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Market discrimination, market participation and control over revenue: A gendered analysis of Cameroon's cocoa producers

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Abstract

Using micro level data from Cameroon this paper applies the theories of intrahousehold bargaining to models in which female farmers decide whether to take up cocoa marketing on their own or to rely on others to sell the product. We analyze the effect of marketing on control over the proceeds. We find that controlling both production and marketing provides higher bargaining power over proceeds compared to a situation in which the farmer participates only in production and delegate the task of marketing to another family member. Our data also indicate that in the cocoa sector of Cameroon, female farmers' market participation is hindered by existing price discrimination, which in turn reduces their intrahousehold bargaining power. In other words, participating female farmers receive much lower prices for their produce than participating males. To generate higher revenue, female farmers hand over the marketing responsibility to a male in the family. Such non-participation results in lower control over the proceeds by the female farmer, as the individual doing the marketing can now claim a higher share in the revenue. Additionally we find that collective marketing contributes to eliminating price discrimination and promoting female market participation and thus their control over proceeds.

Keywords: Cocoa Marketing; Gender, Price Discrimination, Control over Revenue
JEL Code: D11, Q12, Q13

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1. Introduction

A fundamental issue in microeconomics with particular relevance to developing countries is how to model household behavior when systematic differences in preferences exist. Undoubtedly household decisions, such as who works for how many hours, how to generate income, and who receives how much of the household resources, are the outcome of intrahousehold decision making and have crucial implications for individual welfare. It has been shown that household members with higher bargaining power have more influence on decision making than members with less bargaining power (e.g. Sen, 1990; Thomas 1997, World Bank 2001, Klasen, 1998). Therefore, intrahousehold bargaining[2] and associated intrahousehold outcomes have generated great interest among researchers and policy-makers concerned about the well-being of women and children, which is largely dependent on the outcome of this intrahousehold bargaining.

The empirical literature has confirmed that women with lower bargaining power tend to have less access to household resources, such as resources allocated to health, education and access to land, than their male counterparts (Thorsten, 2002; Udry et al, 1995; Chiappori, 1988, 1992; Browning & Chiappori, 1998; Klasen, 1998). Second, causal association between bargaining and household decision-making in the allocation of resources flows both ways. Unequal access to resources affects bargaining and then lower bargaining power causes lesser access to household resources (Basu, 2006). Therefore, persistence of a gender gap in intrahousehold bargaining could be attributed to gender gaps in access to any income generating activities or access to assets and unearned incomes (Rocheleau & Edmunds 1997; Rose & Hartmann 2004, Thomas, 1997). Furthermore, such differences tend to be even stronger in rural economies where family and community norms regarding the accumulation and transmission of wealth are important to determine the within-household wealth allocation, which in turn affects the bargaining power of male and female household members. Under these customary norms in many rural settings in developing countries, production systems favor male over their female counterparts in terms of access to productive resources, such as

[2]Intrahousehold bargaining models are typically modeled within a cooperative bargaining framework. A typical cooperative bargaining model of marriage starts with a family consisting of only two members: a husband and a wife. Individual agents, whose utility depends on their consumption of a private good, bargain with each other and depending on their relative bargaining strength, family demand is determined. If agreement is not reached between spouses, then the payoff received is represented by the utilities associated with divorce or a non-cooperative equilibrium within marriage, which are often known 'threat points'; as a result, bargaining outcomes within marriage depend on this threat point as this circumscribes the bargaining solution (Manser-Brown, 1980 and McElroy-Horney, 1981, 1990, Chiappori, 1992 and Browning & Chiappori, 1998). Recent empirical tests of predictions of household models have strongly supported the role of bargaining power for household decisions, while debates continue whether the outcome of bargaining is pareto efficient or not (e.g. Browning and Chiappori, 1998; Haddad, Hoddinott, and Alderman, 1997).

land, which then translates into lower productivity and income levels for female-headed farm units (FAO, 2011; Quisumbing & Pandolfelli, 2010; World Bank, FAO, & IFAD, 2009).

While unequal access to productive resources has well been discussed in the literature to address the gender gap in agricultural productivity and income (Udry, 1996; Fletschner, 2009, Zwarteveen, 1996), research on inequalities arising in the post-harvest period is relatively rare. Factors, such as information asymmetry (Fletschner & Mesbah, 2011, Chowdury, 2006; Ngimwa et al., 1997), incomplete integration of farmers in high-value production and marketing chains could potentially affect farmers' intrahousehold bargaining by reducing the opportunities of better market access and higher income. So even if women have access to assets and control production, if they do not control the marketing of output, they may still have little control over the proceeds and thus lower household bargaining power. This could be particularly true for female farmers, who are typically less involved in commercialized farming due to lower adoption of new technologies, lower access to extension service, lower integration with marketing channels etc., which results in unequal market participation by them (e.g. Blackden & Bhanu, 1999; Blackden et al. 2006; Kumase, Bisseleua & Klasen, 2010).

In our study we investigate female participation in commercialization of agricultural product and examine its impact on intrahousehold bargaining. The contribution of the study is threefold. Based on a survey with 911 male and female cocoa farmers in Cameroon, we first attempt to investigate the causes of unequal market participation by male and female farmers; second, we estimate the impact of market participation on intrahousehold bargaining; and third, we also explore the role of collective marketing in improving female market participation. Specific hypotheses that we examine are (1) market participation by female farmers is positively associated with collective marketing but negatively influenced by gender-based price discrimination in output markets (2) market participation affects control over cocoa revenue positively, where control over revenue is measured by the proportion of revenue controlled by the farmers individually.

Given that unobserved factors that explain female participation in marketing activities can be correlated with control over proceeds, simple OLS estimations would lead to biased results. We address this problem by linking the hypotheses above. In particular, our estimation uses the presence of collective marketing institutions (and male participation in these channels) as instruments for female market participation.

Cameroon's cocoa production provides us with a unique platform to address the research objective as, unlike in Asia, in many Sub-Saharan African countries, such as in Cameroon, agricultural production is often managed and controlled by male and female farmers separately. Decision-making authority with respect to the cultivation on these plots rests with individual household members; cultivation expenses are paid by the individual; and output from the plot is attributed to that individual (Duflo & Udry 2004, Kumase, Bisseleua & Klasen, 2010). This enables us to investigate marketing activities and resulting income inequalities by gender of the farmer.

Our data shows that although female farmers manage cultivation individually, marketing of cocoa mostly rests in the hands of the men. In contrast, male farmers usually control both the production as well as the marketing of cocoa. An important point to note here is that for (mostly female) farmers who do not participate in marketing, our data show that the task is then mainly carried out by another (typically male) family member. We also find that one of the plausible factors that could explain the lower market participation by female farmers is price discrimination. In particular, female farmers who market their cocoa receive significantly lower prices than their male counterparts. Consequently, revenue received by participating women is much lower than by participating men indicating that income opportunities are higher if a man takes over the marketing task. In our research area, we therefore find a large number of women relying on male members of the family for marketing their produce. While this strategy leads to higher revenues for the household, we find that it lowers the share of resources controlled by women compared to the situation where female farmers carry out the marketing themselves. Finally, our estimation shows that villages with better access to collective marketing could bring down the gender disparity in market participation by lowering the existing price discrimination. In particular, if male farmers increase their participation in collective marketing, the price received is uniform across all group members, thus removing the gender gap in prices, which in turn encourages female farmers to take part in the marketing and improves their control over proceeds.

The paper is organized as follows. Section 2 provides a brief description of the study context and discusses the data; section 3 provides a description of the estimation strategy; section 4 discusses the results; and section 5 concludes the paper.

2. Study context

2.1. The cocoa market in Cameroon

The organization of cocoa marketing in Cameroon is characterized by the interactions between licensed buyers, buying agents[3], Common Initiative Groups (CIGs)[4] (who often present themselves as producers' organizations) and producers' organizations (PO)[5]. Activity wise the POs and CIGs do not differ much from each other. They are different to some extent with respect to their funding sources. Licensed buyers are mostly based in the cities and buy cocoa in large quantities. They purchase either directly from farmers or rely on buying agents, who collect cocoa from large numbers of smallholder farmers. Buying agents often have long-standing relationships with farmers and offer them pre-harvest financing for input purchases. At harvest, they collect cocoa at the farmgate and then resell it to the licensed buyers. Licensed buyers transport the cocoa in large quantities to the buying centers, where it is sold to the exporters. Producers can market their cocoa either individually or collectively through POs and CIGs. Cocoa cultivation in Cameroon is a small-scale business with plantations ranging between two to five hectares. Most farmers are members of CIGs or POs, even if they market their cocoa individually. As members of such groups they can leverage the benefits of collective action, in terms of easier access to fertilizers and pesticides, regular contacts to government extension officers and exchange of knowledge, and better marketing opportunities and prices.

In case of collective marketing, these groups sign contracts with buyers, identify those members who have cocoa for sale, and then sell the total amount of cocoa collectively to the buyer. Thus, in the case of collective sales, CIGs and POs act as procurement organizations for buyers (Folefack & Gockowski, 2004; Gockowski, 2008). However, cocoa sales do not figure high on the priority list of all CIGs. Many CIGs instead focus on the protection of farmers' rights, on the organization of extension visits to obtain information on new farming

[3] Buying agents work for a licensed buyer and are paid on commission.

[4]After liberalization in 1994, the government withdrew all financial support and farmers found it difficult to procure fungicides and pesticides from private suppliers and as a result many of them started to look for alternative agricultural activities. Under such a scenario, the government and many non-governmental-organizations (NGOs) started to encourage cocoa farmers and traders to organize themselves in 'common initiative groups' (CIGs) to promote welfare through bulk marketing. The formation of CIGs helped to reduce transaction costs and as a result the prices paid to producers increased. In 1997, world cocoa prices started to recover from previous lows, thus bringing back many farmers to cocoa production (Dugum, Gockowski, Bakal, 2001).

[5]After liberalization, in the Centre region the former state cooperatives disappeared. POs primarily grew up with the support from development projects such as the Sustainable Tree Crop Program based at the IITA. According to Folefack & Gockowski (2004), 40% of the cocoa producers in the Centre are members of a PO. In the Southwest, the former cooperatives (such as the Southwest Farmer Cooperative Union based in Kumba) were placed in the hands of CIGs. In the absence of projects supporting producers' initiatives, no POs have been able to emerge in the Southwest.

techniques, and on the promotion of farmer-to-farmer assistance through the creation of farmers' networks. However, most of the smallholders living in remote villages are not well connected with the market and lack sufficient knowledge about market prices. As a result, farmers can be exploited by buying agents who tend to behave opportunistically by offering lower prices than the market price. In addition, farmers often obtain input credit from buyers to purchase fertilizers and pesticides during the production phase, which is then deducted from their cocoa deliveries at harvest. Due to their repayment obligations, farmers also face a lower bargaining position vis-à-vis the buyer in such a situation. In this context, collective sales organized through CIGs can improve the farmers bargaining situation vis-à-vis buying agents and thus protect them from opportunistic behavior.

Hence, collective sell through the reduction of transaction costs not only facilitates better access to marketing channels, but it also secures access to new technologies, and allows farmers to tap into high value markets (Stockbridge, Doorward, Kydd, 2003). Additionally, there is evidence that collective action can help smallholders to reduce barriers to entry into markets by improving their bargaining power with buyers and intermediaries (Thorp, Stewart, Heyer, 2005; Kherallah et al., 2002).

2.2. Empirical data and descriptive statistics

The empirical analysis is based on primary data, which was collected in six major cocoa producing subdivisions in Southwest and Center Cameroon, namely Ngomedzap, Boumyebel, Obala, Mbangassina, Bokito and Kumba (Kumase, Bisseleua, Klasen, 2010)[6]. The survey was conducted in October and November 2007 using a multi-stage random sampling approach. In the first stage, twelve communities were randomly selected within the six sub-divisions. Subsequently, within these twelve communities, 53 villages and 911 respondents were selected randomly. In total, 181 female farmers and 770 male farmers participated in the survey. All survey participants are members of Common Initiative Groups (CIGs). The villages are small (500 - 5000 inhabitants), yet, differ regarding their ethnic background and market orientation. Villages in Kumba and Mbangassina are mainly composed of migrants, who are more market-oriented and less concerned with land accumulation than their indigenous counterparts. Women in these communities are more engaged in commercial activities that require them to leave their homesteads. Villages in Bokito, Boumyebel, Ngomedzap and Obala are mainly composed of local people who are less market-oriented. Women in these communities are involved in small income-generating activities, but unlike

[6] The survey in Kumase, Bisseleua, Klasen (2010) was generated with support from BMZ via GIZ.

the women in Kumba and Mbangassina, they generally carry out their activities at home and generate considerably lower earnings.

Table1 presents descriptive statistics of individual characteristics by gender. Results show that while overall 78% of the farmers in our sample are married, marriage rates are significantly higher for male farmers. This is due to the fact that many female farmers are either widowed or single women, which is part of the reason that they control cocoa production. Nonetheless, a considerable share of female farmers in our sample is married (37%) and still controls cocoa production. Our data further suggest that female farmers are significantly less educated than male farmers: while 64% of men have completed primary education only 37% of women have done so. Moreover, our data confirm results found in other studies that women have substantially lower access to extension services. Interestingly, although significantly fewer women inherited the land they use, they hold more land titles than men. For many women in our sample, access to land has come as a result of land purchases, where titles are commonly awarded (Kumase, Bisseleua, Klasen, 2010).

With respect to cocoa marketing, we find that 40% of female farmers in our sample are not marketing their cocoa themselves, whereas only 4% of the male farmers delegate the marketing to somebody else. Similarly, the average price received by cocoa producers varies significantly across gender. On average, male farmers receive 811 CFA[7] per kilogram of cocoa, whereas female farmers receive only 570 CFA. This provides some evidence that gender-related price discrimination exists in the Cameroonian cocoa market. Finally, control over income is measured as the share of the cocoa revenue controlled by the individual farmer. In the questionnaire, farmers were asked what proportion of the revenue they could dispose of. Results of a t-test on gender differences show that the average share of income controlled does not differ significantly between male and female farmers in our sample.

[7] CFA is the currency of central and West Africa, which has been firmly linked to the French franc since 1948.

Table 1: Descriptive statistics of individual characteristics by gender

	Mean (sd)			
	All	Female	Male	t-stat
Share of revenue controlled	0.46	0.47	0.45	-0.76
	(0.23)	(0.22)	(0.23)	
Female	0.22			
	(0.41)			
Participation	0.88	0.61	0.96	16.10
	(0.32)	(0.49)	(0.2)	
Extension service	0.42	0.28	0.46	5.04
	(0.49)	(0.45)	(0.5)	
Age of plant (months)	41.30	35.88	42.82	1.03
	(2.78)	(1.44)	(3.53)	
Age	49.58	50.3	49.39	-0.94
	(12.83)	(10.97)	(13.32)	
Household size	7.02	6.32	7.23	2.81
	(4.32)	(3.21)	(4.57)	
Secondary and above	0.06	0.02	0.07	2.53
	(0.23)	(0.14)	(0.25)	
Primary completed	0.58	0.37	0.64	7.35
	(0.49)	(0.48)	(0.48)	
Less than primary	0.36	0.61	0.29	-8.88
	(0.48)	(0.49)	(0.46)	
Married	0.78	0.37	0.89	19.18
	(0.42)	(0.48)	(0.31)	
Land title	0.16	0.26	0.13	-4.42
	(0.37)	(0.44)	(0.34)	
Non-farm activity	0.25	0.21	0.26	1.63
	(0.43)	(0.41)	(0.44)	
Cocoa area	4.84	4.52	4.94	1.05
	(5.19)	(5.04)	(5.24)	
Age of cocoa plant(months)	41.30	35.88	42.82	1.03
	(2.78)	(1.44)	(3.53)	
Price	757.93	570.44	811.06	3.34
	(30.02)	(30.86)	(37.30)	
Female to male average price ration in village	0.92			
	(0.57)			
Marketing through CIG	0.27	0.23	0.28	1.43
	(0.44)	(0.42)	(0.45)	

Table2 reports the share of revenue controlled by market participation status and gender. We find that farmers, who market their cocoa, in general have slightly higher control over the proceeds from cocoa marketing; however, the difference between market participants and non-participants is not statistically significant. Yet, in the case of female farmers the control over revenue is significantly higher in the case of market participation. This indicates that for

female farmers, market participation is positively associated with their intra-household bargaining power providing evidence in support of our hypothesis that market participation renders higher control over proceeds.

Table 2: Share of revenue controlled by market participation and gender

	All	Participants	Non-Participants	Participants – Non-participants	t-stat
All	0.46	0.46	0.44	0.02	1.08
	(0.01)	(0.02)	(0.01)	(0.02)	
Male	0.45	0.45	0.43	0.02	0.56
	(0.01)	(0.01)	(0.03)	(0.04)	
Female	0.47	0.48	0.44	0.04	**1.64**
	(0.01)	(0.02)	(0.02)	(0.03)	

Note: Standard errors are reported in the parentheses.

Table3 presents further evidence on price discrimination in cocoa markets and how collective marketing relates to such discrimination.

Table 3: Prices received by gender

	Male	Female	t-stat
All	811.06	570.44	**3.34**
	(37.30)	(30.86)	
Participants	813.82	526.51	**3.13**
	(38.20)	(15.00)	
Non-participants	760.66	624.74	0.75
	(207.44)	(77.69)	
t-stat	0.27	1.51	
Selling through CIG	682.38	584.92	0.76
	(60.2)	(39.89)	
Not selling through CIG	862.7	556.48	**3.43**
	(46.71)	(40.05)	
t-stat	**2.16**	0.37	
Participants selling through CIG	682.07	538.64	0.73
	(61.26)	(17.11)	
Participants not selling through CIG	867.64	522.02	**3.27**
	(47.53)	(17.68)	
Non-Participants, selling through CIG	699.44	620.03	0.41
	(122.33)	(68.77)	
Non-participants, not selling through CIG	770.29	624.79	0.6
	(255.68)	(114.34)	
Villages without male farmers selling through CIG*	1098.91	627.57	**2.78**
	(82.71)	(86.21)	
Villages with male farmers selling through CIG	644.23	542.65	1.63
	(32.09)	(17.77)	

Note: Standard errors are reported in the parentheses, *these are villages where either no farmer or only female farmers participate in collective marketing. In our sample, 34% of the villages reported no male participation in collective marketing, whereas 33% of the villages are without any collective marketing. Gender differences in received prices in villages where no farmer is involved in collective marketing are also highly significant (at less than 1%).

The results allow us to make four distinct observations. First, irrespective of the marketing channel and farmers' market participation status, female farmers receive significantly lower prices than male farmers on average. Second, price discrimination occurs when female farmers are doing their own marketing; if they rely on others to do the marketing; they receive better prices, but still not the prices that are as high as those of male participants. Compared to the few male non-participants, however, the price differences are insignificant. Third, such discrimination is absent in collective sales, even if the female farmer is choosing to participate in marketing; conversely, gender-specific price discrimination is largest in the case of individual marketing. Fourth, in regions where males do not participate in collective marketing, the gender gap in prices is significant whereas in regions where male do take part, this gap becomes insignificant.

3. Estimation strategy

This section provides details on our estimation strategy identifying the determinants of market participation and the impact of market participation on control over cocoa proceeds. Hence we are interested in estimating the following model:

$$S_{ij} = \alpha_0 + \alpha_1 P_{ij} + \alpha_2 X_{ij} + e_{ij} \ldots (1)$$

Where S_{ij} is the share of revenue controlled by farmer *i* in village *j*; P is the market participation dummy and X is a set of exogenous variables. The α's are the parameters to be estimated; and e is unobserved error terms.

OLS estimates of the parameters in equation (1) are likely to be bias. In particular, female farmers may self-select out of market participation because of factors such as lower negotiation skills, lack of sufficient information, lower bargaining power, etc. (Fletschner & Mesbah, 2011, Chowdury, 2006; Ngimwa et al., 1997). If those unobserved variables correlate positively with control over revenues as well as with the market participation decision, OLS estimates of α_1 in equation (1) are biased upward, since part of the estimated effect of participation on control over proceeds can be attributed to female bargaining. Therefore, we need to account for potential endogeneity (from omitted variable bias and selection bias) using instrumental variables.

3.1. Identification

We use the percentage of male farmers in a village who sell collectively through CIGs as well as its interaction with gender as instruments in our analysis. We base our IV on the hypothesis that the higher the proportion of male farmers involved in collective marketing, the lower the

gender-specific price discrimination in the village, which then would promote female market participation.

The data presented in Table3 show that price discrimination in our set up arises when male farmers sell individually and thus receive higher prices than women. Consequently, a female farmer might decide not to engage in marketing (either individually or collectively), but rather rely on a male family member to carry out the task. As shown in Table3, however, in villages where male farmers participate in collective marketing, the prices received are similar for both men and women. Accordingly, as shown in Table4 below, women are more likely to participate in marketing in these villages.

By linking collective marketing to the likelihood of female market participation, we are able to test for the effect of market participation on the share of cocoa revenue controlled by the farmer.

The model that considers potential endogeneity of female market participation can be specified as the following two stage model.

$$S_{ij} = \alpha_0 + \alpha_1 P_{ij} + \alpha_2 X_{ij} + + v_j + e_{ij} \ldots (1),$$

First Stage:

$$P_{ij} = \beta_0 + \beta_1 z_{ij} + \beta_2 X_{ij} + v_j + n_{it} \ldots .. (2)$$

Second Stage:

$$S_{ij} = \alpha_0 + \alpha_1 \hat{P}_{ij} + \alpha_2 X_{ij} + + v_j + e_{ij} \ldots (1),$$

where $\hat{P}$ is the estimated market participation dummy v_j are village fixed effects z is our instrument, and β's are parameters to be estimated; and n are random error terms. In the following section we discuss the endogeneity issue and the identification strategy used in our analysis.

One potential concern here is that it is possible that female farmers are receiving lower price because of differences in quality. Our data does not provide us the scope to test for such differences. However, if this is one factor causing differences in price received by male and female farmers, such differences should exist even among those who sells collectively and among the non-market participants. Instead, we observe significant difference only for females who are participating in marketing and choosing to sell individually, which is a strong indication of price discrimination due to gender discrimination, not due to quality

differences.[8] However, to control for cocoa quality we use age of cocoa plant (in moths) to control for quality of cocoa (Dada, 2007).

Another issue is that it appears that men are losing out by choosing to market their produce collectively; as shown in Table3, they receive lower prices when selling through CIGs. So why are they still choosing to participate in collective marketing? Two factors may play a role. One is that participation in collective marketing generates other benefits of a more active CIG that makes it attractive for male farmers to participate. This could include more stable prices, better access to inputs and credit, access to subsidized services, and the like. Second, there might be self-selection issues with more assertive males choosing to market individually, while others rely on collective marketing. It is beyond the scope of this paper to investigate these interesting issues in more detail. Nonetheless, neither of these factors would adversely affect the relevance of this variable as an instrument for female participation, the focus of our study.

Table 4: Market participation by gender in villages with and without male farmers selling through CIG

	All	Male	Female
Villages without male farmers selling through CIG	0.86	0.94	0.52
	(0.02)	(0.01)	(0.05)
Villages with male farmers selling through CIG	0.9	0.97	0.65
	(0.01)	(0.01)	(0.04)
t-stat	**-1.9**	-1.26	**-1.96**

Note: Standard errors are reported in the parentheses

3.2. Exogeneity of instrument

Regarding exogeneity of the instrument, we suggest that this (village-level) aggregate measure is unlikely to have a direct influence on the share of female proceeds other than through the impact it has on the likelihood of female participation in the marketing chain. In order to test the exclusion restriction we regress the instrument on the share of cocoa revenue controlled by the farmer. Exogeneity of the instrument would imply that the instrument should not have any significant impact on share of revenue controlled by the farmer. In Table5 (see appendix) we show the exogeneity condition and the models estimated show that percentage of male farmers selling collectively and its interaction with female dummy are appearing with insignificant coefficient, thereby, supporting our suggestion that the instrument is exogenous.

[8] Price discrimination might also occur because of lower bargaining power of women. Kamdem et al, (2010) in their study analyzed the determinants of cocoa price in Cameroon. They argued that when prices are non- negotiable and there is information asymmetry buyers seize the entire surplus generated by trade. In this context they also discussed the welfare role played by collective action to ameliorate arbitrate and negotiate the price.

4. Results

4.1. Market participation

Estimation results from the linear probability model on market participation are shown in Table6. Regressing market participation on a set of exogenous controls, we find that female farmers are significantly less likely to participate in cocoa marketing (see Model1). Compared to male farmers, female farmers have a 32% lower probability to participate in markets. Furthermore, the coefficients on age and age squared are statistically significant indicating that participation increases with age, albeit at a decreasing rate. We also find evidence that higher education is critical for market participation. Compared to farmers with lower education (less than primary or no education at all is the left-out category), farmers who completed secondary education have 8% higher probability to participate in the market.

In Model 2, we include our main identification variable percentage of male farmers selling through CIGs in village along with additional controls: age of cocoa plant in months and interactions of female dummy with land title and marriage dummy. As per our expectation the identification variables appears with a significant and positive coefficient. Age variable loses its significance, but age square still has a negative impact and higher education still exerts similar impact on participation. Additionally we find that married women are likely to participate less than the unmarried women.

In Model 3 includes all the controls in Model 2 and additionally it controls for female to male average price ratio in village. When including these additional variables, results on female dummy, higher education and age remain robust across all the three model specifications. However, we find that after including price ratio as additional regressor, our identification variable, percentage of male farmers selling through CIG, again appears with a significant and positive coefficient, but compared with Model 2 size of its coefficient decreases significantly (at less than 5% level). On the other hand, price ratio influences participation significantly and positively with its impact being 4%. Thus, as the prices received by female farmers increase relative to that received by men (and thus price discrimination against female farmers decreases) female market participation is promoted.

Table 6: Determinants of market participation

Dependent variable: Market Participation dummy	Model1	Model2	Model3
% of male farmers selling collectively in village		1.008***	0.624***
		(0.053)	(0.077)
Female to male average price ratio in village			0.043***
			(0.012)
Female	-0.329***	-0.223***	-0.249***
	(0.068)	(0.083)	(0.081)
Age	0.011*	0.008	0.010*
	(0.006)	(0.005)	(0.006)
Age sq.	-0.011*	-0.009*	-0.012*
	(0.006)	(0.005)	(0.006)
Household size	0.004	0.004	0.004
	(0.002)	(0.002)	(0.003)
Married	-0.061	0.008	-0.021
	(0.049)	(0.039)	(0.038)
Primary completed	0.040	0.035	0.030
	(0.025)	(0.025)	(0.026)
Secondary and above	0.088**	0.080**	0.076*
	(0.038)	(0.036)	(0.038)
Land title	-0.041	-0.036	-0.041
	(0.036)	(0.036)	(0.041)
Cocoa area	0.770	0.642	2.175
	(2.876)	(2.866)	(2.741)
Non-farm activity	-0.011	-0.008	-0.004
	(0.027)	(0.026)	(0.026)
Extension service	0.004	0.009	0.006
	(0.019)	(0.020)	(0.022)
Age of cocoa plant(months)		-2.6E-05	-1.7E-05
		(5.7E-05)	(4.8E-050)
Land title*Female		-0.019	-0.014
		(0.101)	(0.101)
Married*Female		-0.198*	-0.170
		(0.110)	(0.105)
Constant	-0.094	-0.177	0.311*
	(0.103)	(0.122)	(0.165)
Observations	911	911	780

Note: Robust standard errors in parentheses;*** p<0.01, ** p<0.05, * p<0.1; for education the left-out category is less than primary education; village fixed effects are included in all models. In Model 3 sample size is reduced because there are some villages without any female respondent.

Since, after including price ratio as a regressor, coefficient on the identification variable falls in magnitude significantly, one could also see this as a transmission channel through which the identification variable is affecting participation[9].

[9] To test for the impact of male participation in collective marketing on village price discrimination we ran a separate regression with price ratio as a dependent variable and our instrument, percentage of male selling through collective marketing, as an independent variable along with other controls in Model2. The instrument is found to improve discrimination significantly (at less than 1% level) by 40%.

4.2. Control over revenue

Table7 provides the estimation results from the instrumental variable analysis of control over cocoa revenue treating market participation choice as endogenous regressor.

Similar to Table5 and Table6 the basic model we use for our analysis is Model 1 with covariates female dummy (which takes the value 1 if the producer is female), age variables, household size, marriage dummy, primary and higher education dummies, land title dummy, area of cocoa cultivated, non-farm activity dummy and access to extension service dummy. To this basic model we added and subtracted other covariates and produce estimation results for various other model specifications. Model 2 also includes interactions of female dummy with land title dummy and marriage dummy. Model 3 excludes extension service from Model 1. Model 4 includes interaction between female dummy and participation. In addition it also includes age of cocoa plant and subtracts age square, marriage dummy and non-farm activity from Model 1. Finally Model 5 includes all covariates of Model 1 and 4. Hence, the first three models in Table7 report the estimation results of the impact of market participation on control over cocoa revenue and last two models additionally estimates differences in impacts of market participation by gender.

Model 1, 2 and 3 show positive and significant impacts of participation on farmers' control over the proceeds and the magnitude of impact varies in a range from 50% to 58%. The female dummy has a positive and significant coefficient in Model 1 and 3. This suggests that female producers tend to have a higher control over proceeds, controlling for the all covariates including participation. However, when the female dummy is interacted with land title and marriage dummies (see Model 2) the significance of female dummy disappears and coefficient of female and married dummy appears with significantly positive impact; this suggests that married female producers can claim a higher share. Quantitatively, it indicates that marriage provides 16% higher control over revenue to women than to men. The marriage dummy has no significant coefficient indicating that marital status does not have a significant impact on control over revenues by men. Furthermore, estimating the impact of marriage for all farmers (joint effect of marriage and the interaction between female and marriage dummies) we find that marriage increases the share of revenues controlled by 11 % (significant at 5%). Additionally, we find that in all three models holding a land title increases control over revenue by 4% to 5%, indicating that land rights provide higher control over revenue and thus also provides higher bargaining power.

In Model 4 and 5 we include an interaction term between market participation and gender and age of the cocoa plant. In Model 4 we find that by female farmers who participate in the market control significantly higher proportion of the cocoa revenue. In Model 5, the interaction term has the nearly the identical quantitative magnitude but just misses significance, presumably doe to correlations with the additionally included covariates. In both models, the coefficient of participation is positive but insignificant indicating that participation does not have significant impact on male control over cocoa proceeds. Considering the joint impact of participation and its interaction with female dummy we find positive and significant (at 1% and 5% level, respectively) impact of participation on control over revenue in both models. Additionally in Model 4 extension service exerts a positive and significant impact by increasing farmers' control over revenue by 11%.

Looking at the instruments we find that percentage of male farmers selling collectively in village has strong positive impact on participation (see Table8 in appendix in which we reported the first stage regression results of models estimated in Table7). In Model 4 and 5, we additionally included interaction of the instrument and female dummy to control for the endogeneity of interaction of participation and female dummy. In models where participation is included as endogenous regressor percentage of male farmers selling through CIGs is included as IV and models that additionally interacts female dummy with participation utilizes IV interacted with female dummy as the IV. Therefore, all our models are exactly identified. The first stage results shows that the interaction of our main instrument and female dummy has a significant but negative impact on participation in both specifications, implying that in general the instrument has a positive impact on participation, however its impact on female farmers participation is less than that on male farmers. However, it does not affect interactions of participation and female dummy significantly indicating that it is not a strong instrument for this interaction, so that identification relies largely on the other instrument.

Table7: Instrumental variable analysis of control over cocoa revenue

Dependent variable: Share of cocoa revenue	Model1	Model2	Model3	Model4	Model5
Participation	0.560**	0.504**	0.586***	-6.429	-6.890
	(0.235)	(0.229)	(0.192)	(4.252)	(4.677)
Participation*Female				7.548*	7.834
				(4.414)	(4.906)
Female	0.173**	0.064	0.183**	-6.858*	-7.110
	(0.088)	(0.082)	(0.076)	(4.160)	(4.623)
Age	-0.005	-0.002	-0.005	-0.005	-0.006
	(0.004)	(0.004)	(0.004)	(0.005)	(0.006)
Age sq.	4.0E-05	4.0E-05	4.0E-05		
	(3.0E-05)	(3.0E05)	(3.0E-05)		
Household size	-0.002	-0.001	-0.002	0.003	0.003
	(0.002)	(0.002)	(0.003)	(0.009)	(0.012)
Married	0.012	-0.050	0.012		0.129
	(0.035)	(0.033)	(0.036)		(0.128)
Primary completed	0.001	0.007	-0.001	0.080	0.092
	(0.015)	(0.013)	(0.016)	(0.107)	(0.112)
Secondary and above	-0.058*	-0.046	-0.060*	0.286	0.372
	(0.032)	(0.029)	(0.035)	(0.231)	(0.280)
Land title	0.051***	0.040**	0.051**	-0.106	-0.121
	(0.020)	(0.019)	(0.020)	(0.176)	(0.194)
Cocoa area	-4.0E-04	-2.0E-04	-4.6E-05	-0.003	-0.004
	(0.002)	(0.002)	(0.002)	(0.010)	(0.011)
Non-farm activity	-0.005	-0.009	-0.005		-0.115
	(0.020)	(0.018)	(0.020)		(0.147)
Extension service	-0.007	-0.011		0.114*	0.110
	(0.021)	(0.021)		(0.058)	(0.082)
Age of cocoa plant(months)				-4.6E-05	-6.1E-05
				(2.0E-04)	(2.0E-04)
land title*Female		0.028			
		(0.048)			
Married*Female		0.165***			
		(0.061)			
Constant	0.034	0.076	0.018	0.018	7.097
	(0.257)	(0.251)	(0.236)	(0.236)	(4.663)
Observations	911	911	911	911	911
Excluded instruments					
% of male farmers selling collectively	Yes	Yes	Yes	Yes	Yes
% of male farmers selling collectively	No	No	No	Yes	Yes
F-stat of excluded instruments					
Participation	15.92	17.22	18.43	5.09	6.68
Participation*Female				8.34	11.5

Note: Robust standard errors in parentheses;*** p<0.01, ** p<0.05, * p<0.1; for education the left-out category is less than primary education; village fixed effects are included in all models; First stage results are reported in the appendix. For participation*Female we use % of male farmers selling collectively in village*Female as instrument. Result of the first stage regressions in shown in Table 2.8 in the Appendix.

Additionally, in Table8 we report the test results of endogeneity of participation choices using Durbin-Wu-Hausman chi-sq test. Under the null hypothesis that participation is exogenous, these statistics are all significant indicating endogeneity of participation.

5. Conclusion

This paper examines participation of female farmers in agricultural marketing and its impact on control over revenues. Using data micro level data from Cameroon's cocoa producers in our study we measure commercialization of farmers by their integration with cocoa markets and argue that by participating in cocoa marketing farmers; especially the female farmers who generally participate less in marketing; could increase their intrahousehold welfare. Our data shows that a female farmers, individually, are managing their cocoa production which is a major cash crop of the country (Duguma, Gockowski, Bakala, 2001), but very few of them take up the marketing activities. In other words, while male farmers are producing as well as marketing their own produce, female farmers participate only in production and not in marketing. Consequently, family members who help her in marketing could then claim a share in the revenue, reducing her own control over the sharing decision. Therefore, we argue that market participation provides higher bargaining power in deciding the sharing decision and provides higher control over the proceeds.

In our analysis we identify price discrimination against female farmers as a factor explaining significant gap in male and female market participation in cocoa markets in Cameroon. We make the argument that lower male participation in collective marketing leads to significant price discrimination against female farmers which then discourage female market participation. Essentially, such discrimination occurs because men with better marketing abilities despite their membership with CIGs decide to sell individually which then creates significant price gap between farmers selling individually and collectively. We do not find similar evidence for female farmers: female farmers do not gain significantly by selling individually. There could be various reasons for such different price attainments, such as, asymmetric information on market price, lower negotiation skill of female farmers, lower network opportunities etc. However these factors are all beyond the scope of our study. We precisely make the argument that our data shows evidence on gender discrimination in price received by cocoa farmers lowering their market participation.

We further argue that price discrimination is likely to be lower in regions where male participation in collective marketing is higher than those regions with lower male

participation. As a result lower price discrimination will motivate more women to take up their own marketing. Therefore, in the estimation of impact of market participation on share of cocoa revenue controlled by farmer herself we use proportion of male farmers selling collectively in village for instrumenting market participation. This instrument satisfies the exogeneity condition of instrument as in a household model, extra-household factors, such as, male participation in collective marketing in any region, is likely to vary exogenously. Our estimation results confirm that the instrument has a significantly positive impact on market participation and market participation influences control over revenue positively. Therefore, our study establishes three major conclusions: price discrimination has been inhibiting female market participation; second, higher male participation in collective marketing reduces price discrimination and positively impacts on female market participation and finally, by participating in marketing female farmers could achieve higher control over cocoa revenue.

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APPENDIX

Table 5: Testing for the exogeneity of % of male farmers selling collectively in village

Dependent variable: Share of revenue controlled by farmer	Model1	Model2
Participation	0.017	0.023
	(0.021)	(0.022)
% of male farmers selling collectively in village	-0.129	-0.166
	(0.236)	(0.231)
% of male farmers selling collectively in village*Female		0.013
		(0.040)
Female	-0.005	-0.047
	(0.024)	(0.035)
Age	0.001	0.002
	(0.004)	(0.004)
Age sq.	-0.002	-0.003
	(0.003)	(0.003)
Household size	0.000	0.000
	(0.002)	(0.002)
Married	-0.021	-0.045*
	(0.021)	(0.027)
Primary completed	0.022*	0.024*
	(0.013)	(0.013)
Secondary and above	-0.010	-0.007
	(0.031)	(0.031)
Land title	0.028	0.022
	(0.021)	(0.025)
Cocoa area	-0.023	0.097
	(1.229)	(1.251)
Non-farm activity	-0.011	-0.013
	(0.016)	(0.016)
Extension service	-0.005	-0.007
	(0.014)	(0.014)
Age of cocoa plant(months)		-5.0E-05
		(4.0E-05)
Land title*Female		0.020
		(0.039)
Married*Female		0.069*
		(0.041)
Constant	0.456***	0.459***
	(0.133)	(0.132)
Observations	911	911

Note: Robust standard errors in parentheses;*** p<0.01, ** p<0.05, * p<0.1; for education the left-out category is less than primary education; village fixed effects are included in all models

Table8: First stage regression results of IV models presented in Table 2.7

	(M1) Participate	(M2) Participate	(M3) Participate	(M4) Participate	(M4) Participate *Female	(M5) Participate	(M5) Participation *Female
Female	-0.329***	-0.223***	-0.329***	-0.206***	0.733***	-0.232***	0.702***
	(0.068)	(0.083)	(0.068)	(0.072)	(0.070)	(0.083)	(0.079)
Age	0.011*	0.008	0.011*	-0.001	-0.000	-0.001	-0.000
	(0.006)	(0.005)	(0.006)	(0.001)	(0.001)	(0.001)	(0.001)
Age sq	-1.0e-04*	-9.0e-05*	-1.0e-04*				
	(5.0e-05)	(5.0e-05)	(5.0e-05)				
Household size	0.004	0.004	0.004	0.004*	0.003	0.005**	0.004*
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Married	-0.061	0.008	-0.060			-0.055	-0.067
	(0.049)	(0.039)	(0.049)			(0.050)	(0.043)
Primary	0.040	0.035	0.040	0.036	0.023	0.040	0.026
	(0.025)	(0.024)	(0.025)	(0.025)	(0.019)	(0.027)	(0.021)
Secondary	0.088**	0.080**	0.088**	0.095**	0.043	0.088**	0.029
	(0.038)	(0.036)	(0.038)	(0.037)	(0.028)	(0.039)	(0.026)
Land title	-0.041	-0.036	-0.041	-0.045	-0.021	-0.039	-0.016
	(0.036)	(0.035)	(0.036)	(0.038)	(0.031)	(0.038)	(0.031)
Area of	0.001	0.001	0.001	0.001	0.001	0.0003	0.001
	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)	(0.002)
Non-farm	-0.011	-0.008	-0.011			-0.002	0.011
	(0.027)	(0.026)	(0.027)			(0.028)	(0.019)
Extension	0.004	0.008		0.009	-0.008	0.013	-0.003
	(0.019)	(0.020)		(0.017)	(0.010)	(0.017)	(0.009)
Age of plant				-2.3E-05	-2.3E-05	-2.3E-05	-2.3E-05
				(5.0E-05**)**	**(**3.0E-05**)**	**(**5.0E-05**)**	**(**3.0E-05**)**
Land* Female		-0.019					
		(0.101)					
Married* Female		-0.198*					
		(0.110)					
IV	1.610***	1.714***	1.587***	0.268***	0.267***	0.302***	0.306***
	(0.404)	(0.413)	(0.370)	(0.094)	(0.085)	(0.091)	(0.081)
IV *Female				-0.276*	-0.233	-0.302*	-0.264
				(0.166)	(0.161)	(0.168)	(0.162)
Endogeneity test (p-val)	0.16	0.04	0.04	0.04	0.00	0.00	0.00
F-stat	15.92	17.22	18.43	5.09	8.34	6.68	11.5
Observations	911	911	911	911	911	911	911