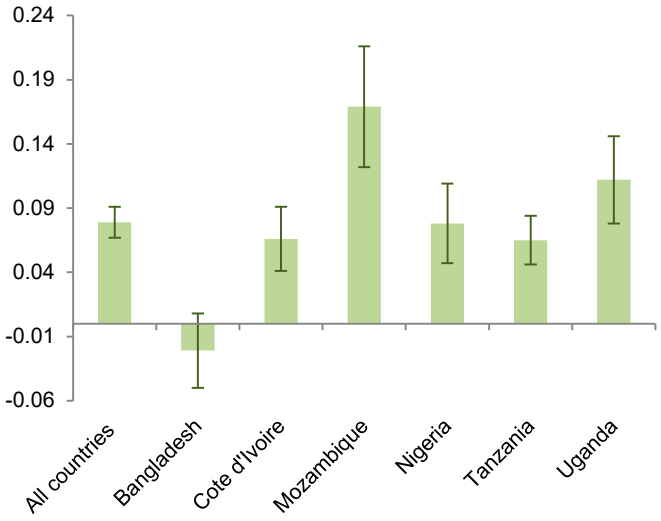

Fig. 1. Differences in labor demand between households without and with contracts. The outcome variable is a dummy variable indicating whether households have an increased demand for hired labor. Differences in percentage points are indicated on the *y* axis. Coefficients are obtained via regressions represented in Eq. **2**. SEs are shown. All figures refer to the household level.

to use location and household fixed effects—the latter of which is an exception in a literature wherein most data are cross-sectional and treat the household as the unit of observation. Is the internal validity of our results inferior? Matching approaches critically depend on the conditional independence assumption which is difficult to defend in the context of contract farming, where farmers select on the basis of typically unobserved quantities such as their risk or time preferences, or their entrepreneurial ability. Similarly, the validity of many instrumental variables is questionable (6). Thus, weaker internal validity is hardly a convincing candidate explanation for smaller effect sizes presented here.

Another concern may be data quality, especially the quality of our proxies for household income (which does not capture the value of self-consumed agricultural produce) and labor demand (which does not tell us much about wages and the actual number of laborers employed). We acknowledge limitations in terms of data quality and encourage future research into this direction. Yet concerns related to the quality of data are common in survey-based research and hold for all studies of this type. Thus, measurement error is unlikely to be a satisfactory explanation for the differences between our and previous findings.

A more likely explanation relates to publication bias. Recent evidence suggests that studies reporting positive and significant effects of contract farming have a higher likelihood of being published (20). If it were possible to consider the overall body of published and unpublished studies, our results may diverge less. A more subtle form of publication bias occurs when studies that may find marginal, negative, or nonsignificant results have a low likelihood of ever being conducted, written up, or submitted for publication.

This last problem is closely related to our preferred explanation, which is that the extant evidence largely lacks external validity. Available studies are almost exclusively case studies that focus on a small geographic area or a single contract scheme. Given these nonrandom elements, results are not generalizable.

Sampling designs with nonrandom (e.g., choice-based) elements are a common feature of case studies, and they are nevertheless a valid and important tool to contribute insights on topics that are hitherto poorly understood. Yet the literature on contract farming has been growing constantly over the past 3 decades (6, 18–20), and case studies, especially when involving nonrandom sampling, are less suitable to test existing hypotheses. To understand why, we have to consider how research teams select case study areas.

Research teams, when deciding where to implement a survey, consider various factors, including the characteristics of the location and contract scheme (e.g., safety, accessibility, and the willingness of companies, development agencies, and authorities to collaborate or allow surveys to be undertaken). As a result, specific types of contract schemes may be unlikely to be selected by research teams and thus are likely underrepresented in the available evidence, namely smaller, more-informal, domestic, or ill-functioning contract schemes; and those located in difficult-to-access areas. These may be precisely the schemes and locations where farmers benefit less or not at all. Thus, the current body of case study based evidence may be "representative" of large, formal, export-oriented, well-functioning schemes in the most privileged locations.

Our data and contract farming definition capture a wide range of—possibly both well- and ill-functioning—contractual arrangements, involving different products, buyers, pricing policies, degrees of formality, and services attached. One may be tempted to suggest that large, formal contract schemes that provide inputs and other services (previous results) generate much larger income gains for farmers than what one would expect on average (our results). Exploring whether this is the case is beyond the scope of this paper, given that we do not have detailed information on contract features. Yet intuition suggests—and robustness checks seem to support—the following: More-formal contracts with larger buyers can be as (un)beneficial for participating farmers as more-informal preharvest agreements with smaller buyers.

One may wonder why research teams even conduct their own surveys when large, nationally representative datasets are available from organizations such as the World Bank. While readily available, such data often do not cover topics such as contract farming. And even when covered, participation rates vary across countries, and there may be too few cases of participation to allow meaningful analyses. Similarly, secondary datasets rarely cover all issues of interest, which also holds for this study. In the future, larger surveys will hopefully include more information on values chains and contract farming. In the medium term, small surveys conducted by smaller institutions will remain the only way to gain a deeper understanding of impacts and impact pathways.

Given the aforementioned reasons, current sampling designs lead to data that are less representative than they could and ought to be. One way to improve external validity is to select contract schemes at random instead of purposely. Such approaches are more costly because they require preparation of lists of all contract schemes in a given country or region from which to sample, but they are not infeasible (43).

Another way to improve external and internal validity is to move beyond small surveys conducted by individual research teams. Collaborative projects could allow collecting data suitable to control for yearly differences and idiosyncratic characteristics of households and locations. Samples including a larger number of contract schemes would also allow analyzing the role of specific contract features in more detail. A better understanding of the conditions under which farmers and their communities benefit would be a policy-relevant contribution in light of our finding that contract farming does not unambiguously improve welfare.

Materials and Methods

Data. We use survey data provided by CGAP (34–39), a think tank that seeks to improve smallholder farmers' access to financial services (40).

CGAP Smallholder Household Surveys were conducted in the years 2015 and 2016 in 6 countries, namely, Bangladesh, Côte d'Ivoire, Mozambique, Nigeria, Tanzania, and Uganda. Data are publicly available at the World Bank's

Central Microdata Catalog (41). CGAP data are nationally representative for smallholder households, where CGAP defines smallholder households as households who own "up to five hectares OR farmers who have less than 50 heads of cattle, 100 goats/sheep/pigs, or 1,000 chickens."

CGAP surveys are based on multistage stratified sampling strategies. Primary sampling units are enumeration areas (EAs). EAs are small geographical areas that were defined in the frame of previous national censuses, including population and agricultural censuses. For CGAP surveys, only EAs that contain agricultural households were considered. Therefore, data are only representative for farm households and not for the entire population.

In the first sampling stage, around 200 EAs (with some variation across the 6 countries) were randomly selected. In the second stage, lists containing all agricultural households in the selected EAs were prepared. From each of these lists, 15 households were randomly selected.

For stratification purposes, broader geopolitical or agricultural zones were defined. These zones were separated into urban and rural areas, yielding 6 to 14 strata for each country. The sample was selected independently from these strata.

CGAP surveys include different questionnaires. Our analysis is based on 1) the household questionnaire and 2) the multiple respondent questionnaire. The household questionnaire contains a household roster and questions on household income and was predominantly conducted with household heads. The multiple respondent questionnaire was conducted with all household members above the age of 15 y who contribute to household income. The questionnaire includes questions on farming activities, including contract farming, and other income-generating activities.

Measurement of Treatment and Outcome Variables. Our main variable of interest captures whether farmers "have a contract to sell any of [their] crops or livestock." This question was asked the same way across countries. We asked native speakers to rule out misleading terms and translations, especially for Tanzania. The question is part of the multiple respondent questionnaire, implying that each household member was asked this question, provided he or she was above 15 y, involved in agricultural activities, and contributing to household income. Based on these individual-level responses, we classify households as contract households when at least 1 household member is a contract farmer.

CGAP questionnaires do not include questions on specific contract features, for instance, whether the contractor provides services and whether the contract is oral or written. Similarly, we do not have information on the contracted crop. As a result, we cannot consider specific contract features in our analysis or estimate crop-level or plot-level effects. Thus, we focus on outcomes at the individual and household level.

Our first outcome variable of interest is the logarithm of household income, which we use as a proxy for general household living standards (44). Rural households often rely on several income-generating activities and may reallocate household resources when facing shocks or new income opportunities (e.g., contract farming). Thus, a focus on income from (contract) farming alone may mask overall welfare implications of contract farming (45).

The survey question captures average monthly household income across all sources of income. Values are missing for 16,140 − 14,573 = 1,567 households, most prominently in Mozambique. Original values were reported in local currencies. We translated all values into US$ using the official exchange rate during the time of the survey (i.e., 2016). Surveys in Mozambique and Uganda were conducted in 2015. For these 2 countries, we used the consumer price index to account for inflation. We transformed monthly household income into income per capita and day, by dividing monthly income by (365/12) and by the number of household members.

Our second outcome variable of interest captures increased demand for hired labor. This dummy variable captures respondents' answer to the question, "For managing the land and livestock, do you use hired labor for an extended period of time?" The question is part of the multiple respondent questionnaire, meaning that we have multiple responses per households. Based on this individual-level variable, we also generated a household-level variable. This dummy variable is coded as 1 if at least 1 household member uses hired labor for an extended period of time.

Empirical Framework and Statistical Analysis.

Contract farming and income. To estimate income differences between households that participate and those that do not participate in contract farming, we estimate regressions of the following type:

$$\ln(Y_{jk}) = \beta_0 + \beta_1 C_j + \beta_2 HH_j + \delta_k + \varepsilon_{jk}, \quad [1]$$

where $\ln(Y_{jk})$ is the logarithm of total income (per capita and day) of household j in geographical unit k (i.e., country, administrative unit, or cluster); C is a dummy variable indicating whether (at least household member of) household j participates in contract farming; HH is a vector of household j's characteristics that may simultaneously determine the decision to participate in contract farming and household income; δ represents geographical unit fixed effects (i.e., country, administrative unit, or cluster fixed effects), thereby reducing bias due to differences across locations; and εrepresents an error term with mean zero. We cluster SEs at the country, administrative unit, or cluster level, depending on the level of the fixed effects (46). Exact elasticities can be computed using Kennedy's method (47). As we observe important differences across countries (*SI Appendix*, Fig. S3), we also estimate income differences for each country separately.

Contract farming and labor demand. At the household level, our equation of interest is

$$LD_{jk} = \beta_0 + \beta_1 C_j + \beta_2 HH_j + \delta_k + \varepsilon_{jk}, \quad [2]$$

where LD is a dummy variable indicating whether (at least 1 household member of) household j and geographical region k hires laborers for an extended period of time. As in Eq. **1**, C is a dummy variable indicating whether (at least 1 household member of) household j participates in contract farming, HH is a vector of household j's characteristics, δ represents geographical-unit fixed effects, and $\varepsilon$is an error term with zero mean.

At the individual level, our equations of interest are the following:

$$LD_{ijk} = \beta_0 + \beta_1 C_i + \beta_2 X_i + \beta_3 HH_{ij} + \delta_k + \varepsilon_{ijk} \quad [3]$$

$$LD_{ij} = \beta_0 + \beta_1 C_i + \beta_2 X_i + \tau_j + \varepsilon_{ij}, \quad [4]$$

where LD indicates whether individual i in household j and geographical region k hires laborers for an extended period of time, C is a dummy variable indicating whether individual i is a contract farmer, X is a vector of individual i's characteristics, and HH is a vector of household j's characteristics.

While we use geographical unit fixed effects (represented by δ) in Eq. **3**, Eq. **4** includes household fixed effects (represented by τ). By including household fixed effects, we control for a wide range of unobserved factors that are typically difficult to control for. Eqs. **2**–**4** are estimated via linear probability models.

Spillover effects on nonparticipating households. To estimate income effects on nonparticipating households, we estimate regressions of the following type:

$$\ln(Y_{jk}) = \beta_0 + \beta_1 S_c + \beta_2 HH_j + \delta_k + \varepsilon_{jk}, \quad [5]$$

where $\ln(Y_{jk})$ is the logarithm of total income (per day and capita) of household j in cluster c and geographical unit k (here, country or administrative unit; we only consider the subsample of noncontract farmers in these regressions), S is the proportion of contract farmers in cluster c, HH is a vector of household characteristics, and δ represents geographical unit fixed effects.

Data Availability. Data are publicly available at the World Bank's Central Microdata Catalog. Reproduction materials and do-files are available at Cornell's data repository, https://doi.org/10.6077/190x-1677.

ACKNOWLEDGMENTS. This research was financially supported by the German Research Foundation (DFG) (DFG Fellowship ME 5179/1-1) and by the US National Institute of Food and Agriculture (Grant MIN-14-061).

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