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SMALLHOLDER FARMERS' CHOICE OF OIL PALM COMMERCIALISATION MODEL AND HOUSEHOLD WELFARE IN SOUTH-WESTERN GHANA

Fred M. Dzanku, Kofi Takyi Asante, William Quarmine and Louis S. Hodey

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Fred Dzanku is a development economist and senior research fellow at the Institute of Statistical, Social and Economic Research (ISSER) of the University of Ghana. Kofi Takyi Asante is a sociologist and research fellow at ISSER. William Quarmine is a development economist and dean of the School of Business and Communication at BlueCrest University College, Ghana. Louis S. Hodey is a principal research assistant at ISSER.

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ACRONYMS

8DN	8 Degrees North
B-BOVID	Building Businesses on Values, Integrity and Dignity
BOPP	Benso Oil Palm Plantation
COGM	Cooperative Outgrower Model
COVE	Corporate Village Enterprises
FFB	fresh fruit bunches
FHH	female-headed household
GoG	Government of Ghana
GOPDC	Ghana Oil Palm Development Corporation
IOGM	Individual Outgrower Model
IPWRA	inverse-probability-weighted regression adjustment
ISMM	Independent Smallholder Marketing Model
IV	instrumental variable
JOML	Juaben Oil Mills Ltd
MNL	multinomial logit
MPM	Mill Partnership Model
NGL	Norpalm Ghana Limited
NOPP	National Oil Palm Plantation
NSM	Nucleus-Smallholder Model
OPC	oil palm commercialisation
PPP	public-private partnership
SSA	sub-Saharan Africa
TOPP	Twifo Oil Palm Plantations Limited

EXECUTIVE SUMMARY

This paper uses cross-sectional household survey and qualitative data from two districts in the Western Region of Ghana to study smallholder farmers' choice of oil palm commercialisation channels and implications for household welfare. The paper addresses these research questions: (a) Which factors have contributed to the breakdown of trust in contractual arrangements between farmers and oil palm companies and intermediaries and to what extent has this induced participation in higher niches of the oil palm value chain? (b) Which factors encourage or exclude households when it comes to participating in higher return oil palm commercialisation arrangements? (c) Are there welfare differences associated with engagement in the observed channels of oil palm commercialisation?

Our results show that although the literature suggests there are benefits of farmer participation in global value chains through various contractual arrangements between smallholders and agribusiness companies, such arrangements have all but disappeared in the oil palm belt of south-western Ghana, where two of the four largest oil palm companies operate. This, we found, is because of dissatisfaction with contractual arrangements and a general breakdown of trust between companies, agents and farmers. While about 60 per cent of producers still sell their output to oil palm companies directly or indirectly through agents without formal contracts, the lack of trust in the new relationships as well as the absence of vibrant farmer cooperatives have resulted in farmers feeling that they do not reap adequate benefits from their oil palm enterprises. This is particularly true for those using the services of agents. While the processing of palm fruits into palm oil has been prevalent in most oil palm producing areas of Ghana for several decades, we find that dissatisfaction with selling fresh fruit bunches (FFBs) has led to increased interest in own-processing where possible.

Using multiple measures of welfare and identification strategies to at least minimise the bias resulting from welfare and choice of commercialisation pathways being jointly determined, we can easily reject the hypothesis that the observed oil palm commercialisation pathways yield identical welfare. Considering only objective measures of welfare, own-processing represents the best outcome for increasing household welfare, and selling to local market traders the worst. However, once we consider subjective wellbeing, we find the unhappiest and most discontented are those who engage the services of agents.

The analysis also unravelled household and meso-level factors that promote or hinder participation in high return commercialisation channels. At household level, being a female-headed household (FHH), being a couple household, land holding, and distance to an oil palm company correlate significantly and positively with the likelihood of own-processing. At community level, the availability of agro-services and a processing mill significantly raises the likelihood of own-processing. The likelihood of selling directly to a company, which is also welfare-enhancing relative to the remaining two options, is positively correlated with the availability of working capital, level of palm fruit output and access to a paved road; but negatively associated with age of famer, distance to a company and the presence of a processing mill in the community.

The implications of our results for agricultural commercialisation policy and practice are as follows. Given that own-processing and direct sales to oil palm companies are the most significant welfare-increasing options, these channels could be the target of interventions. Because the presence of a processing facility is the strongest predictor of own-processing, a public-private partnership (PPP) arrangement that provides an incentive for modern community-based mechanised processing facilities could boost processing and possibly enhance household welfare. For those who prefer dealing directly with the oil palm companies, infrastructure development, particularly improved roads, could make this possible and more beneficial as it reduces the cost of transactions. In addition, the formation of strong oil palm-based farmer associations, which we found to be missing in the study areas, could help lower the unit cost required for engaging directly with the companies.

1 INTRODUCTION

Agriculture remains the single most important employer of labour in Ghana; particularly in rural areas (World Bank 2018). The agriculture sector is therefore pivotal in Ghana's economic transformation and poverty reduction.[1] Despite this, the sector has consistently performed below potential and as the global evidence shows (Castañeda *et al*. 2018), poverty is more prevalent among those employed in agriculture than in other sectors of the economy. Increased agricultural commercialisation is widely seen as a key strategy for achieving economic transformation and improving welfare outcomes for the rural poor in low income countries (Carletto, Corral and Guelfi 2017; Muamba 2011; Omiti *et al*. 2009). This expectation is guided by the premise that when farm households become more commercially oriented, their farm enterprise selection, input utilisation patterns and farm management choices are increasingly influenced by market forces (Mitku 2014; Gebremedhin, Jaleta and Hoekstra 2009; Braun and Kennedy 1994), leading to increased resource use efficiency, improved technology utilisation, higher productivity, rapid growth in agricultural incomes, and general welfare gains (Carletto, Corral and Guelfi 2017; Asante, Osei-Asare and Kuwornu 2016; Timmer 1997).

As part of efforts aimed at reversing the erratic performance of the agriculture sector, the Government of Ghana (GoG) selected specific crops, including oil palm, for priority attention (GSGDA II 2016). The selection of oil palm aims to promote agricultural commercialisation through domestic agroindustry development and exports. More recently in 2019, under its flagship programme for the agricultural sector called the Planting for Food and Jobs initiative, the GoG launched an arm known as the Planting for Export and Rural Development involving six priority tree crops including oil palm. These recent developments, however, reflect Ghana's long history of direct state involvement in the commercialisation of specific crops, including oil palm. The Corporate Village Enterprises (COVE) programme, which was introduced in 2003, is one of several direct state interventions in the last two decades (Ofosu-Budu and Sarpong 2013). The COVE programme was part of the then government's oil palm sector development initiative via a PPP arrangement aimed at overcoming barriers to oil palm sector value chain development such as customary land tenure arrangements and poor linkages between smallholders and oil palm estates. However, the programme was generally unsuccessful in achieving the objectives for which it was set up (Asante 2012).

Linking smallholder farmers to markets involves risks that are more binding in rural sub-Saharan Africa (SSA) due to several market imperfections (Barrett 2008). The promotion and facilitation of various models of structured marketing arrangements such as contract farming is often viewed as a way of overcoming some of the risks associated with commercialisation (Bellemare and Bloem 2018). Broadly speaking, a commercialisation model is an institutional arrangement or scheme that coordinates farmers in organising their production activities based on market signals (Eaton, Meijerink and Bijman 2008). In Ghana, the literature highlights various oil palm commercialisation (OPC) models such as plantations, varying forms of contract farming, and cooperative arrangements (Yaro, Teye and Torvikey 2017; Danyo 2013). However, we show in this paper that in two districts of south-Western Ghana (where two of the country's 'big four' oil palm estates are located), the commercialisation arrangements neatly described in the literature involving, for instance, contracts between farmers and buyers are absent and that under prevailing circumstances, even the big oil palm companies prefer informal arrangements with producers rather than contracts (even if informal).

An important question is which OPC pathways are more pro-poor and enhance household welfare, which households benefit from such OPC arrangements, and why. With the literature showing that structured commercialisation arrangements such as contract farming and its variants tend to be generally associated with improved welfare and poverty reduction (Bellemare and Bloem 2018; Wang, Wang and Delgado 2014), even if not in all contexts (Meemken and Bellemare 2020; Otsuka *et al*. 2016), it is important to ask whether the observed informal oil palm commercialisation arrangements are hierarchically ordered in welfare terms and if some groups face binding entry barriers en route to participation in arrangements that are associated with better welfare outcomes.

It has been shown in some contexts that structured commercialisation models such as contract farming

have the potential to precipitate inequality (Isager, Fold and Nsingdagi 2018) because resource-poor farmers are often excluded from such lucrative commercialisation arrangements (Michelson 2013). This has also been documented specifically in the case of remunerative OPC models (Baumann 2000). However, Manley (2016) suggests that there could be more complex underlying tensions between smallholders and oil palm estates which, in some cases, have led to deliberate choices by farmers to partially include or exclude themselves from contractual OPC arrangements. In this paper, we show how several years of strained contractual relationships between farmers and oil palm companies – mainly due to contract nonadherence (including side-selling) – have led to a breakdown of trust between farmers and companies (or agents) and among farmers and farmer groups; thus eroding any potential benefits that could result from such structured marketing arrangements. We further add to the extant literature by documenting how this breakdown of trust has motivated increased participation in oil palm value chains beyond the sale of the primary commodity (palm fruits), and how such a metaphorical blessing in disguise could provide an entry point for policies and practices aimed at poverty reduction and inclusive commercialisation.

With the foregoing in mind, we reiterate the research questions this paper aims to address: (a) Which factors have contributed to the breakdown of trust in contractual arrangements between farmers and oil palm companies and intermediaries and to what extent has this induced participation in higher niches of the oil palm value chain? (b) Which factors encourage or exclude households when it comes to participating in higher return OPC arrangements? (c) Are there welfare differences associated with engagement in the observed channels of OPC?

The rest of the paper is structured as follows. Section 2 provides an overview of the literature on oil palm development and models of commercialisation and processing in Ghana. Section 3 describes the sampling strategy and sample descriptive statistics. Each of the three research questions are then addressed in the fourth, fifth and sixth sections, respectively. Section 7 summarises and concludes.

2 OVERVIEW OF THE LITERATURE

2.1 Oil palm development in Ghana

Oil palm (*Elaeis guineensis*) is native to West Africa and has always been part of the agricultural economy of Ghana (Hilson 2002). Although oil palm plantations were first established in Ghana by Dutch missionaries in the 1800s, most of the oil palm output was harvested from wild groves until the 1950s (Huddleston and Tonts 2007). Since the 1960s, oil palm production has been touted by successive governments of Ghana as having high potential for poverty reduction among farmers (Adjei-Nsiah, Sakyi-Dawson and Kuyper 2012).

About 430,000ha of Ghana's arable land is under oil palm cultivation (MoFA 2016). About 12 per cent of the total land area under oil palm production is dedicated to estate plantations; 42 per cent to 'unorganised small holdings' and 46 per cent under wild groves (Ofosu-Budu and Sarpong 2013). About 80 per cent of Ghana's oil palm output is produced by smallholders who hold about 2ha or less under cultivation and utilise relatively basic technology (Huddleston and Huddleston 2012). FFB yields vary widely depending on agronomic practices and production systems. Whereas yields under large estates range between 10 and 13t/ha, smallholders hardly achieve more than 3t/ha; a situation attributed mainly to poor farm management practices (Ofosu-Budu and Sarpong 2013).

Oil palm development in Ghana can be summarised into three distinct eras: (a) the establishment era, (b) the era of expansion, and (c) the privatisation era. The first, which followed immediately after independence in 1957 and spread throughout the 1960s, was the era of establishing new plantations. Upon gaining independence, Ghana followed a socialist development pathway involving the establishment of new large-scale state or cooperative-owned plantations (Yaro, Teye and Torvikey 2018). As a result of direct state intervention, about 3,765ha of oil palm plantations were established by the State Farms Corporation and the Ghana Farmers Council (a cooperative association).

The 1970s heralded the era of expansion. Several factors including rising debts, low commodity prices, global recession as well as mismanagement and conflicts over land acquisition led to the failure of the large-scale state-driven oil palm establishment strategy (Doward, Kydd and Poulton 1998; Daddieh 1994). Hence, agricultural policy shifted from 'large-scale state' to 'large-scale private' investment in plantation agriculture. In addition to the then existing state-run National Oil Palm Plantation (NOPP) in South-Western Ghana, three other large-scale private estates were established in the 1970s: (a) the Ghana Oil Palm Development Corporation (GOPDC) in the Eastern Region, (b) Benso Oil Palm Plantations Limited (BOPP) in western Ghana, and (c) Twifo Oil Palm Plantations Limited (TOPP) in the Central region (Huddleston and Tonts 2007). Under these estates, area under oil-palm production expanded to over 100,000ha by the 1990s (Gyasi 1996).

Ghana's oil palm development entered the phase of full-scale privatisation post-1990s. This period was characterised by market liberalisation involving the abolition of state controls in the real sector. The state sold the majority of its shares in the large-scale oil palm estates (GOPDC, BOPP, NOPP and TOPP) and instead focused more on policy and regulation.[1]

2.2 Oil palm commercialisation models in Ghana

Six stylised smallholder OPC models have been documented in Ghana. The most dominant is the independent smallholder marketing model (ISMM), which involves about 70 per cent of oil palm farmers (Ofosu-Budu and Sarpong 2013). These independent smallholders have no formal contracts with buyers. The second model can be termed the individual outgrower model (IOGM) operated by GOPDC, BOPP, Norpalm Ghana Limited (NGL), and TOPP. Under IOGM, farmers operating on their own lands agree to supply a proportion of their harvest to a processing mill or a large estate in exchange for incentives such as farm inputs and credit. The agreement, which is often not written, is binding until the loans are repaid.

The third model is the Cooperative Outgrower Model (COGM) operated by Juaben Oil Mills Limited (JOML). The Juaben Oil Palm Out-growers Cooperative Society

is a producer organisation made up of over 600 members in the Ashanti Region that supply their output to JOML under a collective outgrower agreement. The fourth is the Nucleus-Smallholder Model (NSM), operated by GOPDC, BOPP, NGL and TOPP. Under the NSM scheme, a parcel of land belonging to the oil palm company is allocated to selected farmers. In addition, the estate assists in the management of the farm by providing inputs and extension services. The farmer is then required to sell all harvests to the estate. The farmer is paid after the estate nets out the total cost of production from the value of total output harvested.

COVE – the fifth model – emerged in the early 2000s under the President's Special Initiatives. The COVE is a vertically integrated model in which smallholder farmers were to be majority shareholders of a professionally run oil palm processing mill to which they supplied their FFBs.

Following the failure of the COVE to take off, and given that over 20,000ha of oil palm had been planted in anticipation, a private mill, 8 Degrees North (8DN) absorbed some of these smallholders under the sixth model; the Mill Partnership Model (MPM). Smallholders who met the criteria set by 8DN were selected to become partners. Figure 1 provides a summary of these oil palm commercialisation models.

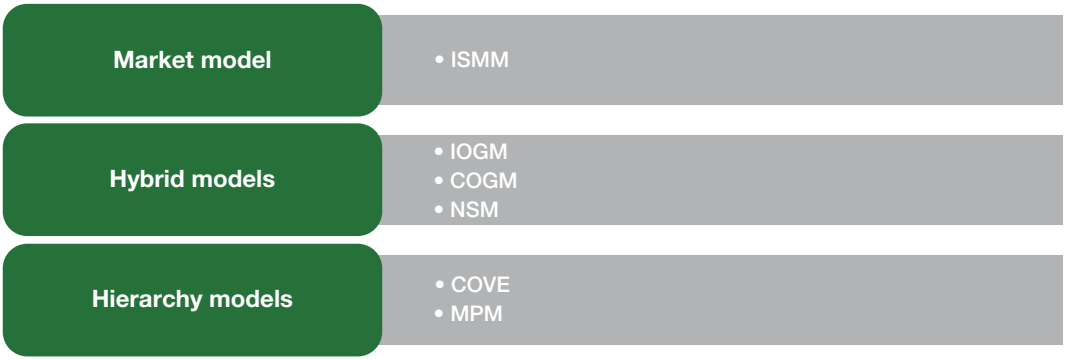
This paper shows that most of these contractual oil palm models have become less common in our study areas, which are dominated by oil palm production and the presence of large oil palm companies.

2.3 Oil palm processing in Ghana

Some farmers process their own FFBs rather than sell to companies or traders and so will not fall within any of the OPC models described above. Historically, oil palm processing in Ghana started in the sixteenth century and was first traded to England in 1590 (Henderson and Osborne 2000). However, trading in commercial quantities started in the early 1880s following the industrial revolution (GoG 2011). Largely dependent on palm fruits from natural groves managed by peasant farmers at the time, oil palm processing was rudimentary and involved no mechanisation. Plantations were established first by the Dutch and later by the British and other Europeans around the nineteenth and twentieth centuries; thereby promoting oil palm as the leading foreign exchange earner for the then Gold Coast from the mid-nineteenth century to the beginning of the twentieth century (GoG 2011). Commercial oil palm processing activities started in the 1910s when mill operators started the mechanical extraction of palm oil within the vicinity of the oil palm plantations. The boom in commercial oil palm processing was short-lived; plummeting as a result of rivalry and political insecurity among the European powers in pursuit of territorial supremacy (Osei-Amponsah 2013). Following a policy shift towards greater emphasis on plantation agriculture in the wake of Ghana achieving independence in 1957, several initiatives were undertaken to modernise and boost oil palm processing; but resulted in very little success (Miracle and Seidman 1968). It was not until 1977 and the establishment of three large-scale oil palm processing plants in the Eastern, Western and Central regions (Miracle and Seidman 1968) that commercial oil palm processing became resurgent.

Medium and large-scale oil palm processing generally takes place in oil palm estates that have their own processing plants. Fruits are sourced from their nucleus schemes in addition to outgrower production schemes based on lands owned or leased by individual farmers (Osei-Amponsah 2013). The relationship between smallholder farmers and these processors is, in most cases, bound only by unwritten contracts. Processing of FFBs is highly mechanised and the capacity of such processing units is about 15–60t/h with palm oil extraction rates of 18–22 per cent (GoG 2011). Generally, compared to small-scale oil palm processors, palm oil produced by medium and large-scale processors is of superior industrial quality (Osei-Amponsah 2013). As a result, palm oil produced by

Figure 1.1 Smallholder OPC models in Ghana based on Eaton, Meijerink and Bijman (2008)



medium and large-scale processors is sold to domestic and foreign manufacturing industries, and locally to supermarkets as edible vegetable oil. Prices of palm oil produced by medium and large-scale processors is determined by the quality and prevailing world market prices, and often better than the prices received by small-scale artisanal processors (GoG 2011)

The small-scale processing enterprise, which is made up of artisanal mills, is the most common in most oil palm producing areas of Ghana and is dominated by women (Osei-Amponsah *et al*. 2012; GoG 2011). Processing is semi-mechanised with palm oil extraction done mainly through the use of a separate digester and hand spindle press. Processing capacity is usually about 3–8t of FFB per day with an extraction rate of only 9–15 per cent (GoG 2011). The quality of palm oil produced by small-scale processors is generally low due to poor handling; particularly prolonged fruit storage periods (Osei-Amponsah 2013). The price of the commodity received by small-scale processors is often determined by the quality of palm oil and the FFB production seasons.

Because farmers face volatile FFB prices and processing constraints, an important decision is whether to sell FFBs to oil palm companies, traders and processors, or to process their own FFBs. This choice is a particularly important feature for independent small-scale farmers who do not have any binding contracts with oil palm companies. This paper offers some preliminary insights into some of the factors that shape that choice to participate in own-processing of oil palm or not.

2.4. Industrial organisation and contract farming

It is argued that vertical integration of farm production into high-value crop value chains – both in input and output markets – promotes agricultural commercialisation and improves the incomes of farmers (Kirsten and Sartorius 2002). In African economies, however, the vast potential for vertical integration and competitive commercial agriculture is hampered by several factors including high transactions cost in the presence of volatile prices in agricultural markets (Collier and Dercon 2009).

Evidence highlighting the positive welfare effects of farmer participation in agricultural value chains abounds (e.g. Wang, Wang and Delgado 2014; Barrett *et al*. 2012; Bellemare 2012). These notwithstanding, the level of participation of smallholder farmers in agricultural value chains – particularly those in SSA – remains very low. Participation in contract farming, for example, is typically around 15 per cent (Oya 2012), although it could be much higher (up to 80 per cent) in parts of Tanzania (Meemken and Bellemare 2020). The low participation in modern agricultural value chains is attributable to high transaction costs, limited access to financial markets, lack of regulatory transparency, and issues with supply-chain governance (OECD *et al*. 2013). These factors contribute to costly and unpredictable market exchange in SSA (Fafchamps 2004). Contract farming is often seen as one of the potentially effective tools that could help surmount these obstacles – although thus far, contract farming has had varying levels of success for both farmers and buyers (Ruml and Qaim 2019).

Contract farming is an intermediate form of industrial organisation, working as a vertical coordination mechanism between spot markets and full vertical integration (Bellemare and Lim 2018). Two key types of contracts are identified in the literature: production and marketing contracts. The former involves the processor on the one hand; exercising control over production decisions and providing key inputs, and the farmer (grower) on the other hand supplying labour and, in some cases. land and equipment. In marketing contracts, however, growers are largely autonomous in terms of production decisions, while processors stick to determining the price and quantity. Due to the high risk and low technology adoption in smallholder farming, a contract that reduces marketing risk may increase technology adoption and input use, and thus improve yields and income (Meemken and Bellemare 2020; Bellemare 2012).

Theoretical explanations of contracts and vertical integration and its associated issues (e.g. risk and information) have been ventured by economists since the formal exposition by Coase (1937). Application of the theoretical insights that emerged form Coase's seminal works were a growing influence on contract farming in OECD countries by the end of the 20th century (Bellemare and Lim 2018). Benefits of contract farming include improvements in food availability, safety, quality, and a generally enhanced food security status (Barrett 2010). Contract farming also mitigates production and marketing risks, reduces transactions costs, and increases farmer productivity (MacDonald 2011). Thus, the vertical integration contract farming offers could contribute to reducing market failures and facilitate transition to modern agriculture and structural transformation across the broader economy (Fafchamps 2004).

Notwithstanding the expected benefits, the challenge of contract enforcement limits the uptake and spread

of contract farming in developing countries (Narayanan 2012). The presence of weak institutions serves as a soft ground for farmers and agribusiness firms to renege on contracts; resulting in parties resorting to various forms of self-regulation and other private means of enforcement to maintain transactional relationships. Policies that promote the establishment of legal and institutional mechanisms for enforcing contracts between farmers and firms have been proposed for enhancing the expansion of contract farming (Narayanan 2012). Such prescriptions are predicated on the notion that developing a legal framework for contracting and enforcement is desirable and therefore both necessary and sufficient for maintaining agribusiness-farmer relationships. However, this may not be true for many developing countries. In India, for instance, Narayanan (2012) showed that contract farming arrangements are seen more as relationships and less as contracts, with formal enforcement mechanisms playing only a marginal role in maintaining and supporting transactions.

Indeed, traditional economics acknowledges the framework of law as a necessary condition for markets to succeed because in its absence, unbridled opportunistic behaviour could lead to a dysfunctional societal system. Another view derived from Coase (1937) suggests that a legal framework might even be sufficient in itself in that as long as property rights are well-defined, voluntary economic exchange would follow as a matter of course and produce optimal welfare outcomes in the absence of transactions costs. Early views in the development literature associated development with a move from relation-based transactions to rule-based transactions, or from custom to contract and informality to formality (Harriss-White 2008). However, based on the understanding all economic systems depend upon systems of meaning that are usually specific to particular places, Granovetter (1985) suggests that social embeddedness of transactions is an issue of concern in understanding firm-farm contract relationships. The concept of social embeddedness highlights the fact that all economic activities depend on the social context in which they occur; hence economic systems are the product of conventions applied by reflexive human agents (Granovetter 1985).

In Ghana, the institutional landscape of agriculture has been changing contract arrangements and output commercialisation – especially in the areas of cash crop farming. As we will show, there appears to be a breakdown of trust among participants (farmers, oil palm companies, and intermediaries between farmers and companies) in the oil palm economy in our study areas of south-Western Ghana; resulting in serious market frictions that have led to the absence of binding contracts between farmers and oil palm companies. This behaviour is consistent with recent findings by Ruml and Qaim (2020) stating oil palm contract farmers in parts of Ghana were so dissatisfied that 62 per cent would exit existing contracts when they expire. The general absence of contracts and the fragility of trustful relations in the context of widespread material deprivation hurts the poor the most and has the potential to further entrench inequality.

2.5 Choice of oil palm commercialisation channel

As described in subsection 2.2, oil palm farmers often face multiple options when it comes to marketing their oil palm output. Some of these options are determined ex ante by the nature of their production arrangements. Some of the production arrangements are motivated by farmers' demands or need for services provided by buyers (particularly oil palm companies) and eligibility criteria instituted from the demand side. Need-based determinants include the search for a reliable supply of inputs (Armah *et al*. 2010), credit (Azumah, Donkoh and Ehiakpor 2016), extension services (Munyati *et al*. 2013), and reduced transportation costs (Masakure and Henson 2005). While some oil palm farmers in Ghana freely include or exclude themselves from some production arrangements (Manley 2016), others may be excluded even if they desire participation because of eligibility criteria such as size of holding (Baumann 2000).

Differences in personal, household, farm, and community characteristics determine differences in farm services needs as well as eligibility criteria (Hananu, Abdul-Hanan and Zakaria 2015; Mensah-Bonsu 2010). For example, some evidence suggests that female farmers and FHHs are more likely to be excluded from contract-based commercialisation channels (Armah, Schneider and Plotnik 2010; Porter and Philips-Howard 1997) . There is also some evidence that married farmers and those with children are more likely to participate in outgrower schemes because contractors perceive these characteristics as indicators of responsibility and availability of labour, which is important for a labour-intensive crop like oil palm (Baumann 2000). Older and more experienced oil palm farmers in Ghana are also more likely to engage in contract models (Sambuo 2014; Loggoh 2013; Munyati *et al*. 2013).

There is an association between land-ownership structure and choice of commercialisation model, with farmers owning their own land being more likely

to engage in contract farming arrangements (Loggoh 2013). However, ownership of land is important only to the extent that it guarantees security of tenure (Väth and Gobien 2014). Aside land tenure, scale of production matters as the literature shows that the likelihood of participating in contract farming rises with farm size (Meemken and Bellemare 2020; Akuriba 2017).

At the community or meso level, Gatto *et al*. (2015) shows that infrastructure matters for choice of oil palm commercialisation arrangement with farmers in better endowed communities tending to choose contracts instead of market models of oil palm commercialisation. As could be expected, proximity to markets or buyers is an important determinant of choice of oil palm commercialisation model (Masakure and Henson 2005). We test some of these determinates of oil palm commercialisation channel in Section 6 of this paper.

3 SAMPLING AND DESCRIPTIVE STATISTICS OF SURVEY SAMPLE

3.1 Study area and sampling

Our study is sited in the Ahanta West and Mpohor Districts; located within the oil palm belt of south-Western Ghana. These districts were purposively chosen because of the high concentration of oil palm production involving smallholder farmers and the presence of two of Ghana's 'big four' oil palm companies (Norpalm Ghana Ltd and Benso Oil Palm Plantation Ltd). The two districts also fall within the operational area of Building Business on Values, Integrity and Dignity (B-BOVID); a medium-scale oil palm processing company. Following a review of the literature and two visits (an initial reconnaissance survey and a follow-up qualitative study), we identified several broad channels through which oil palm producers engage with output markets after harvesting their fruits: selling to oil palm companies directly *or* indirectly through intermediaries known as buying agents; selling on the local open market (to market women, food vendors and artisanal and small-scale processors); avoiding selling altogether and instead processing the fruits into palm oil or, less frequently, alcoholic beverages or soap. Based on this information, we obtained a list of communities in which farmers were engaging with the various commercialisation channels. Because a reliable sampling frame was not available, we randomly selected 20 communities (Figure 3.1) and carried out a census for constructing a frame.

Based on sample size calculations, we originally planned drawing on 600 oil palm-producing households at random with each ex ante group adequately represented.[2] However, an analysis of the census data suggested the need to draw a larger sample due to the heterogeneity within the sales channels. For example, we had to distinguish between those selling directly to the companies and those doing so through agents. Given resource constraints, we targeted a sample of 700 farm households but ended up achieving a sample size of 726. The survey data collection lasted for three weeks (from late November to mid-December 2017).

Aside from a small-scale qualitative data collection exercise carried out in 2016 prior to the survey, a full-scale qualitative study was conducted as a follow-up to the baseline survey in order to throw light on some emerging quantitative findings. We adopted a multi-stage purposive sampling procedure. Since the qualitative study was a follow up to the quantitative study, we selected five communities based on the dominant sales channels identified in the quantitative data. The selected communities are Adum Dominase, Butre, Kwesikrom, New Akwidaa, and Pretsea. In each community, we sampled at least five heads of household. For each household, we also sampled the next oldest member, who mostly happened to be a spouse, and the eldest dependent.

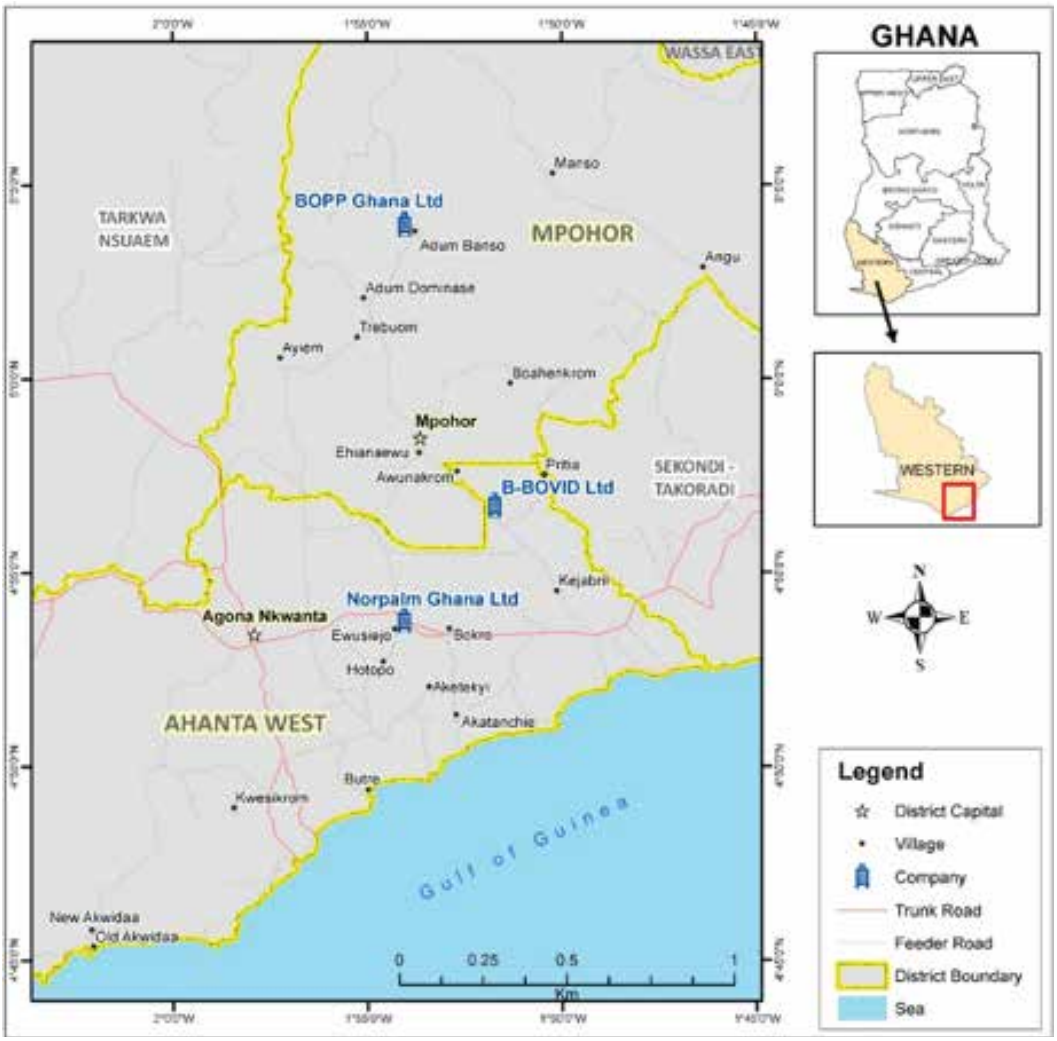
At household level, we conducted interviews with each household head – each lasting around an hour and complemented these with shorter interviews with spouses and dependents. In our sample, FHHs tended to be divorced or widowed, hence there was no spouse to be interviewed. We also interviewed key actors in the oil palm economy in each community; including farm hands or workers, aggregators or buying agents, and processors. In each community, we also conducted key informant interviews with traditional leaders such as chiefs, unit committee chairs, and assembly members. We conducted two focus group discussions – separating males and females – in each community. At district level, we conducted expert interviews with district agricultural officers of the Ministry of Food and Agriculture in Mpohor and Ahanta West. Finally, we interviewed representatives of the oil palm companies (BOPP, NGL, and B-BOVID).

In all, we conducted 38 household interviews (separately with heads, spouses, and dependents), 25 interviews with actors in the oil palm industries (with labourers, buying agents, and processors), 11 key informant interviews (with traditional rulers, agriculture extension officers and community leaders), and 10 focus group interviews at community level. Fieldwork lasted for two weeks. The data was subsequently transcribed and analysed using the Atlas.ti Qualitative Data Analysis - Software & Tools.

3.2 Descriptive statistics of the survey sample

Of the 726 oil palm farm households in the survey sample, 67 (approximately 9 per cent) did not harvest

Figure 3.1. Map showing the study villages and other important features



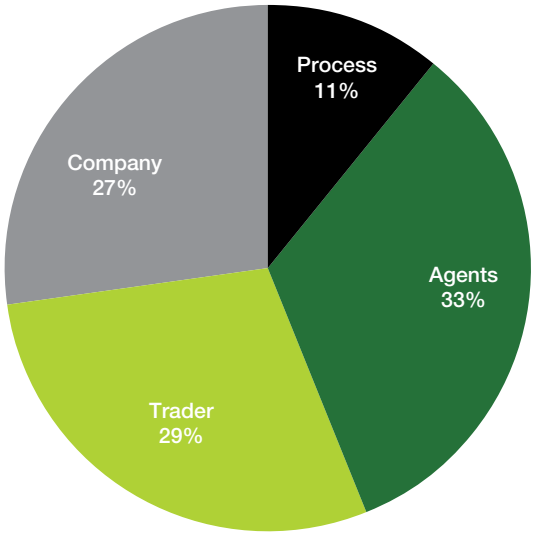
Source: Authors' own, © University of Ghana

any FFBs because their farms had not started bearing fruits. Therefore, our analysis is based on the remaining 659 households that reported FFB harvests. As indicated earlier based on our qualitative study, we identified four channels through which households that harvested FFBs interacted with oil palm markets: (1) direct sales to oil palm companies; (2) selling to oil palm companies through agents; (3) selling to individual buyers within the community or market women; and (4) processing own output. Approximately 7.6 per cent (i.e., 51 households that harvested FFBs) reported using multiple channels. This, in addition to our finding that most farmers have been dealing with the same dominant channel for the past seven years, on average, demonstrates considerable stability in choice of commercialisation channel. For the 51 households reporting multiple channels, we place them in their most dominant channel.

Figure 3.2 displays the distribution of the channels showing that the largest group are those who sell to the oil palm companies through agents (33 per cent) and the smallest group is those that process their own FFBs (11 per cent). Our qualitative study suggests that these oil palm marketing channels are not equally accessible to all farmers and may depend on other structural factors or personal resources, which are discussed below.

In Table 3.1, we present mean descriptive statistics of the sample across the four OPC channels. The p-values in column 6 are from joint F-test of the hypothesis that a respective variable is identical across the four OPC channels. About 70 per cent (21 out of 30) of the variables listed show statistically significant differences across the commercialisation channels. We highlight a few here:

Figure 3.2 Distribution of households by their commercialisation channels



Source: Authors' own

1. Those selling directly to the companies and those that process their own FFBs appear distinct from those selling through agents and to local market traders with respect to some characteristics. The former groups have more highly educated heads (particularly those selling directly to the companies), and have larger farm sizes (including area under oil palm).

2. Compared with the rest of the sample, those selling directly to the companies have the following distinct characteristics. Using land inheritance as a proxy for secure land tenure, we observe that they likely have better land tenure security; are wealthier in agricultural working capital; received higher average price per tonne of FFB sold (about US$9 more than the sample average); a higher proportion of company-associated households have inherited land; they live closer to an oil palm company; they have better access to a paved road; they have longer supply relationship durations with their buyer, and they expressed more satisfaction with past relationship with the companies.

3. Compared with the rest of the sampled households, the group processing its own FFBs contains a higher proportion of married couple households. Because artisanal oil palm processing is labour-intensive, a plausible reason for this is that couple households can call on more labour (about two extra hands) than households in the rest of the sample. As might be expected, there are more processors in villages where there is a small to medium sized processing mill. Finally, processors also seem wealthier in terms of consumer assets, livestock, and land.

Table 3.1 Mean summary statistics, by the OPC channel

Variables	Total n = 659 (1)	Company n = 179 (2)	Agent n = 215 (3)	Trader n = 192 (4)	Process n = 73 (5)	F-stat *p*-val. (6)
FHH (yes=1)	0.17	0.16	0.16	0.20	0.19	0.69
Age of household head	52.02	51.16	53.08	51.57	52.22	0.49
Mean age of adult household members	42.21	41.21	43.33	41.88	42.21	0.40
Household size	4.27	4.36	4.31	4.13	4.29	0.75
Number of female adults	1.34	1.38	1.30	1.31	1.44	0.68
Number of male adults	1.24	1.27	1.27	1.19	1.16	0.72
Dependency ratio	0.90	0.82	1.00	0.86	0.91	0.37
Household head is married (yes=1)	0.72	0.73	0.74	0.65	0.81	0.05
Head's years of schooling	7.55	8.42	6.93	7.31	7.92	0.01
Secondary education or higher (yes=1)	0.45	0.54	0.41	0.42	0.48	0.05
Total cultivated area (ha)	3.41	4.19	3.11	2.64	4.39	0.00
Area cultivated to oil palm (ha)	1.82	2.09	1.73	1.45	2.40	0.00
Share of land devoted to oil palm	0.60	0.56	0.62	0.60	0.59	0.19
Number of plots cultivated	1.56	1.86	1.51	1.28	1.73	0.00
Inherited some land (yes=1)	0.23	0.34	0.19	0.17	0.27	0.00
Number of crops cultivated	2.23	2.41	2.08	2.16	2.40	0.04
Value of productive assets (US$)	41.25	55.27	33.52	35.95	43.58	0.00
Value of consumer assets (US$)	278.40	330.73	182.81	302.49	368.30	0.00
Livestock wealth (TLU)	0.43	0.48	0.34	0.36	0.72	0.03
Total land holding (ha)	5.99	7.04	5.48	4.80	8.10	0.00
Non-farm employment (yes=1)□	0.49	0.51	0.51	0.42	0.55	0.13
Index of agro-services available	0.40	0.41	0.40	0.38	0.46	0.10
Established market in village (yes=1)	0.47	0.51	0.37	0.51	0.58	0.00
Price received per tonne of FFB (US$)	69.11	77.80	66.29	66.64	—	0.00
Distance to district capita (km)	15.30	18.84	14.22	14.30	12.46	0.00
Distance to regional capital (km)	20.27	20.95	21.29	18.49	20.31	0.00
Distance to main company (km)	7.36	5.45	8.23	8.09	7.55	0.00
Access to paved road (yes=1)	0.39	0.54	0.23	0.44	0.34	0.00
Supply relationship duration (years)	7.20	8.45	6.97	6.30	—	0.00
Processing mill available	0.19	0.07	0.25	0.15	0.41	0.00

Note: □ Excludes income from participation in processing.

Source: Authors' computations based on APRA-Ghana WS1 survey, December 2017

4 TRANSACTIONS AND TRUST IN THE OIL PALM ECONOMY

In subsection 2.4, we highlighted the potential benefits of structured commercialisation arrangements and farmer participation in agricultural value chains such as contract farming. However, the literature (Ruml and Qaim 2020; Gatto *et al.* 2017; Ochieng, Veettil and Qaim 2017; Andersson *et al.* 2015) documents several instances of farmer dissatisfaction with participation in value chains regarding contracts, for example. In our study areas, we observe that hardships brought on by material deprivation can undermine the ability of poor farmers to nurture trust; a situation which makes it difficult to enter into long-term transactional relations. Such long-term transactional relations can be nurtured most effectively when economic actors are connected by ties that transcend the narrow confines of one-off transactions. This means that informal social relations are crucial to long-term economic relations. However, it is important to distinguish between the informality that characterises face-to-face social relations and the informality that facilitates economic transactions. The first type of informality can be found in many close-knit circles such as villages or immigrant communities (Portes 1998; Portes and Sensenbrenner 1993). The tight social bonds that develop between individuals in these social contexts have been described as 'social capital' and have been argued to be a crucial ingredient in building healthy and vibrant communities, promoting strong democracies, and even empowering vulnerable communities to effectively respond to natural disasters (Aldrich and Meyer 2015). In economic sociology, scholars explain that the trust that emanates from social capital provides indispensable resources that can be channelled into economic activities (Uzzi 1997, 1999; Portes 1998; Granovetter 1985), although these economic benefits tend to be 'mediated by the distinctive nature of the community as well as the resources that beneficiaries have at their disposal' (Asante 2018: 433).

In our study communities, social relations were intimate and informal – as could be expected of rural communities. This informality also extended to some economic transactions. Many farmers were found to be close friends with the agents or aggregators they do business with. Some of these relations were so close that some agents were willing to advance soft loans to farmers without the protection of a binding agreement. One farmer (Respondent #16) explained that he often borrowed money from an agent. He said: "We will not sign any document to show that I have taken any money – it is just between us." Farmers usually paid back these loans in kind, by offering their creditors the equivalent value of the money in palm fruits.

However, trustful relationships were the exception rather than the rule among the actors in this oil palm economy. Mistrust was rife among the various actors; making most attempts at economic cooperation all but impossible. Even though many of the farmers were poor and were often in need of money, it was difficult to secure a loan from the aggregators or market women they transacted with. Even those who managed to secure a loan complained that the amount they received tended to be way below what they needed. They consider this failure to assist them in their time of need as a betrayal of some unspoken agreement guiding their relationship. On the other hand, the reluctance of the aggregators and market women to lend is often the result of bad personal experiences. From the farmers' own admission, this situation has resulted from a history of farmers failing to honour their obligations after their customers have advanced loans to them. According to one farmer:

> "Some [market] women can do that [lend money to farmers] and sometimes they give you the money, but during harvesting time, the farmers sell their harvest to another customer. When that happens, the woman who loaned you the money loses out. Because of this, that kind of arrangement does not work here. If you harvest your palm fruits and you leave it by the roadside, people will see it and buy it or move on." (Interview #29)

When violations of this kind occur, there is very little room for aggrieved parties to seek redress. For instance, litigation would be too tedious and costly and although traditional authorities are revered, there are serious reservations about their impartiality or incorruptibility. Given these circumstances, the transacting partners tend to fall back on equally informal means to settle their differences. As another respondent reported: "Sometimes, when the women pre-finance me and I am unable to harvest the oil

palm for them, we have disagreements. I later go and apologise." (Respondent #27)

On their part, farmers also felt aggrieved about what they perceived to be dishonesty on the part of agents. Indeed, when they can afford to do so, most farmers preferred to sell directly to the company mills in order to cut out the intermediaries. The perception of dishonesty partially arose from the fact that the prices agents offered were lower than what could be had at the mills. Moreover, the agents' practice of rigging their scales further fuels this mistrust. Even though farmers have caught on to the practice of using rigged scales, they nevertheless felt powerless to do anything about it, and believe that switching agents would not help much because the practice is widespread:

> "At first, the companies used to come here with their own cars and when they weighed the fruits, the price was good but the private ones who later started buying from us adjusted their scales – so fruits that were initially giving you about GHS150 (about US$29) now gives you just about GHS100 (about US$20). They have been cheating us." (Respondent #8).

Trust is also eroded by the widespread prevalence of other underhand practices by some agents. Many farmers claimed that when they decided to sell directly to the companies, agents tried to dissuade them with lies. For instance, they exaggerated the expense involved in transporting their own fruits to the companies and gave an impression of an impossibly complex bureaucratic maze to be confronted in selling directly. However, as Respondent #7 later found out: "They were telling lies when we decided to send our produce to BOPP for the first time. They just did not want us to go to BOPP since they thought they will lose customers."

As observed above, because most farmers cannot afford the cost of transporting their fruits to the companies themselves, they pooled resources in informal groups to pay for the trip. However, these arrangements are themselves not immune to the corroding effects of mistrust and inevitably ended up collapsing. The result is a paradoxical situation where actors are enmeshed in dense social relations but are at the same time isolated when taking consequential economic decisions. This situation precludes the economically beneficial kinds of joint action. Relations could get so acrimonious in some groups that some farmers would rather sell to agents – a suboptimal choice for most of them – than collaborate with other farmers. After leaving one such association, Respondent #3 said that at the moment: "I just handle my farming activities myself and sell my palm fruits to the agents after harvest and then I am done. I do not have other engagement with anyone aside from that."

The farmers' tendency to be suspicious of other actors in the market appears to be fuelled by their relative powerlessness. Their lack of autonomy shapes whom they sell to, at what price, and under what conditions. For instance, when it comes to pricing, many farmers readily acknowledge their lack of voice in its determination. As Respondent #8 explained: "As for us farmers, we have no option. They used to buy one basket at GHS80 (about US$16), then 100 (about US$20), and it came to 300 (about US$59) so he [the buyer] is the one who determines the price. We the farmers don't have a say." Another farmer (Respondent #2) would have loved to sell his fruits at GHS50 (about US$10) per 100kg basket, but is compelled to sell at GHS30 (about US$6) according to the wishes of the aggregator he sold to. The oil palm economy is essentially controlled by buyers, especially in the bumper season. In addition to this, with only three processing companies, the farmers are left with very little choice: As Respondent #29 explained:

> "In the peak season, all three stations become busy so you would have to queue wherever you go. In such cases, you could harvest for the factory and also sell some for the market. Then you use the loose fruits for producing palm oil. So, apart from the companies, there are no major customers who can buy your fruits in huge quantities. There are no alternative avenues or customers who can assure you of buying 1t of palm fruits so, in a situation like this, as a farmer you pause on the harvesting. It is advisable to wait for about three to four weeks when there is less traffic to harvest new fruits [even though] some of the fruits do go bad. Definitely, some will go rotten – but it is better when it is on the tree than when it has been harvested."

The prevailing OPC model in the study communities is the independent smallholder model. While the individual outgrower model (where farmers are obligated to sell to the estates upon harvest in exchange for inputs) was very common among the 'big two' estates, side selling has all but collapsed the schemes, particularly in the case of Norpalm Ghana Ltd. BOPP had measures in place such as placing security gates on all roads to ensure that scheme smallholders farming on land

provided by the estate do not divert fruits upon harvest. However, a manager (interview #87) reported that side selling is common. He said: “Even if you give them help, you advance fertiliser to them, when it comes to selling to you so that you will make the deduction, they’ll go and sell it to your competitor so that they will dodge the deduction.”

This situation makes contractual relations between the estates and farmers extremely tenuous. Accordingly, BOPP has chosen to avoid any contracts with the independent farmers because even after providing them with inputs, they can only “hope that they will sell to us,” – a hope that tends to be vain when “your competitor comes and is prepared to pay one cedi extra” and the farmers often choose to sell to the highest bidder.

Thus, a combination of material deprivation and the desire to avoid repayment of inputs leads to the rampant violation of contracts or informal agreements, especially among the poorest farmers. While the large estates are avoiding contracts with independent farmers due to mistrust and side selling, the CEO of B-BOVID, the medium-scale processor, is deliberately trying to “do away with contracts” – preferring instead to develop a relationship with the farmers based on what he calls “moral trust” built on his “unique model.” However, since many elements of this model (such as the passbook system)[3] have not yet been rolled out, it is not yet clear how it might shift the incentives of farmers.

We use insights from the qualitative analysis for fruitful lines of inquiry in the quantitative analysis that follows. Some of the qualitative results about the welfare effects of participation in the various channels of commercialisation are also subjected to more rigorous quantitative testing.

5 DETERMINANTS OF HOUSEHOLD PARTICIPATION IN THE OIL PALM COMMERCIALISATION CHANNELS

Given that participation in the various oil palm commercialisation channels is associated with differing household welfare, what determines participation in a commercialisation arrangement? For the quantitative analysis, we employ a multinomial logit (MNL) model for answering this question. Let Y_{ij} denote the jth commercialisation channel to which household i belongs, and let X_k denote a vector of household, farm, community and institutional variables that could determine participation in the jth channel. The probability that household i participants in the jth channel is given by:

$$P_{ij} \equiv p(Y_i = j) = \frac{\exp(\beta'_{kj} X)}{\sum_{j=1}^{4} \exp(\beta'_{kj} X_k)} \quad (1)$$

where β_{kj} is a vector of parameters to be estimated. Normalising one of the alternative channels to 0 yields the MNL model:

$$P_{ij} \equiv p(y_i = j) = \frac{\exp(\beta'_{kj} X)}{\sum_{j=1}^{3} \exp(\beta'_{kj} X_k)} \text{ for } j = 1, 2, \ldots, J-1. \quad (2)$$

Since the parameter estimates (β_k) from the MNL model do not provide actual magnitudes of effect of an explanatory variable, we base our discussions on estimated average marginal effects and differences in predicted probabilities. Table 5.1 presents the MNL estimates of the determinants of the FFB sales channels. Table 5.2 presents the predicted probabilities of choosing a commercialisation channel as well as the differences in predicted probabilities for variables that are significantly different from zero in Table 5.1.

Seven household level variables (sex and age of household head, number of male adults, marital status, working capital, land holding, and quantity of FFBs harvested) are statistically different from zero in predicting the likelihood of participation in one commercialisation channel relative to another. FHHs are more likely to be own-processors than sell through agents or to traders. This result may be associated with the nature of gender roles in Ghana whereby women are traditionally responsible for food processing in general (Manley and Van Leynseele 2019; Osei-Amponsah *et al.* 2012). The probability of own-processing is about 10 percentage points higher for FHHs (Table 5.2, column 4). Similarly, the presence of a woman within the household increases the probability of own-processing significantly (relative to the other three channels). Conditional on being a couple household, the differences in predicted probabilities of own-processing on the one hand and using the other channels on the other hand are large (from about 5 percentage points for own-processing versus direct sale to a company to about 17 percentage points for own-processing versus selling to a trader). As age of household head increases, the probability of selling directly to a company decreases while the probability of selling through an agent increases;[4] the difference in these probabilities is about 0.5 percentage points for an additional year increase in age (column 8 of Table 5.2). Since the companies stopped going to the communities to purchase FFBs themselves, selling directly to a company is a demanding task as farmers mostly have to accompany their output and it takes a lot of effort and time to do so during the peak season in particular. This seems to discourage older farmers.

Due to concerns about reverse causality, lagged working capital should have entered the choice of channel equations as covariate, but the variable here is composed of both contemporaneous and lagged values since the cross-sectional data did not disentangle the two. Except for selling though agents, where probability is decreasing with working capital, the probability of choosing the other channels is increasing with working capital. Since the previous section showed that those selling through agents are not poorer (in income or composite wealth) than those selling to traders, it is not clear how endogeneity may be influencing this outcome. This confounding result could be mitigated somewhat when panel data becomes available.

Table 5.1 Determinants of participation in oil palm commercialisation channels: MNL

Variables	Process versus company (1)	Process versus agents (2)	Process versus trader (3)	Company versus agents (4)	Company versus trader (5)	Agent versus trader (6)
Female head	0.72	1.09**	0.94*	0.37	0.23	–0.15
	(0.21)	(0.04)	(0.08)	(0.39)	(0.59)	(0.69)
Head's age	0.01	–0.01	0.01	–0.02**	–0.01	0.01
	(0.27)	(0.62)	(0.64)	(0.04)	(0.37)	(0.17)
Number of female adults	0.01	–0.07	0.01	–0.09	–0.00	0.08
	(0.95)	(0.66)	(0.97)	(0.52)	(0.97)	(0.52)
Number of male adults	–0.18	–0.34*	–0.20	–0.15	–0.02	0.13
	(0.33)	(0.06)	(0.27)	(0.26)	(0.88)	(0.30)
Dependency ratio	–0.14	–0.08	–0.02	0.06	0.11	0.05
	(0.43)	(0.64)	(0.89)	(0.64)	(0.38)	(0.63)
Couple households	0.88*	0.81*	1.24**	–0.06	0.36	0.42
	(0.09)	(0.10)	(0.01)	(0.86)	(0.29)	(0.18)
Migrant household	0.22	0.27	0.19	0.04	–0.03	–0.07
	(0.57)	(0.46)	(0.60)	(0.88)	(0.92)	(0.79)
Head's years of schooling	0.03	0.05	0.03	0.03	–0.00	–0.03
	(0.44)	(0.12)	(0.46)	(0.35)	(0.96)	(0.29)
Working capital	–0.19	0.35**	–0.02	0.54***	0.17	–0.37***
	(0.29)	(0.05)	(0.91)	(0.00)	(0.19)	(0.00)
Assets	0.09	0.06	0.19	–0.02	0.10	0.12
	(0.56)	(0.64)	(0.18)	(0.84)	(0.35)	(0.20)
Land holding	0.04**	0.04**	0.05**	–0.00	0.01	0.01
	(0.02)	(0.03)	(0.01)	(0.88)	(0.54)	(0.46)
Quantity of palm fruits (log)	–0.1	–0.08	0.19	0.09	0.36***	0.27***
	(0.17)	(0.51)	(0.11)	(0.32)	(0.00)	(0.00)
Agro-services available	1.02***	0.85**	0.69**	–0.17	–0.32	–0.16
	(0.01)	(0.01)	(0.05)	(0.57)	(0.27)	(0.56)
Distance to nearest company	0.11***	0.02	0.01	–0.09***	–0.10***	–0.01
	(0.00)	(0.47)	(0.73)	(0.00)	(0.00)	(0.58)
Processing mill available	2.11***	1.22***	1.76***	–0.89**	–0.34	0.54*
	(0.00)	(0.00)	(0.00)	(0.02)	(0.38)	(0.07)
Access to paved road	–0.38	0.79**	–0.07	1.17***	0.32	–0.86***
	(0.28)	(0.03)	(0.85)	(0.00)	(0.21)	(0.00)
Regular market in village	0.55	0.64*	–0.15	0.09	–0.70***	–0.79***
	(0.13)	(0.06)	(0.66)	(0.73)	(0.01)	(0.00)
Ahanta West *versus* Mpohor	1.29***	0.37	0.40	–0.93***	–0.89***	0.03
	(0.00)	(0.35)	(0.30)	(0.00)	(0.00)	(0.90)
Intercept	–4.44***	–4.64***	–4.90***	–0.20	–0.45	–0.26
	(0.00)	(0.00)	(0.00)	(0.82)	(0.59)	(0.75)
Observations	659					
Log-likelihood	–748.9					
Pseudo R-squared	0.141					

Note: p-values are in parentheses; *, **, and *** denote significantly different from 0 at 10 per cent, 5 per cent, and 1 per cent, respectively.

Source: Authors' own

Table 5.2 Predicted probabilities of choice of oil palm commercialisation channel

	Predicted probability (%)				Difference in predicted probability (%)					
	CH1 (1)	CH2 (2)	CH3 (3)	CH4 (4)	CH4 *versus* CH1 (5)	CH4 *versus* CH2 (6)	CH4 *versus* CH3 (7)	CH1 *versus* CH2 (8)	CH1 *versus* CH3 (9)	CH2 *versus* CH3 (10)
Female head	1.5	–8.0	–3.5	10.0	—	18.0	13.5	—	—	—
Couple household	0.4	2.0	–9.9	7.5	7.0	5.4	17.4	—	—	—
Age	–0.2	0.3	–0.1	0.0	—	—	—	–0.5	—	—
Male adults	–0.7	3.4	–0.5	–2.2	—	–5.6	—	—	—	—
Working capital	5.2	–8.1	2.2	0.7	—	8.8	—	13.3	—	–10.3
Land holding	–0.0	0.0	–0.3	0.4	0.4	0.4	0.7	—	—	—
Quantity of FFBs	3.5	2.1	–5.4	–0.1	—	—	—	—	8.9	7.5
Agro-services	–5.9	–3.8	1.2	8.4	14.3	12.2	7.2	—	—	—
Distance	–1.5	0.4	0.8	0.4	1.9	—	—	–1.9	–2.3	—
Mill present	–14.0	4.1	–9.8	19.7	33.7	15.6	29.5	–18.2	—	14.0
Paved roads	11.1	–18.3	5.7	1.5	—	19.8	—	29.4	—	–23.9
Regular market	–5.5	–10.1	12.5	3.1	—	13.2	—	—	–18.0	–22.6

Note: CH1≡ Company; CH2 ≡ Agent; CH3 ≡ Trader; CH4 ≡ Process

Source: Authors' own

The probability of own-processing is significantly increasing with land holding; an extra hectare of land boosts the probability of own-processing by about 0.4 percentage points. Indeed, the probability of own-processing is increasing with land holding relative to the three other channels. Here again, we cannot rule out the possibility of reverse causality if own-processing does indeed increase the ability to acquire land due to improved earnings – but this is unlikely given the average age of the oil palm farms compared with the average period over which these households have been processing their own output.

Scale of production (i.e. quantity of FFBs harvested) influences choice of commercialisation channel. Indeed, one of the major differences we found from the qualitative study that distinguished those that sell to traders from those who sell though agents was that the former had relatively smaller output and sold piecemeal. On the other hand, one needs a relatively large quantity of output to make economic sense of transporting to a company in the absence of an aggregation association. Similarly, agents prefer to pick up relatively large quantities at a time to reduce the cost of transactions. It therefore does not surprise us that while the probability of selling to a company or through an agent increases by approximately 4 and 2 percentage points for a 10 per cent increase in the volume of FFBs harvested, the probability of selling to traders decreases by about 5 percentage points for the same per cent rise in the volume of output (other factors remaining constant). As columns 5 and 6 (Table 5.1) and columns 9 and 10 (Table 5.2) show, the probability differences are significantly different from zero and meaningful in magnitude (for a ten per cent rise in FFB output, the relative probability of selling to a company or through an agent relative to traders increases by approximately 9 and 8 percentage points, respectively).

As could be expected, the probability of selling directly to a company relative to the other channels decreases as the distance to a company increases due to transaction costs; particularly the cost of transportation. Living an extra kilometre away from a company, all other things being equal, decreases the probability of selling to a company by about 1.5 percentage points (p-value = 0.000). For example, the estimated probability of selling directly to a company is 38 percentage points at the 5th percentile distance and 10 percentage points at the 95th percentile, with the p-value of the difference being zero.

Four village-level covariates (availability of agro-services, availability of a processing mill, access to paved roads, and the presence of an established market) are strongly associated with choice of commercialisation channel. Artisanal palm oil processing is labour intensive as it involves very little or no mechanisation and thus could be a disincentive to processing. It is

Table 5.3 Probability of selling through an agent at percentiles of the distance distribution (per cent)

Distance percentiles	Paved road (1)	Unpaved road (2)	Difference (3)	*p*-value (4)
5th	28.0	28.3	0.3	0.969
25th	24.5	32.4	7.9	0.135
50th	19.8	37.8	18.1	0.000
75th	16.0	42.1	26.1	0.000
95th	6.6	53.4	46.8	0.000

Source: Authors' own

therefore not surprising that the presence of a small-scale mill increases the probability of own-processing by a large magnitude (about 20 percentage points), but decreases the probability of selling to a company or a trader by about 14 and 10 percentage points, respectively. Good roads improve market access (Berg, Blankespoor and Selod 2018), and road-induced improvements in market access could come from either the development of vibrant markets within the villages or making access to markets outside the village easier. We find that access to paved roads significantly increases the probability of directly selling to a company by about 11 percentage points while it decreases the probability of selling through agents by about 18 percentage points. Access to paved roads also seems to improve local market activity as it increases the probability of selling to traders by approximately 6 percentage points. Demand for agent services tends to be greater in communities isolated from oil palm companies by unpaved roads. We test this hypothesis from the survey data by interacting the distance to company variable with access to paved roads. Table 5.3 reports the probability of selling through an agent as distance to a company increases with and without a paved road. As the results show, the probability of selling through an agent decreases with distance in the presence of a paved road (column 1) but increases with distance in the absence of a paved road even after adjusting for a wide range of other factors. Column 3 shows that the differences in probability at the various distance percentiles with and without a paved road are large and highly statistically significant beginning at the 50th percentile of the distance distributions (i.e. at about 3.1km and above).

Finally, whereas the availability of an established market in the community decreases the probability of selling directly or indirectly (through an agent) to a company by approximately 6 and 10 percentage points respectively, it raises the probability of selling to traders and own-processing by about 13 and 3 percentage points respectively. The established local market effect on selling to traders depends on the quantity of output, however. Interacting the presence of an established local market and FFB output, we find that the probability of selling to a trader decreases with output irrespective of whether there is an established market in a village or not.

6 WELFARE EFFECTS OF THE COMMERCIALISATION CHANNELS

This section addresses the second objective of the paper, which is to identify the welfare differences – if any – associated with engagement in the observed channels of oil palm commercialisation.

6.1 Measures and identification strategy

Welfare is a complex and multidimensional concept and an improvement in one dimension may not necessarily translate into improvements in other dimensions (Dzanku 2015; Grosse, Harttgen and Klasen 2008). With this in mind, we employ three indicators of welfare. The first is income, which is the most common indicator in the related literature. This is measured by aggregating cash income received by all household members from all sources as well as the value of own-produced food consumed by the household over a one-year period minus the cost of generating all such incomes. Thus, we use net income, which is then divided by the number of household members to arrive at household income per capita per year.

Given the shortcomings of using money metric indicators for measuring poverty (Filmer and Pritchett 2001; World Bank 2001), we construct a composite welfare index following Finan, Sadoulet and De Janvry (2005) and Dzanku (2018) using productive assets (ownership of sprayers, water pump, sickle and spade), household durables (ownership of refrigerator, television, bicycle, motorcycle, and car/truck), household dwelling characteristics (availability of running water, type of material used for roofing, wall and floor), in addition to income as a short-term measure of welfare. We aggregate these measures of welfare using principal component analysis. For our data, as others' (Filmer and Scott 2012), the first Eigen value captured a substantial proportion of the total variance compared with the next Eigen value from higher order components. This composite welfare indicator measures both medium to long-term wealth accumulation, access to public goods as well as short-term indicators of welfare (i.e. income).

Finally, because people's feelings about their living conditions is important irrespective of what objective welfare indicators might suggest (Posel and Rogan 2016), we also employ a subjective welfare index using five questions that assess a household's perception of their living conditions and life circumstances. The survey asked the main respondent (mostly household heads) for their perceptions about their household's living conditions using the following questions: (a) Compared to others in this village, how would you describe your household? (b) How would you describe your own household circumstances? (c) In general, how would you describe your household? These subjective welfare measures are aggregated using principal component analysis as described above to create a subjective welfare index.

With these welfare indicators, the general welfare regression to be estimated is

$$Welf_i = \alpha_1 + \varphi_1 Company_i + \varphi_2 Agent_i + \varphi_3 Trader_i + \beta_1 X_i + \delta_1 V_j + \varepsilon_{ij} \quad (3)$$

where i and j indexes household and village respectively, *Welf* is an indicator of welfare (described above); *company*, *agent*, and *trader* are the oil palm commercialisation channel categorical variables, meaning that *process* is the reference channel; X is a vector of household characteristics that is likely simultaneously correlated with selection into one of the four commercialisation channels; V represents village fixed effects; and ε is the error term with zero mean.

From equation 3, our main interest is in the estimates of $\varphi 1$, $\varphi 2$ and $\varphi 3$, which represent the welfare effects of the commercialisation channels. Unfortunately, we cannot be sure that these parameters actually measure what we intend to measure. In econometrics, this issue is referred to as the identification problem. Simply put, households were not assigned at random into the observed commercialisation channels, and yet it could be the case that households that are better-off ex ante self-selected into higher return commercialisation channels, which means that we cannot identify a 'pure' welfare effect of engaging in a particular channel of commercialisation. Besides, both time-constant and time-varying unobserved factors that affect choice of commercialisation channel may also be correlated with household welfare; representing missing data in this context and thus presenting the problem of omitted variables.

To some extent, the inclusion of geographic units – in our case village fixed effects (V) – helps minimise the bias in estimating the welfare parameters due to locational differences that influence selection into the commercialisation channels (Meemken and Bellemare 2020). In addition to village fixed effects, we also include a set of observed characteristics that adjust for self-selection leading to the so-called selection-on-observables strategy (Meemken and Bellemare 2020; Maertens and Swinnen 2009). However, because these may not suffice, in order to identify the association between the commercialisation channels and welfare – or to at least minimise the bias in estimating $\varphi 1$, $\varphi 2$ and $\varphi 3$, we also use instrumental variables (IVs), which are variables that are sufficiently correlated with participation in the observed commercialisation channels but possibly exogenous to household welfare. Following (Meemken and Bellemare 2020),[5] we use the proportion of households in the village that engage with each of the commercialisation channels, distance to an available oil palm company, and the level of trust in a buyer based on past relationships proxied as the duration of supply relationship between farmers and buyers as IVs for selection into the commercialisation channels.

As we will show in the next subsection, these variables are highly correlated with a household's likelihood of selecting into the commercialisation channels, but plausibly conditionally exogenous to household welfare. However, as noted by Bellemare and Bloem (2018), we cannot rule out reverse causality even if these instruments meet the exclusion restriction assumption. Given the multivalued nature of our main variables of interest (the four channels of oil palm commercialisation), we apply a control function approach as follows. We first estimate an MNL model for choice of commercialisation channel, with the regressors being all exogenous variables (including the instruments). Thereafter, we obtain inverse Mills ratios – otherwise called the non-selection hazards, which we then enter as additional explanatory variables in the welfare equations to correct for endogeneity (Blundell and Powell 2004) in the spirit of Heckman (1979).

Finally, as a robustness check, we use the treatment effects framework for causal inference where identification still depends on observable characteristics of our sample but adjusts the estimates of the welfare effects ($\varphi 1$, $\varphi 2$ and $\varphi 3$) using a constructed comparable counterfactual from the data. With our (nominal) multivalued treatment variable, we use the inverse-probability-weighted regression adjustment (IPWRA) procedure for this purpose (Cattaneo 2010; Imbens and Wooldridge 2009; Wooldridge 2007). The estimate of the average treatment effect is:

$$ATE = E(Welf_k - Welf_0) \quad (4)$$

where $Welf_k$ is the value of the welfare indicator for households that selected into the kth channel and $Welf_0$ is the value of the welfare indicator for those in the reference group. Comparison of welfare effects between the kth pair of commercialisation channels follows from the above.

6.2 Results of the welfare effects of the commercialisation channels

We first report naïve estimates of average household welfare differences between the commercialisation channels and then apply both parametric and nonparametric tests for assessing if there is evidence (although naïve) to reject a hypothesis that welfare is identical across all four groups of households. Following these results, which are to be seen only as illustrative, we report results that make an attempt to deal with the identification issues described earlier.

6.2.1 Naïve descriptive parametric and nonparametric evidence

Table 5.1 reports mean values of the welfare indicators by the commercialisation channels and tests the hypothesis that the mean values are jointly identical across the groups (column 5). These naïve results provide strong evidence against the null hypothesis of identical welfare across the commercialisation channels, irrespective of welfare measure. On average, all three welfare indicators appear highest for those that process their own FFBs compared with their counterparts in the other groups, with mean income being a respective 8 per cent, 38 per cent and 58 per cent higher for own-processors than for those using the company, agent, and trader channels. Comparing pairs of households, we find that the 8 per cent difference between processors and the company channel is due to chance variation and so are the mean differences between the two groups with respect to composite and subjective welfare.

Next, figures 4–6 provide nonparametric analysis by plotting kernel density estimates by the commercialisation channels for the welfare indicators. Figure 4 suggests that household per capita income is highest for processors, followed by company, agent and trader channels in that order. The order in Figures 5 and 6 suggests that those selling directly to the companies and those processing their output are distinct from those operating through traders and agents. The subjective welfare result (Figure 6) in

particular tells a similar story to the narrative from the qualitative study, where we found that those operating through agents are the most discontented with their commercialisation arrangement.

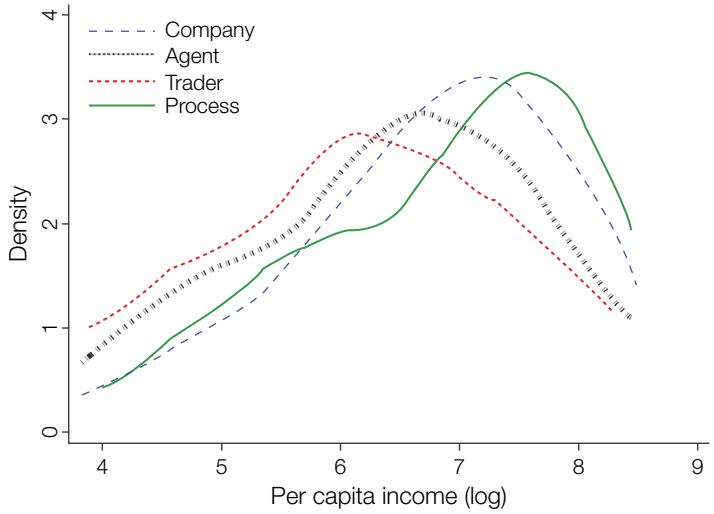
We must reiterate that one cannot tell whether these welfare differences are a consequence of participation in a particular channel or rather that particular households are able to take advantage of more remunerative channels (selling through companies or processing) because they are better off ex ante. Next, we report and discuss results that attempt at dealing with the identification issues.

Table 6.1 Averages of the welfare indicators by the OPC channel

Distance percentiles	Company (1)	Agent (2)	Trader (3)	Process (4)	F-stat p-val. (5)
Income (US$/capita)	1394	1094	953	1505	0.00
Composite welfare index	0.33	0.26	0.26	0.35	0.00
Subjective welfare	0.57	0.43	0.47	0.59	0.00

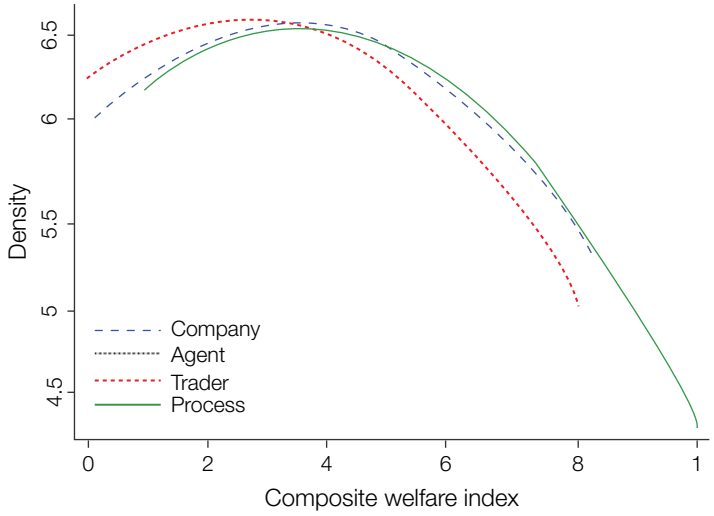
Note: p-values from F-tests for differences in means across the commercialisation channels.
Source: Authors' own

Figure 6.1 Kernel density estimation of per capita income



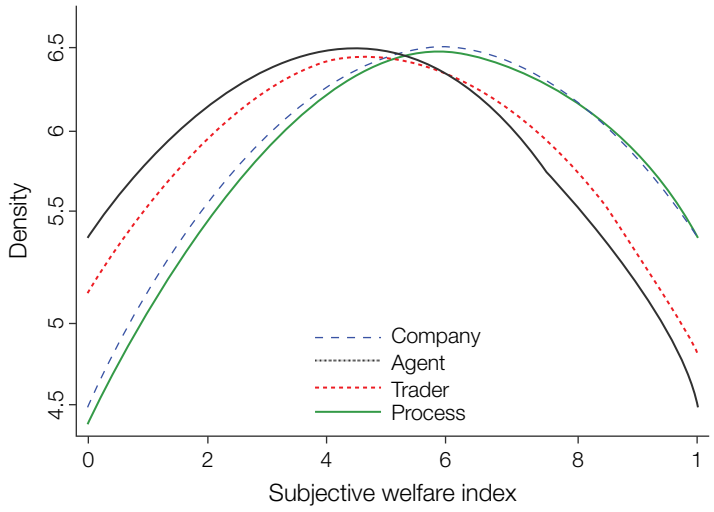
Source: Authors' own

Figure 6.2 Kernel density estimation of composite welfare



Source: Authors' own

Figure 6.3 Kernel density estimation of subjective welfare



Source: Authors' own

6.2.2 Parametric evidence after accounting for some confounders

While the results in the previous subsection tell us something useful about the correlation between the commercialisation channels and household welfare, they are not useful if we are interested in saying something about whether or not a particular channel is more welfare-increasing than another. While we still may not be able to claim that a commercialisation channel causes an increase in household welfare, we make attempts here at minimising the bias that may be associated with the naïve estimates reported above by providing a more systematic analysis of the possible effect of each commercialisation channel on household welfare.

We begin by providing results that adjust the estimated parameters of interest for possible endogeneity using the control function approach. That is, we first regressed the nominal commercialisation channel variable on the vector of plausibly exogenous variables (including the full set of instruments and district fixed effects) from which we derive the endogeneity correction terms that enter the welfare equations.

Because this first stage regression is of direct interest aside from providing the correction terms, we defer any detailed discussion of those results to the next section. However, it is important to report results of statistical significance tests of the IV coefficients in the MNL equations here. We have three IVs in each equation (i.e. the share of households that selected into each commercialisation channel in each location relative to distance to the nearest oil palm company). The F-statistic values (with three degrees of freedom) for testing joint significance in the equations are equal to 25.21, 20.55 and 18.37 in the company, agent, and trader equations, respectively. Furthermore, the F-statistic for testing joint significance across all the MNL equations (with 9 degrees of freedom) equals 24.72, which is larger than the threshold suggested by Stock and Yogo (2005) for avoiding the weak instrument problem.[6]

With these results, we provide the control function estimates in Table 5.2 together with the naïve estimates that do not adjust for possible endogeneity bias. However, before discussing the results, we need to deal with the issue of whether or not to adjust our standard errors for clustering. Based on evidence and insights from Abadie *et al*. (2017), our data structure wherein we first randomly sampled villages and then households within villages requires estimation of standard errors that account for village level clustering. Despite this, the number of clusters (i.e. 20 villages) may not be large enough given that estimations of such standard errors are based on asymptotic theory. The implication is that tests tend to over-reject the null hypothesis, meaning that we may conclude that an effect is statistically significant when in fact it is not. We therefore employ bootstrap-t procedures to account for the clustered nature of the data (Cameron and Miller 2015; Cameron, Gelbach and Miller 2008). This procedure works well with clusters of as few as six in some cases.

Columns 1, 3, and 5 of Table 6.2 represent the naïve estimates that have not adjusted for endogeneity of participation in the various channels of commercialisation. The corresponding instrumented regression results are reported in columns 2, 4, and 6. In the interest of brevity, we focus the discussion mainly on the results that account for endogeneity

Table 6.2 Welfare effects of the commercialisation channels: instrumented and non-instrumented regressions

Variables	Income per capita		Composite welfare		Subjective welfare	
	(1)	(2)	(3)	(4)	(5)	(6)
Company	−0.19*	−0.20*	−0.32*	−0.29	0.05	0.11
	(0.06)	(0.08)	(0.09)	(0.16)	(0.84)	(0.62)
Agent	−0.26**	−0.20*	−0.66***	−0.49***	−0.66***	−0.50***
	(0.02)	(0.09)	(0.00)	(0.00)		(0.00)
Trader	−0.56***	−0.51***	−0.68***	−0.61***	−0.52*	−0.30
	(0.00)	(0.00)	(0.00)	(0.00)	(0.08)	(0.26)
Female head	0.04	0.03	−0.34***	−0.37***	−0.20	−0.25*
	(0.77)	(0.82)	(0.00)	(0.00)	(0.17)	(0.06)
Head's age	−0.01*	−0.01*	−0.01	−0.01	−0.02**	−0.02**
	(0.06)	(0.09)	(0.37)	(0.45)	(0.03)	(0.05)
Mean age of adult members	0.01	0.01	−0.01	−0.00	−0.00	−0.00
	(0.18)	(0.14)	(0.63)	(0.83)	(0.93)	(0.93)
Number of female adults	−0.15***	−0.16***	−0.02	−0.02	0.18**	0.15*
	(0.01)	(0.01)	(0.85)	(0.84)	(0.01)	(0.06)
Number of male adults	−0.04	−0.04	0.11	0.14*	0.03	0.04
	(0.50)	(0.60)	(0.19)	(0.06)	(0.72)	(0.71)
Dependency ratio	−0.17***	−0.17***	−0.06	−0.05	0.06	0.05
	(0.00)	(0.00)	(0.11)	(0.25)	(0.56)	(0.64)
Couple households	−0.02	−0.03	0.12	0.12	−0.08	−0.18
	(0.88)	(0.79)	(0.32)	(0.33)	(0.70)	(0.37)
Migrant household	−0.05	−0.04	−0.17	−0.16	0.19	0.17
	(0.65)	(0.69)	(0.23)	(0.28)	(0.37)	(0.46)
Level of education (ref. is none)						
Primary	0.15	0.17	−0.14	−0.09	−0.05	0.01
	(0.33)	(0.28)	(0.29)	(0.57)	(0.81)	(0.98)
Junior high school	0.15	0.18	−0.11	−0.11	0.31	0.38*
	(0.14)	(0.13)	(0.35)	(0.44)	(0.11)	(0.05)
Secondary school and above	0.26***	0.24**	0.34***	0.28**	0.55***	0.55***
	(0.01)	(0.02)	(0.01)	(0.04)	(0.01)	(0.01)
Livestock wealth (TLU)	0.01	−0.02	0.10**	0.03	0.14*	0.09
	(0.89)	(0.66)	(0.02)	(0.51)	(0.05)	(0.26)
Land holding	0.03***	0.03***	0.04**	0.03**	0.05**	0.03
	(0.00)	(0.00)	(0.01)	(0.05)	(0.02)	(0.12)
Regular market present	0.52*** (0.00)	0.50*** (0.00)	0.19* (0.09)	0.10 (0.37)	0.35** (0.02)	0.33** (0.02)
Access to paved road	0.17	0.17	0.02	−0.02	0.33*	0.37**
	(0.28)	(0.28)	(0.91)	(0.92)	(0.06)	(0.04)
Nonfarm participation	0.59***	0.57***	0.21**	0.21**	0.01	−0.08
	(0.00)	(0.00)	(0.01)	(0.02)	(0.91)	(0.57)
Monthly transfers			0.03**	0.03**	0.06***	0.06***
			(0.02)	(0.03)	(0.00)	(0.00)
Ahanta West district	−0.51***	−0.43***	−0.64***	−0.49***	0.25*	0.34*
	(0.00)	(0.00)	(0.00)	(0.00)	(0.05)	(0.06)

Endogeneity correction terms						
Inverse mills ratio 1		–0.04		–0.10***		–0.04
		(0.12)		(0.00)		(0.38)
Inverse mills ratio 2		–0.04		–0.04*		–0.08**
		(0.17)		(0.08)		(0.03)
Inverse mills ratio 3		–0.00		–0.00		0.02
		(0.82)		(0.91)		(0.47)
Intercept	6.81***	6.26***	1.09***	–0.05	0.15	–0.42
	(0.00)	(0.00)	(0.01)	(0.93)	(0.78)	(0.56)
Observations	659	659	659	659	659	659
R-squared	0.29	0.29	0.29	0.28	0.18	0.19

Note: The p-values (in parentheses) are robust to village level clustering. *, **, and *** denote significantly different from 0 at 10 per cent, 5 per cent, and 1 per cent, respectively.
Source: Authors' own

of participation. We first carried out joint tests of the null hypothesis that household welfare does not differ across the commercialisation channels after adjusting the estimates for confounders. For the equations that adjusted for endogeneity, the F statistics for joint significance (with three degrees of freedom each) equal 4.31 (p-value = 0.005), 8.72 (p-value = 0.000), and 6.84 (p-value = 0.000) in the income, composite welfare, and subjective welfare equations, respectively. This means that we can easily reject the null hypothesis for all the welfare indicators and conclude that welfare differs significantly across the commercialisation channels even after adjusting for endogeneity of participation.

More concretely, we need to compare the welfare effects of the individual commercialisation channels. From both the qualitative study and the descriptive evidence provided in Table 5.1, one could expect those that process their own FFBs to be better off than those operating through the other channels; particularly those using agents and traders. Firstly, consider per capita income (columns 1 and 2).[7] After adjusting for endogeneity, we find that own-processor households obtain about 18 per cent, 19 per cent, and 40 per cent higher per capita incomes than households selling directly to the companies, through agents and to traders, respectively (column 2). While all these income differences are economically meaningful, the gaps between own-processors on the one hand and the company and agent-linked households on the other hand are not very precise (i.e. significant only at the 10 per cent level). Column 1 of Table 5.3 provides a pair comparison of per capita income across all four commercialisation channels. We also find that, after adjusting for endogeneity of participation, households selling directly to the companies are not significantly better off than those selling through the agents – a result that surprises us given the narrative from the qualitative study. However, selling directly to the companies or through agents is associated with approximately 27 per cent and 26 per cent higher per capita income, respectively, than selling to traders. Therefore, with respect to income, households selling to traders are at the bottom of the pecking order, which begs the question: why? We will return to this later.

We now turn to the more comprehensive composite welfare measure, which should be preferred to income as an objective welfare indicator since it is multidimensional in nature. The first important result is that the income premium that own-processor households enjoy over those engaging directly with the companies does not translate into superior composite welfare. That is to stay, although own-processing increases welfare by about US$9 monthly relative to selling directly to a company, the estimate is imprecise (std. err. = US$7).[8]

The second important result is that the income superiority of own-processing over selling through agents and traders is strongly sustained in the composite welfare equation, even after adjusting for endogenous participation; the monthly value of the marginal welfare gain from own-processing instead of selling through agents or to traders is about US$16 and US$19, respectively. Thirdly, although selling directly to a company rather than through an agent results in an average welfare gain of about US$6 monthly, we cannot rule out that this difference is due to chance (p-value = 0.180). However, selling to a company rather than to traders increases mean welfare by about US$10 monthly ($p$-value = 0.039) – but as column 3 of Table 5.3 shows, the welfare gap for selling through agents rather than traders is not different from zero (p-value = 0.301).

Table 6.3 Welfare effects of the commercialisation channel: pair comparison from non-instrumented regressions

	Per capita income (1)	Composite welfare (2)	Subjective welfare (3)
Process *versus* company	0.20*	0.29	–0.11
	(0.08)	(0.16)	(0.62)
Process *versus* agent	0.20*	0.49***	0.50***
	(0.09)	(0.00)	(0.00)
Process *versus* trader	0.51***	0.61***	0.30
	(0.00)	(0.00)	(0.26)
Company *versus* agent	0.01	0.20	0.61***
	(0.94)	(0.18)	(0.00)
Company *versus* trader	0.31**	0.32**	0.41*
	(0.05)	(0.01)	(0.08)
Agent *versus* trader	0.30**	0.12	–0.20
	(0.03)	(0.39)	(0.30)
Observations	659	659	659

Note: Estimated from the full regressions reported in Table 5.2, columns 2, 4 and 6. The p-values (in parentheses) are robust to clustering. *, **, and *** denote significantly different from 0 at 10 per cent, 5 per cent, and 1 per cent, respectively.

Source: Authors' own

Table 6.4 Welfare effects of the commercialisation channel: inverse-probability-weighted regression adjustment

	Per capita income (1)	Composite welfare (2)	Subjective welfare (3)
Process *versus* company	0.16	0.17	–0.18
	(0.27)	(0.29)	(0.42)
Process *versus* agent	0.25**	0.49***	0.48**
	(0.04)	(0.00)	(0.02)
Process *versus* trader	0.59***	0.63***	0.36
	(0.00)	(0.00)	(0.11)
Company *versus* agent	0.09	0.32***	0.66***
	(0.50)	(0.01)	(0.00)
Company *versus* trader	0.43***	0.46***	0.54***
	(0.00)	(0.00)	(0.00)
Agent *versus* trader	0.34***	0.14	–0.13
	(0.00)	(0.20)	(0.44)
Observations	659	659	659

Note: *, **, and *** denote significantly different from 0 at 10 per cent, 5 per cent, and 1 per cent, respectively.
Source: Authors' own

Finally, we consider households' own perceptions of their lives and living conditions (Table 6.2, columns 5 and 6). Column 3 of Table 5.3 shows the pair comparison of subjective welfare by the four commercialisation channels after adjusting for endogenous participation. The hypothesis that the level of happiness is the same across the channels can be rejected for three of the six pair comparisons as those processing their own output are happier than those who sell through agents, and those selling directly to the companies are happier than both those selling through agents and to traders (although the latter result is less precise).

We use two other techniques to assess the robustness of our findings in Table 5.2. The first is from the treatment effects framework based on the IPWRA procedure given the multivalued nature of the commercialisation

Table 6.5 Welfare effects of the commercialisation channel: selection-on-observables design

	Per capita income (1)	Composite welfare (2)	Subjective welfare (3)
Process *versus* company	0.40***	0.17	–0.18
	(0.01)	(0.29)	(0.42)
Process *versus* agent	0.37***	0.49***	0.48**
	(0.01)	(0.00)	(0.02)
Process *versus* trader	0.64***	0.63***	0.36
	(0.00)	(0.00)	(0.11)
Company *versus* agent	–0.03	0.32***	0.66***
	(0.79)	(0.01)	(0.00)
Company *versus* trader	0.25**	0.46***	0.54***
	(0.04)	(0.00)	(0.00)
Agent *versus* trader	0.27**	0.14	–0.13
	(0.01)	(0.20)	(0.44)
R-squared	0.36	0.32	0.22
Observations	659	659	659

Note: *, **, and *** denote significantly different from 0 at 10 per cent, 5 per cent, and 1 per cent, respectively.

Source: Authors' own

channels (i.e. the treatment variable). The results (Table 6.1) tell a similar story as those using the control function approach with two exceptions. Firstly, the mildly statistically significant income-based welfare premium from own-processing above selling directly to a company does not hold up to the IPWRA procedure (column 1). Secondly, the increase in marginal welfare value for selling directly to a company rather than through an agent is highly statistically significant when we use IPWRA, which is what we expected based on the qualitative results. We also find that the IPWRA results are generally more precise.

As a final robustness check, we use the less restrictive selection-on-observables design, where, as in Meemken and Bellemare (2020), we simply include village fixed effects in all our regressions and arguethat this adjusts our estimates for some unobserved factors that could affect both participation in the various channels and household welfare. In the interest of space, we present the main results in Table 6.2. In all cases, we bootstrap the standard errors by resampling over households using 10,000 replications. The conclusions regarding our main hypotheses from the income equation are similar to the control function estimates (column 1) although the income gaps are larger and more precise. For the composite welfare equation, we obtain one outcome that differs from the previous results. That is, the own-processor commercialisation channel yields a weak statistically significant mean welfare premium (about US$11 monthly) above selling directly to a company (p-value = 0.076). There are also two null hypotheses not in Table 6.5 that we could reject in the control function and IPWRA estimates: own-processor households are happier than those selling to traders, and those selling to market traders are happier than those selling through agents (although the latter channel yields significantly more income per capita).

To sum up, the results in this section show that (a) in some cases, choice of welfare indicator matters for identifying the welfare effects of participation in the identified oil palm commercialisation channels, (b) adjusting for endogenous participation and choice of identification approach could change the conclusions one might reach, (c) households selling directly to the oil palm companies and those who process their own output mostly have identical welfare, although there is mild evidence that own-processing could be more 'objective' welfare increasing, (d) while selling directly to a company or doing so through an agent seems to yield identical per capita income, the former channel is associated with significantly higher composite and subjective welfare than the latter, and (e) although selling through an agent yields higher per capita income than selling to traders, the former group are not better off when multidimensional and subjective welfare is considered.

7 SUMMARY AND CONCLUSION

Agricultural commercialisation is considered an important pathway to poverty reduction (Ogutu and Qaim 2019; Barrett, 2008), particularly in agriculture-based countries (World Bank 2007). However, commercialisation outcomes are not always identical across all groups of farmers, partly because of differences in commercialisation pathways. The commercial organisation of oil palm – Ghana's first internationally traded cash crop – presents a good case for studying varying ways through which farmers engage with value chains, the welfare effects of participation, and the correlation of participation across varying commercialisation models. We address these using a survey sample of 659 farm households from 20 villages in south-Western Ghana, complemented by qualitative data collected using key informant interviews, in-depth interviews and focus group discussions (separately for men and women).

Firstly, we find that although the literature documents the benefits of farmer participation in global value chains though various contractual arrangements between smallholders and agribusiness companies, such arrangements have all but disappeared in the oil palm belt of south-Western Ghana due to dissatisfaction with contractual arrangements and a general breakdown of trust between the market participants. While about 60 per cent of producers still sell their output to oil palm companies directly or indirectly through agents without formal contracts, the lack of trust in the new relationships as well as the absence of vibrant farmer cooperatives have resulted in farmers feeling that they do not reap adequate benefits from their oil palm enterprises. This is particularly the case for those using the services of agents. While the processing of palm fruits into palm oil has been present in most oil palm producing areas of Ghana for several decades, we find that the dissatisfaction with selling FFBs has led to increased interest in own-processing where possible.

Secondly, using multiple measures of welfare and identification strategies to at least minimise the bias resulting from welfare and choice of commercialisation pathways being jointly determined, we easily reject the hypothesis that the available oil palm commercialisation pathways yield identical welfare outcomes. Considering only objective measures of welfare, own-processing and direct sales to a company hold the best promise for increasing households' welfare; and selling to local market traders the worst. However, once we also consider subjective wellbeing, we find that the unhappiest and most discontented group is made up of those that engage the services of agents. They are the most dissatisfied with their commercialisation arrangement.

Thirdly, we have unravelled household and meso-level factors that promote or hinder participation in high return commercialisation channels. At household level, being an FHH, being a couple household, land holding, and distance to an oil palm company are significantly positively correlated with the likelihood of own-processing. At the community level, the availability of agro-services and a processing mill raises the likelihood of own-processing significantly. The likelihood of selling directly to a company, which is also welfare-enhancing relative to the remaining two options, is positively correlated with the availability of working capital, level of palm fruit output, and access to a paved road; but negatively associated with age of famer, distance to a company, and the presence of a processing mill in the community.

So, what are the implications of our results for agricultural commercialisation policy and practice? Given that own-processing and direct sales to oil palm companies are the most welfare-increasing options, these channels could be the target of interventions. Because the presence of a processing facility is the strongest predictor of own-processing, a PPP arrangement that provides an incentive for modern community-based mechanised processing facilities could boost processing and possibly enhance household welfare. For those who prefer dealing directly with the oil palm companies, infrastructure development – particularly improved roads, could make this possible and more beneficial as it reduces the cost of transactions. In addition, strong oil palm-based farmer associations, which we found to be missing in the study areas, could help lower the costs required for engaging directly with the companies. Such an initiative might need an external stimulus through an apex body such as the Oil Palm Development Association of Ghana (OPDAG) due to the breakdown of trust among locally organised groups. This trust could then be rebuilt over time.

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ENDNOTES

1. Ghana's Shared Growth Development Agenda (GSGDA II), 2016.
2. Our sample size calculations were based on four important statistical assumptions: (a) A 5 per cent level of significance (i.e., α = 0.05); (b) A 0.144 standard deviation of the outcome variables of interest for rural Western region, which was estimated using household dietary diversity scores based on the Ghana Living Standards Survey data (GLSS6); (c) less than 0.10 expected change (or difference) in our outcome variable (i.e., effect size < 0.10); and (d) statistical power of 80 per cent.
3. A farmer who is willing to supply fruits to B-BOVID regularly were to register their farms and upon being registered, a passbook is handed to the farmer, which serves as documentation of an informal agreement between farmers and B-BOVID.
4. We tested a non-linear age effect but found no evidence in support of such a hypothesis.
5. See the appendix accompanying their article.
6. The joint test statistics reported by Stata from the MNL first stage regression are chi-squared distributed, but we convert this to F-statistic by simply dividing by the numerator degrees of freedom.
7. Note that because the dependent variable is log of income, the exact percentage difference in income between the commercialisation channels is computed as $\%\Delta income = 100 \bullet [\exp(\hat{\varphi}_k) - 1]$ where $\hat{\varphi}_k$ is the estimated coefficient on a given commercialisation channel dummy.
8. Given that the asset measures are indices, we simply divided the relevant coefficients by the monthly transfer coefficient which is in US dollars to obtain results that are more comprehensible.

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