Can employment empower women? Female workers in the pineapple sector in Ghana.

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Abstract:

The transformation of global agri-food systems has led to the increased establishment of export-oriented horticultural plantations in developing countries. These labor intense production sites are associated with feminized employment patterns and therefore can provide more paid work opportunities for women in rural areas. The social implications of these developments for women's empowerment remain hardly understood; which is why we investigate empowerment among female workers in the pineapple sector in Ghana, in this paper. Our data set contains primary survey data of 420 married households in Ghana, living in areas of large-scale pineapple plantations. We apply entropy balancing, a new re-weighting technique, and combine this with regression analysis. Our regression results show that female employment has a statistically significant and positive effect on overall household income, female income share, female income and asset ownership and a negative effect on female reproductive workload. We also assess the effect of sole male employment and find that it has a negative effect on female household income share, female income and the female spouse's ability to sell assets and a positive effect on reproductive workload. Neither female nor male employment alone but only joint horticultural employment of both spouses seems to lead to female spouses having more input into household decision-making. Our findings for the pineapple sector in Ghana suggest that large-scale, export-oriented horticultural plantations can contribute to women's empowerment through employment creation for both male and female workers.

Keywords: Women's empowerment, horticultural employment, household decision-making

JEL Codes: D13, J16, J43

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1. Introduction

In recent years, the globalization of agri-food systems has led to an increased integration of developing countries into modern supply chains. Particularly the production of high-value horticultural crops has been fostered by the participation in international trade and foreign-direct investments. The trend towards the consolidation of production units to exercise better control over imposed standards has led to the establishment of labor-intensive production sites, specifically large-scale horticultural and floricultural plantations (Maertens and Swinnen, 2012). These developments are associated with feminized employment patterns as companies often prefer women workers over men due to their perceived dexterity and "nimble fingers" to handle delicate produce (Barrientos et al., 2003). At the same time, companies may perceive women to be more docile than men - accepting lower reservation wages and adverse working conditions. With the ability for women to contribute a stable and potentially permanent income to their household's income, the question remains whether this also leads to women's increased empowerment and higher bargaining power in the household. But work in export-oriented plantation agriculture is often linked to job insecurity, poor working conditions and insufficient wages (Oduol et al., 2017). Its potential for generating social benefits has been questioned (Dolan, 2004). At the same time, interventions to reduce gender inequality at the household level but also in the context of labor and land markets are being discussed in the wider policy context of the Sustainable Development Goals. A study commissioned by the World Bank estimates that gender equality in earnings could increase human capital wealth by 21.7% globally and total wealth by 14% (Wodon and de la Brière, 2018). It further highlights that disadvantages in the work environment such as informality, part-time work and a substantial gender gap in earning can decrease women's bargaining power and voice. On the other hand, economic inclusion of women can improve distributional dynamics within households (Ianchovichina and Leipziger, 2019).

So far, there are only a few studies that address the question of female empowerment through horticultural employment. The majority focuses on the role of female employment specifically on women's empowerment and do not consider the employment status of other household members on female empowerment outcomes. Studies focus on either the gendered nature of modern supply chains in general (Barrientos et al., 2003; Dolan and Sutherland, 2002; Maertens and Swinnen, 2012) or discrimination and exploitation at the workplace (Barrientos et al., 2005; Dolan, 2004). Some exceptions exist. Said-Allsopp and Tallontire (2015) assess the Kenyan tea and cut-flower industries and provide evidence on female worker's greater self-reliance, financial independence and improved resistance of men's domination. Maertens and Swinnen (2012) indicate that 94% of women workers in export-oriented horticultural companies in Senegal report that their decision-making power in the household has increased, 67% that they enjoy more respect within their community, and 78% that they benefit from meeting and exchanging with other women in the companies. Having extended the same dataset through multiple survey rounds, Van den Broeck and Maertens (2017) find that women's employment especially improves the subjective well-being of the poorest women – predominantly through an income effect.

Newman (2002) finds a significant impact of women's participation in formal employment in the cut flower industry in Ecuador on men's participation in housework. However, not all studies find female horticultural employment to be favorable for women's empowerment. Friedemann-Sanchez (2006) evaluates the implications of female and male employment in the Columbian floricultural sector regarding ownership of assets and property. She points out that even though male and female workers' wages are comparatively equal, female workers cannot use their wages to accumulate assets or buy property in the way that male workers can due to women's financial responsibilities towards their households. For the flower industry in Ethiopia, Hjort and Villanger (2011) document a significant increase in physical violence against female workers (13%) and emotional abuse (34%) by their husbands and explain this as men's reaction to changing gender roles. Heath (2014) confirms the connection between female employment and domestic violence in Bangladesh, particularly for women who married young and have low education levels.

We contribute to the literature in three ways: (1) by using a quantitative survey-based method we add to the scarce existing empirical evidence on female empowerment in modern agri-food systems; (2) by applying a wide variety of indicators we provide a multidimensional analysis of women's empowerment and (3) by differentiating between female only, male only and joint horticultural employment in the household we perform a more in-depth analysis of the drivers of women's empowerment through horticultural employment.

2. Conceptual framework

2.1. Women's empowerment and female bargaining power in the context of modern agri-food systems

Theoretical underpinnings of women's bargaining power and female empowerment are related to the functioning of a household. The literature differentiates between two main household modeling approaches. Neoclassical household models assume households to have a single utility function and consider them as a single decision-making entity, where all household members jointly work towards a common interest (Donni and Ponthieux, 2011; Becker, 1981; Becker, 1974). Labor supply, income and asset resources are considered observable indicators of the household's approach to maximize its welfare (Vermeulen, 2002). Labor is allocated according to the comparative advantage of each household member. Based on Becker's reasoning, the choice of the wife to take up work depends on the income of the husband (Becker, 1981; Becker, 1974). The higher his earnings, the less likely it is that his wife will seek to generate an income, for example through participating in the workforce.

However, unitary household models have been highly contested and alternative models depart from the unity assumption within a household (Browning and Chiappori, 1998; Haddad et al., 1997; Anderson et al., 2017). Asymmetric power and gender relations as well as social norms influence expenditure choices and gender-specific divisions of labor. Bargaining models are based on the recognition that household members may have different preferences and interests (Quisumbing, 2003).

It is assumed that the individual bargaining power depends greatly on alternative or outside options spouses would find themselves in when separating (Anderson et al., 2017). The so-called threat point is therefore linked to the spouse's net income as well as the marriage market (Donni and Ponthieux, 2011). Such household models assume that income and assets are also used for influencing household decisions and affect bargaining power. The women's sole or joint decision-making authority concerning different areas in the household is therefore often considered a reflection of their level of empowerment (Acosta et al., 2019; Alkire et al., 2013; Doss, 2005). Linking these assumptions to the choice of participating in the labor market, household members choose to supply labor based on their individual labor and budget constraints, and personal objectives. Consequently, the wife's decision-making regarding income generating activities is also directly linked to the allocation of resources within the household. However, because bargaining power is indeed used to acquire assets and to decide whether to enter the labor market, the direction of effects is not straightforward.

Our focus and approach on women's empowerment implicitly assume a non-unitary household bargaining model in which women's labor allocation to employment is hypothesized to influence their bargaining power within the household. To assess women's empowerment, we follow Kabeer's (1999) definition of empowerment as expansion of people's ability to make strategic life choices. She relates the ability to exercise choice to three connected dimensions: resources (pre-conditions), agency (processes), and achievements (outcomes). Resources include economic (e.g. income or assets), human (e.g. education) but also social resources such as a supportive network. Kabeer (1999) identifies agency as the capacity to define personal goals based on motivation and purpose. This reflects the ability to transform these choices into preferred outcomes (Narayan, 2005) through the use of influence, voice and skills (Kabeer, 2008). Finally, achievements are the result of using resources and agency to translate preferences into outcomes. Studies have found positive correlations between women's enhanced decision-making power and outcomes such as better maternal and child health, increased expenditure on education, and household nutrition (Anderson et al., 2017). In our study we measure women's empowerment through both objective indicators of resources and subjective indicators of self-reported agency and use a variety of indicators to represent these two domains of empowerment. We thus focus on the pre-conditions and processes that empower women to achieve their desired outcomes, rather than on the actual outcomes that depend not only on empowerment per se, but also reflect personal preferences and interests. Kabeer's model assumes an impact pathway from resources to outcomes through agency. We do not test any assumption along this impact pathway but rather consider the three domains as contributing separately to women's empowerment. Kabeer (2008) herself acknowledges that resources mobilized through economic activities may constitute independent pathways to women's empowerment.

We identify four potential ways of how horticultural wage labor could influence empowerment. First, horticultural employment generates a higher income in comparison to other income-generating

activities in rural areas, like agricultural production or small-scale businesses. Therefore, workers can generate substantial financial resources and provide a significant contribution to the household income. This may enable them to acquire and control household assets, such as motorized vehicles or agricultural assets. Second, workers receive regular trainings during their employment. These trainings range from first aid to management skills and learning about product hygiene and handling. The acquired knowledge may be applied to agricultural production of the household and therefore can contribute to more female input into agricultural decision-making. Third, many workers are engaged in labor unions on the plantations. As labor unions ensure that worker's opinions are considered in the company, this requires workers to establish and sometimes voice their viewpoints. The involvement in representation bodies in the workplace may also lead to more engagement outside the company. Fourth, because particularly women may be more confined to the homes and local communities due to their reproductive responsibilities, those women that are employed outside their home may be exposed to a greater variety of perspectives and way of thinking. As workers are usually allocated into task teams, they engage and communicate with different people during the day. The exposure to different ideas and the ability to use their voices may well enhance the agency of female workers.

The implications of employment and especially female employment have been discussed from various viewpoints in the wider women's empowerment literature. Women who work are perceived to provide more value to the household. Some of the reasons for women to take up work are therefore the wish for independence from the husband, greater equality within the partnership and security in case the marriage fails. The pathways are not so clear-cut however. It is argued that women's participation in the labor market may already be an indicator of their empowerment. Being able to work means to have overcome certain constraints within the household and therefore only women who are more empowered to begin with, are able to enter into the workforce. However, initial bargaining power is not the only reason for women to take up work. Also, poverty and economic stress have been identified as drivers of female employment. Additionally, time is another major factor of women's ability to take up paid work or resort to less productive use of their time to generate an income, such as informal or self-employed work.

2.2. Measuring women's empowerment

We differentiate between objective and subjective indicators of women's empowerment to measure the two dimensions of women's empowerment, namely resources and agency.[1] By assessing

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[1] For the specific indicators we select and expand upon suggestions put forward within the framework of the Women Empowerment in Agriculture Index (WEAI), developed by Alkire et al. in 2013. The WEAI is designed to quantitively measure agricultural empowerment among male and female smallholder farmers (Ragsdale et al., 2018). We refrain from composing an index as it provides a too narrow view in our case. The WEAI focuses on measuring empowerment within five domains of agricultural livelihoods: production, resources, income, leadership and time. For our purpose, we use resources, income and time indicators as outcome variables. We also focus on empowerment at the household level and therefore exclude leadership indicators, such group membership or comfort in public speaking.

the proposed indicators collectively rather than individually we are able to obtain a more comprehensive picture that captures different aspects of women's empowerment. However, we acknowlwedge that we can only measure proxies for women's empowerment given the fundamental psychological and psycho-social processes that contribute to the development of self-confidence, self-esteem and self-worth (Rowlands, 1997).

Overall contribution to the income and income share by female spouse

We assess (1) the total annual household income (in log), (2) the female spouse's income level in Ghanaian Cedi and (3) the female spouse's share of the household income to identify the contribution of female wages to generating financial resources for the household. We consider the ability to increase household income to be an indicator of women's empowerment, because a higher household income provides for household monetary wealth. Those household members contributing to household income therefore may be indeed considered valuable to the household's welfare, possibly even more so than household members who only provide non-monetary or less monetary contributions to the household's livelihood. We assume that women's participation in horticultural wage labor leads to a higher income for women in comparison to less effective and less stable income-generating activities, such as agricultural production or small-scale self-employed businesses. Higher income levels also mean that women contribute a higher share to the household income. The ability to obtain an individual income is considered an indicator of empowerment, as it allows women to consume and invest in line with their preferences, such as personal items or their children's well-being. Empirical evidence shows that an autonomous income for women has implications for their bargaining power within the household and for investment in children (Duflo, 2012; Maertens and Verhofstadt, 2013). This implies that she herself can decide over the use of her income. In Ghana, households do not commonly pool incomes and therefore it is likely that female spouses can use their incomes for their preferred choices (Chen and Collins, 2014).

Asset ownership and ability to sell assets

We identify (4) the share of asset categories owned solely by the female spouse or jointly by both male and female spouse. For this purpose, we consider a range of asset categories that are suitable in the Ghanaian context (motorized vehicles, TV set, radio, fans, freezer, gas stove, kente cloth, small animals, and poultry). In addition to information on asset ownership, we also use information on who can decide to sell assets. Based on this information, we calculate (5) the share of asset categories that the female spouse can sell, either independently or together with the male spouse. The ownership of assets and the ability to sell assets are stronger indicators for empowerment than income, as assets are perceived as being more durable and stable. As bargaining power can only be assessed in relative terms against that of other household members (Doss, 2005), these indicators are quantified as the share of assets owned and sold. We assume that horticultural wage labor contributes to increased ownership of assets particularly through the income pathway. Choosing asset ownership as a measure of bargaining

power within the household is based on empirical evidence such as Doss (1996), who shows that assets held by women in the household have implications for household expenditure decisions in Ghana. Empirical evidence also shows that across different contexts world-wide, including in for example Ghana, Kenya and Northern Nigeria, women predominantly have fewer assets than men (Deere and Doss, 2006). A comprehensive synthesis report on gender, household decisions and development (Quisumbing, 2003) finds that an increase in women's control over land, physical and financial assets leads to positive development outcomes at the household level, particularly for outcomes that are associated with women's preferences, such as food security, child nutrition and education.

Reproductive workload

We identify (6) the female spouse's reproductive workload, which is based on the sum of time spent on indoor chores in hours per day (domestic chores such as food preparation, cleaning, washing clothes), outdoor chores (domestic chores such as fetching water, collecting firewood), and care activities (care activities for children, the elderly, the sick). Women in particular are vulnerable to so-called 'time poverty' due to excessively long work hours as they are usually responsible for reproductive tasks such as household chores and childcare activities, in addition to productive tasks and income generation (Bain et al., 2018). In Ghana, most men (65%) spend less than 10 hours per week on reproductive activities while 89% of women spend at least 10 hours per week on such activities and often more (FAO, 2012). Unpaid care work poses a major constraint on the life options for women – independent of the fact that women themselves may indeed attach great values to their roles as wives, mothers and daughters (Kabeer, 2008). Thus, when time-consuming employment activities are taken up, overall workload of women usually increases, which is often considered „the cost of empowerment". However, depending on the bargaining between spouses, female uptake of horticultural wage labor may also lead to a reallocation of reproductive activities among family members (Newman, 2002). Against this background, we choose the 'time spent on reproductive tasks' as an indicator to reflect women's empowerment within the household.

Decision-making power over household decisions

Finally, as subjective indicators of women's empowerment (7) we analyze the self-reported input into various areas of household decision-making, ranging from minor household expenditures to agricultural production decisions. As a measure of agency, to reflect the bargaining process and the feeling of empowerment for women, we evaluate the different spheres of decision-making within the household. We apply a scaling approach to identify the influence on decision-making of the female spouse regarding (a) major household expenditures (large appliances for the house or investments), (b) minor household expenditures (food for daily consumption or other household needs), (c) crops that are grown primarily for household food consumption, (d) crops that are grown primarily for the sale in the market, (e) non-farm economic activities (such as small businesses, self-employment activities etc.), (f)

wage and salary employment and (g) children's education and health. The scale ranges from 1= "No input" to 4= "Input into all decisions in the respective category".

Table 1 Description of variables measuring indicators of women's empowerment

Dependent variables	Type	Variable definition
HH Income	Continuous	Overall household yearly income in log, measured in GHS – accounting for household income from all wage employment, self-employment, value of sold agricultural production and other income sources, e.g. pensions
Female income share	Continuous	Share of the household income that the female spouse generates
Female income	Continuous	Overall yearly income, generated by the female spouse, measured in GHS – accounting for income from all wage employment, self-employment, value of sold agricultural production and other income sources, e.g. pensions
Female asset ownership	Continuous	Share of asset categories (vehicles, TV set, radio, fans, freezer, gas stove, kente cloth, bank account, small animals, poultry) owned solely by the female spouse or jointly by both spouses
Accra capital city	Dummy	Female spouse travels to the capital city Accra alone
Female reproductive workload	Continuous	Female spouse's reproductive workload as the sum of Indoor and outdoor chores and care activities for children or the elderly, measured in hours.
Female spouse's self-identified input into decision-making regarding:		
…major HH expenditures	Categorical	The range of responses is from 1=No input to 4=Input into all decisions.
…minor HH expenditures	Categorical	
…HH food crop production	Categorical	
…HH cash crop production	Categorical	
…HH non-farm activities	Categorical	
…HH wage labor activities	Categorical	
…kid's education & health	Categorical	

3. Data and methods

3.1 Study setting

We select the Ghanaian pineapple sector as case study for a modern supply chain because it is one of the country's most important horticultural export crops. In 2011, Ghana's export volume of fresh and processed pineapple was worth 51 Million USD and therefore represents the 6th most important export crop in terms of value (Gatune et al., 2013). About 15 large-scale plantations produce pineapples for the export market, eight of which make up for 93% of Ghana's pineapple exports. They are located predominantly in rural areas along the coastline of Ghana, in the Greater Accra, Eastern, Central and Volta Region – close to the harbour and airport (Fold and Gough, 2008). The sector has been established for a relatively long time period of 15-20 years. This provides a good setting to assess research questions that reflect a slowly changing cultural and social process such as female empowerment. Plantations are

set up at the periphery of settlements in relatively populated areas where they can source labor easily. Only about 17% of the sampled workers have moved to the area to look for work. Most workers are therefore locals from the surrounding villages of the companies and did not specifically migrate to this area for work opportunities. To recruit workers, the companies share the availability of positions within the local communities and rely on word-of-mouth through their own staff. Even though men and women are to a certain extent hired for different tasks, companies do not apply different recruiting mechanisms for men and women.

In Ghana, languages correspond to the main ethnic groups (see figure A.1). Our data is sourced from the Greater Accra, Eastern, Central and Volta Region. Whereas Greater Accra Region and Volta are dominated by patrilineal ethnicities (Ga and Ewe ethnicity respectively), Eastern and Central Region are dominated by the matrilineal Akan ethnicity. However, as is pointed out by Lambrecht (2016), the translation of kinship structures into social patterns and rules has merged across regions and different ethnicities. For example, it is common for women in both matrilineal and patrilineal societies to move to their spouse's house after marriage (Lambrecht, 2016). Other practices diverge across similar ethnicities. In the patrilineal society in Volta women can rent and buy land, this is not the case for the patrilineal societies in the East- and Upper-West Region (Lambrecht, 2016). This is also the reason why we choose to account for regional differences rather than ethnic differences in the analysis.

Ghanaian households commonly consist of the nuclear family and sometimes additionally extended family members, such as siblings, parents, aunts or uncles of the couple. Polygamy has drastically decreased in Ghana in past decades (Doss, 2005). In rural households of southern Ghana where also pineapple production takes place, only 0.6% along the coast and 1.3% in the forest zones are recorded to be polygamous (Lambrecht, 2016). In our data set, we only record 8 polygamous households. According to the Ghana Living Standard Survey 6[2] the clear majority (82.5%) of households living in rural areas is involved in farming – including 81.3% in rural forest and 64.7% in rural coastal areas (Ghana Statistical Service, 2014). Most households grow food crops, such as maize and cassava, from which they sell what the household does not need. Few households focus on cash crop production of pineapple, tomatoes, pepper or okra. Like in other African settings, women are often responsible for the cultivation of food crops and men for cash crops. But labor is divided also across crops, with land clearing and tilling being mostly a man's task and women sowing, weeding and harvesting (Duncan, 2004). Looking into ownership patterns of land, 85% of agricultural land plots are owned by men, 9.8% by females and 3.5% jointly (Doss, 2005).

When it comes to wage employment in general, men are much more likely to be employed than women: 11.7% of women in comparison to 29.5% of men are engaged in formal wage employment

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[2] The Ghana Living Standard Survey (GLSS) 6 is a nationally representative dataset that has been collected by the Ghana Statistical Service from October 2012 to October 2013.

(Ghana Statistical Service, 2015). In rural areas, only 4.5% of women in comparison to 12.9% of men are employed in private companies, public and non-profit organizations (Ghana Statistical Service, 2015). Instead, women are predominantly engaged in unpaid household work and (non-) agricultural self-employment, such as petty trade, food processing and selling or hair dressing and tailoring (FAO, 2012). It is quite common for rural households to operate small-scale businesses (36.8%, Ghana Statistical Service, 2014), which are largely run by women (69.1%, Ghana Statistical Service, 2014). Self-employed men often work as masons or drivers.

In the Ghanaian context, it is particularly relevant to investigate changing gender patterns. Studies on women smallholder farmers in Ghana have identified gender-based inequalities in access to farming plots, to agricultural inputs and services as well as agricultural decision-making (Ragsdale el al. 2018; Lambrecht, 2016; Doss, 2002). Particularly the country's agricultural transformation may contribute to changes in gender-based access to resources and ultimately women's empowerment. Ghana is integrating into modern agri-food systems through the increased production of high-value export crops such as pineapples, mangoes and horticultural products. This has been particularly supported by the country's political stability in the West African Region and its close vicinity to Europe. Additionally, improvements of infrastructure and business environments have attracted foreign investments (Wiggins and Leturque, 2011; Fold and Gough, 2008). Also, urban consumers in Ghana are increasingly demanding high value produce such as salads, which are mostly provided through emerging supermarkets rather than local food sellers (Wiggins and Leturque, 2011). These developments have implications for women smallholder farmers, and gendered employment and production patterns as empirical evidence already shows (Said-Allsopp and Tallontire, 2014; Rao and Qaim, 2013; Maertens and Swinnen, 2012).

3.2 Survey implementation

We collected original household data in 2015. In a first sampling stage, we purposefully selected eight pineapple plantations that are comparable to each other by choosing those similar in size and scale of capacity. All companies belong to the largest and most productive ones in the sector and can therefore be considered as drivers of the sector. In our context, this is relevant because those agricultural companies that are able to sustain their business over a substantial period of time also have the largest implications for social change and rural development. In a second sampling stage, from the eight selected companies we received lists of villages, from which workers are sourced. We obtained lists of workers within each village, from which we randomly sampled worker households to be interviewed. In addition, we worked with extension workers to receive an overview of villages within the surrounding area of the selected pineapple plantation. We cross-referenced these lists. To generate a control group, we randomly selected non-working households in the same villages. Additionally, we included three villages where no households are employed on pineapple plantations. We asked the extension workers to list additional villages where no workers lived, from which we randomly sampled those three villages.

Our sample consists of 532 households. To allow a more accurate assessment of intra-household bargaining processes, we only incorporate those households that have two decision-makers and exclude all single households for our empirical analysis. We refer to the main decision-makers as male and female spouse in order to utilize a neutral terminology. Due to the exclusion of single-headed households our sample size is reduced to 420 observations. We differentiate between (1) households where only the female spouse is employed on a pineapple plantation *(n=98)* (2) households where only the male spouse is employed on a pineapple plantation *(n=117),* (3) households where both spouses are employed on a pineapple plantation *(n=55)* and (4) households that are not employed on a plantation *(n=150).* A structured questionnaire was used for the survey, which incorporated questions on household characteristics, family health and education levels, land ownership and agricultural production as well as employment conditions, provision of services, and labor union involvement in the companies. For questions regarding income the household respondent was asked to estimate the income generated by each household member. Based on this information we then calculated the share of income the female spouse contributed to the household income. For questions regarding asset ownership we asked the household respondent to identify all household assets from a list of choices. For each item the respondent was asked to whom the asset belonged and whether he or she was also able to sell the asset. An individual-level questionnaire with questions on time allocation, and decision-making power was administered only to the female spouse in the household in a secluded and private setting[3].

3.3. Estimation strategy

To estimate the effect of horticultural employment on indicators of women's empowerment we estimate the following regression model:

(1) $$WE_i = \alpha_0 + \alpha_1 FE_i + \alpha_2 ME_i + \alpha_3 JE_i + \alpha_4 X_{hh} + \varepsilon_i$$

where (WE_i) is the indicator of women's empowerment, FE_i is female wage employment, ME_i is male wage employment, JE_i is joint wage employment of the male and female spouse, X_{hh} is a vector of other individual and household characteristics, the alphas α are parameters to be estimated and ε is a random error term. Women's empowerment (WE_i) is measured through various indicators as described in the previous sections, and separate regressions are run for each indicator. For continuous outcome variables (household income, female income, female income share, female asset ownership, female ability to sell assets, female reproductive workload) we use OLS estimation. For categorical indicators of input into decision-making, which is measured via a rating with four levels, we estimate ordered Probit models. Because not all households are engaged in all areas of measured decision-making, the

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[3] Within the 8 polygamous households, only one of the two female spouses was interviewed according to their availability.

sample size varies across regressions in respect to whether the domain is relevant for the individual household.

We assess the possible effects of modern agri-food systems on women's empowerment through both female and male employment on pineapple plantations. As main explanatory variables we use (1) a treatment dummy that takes a value of one if only the female spouse of the household is employed on a plantation and zero if otherwise (FE_i), (2) a treatment dummy that takes the value of one if only the male spouse of the household is employed on a plantation and zero if otherwise (ME_i), and (3) a treatment dummy that takes a value of one if both spouses are employed on a plantation and zero if otherwise (JE_i). The control group in our sample consists of those households where no spouse engages in horticultural employment on a pineapple plantation. The control variables have been selected in accordance to previous literature on women's empowerment and include among others the education levels of the spouses, size and religion of the household.

As also discussed in section 2, estimating the effect of female employment on horticultural plantations on female empowerment is not straightforward, because of potential selection bias and reverse causality. In addition to empowerment being influenced by employment, the female spouse's choice in work activity may well be the outcome of her existing bargaining power (Basu, 2006). On the one hand, more empowered women may self-select into employment. It is possible that only those women with significant bargaining power can overcome household constraints and are sufficiently mobile to take up employment outside the household. On the other hand, less empowered women may self-select into employment with the aim to increase their bargaining power in the household. We intend to reduce this potential bias by including two proxy variables for initial empowerment of the female spouse in our vector of explanatory individual and household characteristics: the age gap between the spouses and the education gap between the spouses (Anderson et al., 2017). To further reduce potential bias, we apply an entropy balancing method in addition to the unweighted regressions (Hainmueller, 2011).

We combine regression analysis with entropy balancing, a new technique that effectively balances the conditioning variables and improves the comparability between treatment and control groups. Entropy balancing reweights the control group observations on balancing requirements (same mean, variance, and skewness). Among the possible sets of weights that fulfill these requirements, entropy balancing chooses those that deviate as little as possible from uniform weights (Marcus, 2013; Hainmueller, 2011). The counterfactual mean is estimated as follows:

(2)
$$E\left[Y\widehat{(O)}|D=1\right] = \frac{\sum_{\{i\,|\,D\,=\,0\}} Y_i w_i}{\sum_{\{i\,|\,D\,=\,0\}} w_i}$$

where every control group observation receives an entropy balancing weight w_i. These balancing weights are identified via a reweighting scheme that minimizes the entropy distance metric as

described in Hainmueller (2011). In comparison to using propensity scores, which can lead to a decreased balance of some covariates, entropy balancing improves balance for all conditioning variables and is therefore more effective (Marcus, 2013). We select the same conditioning variables for entropy balancing as for the control variables in the outcome regression, which are assumed to be unaffected by female employment. Conditioning variables before and after balancing are reported in appendix table A.2. We then use the entropy balanced data to estimate regression (1).

5. Results and discussion

5.1. Descriptive statistics

To relate the potential pathways of women's empowerment in the context of our study, it is important to understand working conditions in and company characteristics of the sampled pineapple plantations in Ghana. Table 2 provides us with information on workplace characteristics, the types of jobs workers are engaged in and the services that are provided by the company. The female workers in our sample work on average 7.83 hours a day and therefore slightly less than male workers, who work on average 8.28 hours a day. Most men and women (73%) have a permanent work contract. This means that their employment on pineapple plantations represents their dominant work activity for income generation. At work, they receive trainings ranging from product and personal hygiene to first aid. They are also trained in their particular work task, contributing to their human resources. About 40% of interviewed female workers and about 30% of male workers report to have participated in at least one training in the past 12 months. Unionization of workers is common in Ghana. Most pineapple plantations in our study have a company labor union; and 40% of female workers and 38% of male workers are members of such a union. When it comes to their individual jobs, most women are engaged in washing and packaging of pineapples or field maintenance including soil preparation and weeding. Other work categories are more male-dominated, such as chemical application. More men also work in technical and administrative jobs.

Table 2 Workplace characteristics of horticultural wage workers in the sample

	Variable	Female horticultural worker (n=98) Mean Value	Male horticultural worker (n=117) Mean Value
Workplace characteristics	Work hours per day	7.58 (1.88)	8.28 (2.23)
	Average years of employment	5.15 (4.07)	6.76 (5.05)
	Permanent contract	73%	73%
	Participated in a training in the past 12 months	39%	29%
	Number of trainings received in the past 12 months	1.48	1.05
	Labor union present at the company	52%	60%
	Labor union membership	40%	38%
Type of job	Planting and Harvesting	20%	15%
	Export and Packaging	24%	8%
	Field preparation and maintenance	26%	18%
	Sucker management	17%	7%

Chemical application	6%	19%
Technical management including agronomy	3%	11%
General management including administration and supervision	0%	9%

Table 3 provides an overview of characteristics of households where (1) only the female spouse is employed on a pineapple plantation, (2) only the male spouse is employed on a pineapple plantation, (3) both spouses are employed on a pineapple plantation in comparison to households that do not work on a plantation at all. We see that overall there are only few differences between these groups. They are comparable regarding household demographics in terms of age of the spouses, their religious affiliations, and the number of dependents. Educational attainment is similar across the groups except for those households where both spouses work on a plantation. Fewer female and male spouses in that group assess their ability to read and write to be adequate. Living conditions are also comparable across households, including access to improved sanitation (approx. 20%), clean drinking water (approx. 80%) and electricity (approx. 85%). Only about 10% of the households own a gas stove, which implies a high demand for firewood for which women are responsible to collect. Distances to points of services (markets, health centers, schools) are comparable only to a certain degree. The group of households, where the male spouses are employed on pineapple plantation, live closest to the nearest marketplace, primary school and health center, including clinics and doctors' offices that provide health services. Households where both spouses work on a plantation live closest to Accra capital city and furthest from health centers. It is not surprising to see a large difference in terms of the ownership and usage of agricultural lands. Households that are not engaged in horticultural employment have significantly more land than the comparison households. This is in line with the hypothesis that particularly the landless and near landless self-select into horticultural wage employment.

Table 3 also provides an overview of the individual sources of income for the households, such as income from horticultural wage employment or self-employment (such as trading or business). Horticultural employment in comparison to other sources of employment is the largest income source for households engaged on plantations. The most important income sources for households that do not work on plantations is small-scale businesses, followed by agricultural production.

Table 3 Descriptive statistics of individual and household characteristics

Variable	HH with only female spouse working on plantation (N = 98) Mean	HH with only male spouse working on plantation (N = 117) Mean	HH with both female and male spouse working on plantation (N = 55) Mean	HH not working on plantation (N = 150) Mean
Age of male spouse	41.36 (9.68)	39.50 (10.28)	38.02* (8.58)	40.56 (9.74)
Age of female spouse	36.65 (8.78)	33.54 (9.62)	33.44 (7.71)	35.17 (9.57)
Number of dependents	2.30 (1.60)	2.27 (1.61)	2.24 (1.56)	2.42 (1.66)
Male spouse has no schooling	0.14	0.09	0.17	0.13
Male spouse has primary schooling only	0.17	0.13	0.24	0.20
Male spouse has secondary schooling or higher	0.68	0.78*	0.59	0.67
Male spouse is literate	0.66	0.71	0.52**	0.67
Female spouse has no schooling	0.26	0.26	0.37	0.29
Female spouse has primary schooling only	0.27	0.30	0.35	0.27
Female spouse has secondary schooling or higher	0.48	0.44	0.28**	0.44
Female spouse is literate	0.45	0.38	0.28**	0.43
Protestant	0.20	0.25	0.20	0.21
Pentecostal	0.68*	0.54	0.62	0.57
Catholic	0.07	0.08	0.07	0.06
Muslim	0.01	0.04	0.5	0.04
Traditional	0.03**	0.09	0.05	0.11
Access to improved sanitation	0.27	0.21	0.20	0.19
Access to clean drinking water	0.76	0.80	0.82	0.81
Access to electricity	0.84	0.86	0.89	0.82
Distance to market (km)	7.03 (6.79)	6.10** (5.60)	7.60 (7.13)	8.15 (7.45)
Distance to health center[4] (km)	3.87 (4.45)	2.66* (3.91)	5.81*** (5.64)	3.50 (3.76)
Distance to primary school (km)	0.20 (0.61)	0.12* (0.48)	0.23 (0.72)	0.24 (0.63)
Distance to Accra capital city (km)	67.26 (55.67)	87.66* (63.78)	56.36** (41.17)	73.36 (58.34)
Distance to pineapple plantation (km)	3.75 (3.40)	3.37 (3.00)	3.69 (3.74)	4.08 (4.02)
No. of HH asset categories	3.69 (2.18)	3.64 (2.10)	3.56 (2.18)	3.64 (2.13)
HH owns gas stove	0.10	0.12	0.11	0.09
Agricultural land (in acres)	1.19*** (1.34)	1.28*** (1.41)	0.99*** (1.37)	2.10 (1.98)
Total yearly income (GHS)[5]	7086.43 (7044.31.34)	4893.25 (4324.38)	5621.26 (2743.13)	5843.40 (6469.50)

[4] Health centers include clinics and doctors' offices that provide health services.
[5] GHS = Ghanaian Cedi (Exchange rate: 1 GHS = 0.21 Euro cent on 15.June 2015 at the time of survey implementation)

Total yearly income per adult equivalent [6] (GHS)	2517.47* (3003.59)	1772.27 (2289.63)	1993.27 (1211.16)	1898.77 (2225.74)
Horticultural wage labor income (GHS)	2285.28*** (1271.74)	2856.39*** (1487.48)	4503.04*** (1893.53)	0
Agricultural income (GHS)	1316.83 (4776.11)	869.00 (3092.20)	488.11* (2069.14)	1414.12 (4020.33)
Income from self-employment (GHS)	1357.21*** (899.97)	759.32*** (1365.77)	198.65*** (760.37)	2552.92 (3493.74)
Other wage labor income (GHS)	1381.96 (3368.07)	82.05*** (887.52)	0***	1142.01 (2978.25)
Other income (e.g. gifts, remittances) (GHS)	108.01 (362.49)	34.53*** (94.75)	29.45* (81.98)	194.35 (648.85)

Standard deviations in parenthesis. * (p<0.1), ** (p<0.05) and *** (p<0.01) for ttest of continuous variables and chi2 test for categorical variables

[6] We apply the OECD adult equivalence scale that is weighted accordingly: value 1 for first household member, value 0.7 for each additional adult and value 0.5 for each child under the age of 18 years

Table 4 and table 5 present descriptive statistics of both objective and subjective indicators of women's empowerment for sampled households. Within the resources domain, we see significant differences between those households where the female spouse is employed and those where she is not. We observe that the yearly income generated by the female spouse and her share in total income are highest in households where she is the only one working on a pineapple plantation. Female asset ownership – both in terms of number and share - is highest in those households where both spouses are employed. Female horticultural workers, whose spouses do not work on a plantation are significantly more likely to decide on whether an asset can be sold or not. While we see clear indications of female employment being positively related to indicators of female empowerment, this is not the case for male employment. In households where only the male spouse works on a plantation, their female spouses earn the lowest income across the comparison groups and they contribute the lowest share to the household income at only 12.53%. Only about a quarter of them report to own assets and even less can sell them. It is indeed interesting to note that these proxies for women's empowerment are also significantly lower than in the control group, where no household member works on a pineapple plantation. At the same time, female spouses of male workers have the highest reproductive workload with almost six hours daily, which can mostly be attributed to the time spent on indoor chores. In comparison, female horticultural workers, whose spouses do not work on a plantation, spend with slightly more than 4 hours daily the least amount of time on reproductive activities across the comparison groups. In households that do not work on pineapple plantations, the female spouses are predominantly engaged in small-scale businesses and own farm production next to their reproductive chores. Overall workload (sum of income-generating and reproductive activities) is not significantly different across the treatment and control groups.

We are also interested in women's input into decision-making within the household as a subjective indicator of agency for women's empowerment. As can be seen in Table 5, the results are comparable across the two comparison groups with female horticultural workers. Input into decision-making is significantly higher for those female workers whose spouses also work on a plantation, especially regarding major household expenditures and household wage labor activities. It is interesting to note that the female spouses of male horticultural workers, who do not work themselves, have significantly less decision-making input into household domains like food crop production, cash crop production and wage labor activities.

Table 4 Descriptive statistics of objective indicators of women's empowerment

	Variable	HH with only female spouse working on plantation (N = 98) Mean	HH with only male spouse working on plantation (N = 117) Mean	HH with both female and male spouse working on plantation (N = 55) Mean	HH not working on plantation (N = 150) Mean
	Female yearly income in GHS	2472.54** (1659.61)	813.68* (1594.65)	2327.68 (990.70)	1557.94 (3753.40)
	Female income share	50.68*** (32.30)	12.53*** (18.10)	44.47*** (13.19)	23.01 (32.16)
	Female asset ownership (number)	1.64 (1.25)	1.07** (1.84)	2.08 (1.92)	1.65 (1.94)
	Female asset ownership (share)	47.49* (34.69)	25.93** (41.00)	52.9%* (42.05)	38.63 (39.35)
	Female ability to sell assets (number)	1.82 (1.71)	0.65*** (1.15)	1.42 (1.64)	1.47 (1.64)
	Female ability to sell assets (share)	50.24*** (37.41)	17.53*** (27.06)	37.70 (34.42)	39.77 (37.37)
	…work-related activities (sum of income-generating and reproductive activities)	16.20 (2.78)	16.35 (4.80)	16.30 (3.37)	15.56 (4.66)
	…reproductive activities (sum of indoor chores, outdoor chores and care activities)	4.07*** (1.82)	5.87*** (2.99)	4.52 (2.65)	4.88 (2.51)
	…personal activities	1.98 (1.24)	2.21 (1.42)	2.03 (1.09)	2.22 (1.36)
	…own farm production	0.48*** (1.34)	1.57 (2.84)	0.43*** (1.29)	2.17 (3.14)
	…pineapple plantation	7.37*** (2.87)	0	6.75*** (3.29)	0
Time spent by female spouse on…(in hrs per day)	…agricultural work off the own farm	0.02 (0.14)	0	0.04 (0.27)	0.13 (0.78)
	…off-farm non-agricultural work	0.16*** (1.04)	3.05 (3.95)	0.05*** (0.40)	3.47 (4.09)
	…educational activities	0	0.06 (0.56)	0	0.01 (0.08)
	…indoor chores	2.56** (1.17)	3.71** (2.20)	2.71 (1.48)	3.08 (1.85)
	…outdoor chores	0.68 (1.06)	1.10 (1.63)	1.05 (1.58)	0.90 (1.52)
	…care activities	0.83 (1.06)	1.05 (1.54)	0.76 (1.24)	0.89 (1.07)
	…shopping, use of services etc.	0.048 (0.34)	0.07 (0.36)	1.55 (0.60)	0.10 (0.48)
	…social activities	1.51*** (1.38)	2.57 (2.40)	1.65* (1.59)	2.34 (2.37)
	…sleeping	8.33* (1.25)	8.61 (1.38)	8.39 (1.39)	8.70 (1.90)

Standard deviations in parenthesis, * (p<0.1), ** (p<0.05) and *** (p<0.01) for ttest of continuous variables, chi2 test for categorical variables and Wilcoxon–Mann–Whitney test for ordinal categorical variables.

Table 5 Descriptive statistics of subjective indicators of women's empowerment

Female spouse's input into decision-making regarding:	Frequency (%)				Mean
	No input	Input into some decisions	Input into most decisions	Input into all decisions	
HH with only female spouse working on plantation *(N = 98)*					
…major HH expenditures	7.22	31.96	18.56	42.27	2.96 (1.02)
…minor HH expenditures	2.06	23.71	22.68	51.55	3.24 (0.89)
…HH food crop production	4.29	14.29	28.57	52.86	3.30 (0.87)
…HH cash crop production	3.57	19.64	28.57	48.21	3.21 (0.89)
…HH non-farm activities	7.23	22.89	30.12	39.76	3.02 (0.96)
…HH wage labor activities	3.06	30.61	23.47	42.86	3.06 (0.93)
…kid's education & health	2.11	14.74	28.42	54.74	3.36 (0.81)
HH with only male spouse working on plantation *(N = 117)*					
…major HH expenditures	16.24	26.50	19.66	37.61	2.79 (1.12)
…minor HH expenditures	6.84	23.93	21.37	47.86	3.10 (0.99)
…HH food crop production	7.41	29.63	32.10	30.86	2.86 ** (0.95)
…HH cash crop production	12.50	25.00	31.25	31.25	2.81** (1.02)
…HH non-farm activities	8.99	24.72	28.09	38.20	2.96 (1.00)
…HH wage labor activities	11.40	28.95	31.58	28.07	2.76** (0.99)
…kid's education & health	0.90	15.32	31.53	52.25	3.35 (0.77)
HH with both female and male spouse working on plantation *(N = 55)*					
…major HH expenditures	5.45	20.00	20.00	54.55	3.23* (2.93)
…minor HH expenditures	1.82	14.55	21.82	61.82	3.44 (0.81)
…HH food crop production	6.45	9.68	19.35	64.52	3.42 (0.92)
…HH cash crop production	6.45	12.90	19.35	61.29	3.35 (0.95)
…HH non-farm activities	2.86	11.43	31.43	54.29	3.37* (0.81)
…HH wage labor activities	5.66	15.09	35.85	43.40	3.17 (0.89)
…kid's education & health	1.89	15.09	24.53	58.49	3.40 (0.82)
HH not working on plantation *(N = 150)*					
…major HH expenditures	12.93	23.13	21.77	42.18	2.93 (1.08)
…minor HH expenditures	3.31	23.84	14.57	58.28	3.28 (0.94)
…HH food crop production	2.36	30.71	17.32	49.61	3.14 (0.94)
…HH cash crop production	2.75	30.28	17.43	49.54	3.14 (0.95)
…HH non-farm activities	6.92	26.15	21.54	45.38	3.05 (1.00)
…HH wage labor activities	8.13	24.39	24.39	43.09	3.02 (1.00)
…kid's education & health	2.04	19.73	21.09	57.14	3.33 (0.86)

Standard deviations in parenthesis, * (p<0.1), ** (p<0.05) and *** (p<0.01) for ttest of continuous variables, chi2 test for categorical variables and Wilcoxon-Mann-Whitney test for ordinal categorical variables.

5.2. Regression results

The main regression results on objective and subjective proxy indicators of women's empowerment related to their resources and agency are summarized in table 6. The two estimation approaches yield similar results in terms of direction, magnitude and significance of effects, which supports the robustness of our findings. We base our results discussion on the estimates of the entropy balancing approach as the more advanced method to reduce potential bias. The full regression results from entropy balancing regressions including all covariates are reported in appendix tables A.3 and A.4.

Considering the resources indicators for empowerment in table 6, regression results from the entropy balancing model reveal that horticultural employment has a statistically significant positive effect on household income from approximately 65% up to approximately 90% when both spouses work on the plantation. Our findings further show a larger effect of female horticultural employment on household income than male horticultural employment. While female horticultural employment increases the overall household income by up to 81%, male horticultural employment increases overall household income by about 65%. In the context of our study, women workers contribute about 30% more income to the household income than women in households that are not engaged in horticultural employment. In comparison, female spouses of men working on pineapple plantations contribute 13% less to household income. Due to the man's relatively well-paid job on the plantation, their spouses may have less want or economic need to engage in productive income-generating work activities. Table 3 shows that female spouses of male horticultural workers spend less time in own farm production and small-scale business ventures than female spouses in households that are not engaged in horticultural employment at all. Our regression results further show that female horticultural employment has a significantly positive effect on their annual income. Women who are engaged on pineapple plantations generate approximately 915 GHS[7] more income than women who are not engaged on pineapple plantations.

Women employed in the pineapple sector in Ghana also have better control over household assets, such as motorized vehicles, radios and TV sets. But it is interesting to note that female workers' share of household asset ownership increases by more than 20% when their male spouse also works on a pineapple plantation in comparison to only about 13% when the female spouse alone works on a plantation. There is no indication however that higher female asset ownership also leads to an increased ability to sell these assets. On the other hand, spouses of male workers are much less likely to sell assets (-26%). They also have the highest reproductive workload within our sample and spend 1.32 hours more on chores and care activities than women in households not engaged on horticultural plantations. It seems that female employment decreases reproductive workload, but this effect is only significant in households where the men do not work on plantations. Potentially, without the time constraints of a plantation job the male spouse may be available to take over some of the chores usually undertaken by women. But whether the female spouse achieves a lower reproductive workload by higher efficiency, lower performance, or the husband or a child taking over these tasks remains an open question that cannot be answered with our data set. The full regression results (appendix table A.3) show that besides horticultural employment, which has the largest and most consistent effect across the regressions, other factors influence indicators of women's empowerment as expected. These include the household's dependency ratio, the age gap between spouses, the household's religious affiliation and regional differences.

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[7] GHS = Ghanaian Cedi (Exchange rate: 1 GHS = 0.21 Euro cent on 15. June 2015 at the time of survey implementation)

While horticultural employment in our study region shows positive effects on objective indicators of women's empowerment, this does not seem to translate into positive effects on subjective indicators. This finding does not support the conceptual understanding that improvements in the resources domain automatically lead to improvements in the agency domain. The linkages between resources and agency are therefore not clear-cut but require a more in-depth reflection of underlying bargaining powers. Our results certainly show the role that male horticultural employment plays for women's empowerment. Only the horticultural employment of both spouses shows a consistently positive effect on most subjective indicators of women's empowerment. This includes higher decision-making power regarding major expenditures, household food and cash crop production as well as non-farm activities. Higher female decision-making power regarding agricultural production may be due to trainings that women receive on plantations. The ability to apply the training content to the personal farm setting may be highly valued by the male spouse, who also knows the worth of the trainings. Furthermore, female workers may be able to use some of their wage labor income to purchase farm inputs, such as fertilizer, leading to more decision-making power over household agricultural plots. Joint employment does not increase input into decision-making regarding non-farm activities and kid's education and health. Higher decision-making power in one area of decision-making does not necessarily translate into more power in another area. These decision areas may indeed be quite distinct from each other and be bargained over individually. This may depend on the importance the household attributes to the individual area. The full regression results (appendix table A.4) indicate that cultural (religion, regional differentiation) and demographic patterns (age gap) play an important role for determining indicators of agency for empowerment as well.

Table 6 Selected regression coefficients of the effects of female only, male only employment and joint employment (binary variables) on objective and subjective indicators of women's empowerment[8]

Outcome variable	Unweighted regression			Entropy balancing			n
	Female spouse works on pineapple plantation	Male spouse works on pineapple plantation	Both spouses work on pineapple plantation	Female spouse works on pineapple plantation	Male spouse works on pineapple plantation	Both spouses work on pineapple plantation	
HH Income[#]	0.764*** (0.185)	0.587*** (0.178)	0.884*** (0.232)	0.814*** (0.258)	0.648** (0.238)	0.912*** (0.314)	419
Female share of HH income[#]	27.73*** (5.119)	-10.10*** (3.323)	23.29*** (3.305)	27.50*** (4.412)	-12.28*** (3.956)	21.80*** (4.097)	388
Female income in GHS[9][#]	862.3** (354.5)	-708.3** (316.0)	879.7*** (317.2)	914.6*** (270.0)	-717.7* (371.9)	862.9*** (274.2)	419
Female asset ownership[#]	9.75* (5.228)	-12.75*** (4.539)	16.98** (6.552)	12.47** (5.444)	-9.72 (7.312)	20.77*** (7.165)	388
Female ability to sell assets[#]	8.29 (5.987)	-23.37*** (4.892)	-2.27 (5.845)	7.19 (5.579)	-26.23*** (5.469)	-2.85 (6.237)	419
Female reproductive workload[#]	-0.922*** (0.295)	0.872** (0.400)	-0.737 (0.535)	-0.868*** (0.290)	1.321** (0.524)	-0.640 (0.398)	419
Female input into decision-making…							
…major HH expenditures[##]	0.0821 (0.153)	-0.210 (0.137)	0.500*** (0.162)	0.130 (0.164)	-0.0524 (0.188)	0.533** (0.211)	413
…minor HH expenditures[##]	0.004 (0.150)	-0.306* (0.158)	0.371** (0.164)	0.0480 (0.173)	-0.0944 (0.205)	0.382* (0.222)	417
…HH food crop production[##]	0.400** (0.184)	-0.435** (0.170)	0.657*** (0.232)	0.553*** (0.201)	-0.135 (0.210)	0.817*** (0.282)	307
…HH cash crop production[##]	0.178 (0.193)	-0.511** (0.214)	0.541** (0.266)	0.342 (0.208)	-0.201 (0.220)	0.714** (0.296)	258
…HH non-farm activities[##]	-0.032 (0.167)	-0.187 (0.164)	0.502** (0.198)	0.107 (0.180)	-0.0753 (0.208)	0.653*** (0.238)	334
…HH wage labor activities[##]	0.142 (0.161)	-0.382** (0.155)	0.261 (0.205)	0.217 (0.172)	-0.349 (0.226)	0.301 (0.220)	385
…kid's education and health[##]	0.086 (0.158)	-0.055 (0.157)	0.213 (0.181)	0.183 (0.176)	0.0905 (0.196)	0.314 (0.221)	403

Standard errors in parenthesis and clustered at the village level. Significant effects are indicated with * (p<0.1), ** (p<0.05) and *** (p<0.01)
We use OLS regression, ## We use or Ordered Probit regression

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[8] The regression includes: Female spouse works on pineapple plantation, male spouse works on pineapple plantation, both spouses work on pineapple plantation, age gap between spouses, female spouse age, education gap between spouses in years, dummy variable for female spouse literacy, dummy variable for male spouse literacy, dummy variable for religion of the household (Protestant, Catholic, Pentecostal, Muslim, Traditionalist), distance to next market place/ health center and Accra capital, dummy variable for region (Greater Accra, Eastern, Central, Volta). Coefficients are not reported.

[9] GHS = Ghanaian Cedi (Exchange rate: 1 GHS = 0.21 Euro cent on 15. June 2015 at the time of survey implementation)

6. Conclusion

Our findings for the pineapple sector in Ghana suggest that large-scale, export-oriented horticultural plantations can contribute to women's empowerment through employment creation. We differentiate between two different sets of proxy indicators of empowerment: objective indicators, which are linked to resources and subjective indicators, referring to the agency domain (Kabeer, 1999). By doing so, we link the analysis to a conceptual framework of women's empowerment that assumes a non-unitary household bargaining model. Our findings show that agricultural employment in modern agri-food systems by both men and women can contribute to women's empowerment in the domains of resources and agency. However, the emerging picture is nuanced. In our study, female employment on pineapple plantations indeed has positive and significant effects on objective indicators of women's empowerment. We find statistically significant and positive effects for economic resources (household income, female income, female share of household income, asset ownership and ability to sell assets) and human resources (time). The contribution of female pineapple workers to the overall household income is 30% higher than in households where the female spouse is either involved in agricultural production or self-employed. Such opportunities for income generation are particularly relevant in rural areas, where women have few choices of being employed.

In comparison, we find that male employment alone has a significantly negative effect on objective indicators of women's empowerment. This also supports our interpretation of above results on female horticultural employment. Based on the descriptive statistics we see that those women, whose male spouses work on plantations are also engaged in small-scale businesses and agricultural production activities of the household (4.62 hours) but are even more involved in reproductive chores (5.86 hours). Male employment alone also does not show a significant effect on subjective indicators of women's empowerment. Based on our findings within those households where both spouses are employed, we can see that while female employment does create pre-conditions for women's empowerment, male employment seems to reinforce that effect in the agency domain. Only within those households we find positive effects of joint horticultural employment on both objective and subjective proxy indicators of women's empowerment. This implies that female empowerment requires involvement of both spouses.

Failing to acknowledge such nuances in the effects of horticultural employment for male and female spouses as described above and a wrong understanding of the functioning of the household regarding resource allocation and decision-making also has implications for policy and project interventions (Lambrecht et al., 2016). As Quisumbing et al. (2014) point out, neither the unitary household model nor the bargaining model fits most situations. To assume that resources are equally shared within the household would lead to inefficient and ineffective outcomes. Bringing this into the context of this study means that the creation of employment opportunities is not sufficient. Instead, both women and men need a fair and equal access to participate in the labor market. Based on our findings, we can conclude that particularly an environment that provides for gender-mixed employment is most

beneficial for women's empowerment. While labor opportunities for women in the household may have positive effects on resources and so-called pre-conditions of empowerment, this does not necessarily translate into an increased input into household decision-making. This means that targeting one individual in the household might superficially lead to improvements but might not tackle underlying causes of inequality within the household.

However, we recognize the shortcomings of our study. As we use a cross-sectional data set for our analysis, we cannot fully rule out selection bias. We aim to reduce such bias through econometric techniques, particularly the innovative entropy balancing approach that improves the balance of covariate distribution. Panel data evidence would help to fully disentangle causal relationships of employment and empowerment. Further, we can only use proxy indicators for women's empowerment. While we base our measures on an in-depth literature review, proxy indicators remain imperfect but are the only option in the absence of a direct measure. Lastly, we are aware that our case study is focused on one horticultural product in a specific country and that empowerment among male and female spouses is region- and context-specific (Ragsdale et al., 2018). Therefore, we recommend additional research to capture the effects of horticultural employment in different settings and at different stages along the value chain. Focusing further research on female-headed households could identify potential poverty-reducing and empowering effects for this generally considered vulnerable group.

Nonetheless, we believe that with this study we contribute to the scarce empirical literature on gender effects of modern agri-food systems. Our findings add to the studies that assess the ramifications of modern supply chains that rely on gendered structures for agricultural production and processing. Our findings on time resources connected to reproductive workload support those of Newman (2002) and Jarvis and Vera-Toscano (2004) who provide evidence that due to female horticultural employment, the male spouses took over more household responsibilities in Ecuador and Chile. Whether female workers are always able to utilize their resources according to their choices may depend on different regional settings and expectations towards women. Friedemann-Sanchez (2006), for instance, concludes that female flower workers in Colombia have greater constraints in buying assets or property in comparison to male flower workers even though their wages are basically equal. Studies in the Kenyan cut-flower and tea as well as the Senegalese tomato industry find that female workers perceive their decision-making power in the household to be increased because of their employment (Maertens and Swinnen, 2012; Said-Allsopp and Tallontire, 2015). However, since these studies do not differentiate between female workers alone and those whose spouses are also employed in the same industries, we do not know whether it is female employment alone or joint employment that causes these effects.

In the context of the wider policy implications and as outlined above, we acknowledge that an environment that fosters equal opportunites for men and women to enter the labor market is most beneficial for women's empowerment. However, opportunities in rural areas for women to be engaged in employment are rare. But gendered work patterns are evolving and this also applies to modern-agri-

food systems where female workers are sometimes favoured over male workers (Quisumbing, 2014). In the long-term, agricultural industries that are able to employ a workforce in a gender-balanced manner could contribute best to rural households. This does not only require commitment from the private sector but also an enabling environment that fosters gender-equitable rural employment as well as a supportive labor policy (Qisumbing, 2014).

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Appendix

Figure A.1 Main language groups in Ghana (corresponding with main ethnic groups). Source: SIL International (2015) in Lambrecht, 2016
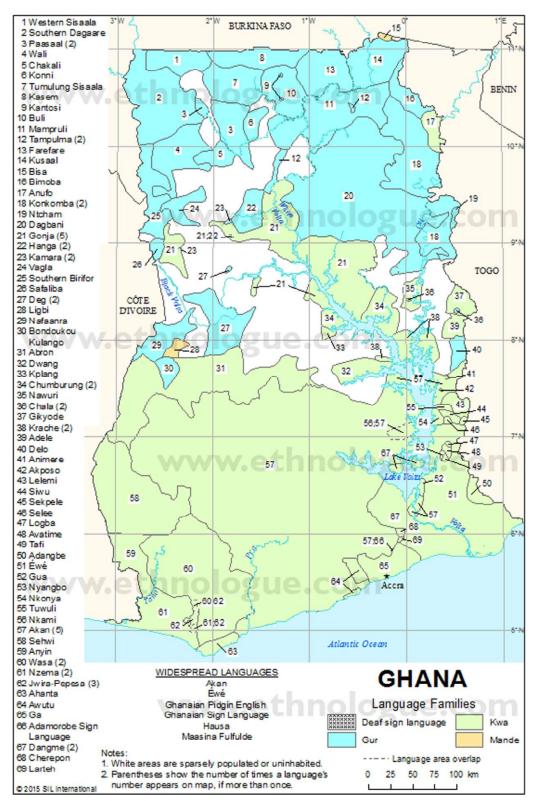
Table A.2 Overview of conditioning variables before and after entropy balancing

Before weighting	Treat			Control			After weighting		
	Mean	Variance	Skewness	Mean	Variance	Skewness	Mean	Variance	Skewness
Male spouse works on pineapple plantation	0.3553	0.2306	0.6048	0.4349	0.2467	0.2625	0.356	0.2301	0.6016
Age gap	4.678	22.94	0.7495	5.602	35.72	1.277	4.675	22.92	0.7518
Female spouse age	35.51	73.09	.4808	34.52	92.58	.6218	35.49	73.04	0.4879
Dependency ratio	101.3	4723	0.8049	10.5.4	5597	0.7831	101-3	4721	0.8076
Education gap between spouses	2.013	17.73	0.5262	2.297	14.58	0.2602	2.012	17.73	0.5271
Female spouse is literate	0.3882	0.2391	0.459	0.4126	0.2433	0.3549	0.3888	0.2385	0.4564
Male spouse is literate	0.6118	0.2391	-0.459	0.6914	0.2141	-0.829	0.6112	0.2385	-0.4561
Catholic	0.07237	0.06758	3.301	0.06691	0.06267	3.466	0.07248	0.06748	3.298
Pentecostal	0.6645	0.2244	-0.6967	0.5576	0.2476	-0.232	0.6637	0.224	-0.6929
Muslim	0.02632	0.02579	5.918	0.04089	0.03937	4.637	0.02636	0.02576	5.913
Traditionalist	0.03947	0.03817	4.73	0.1041	0.0936	2.593	0.03954	0.03812	4.726
Distance to market	7.229	47.86	1.183	7.195	45.83	1.236	7.225	47.83	1.185
Distance to health center	4.53	24.82	0.8783	3.108	14.71	1.305	4.527	24.81	0.8801
Distance to Accra	63.5	2621	1.695	79.66	3727	0.896	63.46	2620	1.698
Eastern Region	0.1053	0.09481	2.572	0.08922	0.08156	2.882	0.1056	0.09479	2.567
Central Region	0.2039	0.1634	1.469	0.2416	0.1839	1.207	0.2046	0.1634	1.464
Volta Region	0.1711	0.1427	1.747	0.3086	0.2141	0.829	0.1716	0.1427	1.742

Table A.3 Regression results after entropy balancing for effects of female only, male only employment and joint employment (binary variables) on objective indicators of women's empowerment

Variable	Female income in GHS[10]#	Female income in log#	Female income share#	Female asset ownership#	Female ability to sell assets#	Female reproductive workload#
Female spouse works on pineapple plantation	914.6*** (270.0)	3.676*** (0.397)	27.50*** (4.828)	12.47** (6.141)	7.189 (6.397)	-0.868*** (0.281)
Male spouse works on pineapple plantation	-717.7* (371.9)	-0.952 (0.674)	-12.28*** (4.016)	-9.717 (6.833)	-26.23*** (5.292)	1.321** (0.550)
Both spouses work on pineapple plantation	862.9*** (274.2)	3.800*** (0.423)	21.80*** (3.609)	20.77*** (6.623)	-2.846 (6.353)	-0.640 (0.511)
Age gap	25.43 (21.49)	0.015 (0.026)	0.157 (0.394)	0.057 (0.502)	-0.819* (0.465)	0.055* (0.033)
Female spouse age	18.14 (13.70)	0.003 (0.020)	0.035 (0.180)	-0.047 (0.236)	0.052 (0.201)	-0.037** (0.017)
Dependency ratio	-4.434** (1.748)	-0.002 (0.002)	0.008 (0.027)	0.086*** (0.032)	0.064** (0.032)	0.001 (0.002)
Education gap between spouses	1.096 (35.81)	0.016 (0.048)	-0.093 (0.468)	-0.218 (0.569)	-0.295 (0.579)	-0.031 (0.039)
Female spouse is literate	158.5 (372.8)	0.643 (0.385)	-3.223 (5.224)	-0.460 (4.778)	-4.213 (4.404)	-0.650** (0.302)
Male spouse is literate	451.6 (344.4)	-0.190 (0.456)	0.498 (3.957)	7.214 (5.589)	8.547 (5.464)	0.331 (0.353)
Pentecostal	1,107 (770.4)	1.022 (0.956)	13.08 (8.769)	-3.338 (10.71)	6.092 (8.535)	-1.061* (0.606)
Catholic	191.1 (139.7)	-0.282 (0.345)	-5.002 (3.875)	-5.996 (6.215)	0.689 (4.566)	-0.589* (0.349)
Muslim	-36.23 (201.3)	-0.128 (1.039)	-8.369 (8.916)	-5.253 (10.20)	-16.36* (9.483)	-1.917*** (0.632)
Traditionalist	186.4 (297.9)	-0.332 (0.748)	-7.159 (6.575)	2.975 (13.53)	15.74 (9.912)	-0.103 (0.890)
Distance to market	-16.48 (14.85)	-0.036 (0.022)	-0.284 (0.263)	0.310 (0.415)	-0.238 (0.423)	-0.026 (0.024)
Distance to health center	-59.20** (28.05)	0.008 (0.036)	0.436 (0.499)	-0.034 (0.761)	-0.933 (0.601)	-0.033 (0.028)
Distance to Accra	5.296 (7.418)	-0.002 (0.010)	-0.051 (0.102)	-0.125 (0.166)	0.010 (0.156)	-0.007 (0.008)
Eastern Region	-679.7** (281.8)	0.896 (0.579)	8.569 (6.051)	20.94*** (7.718)	-5.849 (6.534)	-1.798*** (0.496)
Central Region	-666.1* (345.1)	0.094 (0.377)	6.629 (4.413)	-2.468 (8.128)	-16.09** (6.854)	-1.543*** (0.325)
Volta Region	-1,444 (906.6)	0.172 (1.220)	11.82 (14.74)	17.60 (21.58)	-13.32 (20.36)	-0.484 (1.033)
Constant	1,146 (782.7)	4.137*** (1.135)	23.26** (11.30)	28.34 (17.50)	44.85*** (13.81)	8.002*** (0.775)
Observations	419	419	419	388	388	419
R-squared	0.147	0.417	0.290	0.134	0.175	0.217

Standard errors in parenthesis and clustered at the village level. Significant effects are indicated with * (p<0.1), ** (p<0.05) and *** (p<0.01)
We use OLS regression

[10] GHS = Ghanaian Cedi (Exchange rate: 1 GHS = 0.21 Euro cent on 15.June 2015 at the time of survey implementation)

Table A.4 Regression results after entropy balancing for effects of female only, male only employment and joint employment (binary variables) on subjective indicators of women's empowerment

Variable	Female input into decision-making regarding…						
	…major expenditures	…minor expenditures	…food crop production	…cash crop production	… non farm activities	… wage labor activities	…kid's education and health
Female spouse works on pineapple plantation	0.130 (0.182)	0.048 (0.153)	0.553** (0.215)	0.342 (0.214)	0.107 (0.192)	0.217 (0.180)	0.183 (0.155)
Male spouse works on pineapple plantation	-0.052 (0.150)	-0.094 (0.166)	-0.135 (0.197)	-0.201 (0.219)	-0.075 (0.155)	-0.349 (0.237)	0.091 (0.171)
Both spouses work on pineapple plantation	0.533** (0.207)	0.382* (0.194)	0.817*** (0.241)	0.714** (0.268)	0.653*** (0.184)	0.301 (0.257)	0.314* (0.178)
Age gap	0.020 (0.012)	0.039*** (0.013)	0.052*** (0.014)	0.0527*** (0.0163)	0.017 (0.015)	0.012 (0.010)	0.031*** (0.011)
Female spouse age	0.001 (0.009)	0.001 (0.010)	-0.006 (0.009)	-0.00585 (0.0104)	-0.011 (0.009)	-0.004 (0.007)	-0.006 (0.007)
Dependency ratio	-0.0004 (0.001)	-0.0004 (0.001)	0.001 (0.001)	-0.000788 (0.00108)	-0.001 (0.001)	-0.001 (0.001)	-0.0002 (0.001)
Education gap between spouses	-0.018 (0.020)	-0.027 (0.023)	0.012 (0.029)	-0.0351 (0.0282)	-0.040** (0.019)	-0.018 (0.019)	-0.022 (0.023)
Female spouse is literate	-0.066 (0.184)	-0.299 (0.220)	-0.133 (0.266)	-0.364 (0.249)	-0.292 (0.206)	-0.115 (0.200)	-0.132 (0.158)
Male spouse is literate	-0.185 (0.210)	0.020 (0.261)	-0.105 (0.247)	0.110 (0.244)	0.182 (0.188)	0.006 (0.186)	0.034 (0.179)
Pentecostal	1.019*** (0.334)	0.757* (0.389)	0.800** (0.396)	1.167*** (0.384)	0.896** (0.345)	0.356 (0.312)	1.189*** (0.190)
Catholic	0.012 (0.176)	-0.092 (0.216)	-0.246 (0.219)	-0.0431 (0.219)	-0.321 (0.209)	-0.266 (0.188)	-0.029 (0.206)
Muslim	-0.379 (0.280)	-0.118 (0.345)	-0.573* (0.294)	-0.298 (0.298)	-0.030 (0.405)	-0.008 (0.160)	0.609* (0.319)
Traditionalist	0.655** (0.286)	0.519 (0.348)	0.260 (0.319)	0.434 (0.421)	0.303 (0.435)	0.921** (0.351)	0.040 (0.507)
Distance to market	0.005 (0.008)	0.005 (0.013)	0.021 (0.015)	0.0232 (0.0173)	0.003 (0.012)	0.003 (0.010)	0.024** (0.011)
Distance to health center	-0.039*** (0.013)	-0.021 (0.020)	-0.019 (0.020)	-0.0365* (0.0215)	-0.006 (0.016)	-0.019 (0.014)	-0.023* (0.012)
Distance to Accra	-0.003 (0.003)	0.001 (0.005)	-0.006 (0.006)	-0.00806 (0.00571)	0.005 (0.005)	0.003 (0.004)	0.00004 (0.004)
Eastern Region	-0.047 (0.188)	0.103 (0.199)	0.054 (0.348)	-0.0166 (0.365)	0.010 (0.268)	0.091 (0.239)	0.330 (0.266)
Central Region	0.452*** (0.155)	0.583*** (0.214)	0.600** (0.241)	0.481** (0.236)	0.408** (0.193)	0.586*** (0.130)	0.693*** (0.125)
Volta Region	0.322 (0.452)	0.209 (0.586)	1.298* (0.674)	1.574** (0.747)	-0.280 (0.592)	0.108 (0.544)	0.369 (0.488)
Constant	-1.350*** (0.460)	-1.655*** (0.571)	-1.689*** (0.540)	-1.927*** (0.664)	-1.769*** (0.576)	-1.606*** (0.445)	-1.791*** (0.602)
	-0.403 (0.461)	-0.440 (0.571)	-0.410 (0.567)	-0.643 (0.686)	-0.694 (0.601)	-0.493 (0.457)	-0.590 (0.541)
	0.160 (0.465)	0.129 (0.579)	0.353 (0.532)	0.0727 (0.657)	0.057 (0.583)	0.284 (0.426)	0.260 (0.514)
Observations	413	417	307	258	334	385	403

Standard errors in parenthesis and clustered at the village level. Significant effects are indicated with * (p<0.1), ** (p<0.05) and *** (p<0.01)
We use OProbit regression