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Contract Farming and Multidimensional Poverty in Low-Income Countries: An Analysis of Smallholder Farmers

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Abstract

Poverty is prevalent among rural smallholder farmers in low-income countries. A substantial body of literature suggests that contract farming can enhance smallholders' welfare by improving market access and promoting rural development. Existing studies usually focus on single welfare components and on a single crop, contract scheme or geographical area. 'Big picture' analyses remain scarce. We develop a new multidimensional poverty index and examine the relationship between contract farming and poverty in six low-income countries. We find that contract farming is associated with decreased poverty among smallholders in low-income countries. Yet, major differences appear between countries, indicating that the contract farming-welfare link is contingent on many national and regional factors. We also find that food-crop farming households are more likely to benefit from contract farming than if they farmed cash crops, which tend to be linked to global value chains by default. Since richer farmers can self-select into contracts and bargain better under market conditions, we argue that policy room exists to promote contract farming for low-resourced farmers in low-income countries.

Keywords: contract farming; multidimensional poverty; smallholder; farmers; welfare

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Résumé

La pauvreté est répandue chez les petits exploitants agricoles ruraux des pays à faible revenu. De nombreuses études suggèrent que l'agriculture contractuelle peut améliorer le bien-être des petits exploitants grâce à un meilleur accès au marché, et favoriser le développement rural. Les études existantes portent généralement sur des composantes individuelles du bien-être et sur une seule culture, un seul système contractuel ou une seule zone géographique. Les analyses globales restent rares. Nous construisons un nouvel indice multidimensionnel de pauvreté et étudions la relation entre agriculture contractuelle et pauvreté dans six pays à faible revenu. Nous constatons que l'agriculture contractuelle est associée à une réduction de la pauvreté chez les petits exploitants des pays à faible revenu. Cependant, des différences importantes apparaissent entre les pays. Elles indiquent que le lien entre agriculture contractuelle et bien-être dépend de nombreux facteurs nationaux et régionaux. Nous constatons également que les ménages s'adonnant aux cultures vivrières sont plus susceptibles de bénéficier de l'agriculture contractuelle que ceux pratiquant des cultures de rente, qui tendent à, par défaut, être liées aux chaînes de valeur mondiales. Puisque les agriculteurs les plus riches peuvent eux-mêmes choisir les contrats et mieux négocier dans les conditions du marché, nous soutenons qu'il existe une marge de manœuvre politique dans la promotion de l'agriculture contractuelle auprès des agriculteurs à faibles ressources dans les pays à faible revenu.

Mots-clés : agriculture contractuelle ; pauvreté multidimensionnelle ; petits exploitants agricoles ; bien-être

Introduction

Contract farming (CF) is important for modernising agricultural value chains. In sub-Saharan Africa, the growing role of supermarkets has led to significant increases in the incomes of smallholders who engage in contract farming, ranging from 40 to 50 per cent (Arouna, Michler, and Lokossou 2021). CF remains important for its other perceived benefits, in food security, better yields and rural transformation, broadly (Bellemare and Bloem 2018; Ruml and Qaim 2021). Although contracts in the agricultural sector can be lucrative, power imbalances can lead to losses and unfair outcomes for smallholder farmers in low-income countries (LICs) (Mwambi et al., 2016; FAO, 2020; Vicol et al., 2022). For those in rural poverty in LICs, the full benefits of CF remain untapped. This is particularly so because those with a higher income tend to benefit more from CF than the poorer farmers (Ogutu, Ochieng and Qaim 2020). According to Ruml and Qaim (2021), a

paradox for poorer farmers is that income benefits notwithstanding, farmers remain unhappy and continue to exit from CF. There are documented cases among farmers of covert, indirect and direct resistance to some aspects of CF (Hambloch 2022; Shonhe and Scoones 2022).

Several studies have investigated the impact of CF on smallholder farmers' income in LICs. Earlier studies on the topic are Glover and Kusterer (1990), Little and Watts (1994), Porter and Phillips-Howard (1997) and Singh (2002). They all found that incomes become more reliable with CF. More recently, studies based on micro data have investigated the income effects of CF (Bellemare 2012; Birthal, Joshi, and Gulati 2005; Miyata, Minot, and Hu 2009; Rao and Qaim 2011; Simmons, Winters, and Patrick 2005), and have found higher incomes for farmers engaged in CF. According to Ruml and Qaim (2020), the major problem of focusing on income or profits as welfare proxies is that other economic activities and income sources may be affected by contracts through the reallocation of household resources. We provide an intervention through a multidimensional poverty index that is consistently constructed for the countries in the sample to explore the relationship between CF and poverty. The study's novelty thus broadens the welfare measure to capture potential resource reallocation when farmers engage in CF. Our study is consistent with Little and Watts (2022: 204), who make 'a plea for more systematic comparisons and "big picture" analyses of CF'. We achieve this by utilising a nationally representative dataset of smallholder farmers from six LICs: Bangladesh, Côte d'Ivoire, Nigeria, Uganda, Tanzania, and Mozambique. The analysis is based on experimental survey data from the Consultative Group to Assist the Poor (CGAP) in 2015 and 2016.

We investigate the relationship between CF and multidimensional poverty by studying households without CF, those with informal CF and those with formal CF arrangements. We also explore the differences between households that produce cash crops and those that farm food crops. The entire sample indicates that CF is positively correlated with poverty reduction among smallholder farmers across all six countries. Most importantly, in more vertically integrated formal contract schemes with input provision and large retailers or buyers, the poverty alleviation is estimated to be three times stronger. This is highly important because most rural farmers are too poor to farm (Fibæk 2021), and these vertically integrated contracts may open more than marginal improvements to their welfare conditions.

We also find country-specific nuances in contract formality, in that formal contracts show varying magnitudes of potential welfare benefits of CF. Furthermore, our analysis indicates that, on average, cash-crop farming

households are less afflicted by poverty. Nevertheless, the discrepancy in poverty outcomes between those without contracts and those with contracts is more pronounced among households whose primary focus is on food-crop production. That being said, our results show that the CF-welfare link is contingent upon country settings. Although the overall relationship between CF and the poverty index is significantly positive, important between-country differences prevail. Still, these do not negate the overall positive outcomes in the whole sample.

Our results thus partly support the case study findings of deep dissatisfaction with CF and the high incidence of dropping out (Arouna et al. 2021; Ruml and Qaim 2021). Indeed, the positive relationship between CF and the constructed poverty index is significant in Mozambique, Nigeria and Uganda, whereas Bangladesh, Côte d'Ivoire and Tanzania exhibit insignificant results. This signals that, despite the compelling case of CF, policymakers need to consider contextual factors given that heterogeneity is likely the norm: cultural contexts, crop types, soil types and so on will require idiosyncratic adjustments in these contracts.

Although these factors have hindered the development of a general CF theory (Vicol et al. 2022), our analysis supports the argument that having CF leads to better welfare outcomes, particularly through the channel of input supply in vertical contract schemes. We therefore argue that whereas richer farmers are likely to enter into CF unassisted, poorer farmers, with assistance, may expect positive benefits from CF. This is so even though actual contracts may not be mobile or off-the-shelf transferable. Given the inherent power dynamics in CF, there is room for these contracts to be mediated or facilitated by government agencies working in collaboration with large firms in the value chain.

This article is divided into five main sections. Having given an introduction, the next section reviews theories and existing literature in the field. The following section describes the data and the methodology. The results are then presented and discussed. The final section concludes with some policy implications.

Theory and Literature Review

This section explores definitions, theories and the evolution of empirical approaches to understanding CF. It utilises empirical studies on CF to address some methodological challenges, particularly the issue of publication bias and survivor bias, which tend to overemphasise the positive impacts of CF.

What is contract farming?

In this section, we not only explore theoretical lenses rooted in the neoclassical understanding of CF but also briefly introduce balance by incorparating the radical criticism that emanates from agrarian studies. Defining CF is a controversial undertaking, as there is yet no consensus on the definition (Rehber 2007). Bellemare and Lim (2018) underscore that contracts come in 'all shapes and colours', and similar contracts may have different structures depending on who decides on what in the contractual agreement. Eaton and Shepherd (2001: 2) define CF as 'an agreement between farmers and processing and/or marketing firms for the production and supply of agricultural products under forward agreements frequently at predetermined prices'. In their seminal work, which influenced many in the political economy of agrarian change, Little and Watts (1994: 6) define CF as 'a constellation of institutional and production relations that represents … a crucial means by which agriculture is being industrialised and restructured'.

In their groundbreaking book, *Vertical Coordination in Agriculture*, Mighell and Jones (1963) differentiated three types of agricultural contracts, which also apply to agreements concluded within the realm of CF. Market specification contracts guarantee outlet, time for sale, and sometimes price structures for farmers, and farmers remain independent in terms of production processes. Resource-providing contracts agree to the procurement of resources (technical or physical). This type of agreement is particularly common for complex crops, when specific quality standards must be met, or in cases of imperfect input markets. In these contracts, farmers give up some of their decision-making power (Prowse 2012). In production management contracts, the contracting company determines the production processes and the farmers have no decision-making power. Supposedly, the burden of higher costs that the contracting company must bear for compliance control is offset by the sale of higher-quality output. In this article, all types of contractual arrangements between smallholder farmers and buyers are captured. Since our interest is on broad welfare in a cross-country framework, we adopt a wider definition, which includes any preharvest agreement between farmers and buyers or processors (Bellemare and Lim 2018).

Transaction cost approach

Theoretically, the transaction cost approach is the most prominent in explaining CF. Its starting point is Coase's (1937) idea that any firm's existence can be explained by its search to reduce transaction costs. In this case, firms integrate backward production processes as soon as this becomes cheaper than purchasing these same products on the market. CF is also

seen as a workhorse of agricultural value chains, a process that takes a basic agricultural product through a series of value-addition steps, locally and globally (Bellemare and Lim 2018). Whereas neoclassical approaches deem that spot market prices provide all relevant information for decision-making (Rehber 2007), transaction cost approach proponents, such as Williamson (1979), view market transactions as hazardous endeavours in which substantial losses occur because every actor maximises their self-interest (Da Silva 2005). Transaction costs are especially high in imperfect markets, such as agricultural markets in many LICs, where imperfect markets can cause market failures (Prowse 2012).

Vertical integration offers an opportunity to reduce transaction costs and thus can be understood as a remedy for various risks in CF. CF can reduce uncertainty by providing farmers with guaranteed marketing channels and assuring the company of the quality and quantity of the contracted crop (Da Silva 2005; Prowse 2012). Moreover, it could facilitate investments in productive capital, where guaranteed purchases could serve as collateral for accessing credit. It thereby also favours repeated exchange. Additionally, CF can reduce uncertainties related to credibility, as retailers and firms can gain valuable insights into production processes that may be necessary for meeting traceability requirements (Moyer-Lee and Prowse 2015).

The transaction cost approach posits a voluntary-based CF, which has been criticised radically for its narrow focus that privileges legality and efficiency but does not deal with other issues that emerge when powerful firms interact with underresourced farmers. The transaction cost approach argues that CF integrates farmers into global value chains, but it is accused of seeing 'agribusiness as a "win-win" rural development strategy for smallholders and agricultural corporations' (Vicol et al. 2022: 5). This view posits that power imbalances not only affect negotiations in CF but also structurally disadvantage smallholders through high indebtedness to big monopsony firms (Hambloch 2022). CF is thus seen, through this lens, as 'a legal fiction that imagines formally equal and voluntary relations between large firms and small farmers' (Cohen, Vicol and Pol 2021: 179). This radical view was embedded in the general critique of the Washington Consensus and its development agenda for the LICs, in the 1980s and 1990s.

In its Marxist orientation, the criticism posits that fairness in CF is structurally impossible, that smallholders become 'proletarians in disguise' or 'wage-labour equivalents' (Vicol et al. 2022). Since then, however, progress in CF has meant differentiation and even more favourable CF arising from forces above and below as farmers have gained more bargaining powers (Zhang and Zeng 2022).

Over the years, CF proponents have brought in power imbalance as an accompanying issue in CF. In doing so, it has been argued, CF proponents have 'domesticated the critique, rendering it tractable—a problem to be solved for contract farming rather than a fundamental indictment of contract farming' (Cohen et al. 2021: 180). Accordingly, most official reports from development organisations, such as the World Bank, FAO, and the Asian Development Bank, ensure that their documents cover power imbalance as an issue to be addressed in all CF arrangements (Cohen et al. 2021). According to agrarian political economy studies, the problem is that this does not constitute a fundamental solution because it leads to only a piecemeal solution to a structural problem. Some of the proposed solutions include the need for state regulation and the aggregation of smallholders into associations (Vicol et al., 2022). In this study, we interpret our results, acknowledging their limitations, as espoused in these critical agrarian studies. We turn to empirical literature in the next section to explore existing knowledge.

Empirical literature and its evolution

CF and its welfare implications have enjoyed scholarly attention over the past four decades. Bijman (2008) discerns two waves of econometric analysis of the effect of CF on farmers' income. The first wave was in the 1980s to the mid-1990s. To analyse the income effect of CF, large cross-country studies were conducted (Bijman 2008). CF's other socioeconomic impacts, such as gender relationships and communal development, were also considered (Porter and Phillips-Howard 1997; Singh 2002; Glover and Kusterer 1990; Little and Watts 1994). Generally, the studies found positive effects for contract farmers, the most import of which was more reliable income.

The second wave of studies sought to critique the first, using micro-level data. The availability of extensive survey data facilitated a broader analysis of CF. These studies usually concentrated on a certain area or crop for their analysis (Ton et al. 2018). Miyata et al. (2009) found that contract farmers of apples and green onions in China earned significantly more than non-participating farmers. Additionally, they observed differences in farm incomes by crop types. In contrast, apple contract farmers benefited from CF through higher yields, green onion farmers with contracts sold their produce at higher prices because of increased quality. This showed that input provision and technological assistance potentially improve farmers' income through increased yields and improved crop quality.

Similarly, Khan et al. (2019) found heterogeneous effects of CF on land productivity and the income of maize and potato farmers in Pakistan. For potato CF, they recorded positive price and income effects, whereas for maize CF, no impact on income and productivity was found. Birthal et al. (2005) studied the impact of CF on dairy farmers in India and found that it yielded a significantly higher income. The same goes for Warning and Key (2002) who studied peanut production in Senegal.

Simmons et al. (2005) observed contracts for three types of produce in Indonesia: poultry, rice and maize kernels. They found that poultry and maize agreements yielded increased returns for farmers but that rice contracts did not. Increased efficiency in production is another aspect but it does not always translate into higher income, as Ramaswami et al. (2006) showed for Andhra Pradesh, India. They found that production under contract was more efficient than not, but that most of the production surplus in the case of poultry production was appropriated by the contracting firm. In this regard, Hazell et al. (2010) highlight the potential for multiplier effects that may benefit individuals outside the CF household, potentially to the detriment of those directly involved in CF.

Some studies focus on CF's impact on welfare other than income. In their systematic review of CF impacts, Wang, Wang and Delgado (2014) computed that 92 per cent of all relevant impact studies showed positive effects of CF on farm productivity. They also found that three-quarters of the studies indicated positive income effects. These studies show that, on an income basis, CF is indeed beneficial, but more recent studies reveal that this depends on contract type, sector and crop type, among other variables and factors that can lead to disappointments in CF (Ruml and Qaim 2021). Table 1 captures some recent empirical studies related to our study's countries.

Studies in CF also face a methodological problem. Ton et al. (2018) published a meta-analysis of impact studies on CF, which detected the presence of publication and survivor bias. The latter occurs 'when studies … neglect the empirical instances of CF that failed in the first few years' (Ton et al. 2018: 50). Indeed, it is conceivable that CF agreements fail because of poor performance. Therefore, only CF schemes that 'survived' are studied, which introduces a positive bias. The publication bias occurs because studies with significant results are more likely to get published (Ioannidis and Trikalinos 2007). Hence the academic literature tends to be biased towards significant results (Ton et al. 2018).

Table 1: Studies examining the relationship between contract farming and farmers' welfare

COUNTRY	STUDY	CROP	RESULT
Bangladesh	Islam et al. (2019)	Dairy	CF is associated with increases of 42% in household expenditure, 35% gross margin, 34% net margin per cow and 9% in food safety practice adoption rate.
	Meemken and Bellemare (2020)		No significant relation between CF and income.
Côte d'Ivoire	Meemken and Bellemare (2020)		Significant 12% income increases for contracting households.
Mozambique	Chambati et al. (2019)	Sugar	CF led to social differentiation between farmers and increased food insecurity among contracting farmers.
	Meemken and Bellemare (2020)		Significant 35% income increases for contracting households.
Nigeria	Awotide et al. (2015)	Rice	CF increased productivity by 80%, reduced poverty by 14%, and significantly increased crop income by 64%.
	Meemken and Bellemare (2020)	Rice	No significant relation between CF and income.
	Yusuf et al. (2021)	Maize	The average effect of treatment shows that CF increased income from maize production by $97.53/hectare. However, CF can have negative consequences if food security concerns are not considered in the contract.
Tanzania	Herrmann (2017)	Rice and sugar	Significant household welfare benefits for agro-industry workers and out-growers.
	Meemken and Bellemare (2020)		No significant relation between CF and income.
Uganda	Bolwig, Gibbon and Jones (2009)	Cocoa	CF related to an increase in net coffee revenue of around 75%.
	Meemken and Bellemare (2020)		Significant 29% income increases for contracting households.
	Jones and Gibbon (2011)	Cocoa	Contracts increased real net cocoa farming income by 58-168%, varying according to the econometric model.

Source: Author's table

Meemken and Bellemare (2020) and Ton et al. (2018) also note methodological limits to previous impact studies on CF. Indeed, many of the studies mentioned above highlight the limited generalisability of their findings (Dedehouanou, Swinnen and Maertens 2013). Data availability allowed for impact studies in only limited geographical areas or crop types (Ton et al. 2018; Meemken and Bellemare 2020). In addition, statistical instruments such as instrumental variables, propensity score matching or Heckman approaches often present flaws (Ton et al. 2018).

Recent studies also reveal that, despite positive outcomes, there is a general lack of trust when smallholders enter into contracts with larger firms (Ruml and Qaim 2021). The unfortunate outcome is a high dropout rate, which is commonplace (Ruml and Qaim 2021: 1107). From producing nothing, CF will likely allow income benefits for smallholder farmers, but the contracts can get bedevilled with other issues, including power dynamics between processors and poor farmers (Vicol et al. 2022). The need for transparency, simplicity and mutually beneficial contractual terms remains important (Smaller, Speller and Brewin 2018; Arouna et al. 2021).

The literature has not done enough to research overall welfare improvements, especially for smallholder farmers, who tend to be at the lower end of the income distribution. This is crucial for unravelling the counterintuitive phenomenon of high dropout rates and the observed persistence of the agrarian underdevelopment status quo (Arouna et al. 2021; Ruml and Qaim 2021). Many people in LICs remain employed in agriculture, even though value addition in the sector has declined continuously relative to other sectors.

Figure 1 shows this reality for the countries in our sample. For Mozambique, Tanzania and Uganda, around 70 per cent of total labour works in agriculture. If CF is beneficial, can it be possible that farmers win on farming income and lose elsewhere in the process to warrant the desire to exit contracts? As Ruml and Qaim (2020) note, the major problem of focusing on income or profits as welfare proxies is that other economic activities and income sources may be affected by contracts, through a reallocation of household resources. We contribute to this area of research through a multidimensional poverty measure. By doing so in a manner that allows for greater generalisability than previous case studies, this article adds to ongoing debates about the need to consolidate CF theories.

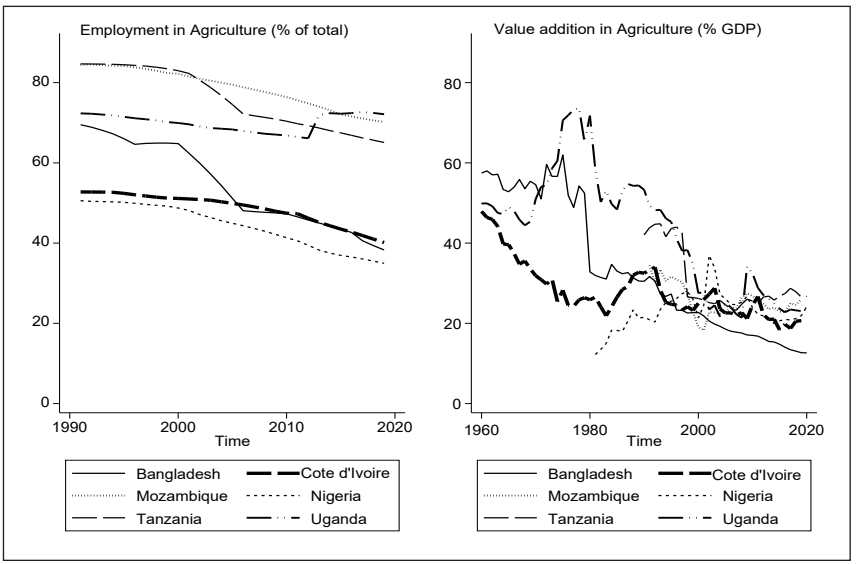

Figure 1: Employment and value addition in agriculture for the six study countries
Source: World Bank Indicators (WDI)

Data and Methodology

Source material

One problem of exploring CF in 'big picture' style is the general lack of consistent data. In this instance, we used experimental data from the CGAP's smallholder household survey, 'Building the Evidence Base on the Agricultural and Financial Lives of Smallholder Households', collected between 2015 and 2016 in six LICs (Bangladesh, Côte d'Ivoire, Mozambique, Nigeria, Tanzania and Uganda). The limitation of the data is that it is cross-sectional, which does not allow for a longitudinal perspective; however, the data are rich across the six countries and various crop types.

Such a study spanning different countries implies that the cross-sectional approach is necessary to inform future studies. Also, with the data publicly accessible on the World Bank's microdata library, it is inexpensive. Given inadequate research resources and data challenges in Africa, all the available datasets have to be used, including replications that are necessary for robust scientific progress in the face of the current bias towards 'new' or 'novel' data (Bryman 2016). We use the data in a novel way by constructing a multidimensional poverty index and thus further contribute to the literature on income.

The samples are nationally representative of the smallholder household population, and the given set of countries reflects a high degree of diversity. The World Bank (2020) classifies three of the six countries as LICs (Tanzania, Uganda and Mozambique) and the other three as lower-middle-income countries (LMICs) (Nigeria, Bangladesh and Côte d'Ivoire). The variety of these countries allows us to move towards generalisable patterns of CF in the developing world. Table 2 shows that the countries also vary in terms of crops and crop prevalence in different types of contracts. This enables us to move beyond crop-specific mechanisms and focus on CF's presence and its relationship to multidimensional poverty.

Table 2: Most important crop by contractual status

Country	**Without Contract**		**Any Contract**		**Formal Contract**	
	(1) Crop	(2) %	(3) crop	(4) %	(5) crop	(6) %
Bangladesh	Rice	58.65	Rice	64.04	Rice	62.5
	Jute	7.27	Maize	12.36	Maize	14.29
	Irish potatoes	5.67	Irish potatoes	2.81	Irish potatoes	4.46
Côte d'Ivoire	Cocoa	34.6	Cocoa	42.89	Cashew	43.75
	Cashew	16.91	Cashew	16.21	Cocoa	15.63
	Cassava	11.64	Cassava/ peanuts	5.86	Peanuts	9.38
Mozambique	Maize	37.52	Maize	46.46	Maize	46.97
	Cassava	12.65	Cassava	7.89	Rice	13.64
	Beans	9	Tobacco	7.02	Beans	9.09
Nigeria	Cassava	28.64	Cassava	29.97	Cassava	31.5
	Yams	10.49	Yams	11.15	Yams	8.9
	Beans	10.14	Rice	6.97	Rice	8.5
Tanzania	Maize	26.67	Maize	16.66	Sunflowers	14.76
	Rice	12	Rice	13.32	Peas	13.86
	Tomatoes/ Sunflowers	5.3	Beans	9.82	Maize	13.25
Uganda	Maize	24.1	Maize	30.46	Maize	27.84
	Beans	16.27	Beans	16.7	Beans	19.59
	Coffee	12	Coffee	8.26	Coffee	12.37

Source: Data from the CGAP datasets

In the CGAP surveys, nationally representative samples were obtained using a multistage stratified sampling strategy. Stratification was achieved by subdividing each geopolitical zone into urban and rural areas. Thus, 6 to 14 strata were created within which the sample was independently selected depending on the country. With regard to multistage sampling, the primary sampling frame included enumerated areas. Weighted by their population size, 200 randomly selected areas were enumerated in the sample (CGAP 2016). Within each enumerated area and with equal chances, 15 households were randomly selected. This study follows the CGAP definition of smallholder farmers, as farmers with less than 5 hectares of land or fewer than 50 head of cattle, 100 pigs, sheep or goats or fewer than 1,000 chickens, and for whom agriculture must provide a meaningful contribution to the households' livelihood, income or consumption.

Empirical approach

Using a non-causal approach, we followed the method of the standard CF and welfare analysis (Gatto et al. 2017; Meemken and Bellemare 2020; Ogutu et al. 2020), but in our treatment of poverty we used a multidimensional poverty index (see below for further details and rationale). The benchmark model is:

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

where Y_{jk} is the dependent variable, the multidimensional poverty index, it describes the poverty levels of the households $_j$ within the specified geographical location $_k$.The treatment variable C_j is a dummy variable indicating whether household $_j$ participates in CF or not. HH_j is a set of household *j's* characteristics that may simultaneously determine a household's propensity to participate in CF and poverty (see Table A1). Furthermore, δ_k represents the unobserved geographical effects (country, administrative or cluster unit) that are constant over time. ε_{jk} is the error term. Standard errors are clustered at the country, administrative or cluster level, conditional on the fixed-effects unit.

We took advantage of the hierarchical structure of the CGAP data and applied household and location fixed effects, in line with other recent studies (Dedehouanou et al. 2013; Meemken and Bellemare 2020). Thanks to improved data quality in terms of external validity, the data allowed for a fixed-effects framework. In particular, the data permits a comparison between contracting and non-contracting smallholding households within the specified hierarchical structure (cluster, administrative level or country). This approach overcomes the difficulties related to selection—and omitted variable bias—that prior studies using IV and propensity matching approaches faced (Ton et al. 2018; Meemken and Bellemare 2020).

Regarding the independent variables, households were considered to be contracting households when at least one adult household member (above 15 years) reported having a selling contract. Consequently, all types of contractual agreements that CF potentially covers were included. Further, the literature suggests that different agricultural agreements might have heterogeneous welfare implications for smallholder farmers (Ochieng, Veettil and Qaim 2017). Aiming to capture these, we constructed a proxy for formal contracts. Households were assumed to be in a more formal contract if they simultaneously (1) had a selling contract, (2) sold to large retailers or buyers and (3) were provided with input.

Multidimensional poverty index

Poverty measures can be classified as direct and indirect (Sen 1981, 1999). Indirect measures, such as income, establish a poverty line and offer insight into the income level at which a specific set of basic needs can be met. But these measures are inherently unable to capture whether the basic needs in question are actually met. Therefore, significant discrepancies in the assessment of poverty remain unaddressed by indirect poverty measures. These include the impact of local prices, gender, age, health, climate, disabilities, intrahousehold distributions, and the affordability of quality services such as water, healthcare, and education (Callan, Nolan, and Whelan 1993; Klasen and Wink 2003; Sen 1981).

On the other hand, direct measures concentrate on whether and to what extent an individual or household fulfils their needs, capabilities or functionalities (Sen 1992). In this regard, the multidimensional poverty index proposed by Alkire and Santos (2014) represents a measure of acute multidimensional poverty. This conceptualisation of poverty is based on the premise that an individual is unable to meet the minimum international standards and core functioning (UNDP 2010). The index comprises 10 indicators, distributed across three equally weighted dimensions: health, education and living standards.

We created a multidimensional poverty index (MPI) to estimate the relation between CF and a broad poverty measure. Rather than using existing MPIs (for example, Alkire and Santos 2014), we built an MPI that was consistent with the dataset using variables in our dataset for internal validity. This index is intended to capture poverty in a broader sense than income or expenditure alone, as these measures cannot account for the multidimensional plight of the poor (Hanmer, Pyatt, and White 1999). Instead, it integrates five variables available in the CGAP surveys across

all six countries: income per capita; expenditure per capita; water supply; mobile phones per capita; subjective financial wellbeing. Thus, the index includes direct and indirect poverty measures.

Apart from the commonly used income and expenditure measures, we included mobile phones. These are an essential household asset for smallholder farmers, as they provide access to important information for agricultural activities and other aspects of farmers' lives (Sife, Kiondo, and Lyimo-Macha 2010). Water supply was included for instrumental and intrinsic reasons, given its significant impact on health (World Bank 1993). Further, access to water is increasingly regarded as a right on its own. Continuous water supply frees up time that would have been spent on accessing water (Klasen 2000). Additionally, the water supply measured here extends beyond household water access to include water supply for agricultural activities. Lastly, subjective financial well-being measures the outcome of the financial situation on the utility that the household is able to acquire with its financial resources.

The index allocates equal weight to every component. Every component can take up to three points, allowing the index to reach a maximum of 15 points. Income and expenditure are continuous variables, whereas mobile phones, water supply and subjective financial status are categorical variables. To include all five variables in the index, the continuous variables maintain their continuous character. To maintain maximum precision in the analysis, their distribution is continuously distributed between 0 and 3. The interquartile range method was applied to determine outliers (Vinutha, Poornima and Sagar 2018). Thus, observations are excluded that lie 1.5 times the difference between the median of the upper and lower half of the frequency distribution below the 25th and above the 75th quintile. Excluding outliers in each country for the variables 'income per capita and day' and 'minimum expenditure required per capita and day' allows for less variation of the observations within the variables. Therefore, the statistical power of the analysis is increased since outliers can be assumed to significantly differ. For illustration, Table A2 indicates that the share of those individuals with a waged job as the main source of income is approximately 8 per cent higher among the outliers. This shows that the outliers are less reliant on farming.

Further, the observations of non-outliers, at 23,982, are still high enough and do not present any threat to statistical power. Therefore, it is reasonable to exclude them. The same holds for the variable minimum expenditure needed per day, where the observations amount to 24,791, excluding outliers. As to the number of mobile phones per household, the per capita indication was computed to ensure comparability between households. The

distribution of mobile phones per capita was then distributed between 0 and 3 to be included in the index. Here, the outliers of each country were excluded for the same reasons as above.[1]

Two variables included in the poverty index are categorical, namely 'water supply' and 'subjective financial situation'. For both variables, the survey question offered four response options which were transferred to the index. Per the response, one point was allocated to the index. Zero points were given to those with the worst water supply (or financial situation), and three to those with the best. One and two points are assigned to intermediate water supply (or financial) situations, respectively.

Empirical Results

This section presents the results and positions them in the existing body of literature. Table 3 displays varying shares of contracting households by country. Usually, household participation rates in CF are below 16 per cent. Lower shares were observed in Bangladesh (4.3%) and Mozambique (5.7%), whereas Tanzania displayed a high household participation rate of 80.8%. These high shares for Tanzania may be explained, at least partly, by the Tanzanian Agriculture Sector Development Programme (2006 to 2013). Its policy of *Kilimo Kwanza* (Agriculture First) emphasised the need to establish institutional arrangements to increase agricultural production, and allocated particular importance to CF (Kuzilwa et al. 2019: 121). This high variability in participation rates suggests that CF is widespread in some countries, extending beyond large, formal, and export-oriented contract schemes (Meemken and Bellemare 2020). Further, it is important to highlight that, in all countries, more than one in three clusters and over three in five administrative units contained at least one contracting household, indicating that CF is a geographically dispersed phenomenon.

Figure 2 indicates the share of households living with less than USD 1.9 per capita in purchasing power parity (PPP) daily, separated by type of contract, revealing that fewer contracting households live below the poverty line. At the same time, in four out of six countries, formally contracting households indicate the lowest poverty shares, showing the potential benefit of CF.

Figure 3 displays the frequency distribution of the poverty index. Although differences appear across nations, the average outcome of the index across all countries is 5.2.[2] The index becomes the important dependent variable in our relationship of interest, namely the relationship between CF and poverty.

Table 3: Sample size and prevalence of contract farming

Country	Individual		Households		Clusters*		Admin. Units	
	N	% CF	N	% CF	N	% CF	N	% CF
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	7.0	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

Notes: * Several clusters exist within single administrative units, which is why there are different clusters and administrative units with at least one CF household

Source: Data from the CGAP datasets

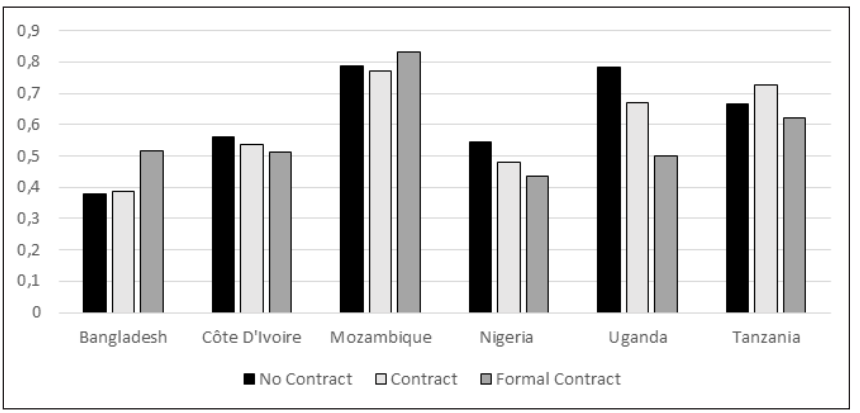

Figure 2: Share of households below the international poverty line (USD 1.9 PPP)
Source: Data from the CGAP datasets

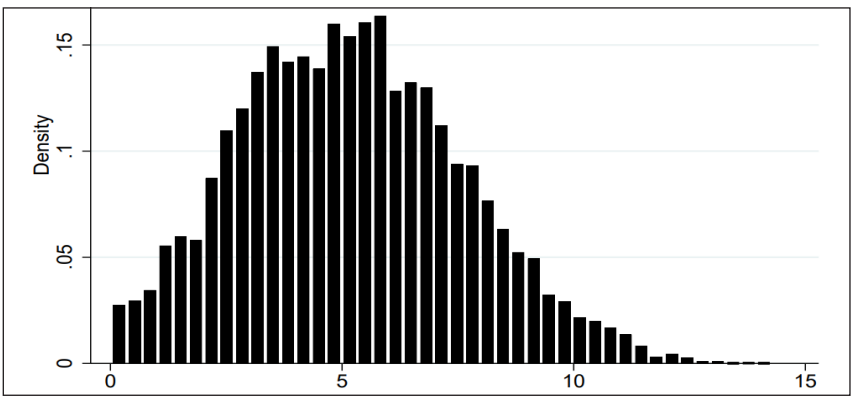

Figure 3: Frequency distribution of poverty index

Source: Data from the CGAP datasets

Table 4 shows the results of the study. At the administrative unit level, households engaged in CF are associated with a statistically significantly 0.177 higher outcome on the index. Although the association is not significant at the country-level fixed effects, it is significant at the cluster level. Indeed, given the cross-sectional structure of the data, it is plausible that comparing groups of 15 neighbouring households—which constitute a cluster—yields the most interesting results because they are likely to share unobserved characteristics. This is less so at the national level, explaining the insignificance of the relationship at the country level. The results are robust to alternative specifications (tables A3 and A4) and consistent with major trends in the literature on the welfare improvements of smallholder farmers participating in CF (Barrett et al. 2012; Bellemare and Novak 2017; Dedehouanou et al. 2013; Ogutu et al. 2020; Rao and Qaim 2011; Meemken and Bellemare 2020).

Table 4: Contract farming and multidimensional poverty index

	Country Fe	Admin. Unit Fe	Cluster Fe
The dependent variable is the poverty index			
Contract household (1/0)	0.233 (0.168)	0.177** (0.070)	0.145** (0.065)
Female-headed household (1/0)	-0.298** (0.090)	-0.397*** (0.059)	-0.411*** (0.053)
Age of household head	0.002 (0.004)	-0.001 (0.001)	-0.002 (0.001)
Household head ever attended school (1/0)	0.780*** (0.106)	0.543*** (0.052)	0.481*** (0.043)
No. of household members	-0.222*** (0.014)	-0.198*** (0.008)	-0.197*** (0.008)
Land owned (ha) by household	0.028*** (0.003)	0.030*** (0.004)	0.031*** (0.004)
Rural (1/0)	-1.118*** (0.158)	-1.039*** (0.126)	-1.739** (0.866)
Constant	6.822*** (0.255)	6.949*** (0.127)	7.619*** (0.744)
Observations	11914	11914	11914

Notes: Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Further, we find that the different components of the poverty index relate differently to CF (Table 5). Heterogeneous associations also prevail between country samples. On average, we see a significantly positive association with CF at administrative and cluster levels regarding income per capita. This finding aligns with prior studies (Ogutu et al. 2020; Otsuka, Nakano, and Takahashi 2016; Ton et al. 2018), indicating a positive relationship between CF and farmers' income. However, the results are driven by two countries, which contests the notion of CF's unambiguous income improvements and thereby supports Meemken and Bellemare's (2020) results. In Meemken and Bellemare (2020), as in our study, this most likely stems from the nationally representative nature of the data, which allows for results that are not subject to publication or survivor biases.

Regarding household assets (access to water and mobile phones per capita), the results indicate that engaging in CF relates to an increase in the number of mobile phones per capita (column 4 of Table 5). Given that the minimum expenditure per capita required is not significantly associated with CF, which would indicate a significant increase in the living standard, but the number of mobile phones per capita is, the results are in line with Michelson's (2013) findings of a positive association between productive household assets and CF.

Regarding water supply, its association with CF is not significant at the country level. However, the supply of water that households can acquire is dependent on the surrounding infrastructure. It is interesting to look at the smallest entity included, the cluster level, because neighbouring households are likely to have similar access to infrastructure. Here, in three countries (Mozambique, Nigeria and Uganda), better water supply is significantly associated with CF.

Participation in CF is associated with an increase in the subjective financial situation (column 6, Table 5). The response options of that variable include whether the household has enough financial resources to acquire sufficient food and whether they can afford to save money. Therefore, an increase in that variable can be perceived as improved food security, given that one in every three households reported not having enough money for food. Thus, the present results align with Bellemare and Novak (2017), finding a positive relationship between CF and food security. Additionally, the analysis corroborates the results of Dedehouanou et al. (2013), who revealed a positive association between CF and subjective farmers' wellbeing. Although subjective financial wellbeing cannot be put at the same level as subjective wellbeing in general, the two are still related to each other (Kruger 2011).

Table 5: Components of poverty index and their respective significance

ADMINISTRATIVE UNIT FE						
	(1)	(2)	(3)	(4)	(5)	(6)
Country	Index[a]	Income	Expend.[b]	Phone	Water	Financ.[c]
All	0.177***	0.073***	0.022	0.035*	0.049	0.084***
Bangladesh	-0.111	0.007	-0.039	-0.008	-0.089	0.065
Côte d'Ivoire	-0.202	0.098*	-0.028	0.005	-0.231***	0.005
Mozambique	0.851***	0.144	0.213	0.029	0.308	0.082
Nigeria	0.492***	0.051	-0.052	-0.009	0.268***	0.213***
Tanzania	0.079	0.020	0.068**	0.065	-0.018	0.058
Uganda	0.551***	0.127**	0.047	0.112**	0.181**	0.091
CLUSTER FE						
	Index[a]	Income	Expend.[b]	Phone	Water	Financ.[c]
All	0.143**	0.067***	0.013	0.031	0.035	0.089***
Bangladesh	0.131	0.063	0.019	-0.006	-0.051	0.120*
Côte d'Ivoire	-0.286**	0.071*	-0.042	0.000	-0.248***	-0.008
Mozambique	0.587**	0.051	0.140**	0.027	0.299***	0.113
Nigeria	0.490***	0.047	-0.054	-0.003	0.260***	0.209***
Tanzania	0.043	0.011	0.061*	0.056	-0.038	0.065
Uganda	0.514***	0.125***	0.045	0.102**	0.153**	0.075

Notes: [a] MPI; [b] Minimum daily expenditure needed; [c] Subjective financial wellbeing.
Standard errors in parentheses $^{*}\ p < 0.1$, $^{**}\ p < 0.05$, $^{***}\ p < 0.01$

Moreover, national differences in the relationship between CF and the poverty index can be observed. Positive and significant associations between CF and poverty were found in Mozambique, Uganda and Nigeria, whereas insignificant relationships were detected in Bangladesh and Tanzania (Table 5). In Côte d'Ivoire, the estimated association is significantly negative, stemming from the negative relationship between CF and water supply (Table 5). Although a negative relationship between CF and water supply is counterintuitive, an explanation might be that Ivorian contract farmers cultivate more water-intensive crops, thereby worsening their water situation by increasing their demand. This reasoning is supported by the data, which suggests that Ivorian CF households reported cultivating cocoa (which is very water-intensive) (Vanham and Bidoglio 2013) (43% of CF and 35% non-CF).

Whether CF is formal or not matters. Here we trace the poverty outcome with non-formal and our proxy for formal CF, where households simultaneously have a selling contract, sell to large buyers and are supplied

with inputs. Figure 4 is a graphical representation of the results (see tables A5 and A6 for the data). At all levels, the association is found to be statistically significant. Overall, at the administrative unit level, formal contracts are associated with a 0.603-point increase in the poverty index, which is a significant increase compared to the 0.177-increase in the case of all contracting households, whether in formal or non-formal contracts.

Thus, the results suggest that more vertically coordinated contract schemes tend to be more beneficial to smallholder farmers in poverty alleviation. This supports the transaction cost approach, which contends that more vertically integrated value chains reduce risks for farmers and decrease transaction costs, thereby benefiting the contracting households (Hennessy 1996; Martin 1997). It may hint at a situation in which CF facilitates the technologically driven intensification of smallholder farming (through input provision) while combining it with sustainable, socially driven intensification (Van der Ploeg 2012), which would be associated with a reduction in multidimensional poverty.

Further, looking at the different countries more closely, we see changes in the relationship between CF schemes and poverty based on contract formality. Indeed, the association between the more formal contracts and poverty is greater than with non-formal ones, except for Bangladesh and Côte d'Ivoire. The results show that CF with formal contracts has better outcomes despite the pessimism on formalisation in the literature (Goldfinch 2015; Alhola and Gwaindepi 2024). This is subject to the caveat that formal CF tends to be recorded more frequently than informal arrangements, which are often not fully documented.

Female farmers frequently encounter disadvantages in the agricultural sector (Croppenstedt, Goldstein, and Rosas, 2013; Navarra 2019; Yaro, Teye, and Torvikey 2017). It is therefore essential to integrate a gender perspective into the analysis. Despite their significant involvement in CF, women often fail to receive or retain a proportionate share of the income generated to the same extent as men in the same households (Von Bülow and Sørensen 1993; Dolan 2002). In Table A7, the dataset is divided into two sections, one comprising male-headed households and the other female-headed households. This allows for a detailed examination of the relationship between CF and the poverty index, with a particular focus on gender-specific nuances. The results are heterogeneous, exhibiting no discernible trend across the six countries included in the sample. The findings are consistent with those of Machio and Meemken (2023), who found that women participate less in CF than men and that the importance of female contract participation for household living standards remains inconclusive.

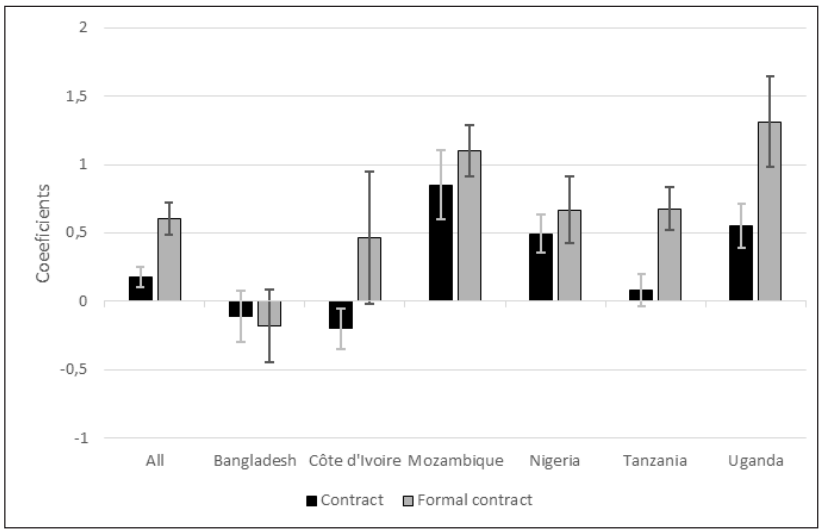

Figure 4: MPI and formal vs any contracts
Source: Administrative unit FE regression with data from the CGAP datasets

The dataset reveals that approximately 14 per cent of households are headed by women, and that the proportion of female-headed households that hold a contract (24.8%) is comparable to that of their male-headed counterparts (23.4%). A potential trend may be obscured by factors that are already known to influence welfare outcomes, such as the type and characteristics of the contract crop (Oya 2012; Verhofstadt and Maertens, 2014), the type of contract (Bellemare and Lim 2018; Ruml and Qaim 2021), and the institutional environment (Sulle and Dancer 2020), which we were unable to control for.

The type of crop smallholders cultivate has been demonstrated to be a significant factor in the realm of CF (Oya 2012; Verhofstadt and Maertens 2014). Indeed, farmers specialising in cash crops intended for export tend to have higher income potential, because prices are generally higher for crops sold on local markets (Glover and Jones 2019; Jha et al. 2022). However, concerns have been raised about the potential impact of increasing food insecurity caused by farmers focusing on cash crops, but the evidence is inconclusive (Hashmiu, Agbenyega and Dawoe 2022; Kuma et al. 2019).

To incorporate this dimension into our analysis, we have classified households into two categories: cash-crop households and food-crop households. The categorisation is based on the household's most important cultivated crop and is constrained by the fact that households typically

cultivate multiple crops, both food and cash crops.[3] Table A8 investigates the disparities in poverty outcomes between households that cultivate food crops and those that cultivate cash crops. A comparison of food-crop households reveals a greater disparity in the poverty index attributed to contract status between contracting and non-contracting households, relative to cash-crop households.

In other words, the existence of a contract for a cash-crop farming household is less influential in determining the poverty outcome than it is for a food-crop cultivating household. Simultaneously, in five out of six countries, cash-crop farming households exhibit higher mean welfare levels. This supports existing evidence showing that smallholder commercialisation can be pro-poor (Geffersa and Tabe-Ojong 2024). At the same time, cash crop farmers show better welfare outcomes in absolute terms, because they are likely to be already better integrated in GVCs global value chains. It is important to exercise caution in interpreting these results. We were unable to track the contracted crops of the households in question, but only whether a household had a contract and their most important crop.

Conclusion

We have explored the relationship between CF and multidimensional poverty in LICs. Unlike most previous studies, the aim was to provide generalisable results beyond a single crop, contract scheme or geographical area. This is in line with recent debates on the need to provide more systematic and 'big picture' analyses on the journey towards robust CF theories. Indeed, the most prominent proxy for poverty in the literature is income-based poverty and misses the household's reallocation of resources, especially when total household income is not considered. Consequently, our goal was to investigate the relationship between CF and a more broad-based definition of poverty, using a consistent MPI for Bangladesh, Côte d'Ivoire, Nigeria, Uganda, Tanzania and Mozambique. One novelty of the study is the construction of an internally valid MPI, which has allowed for a broader analysis of the association between CF and poverty.

Taking advantage of the hierarchical structure of the data, household and location, fixed effects were used to explore the relationship. We also go beyond existing studies by using a nationally representative cross-country dataset likely not affected by survivor bias and publication biases. Overall, this study demonstrates that CF is positively associated with poverty alleviation among smallholder farmers in LICs. The results support previous research indicating that CF is positively associated with higher incomes,

more productive household assets and increased subjective financial wellbeing. Contributing to the debates on formalisation, the results also show that formal CF is positively associated with poverty alleviation with a magnitude three times higher than non-formal CF. Furthermore, regarding the commercialisation debate, it can be observed that the poorer group of farmers, whose most important crops were food crops, tended to derive a relatively greater benefit from CF compared to farmers whose most important crop was a cash crop. Yet, the results also challenge the notion that CF unambiguously improves the welfare of smallholder households. While the overall association between CF and the poverty index is significantly positive, important between-country differences prevail. For formal contracts, Tanzania, for instance, shows higher magnitudes of benefits since the association coefficients are significantly larger.

In light of these findings, the study proposes the following recommendations for further research. New opportunities to better comprehend the heterogeneous relationship between CF and poverty should be explored through improved data availability. Future studies could focus on potential sources of heterogeneity, such as contract schemes, crop types, or CF models. Further, in the context of CF, our MPI should be broadened and continue to be applied to different contracts, countries, crops or other forms of agricultural CF practices. This is because capability studies have emphasised the need to go beyond incomes to fully understand the plight of the poor. Additionally, although the present results indicate a significant relationship between CF and multidimensional poverty, it would be interesting to quantify that impact more precisely by examining different stages, such as farming input contracts and selling contracts.

This study's important policy recommendation is that CF is likely to benefit smallholders when measures are implemented to insulate poorer farmers from exploitative contracts. In light of possible reverse causality and self-selection into CF, we note that the CF-poverty reduction is likely due to the strong association with formalised contracts and input supplies. This suggests that vertical contracts provide inputs and possibly better know-how. They are also more likely to be formalised, reducing the chance of unfair agreements. The outcome is better welfare through poverty reduction. Those farmers at the lowest income levels are likely unable to enter into such contracts, and if they do, they enter at poorer terms than their better-resourced counterparts. This implies that policy room exists for the poorer farmers not to face big firms alone but through mediated forms of CF through government agencies that reduce exploitation and unfair exchange emanating from power imbalances.

Notes

1. In the Nigerian observations, the distribution of mobile phones per household is imprecise for all households with more than three mobile phones, as here all households with three or more mobile phones are grouped together. Nevertheless, in order to exclude outliers, we used the same threshold for outliers as in Côte d'Ivoire, because the data suggests a fairly similar distribution of mobile phones in both countries.
2. It is important to highlight that the index is constructed using assets from the CGAP dataset for consistency. This is partly a limitation in that the data does not have other important assets, such as access to own transport, and farming equipment, among others.
3. The following are classified as cash crops: avocado, cashew, cassava (a food crop in Nigeria), cloves, cocoa, coconut, coffee, cotton, groundnuts, hevea, jute, karite nuts, mango (a food crop in Tanzania), mustard, palm oil, peanut, pigeon pea, pyrethrum, rapeseed, rice (a food crop in Bangladesh), sesame, simsim, sisal, soybeans, sugarcane, sunflower, tea and tobacco. It should be noted that some crops can be both food and cash crops; this distinction is made based on the primary use of the crops in each country.

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Appendices

Table A1: Set of control variables

Variable	Type of Variable	Definition
Female-headed household	Dummy	Is the head of the household female?
Age of head of household	Continuous	Age of head of household.
Education of head of household	Dummy	Has the head of the household ever attended school?
Number of household members	Categorical	How many persons live in the household?
Acres of land owned by household	Continuous	How many acres of arable land is owned by the household?
Rural household	Dummy	Is the household rurally located or urban?

Source: CGAP datasets

Table A2: Is the main source of income a waged job? Income outliers and non-outliers

Main source of income is a waged job?	Frequency No outliers	Percentage No outliers	Frequency Outliers	Percentage Outliers
No	21,385	89.17	3,474	81.05
Yes	2,597	10.83	812	18.95
Total	23,982	100	4,286	100

Source: CGAP datasets

Table A3: Contract farming and multidimensional poverty (incl. outliers)

	Country Fe	Admin. Unit Fe	Cluster Fe
Contract	0.252	0.165***	0.153***
	(0.179)	(0.048)	(0.045)
Female-headed household	-0.056	-0.159***	-0.153***
	(0.095)	(0.036)	(0.035)
Age of household head	-0.000	-0.002*	-0.002**
	(0.003)	(0.001)	(0.001)
Household head ever attended school (1/0)	0.435***	0.268***	0.239***
	(0.063)	(0.036)	(0.030)
No. of household members	-0.095*	-0.068***	-0.067***
	(0.039)	(0.006)	(0.006)
Land owned (ha) by household	0.014***	0.015***	0.015***
	(0.002)	(0.003)	(0.003)
Rural (1/0)	-0.492***	-0.525***	-1.009*
	(0.085)	(0.090)	(0.569)
Constant	3.820***	3.929***	4.381***
	(0.108)	(0.094)	(0.489)
Observations	14420	14420	14420

Notes: Standard errors in parentheses $^{*}p < 0.1,^{**}p < 0.05,^{***}p < 0.01$

Table A4: Contract farming and multidimensional poverty (excluding outliers and land owned as control[a])

	Country Fe	Admin. Unit Fe	Cluster Fe
Contract household (1/0)	0.274	0.217***	0.182***
	(0.164)	(0.070)	(0.066)
Female-headed household	-0.326**	-0.421***	-0.436***
	(0.095)	(0.059)	(0.053)
Age of household head	0.003	-0.000	-0.001
	(0.004)	(0.001)	(0.001)
Household head ever attended school (1/0)	0.774***	0.545***	0.483***
	(0.112)	(0.052)	(0.043)
No. of household members	-0.211***	-0.186***	-0.185***
	(0.016)	(0.008)	(0.008)
Rural (1/0)	-1.098***	-1.026***	-1.593*
	(0.153)	(0.125)	(0.831)
Constant	6.800***	6.929***	7.485***
	(0.240)	(0.126)	(0.714)
Observations	11914	11914	11914

Notes: [a] Land owned (ha) by household potentially stands in reverse causation with having a contract. Despite this, the relationship of interest holds.
Standard errors in parentheses: $^{*}p < 0.1,^{**}p < 0.05,^{***}p < 0.01$

Table A5: Formal contract farming and multidimensional poverty index

	Country Fe	Admin Fe	Cluster Fe
Formal contract	0.693*	0.603***	0.627***
	(3.09)	(5.09)	(5.38)
Female-headed household (1/0)	-0.304*	-0.404***	-0.413***
	(-3.59)	(-6.87)	(-7.78)
Age of household head	0.00209	-0.00128	-0.00184
	(0.50)	(-0.89)	(-1.31)
Household head ever attended school (1/0)	0.789***	0.549***	0.493***
	(7.35)	(10.51)	(11.41)
No. of household members	-0.222***	-0.198***	-0.197***
	(-14.69)	(-24.26)	(-24.25)
Land owned (ha) by household	0.0275***	0.0296***	0.0305***
	(8.99)	(8.19)	(8.45)
Rural (1/0)	-1.107***	-1.039***	-1.680*
	(-7.02)	(-8.17)	(-1.98)
Constant	6.839***	6.970***	7.574***
	(28.23)	(53.09)	(10.38)
Observations	11914	11914	11914

Notes: Standard errors in parentheses $^{*}\ p < 0.1,^{**}\ p < 0.05,^{***}\ p < 0.01$

Table A6: Formal contract farming and components of poverty index administrative unit FE

Country	Index[a]	Income	Expend.[b]	Phone	Water	Financ.[c]
All	0.603***	0.086**	0.047	0.090**	0.167***	0.255***
Bangladesh	-0.178	-0.032	-0.066	0.004	-0.016	0.121
Côte d'Ivoire	0.462	0.182	0.014	0.002	0.229	0.061
Mozambique	1.102***	0.248**	0.407**	0.104	0.517**	0.201***
Nigeria	0.667***	0.009	-0.085	-0.007	0.116	0.355***
Tanzania	0.676***	0.138***	0.055	0.190***	0.083	0.247***
Uganda	1.313***	0.150	0.239**	0.105	0.447***	0.343***
CLUSTER FE						
	Index[a]	**Income**	**Expend.[b]**	**Phone**	**Water**	**Financ.[c]**
All	0.627***	0.085***	0.043	0.084**	0.170***	0.272***
Bangladesh	0.107	0.024	-0.032	0.019	0.035	0.184**
Côte d'Ivoire	0.633	0.192	0.038	0.037	0.240	0.130
Mozambique	0.656*	0.077	0.280***	0.030	0.591***	0.269*
Nigeria	0.678***	0.010	-0.079	0.004	0.107	0.345***
Tanzania	0.715***	0.144**	0.072	0.196***	0.085	0.262***
Uganda	1.329***	0.179*	0.239**	0.097	0.375**	0.327***

Notes: [a] MPI; [b] Minimum daily expenditure needed; [c] Subjective financial wellbeing
Standard errors in parentheses: $^{*}\ p < 0.1,^{**}\ p < 0.05,^{***}\ p < 0.01$

Table A7: Contract farming and multidimensional poverty by gender of head of household

	Country		Admin		Cluster	
	Female	**Male**	**Female**	**Male**	**Female**	**Male**
All	0.52***	0.13***	0.58***	0.06**	0.32***	0.04*
Bangladesh	-0.48	0.03	0.34	0.00	1.88**	0.28***
Côte d'Ivoire	1.43***	-0.15***	1.89***	-0.22***	0.51*	-0.29***
Mozambique	1.07***	0.56***	1.19***	0.58***	2.14***	0.47***
Nigeria	-0.65***	0.48***	-0.29	0.49***	-0.34	0.45***
Tanzania	0.87***	-0.08	0.93***	-0.14**	0.52***	-0.14**
Uganda	0.22	0.46***	-0.34**	0.26***	-0.18	0.25***

Notes: * $p < 0.1$,** $p < 0.05$,*** $p < 0.01$

Table A8: CF and multidimensional poverty by cash vs food crop [a]

	Country		Admin		Cluster	
	Cash	**Food**	**Cash**	**Food**	**Cash**	**Food**
All	-0.12***	0.31***	-0.14***	0.26***	-0.21***	0.23***
Bangladesh	1.95***	-0.05	1.75***	-0.07	1.68***	0.22***
Côte d'Ivoire	-0.33***	0.46***	-0.30***	0.38***	-0.39***	0.11
Mozambique	0.18	0.69***	0.14	0.75***	0.43	0.59***
Nigeria	0.40***	0.45***	0.11	0.78***	0.03	0.78***
Tanzania	-0.01	0.17***	0.47***	0.09	0.43**	0.01
Uganda	0.37**	0.47***	0.36**	0.22***	0.39***	0.18***

Notes: [a] Households are categorised according to their most important crop

* $p < 0.1$,** $p < 0.05$,*** $p < 0.01$