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More Coffee, More Cigarettes? Coffee Market Liberalisation, Gender, and Bargaining in Uganda

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More Coffee, More Cigarettes? Coffee Market Liberalisation, Gender, and Bargaining in Uganda*

Jennifer Golan and Jann Lay

Abstract:

Focusing on intra-household allocation, we investigate the effects of coffee market liberalisation in Uganda. As coffee has traditionally been a male domain, higher income from this activity might increase gender disparities. In addition, gender-related inefficiency in household production might undermine the positive impact of improved incentives. Using data from three household surveys conducted between 1992 and 2006, we estimate Engel curves, coffee yield and labour input equations incorporating bargaining proxies. We find that income from coffee is increasingly pooled and therefore shared more equally among household members. Yet, we can only detect partial improvements in production efficiency: bargaining still appears to constraint output efficiency and the distribution of household resources continues to follow gendered lines. Moreover, female-headed households are deterred from entry into coffee farming mainly because of discrimination in access to land.

Keywords: Coffee, Market liberalisation, Gender, Bargaining, Intra-household allocation, Sub-Saharan Africa, Uganda

JEL classification: D13, D61, J16, O12, O13, O24

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Introduction

The lack of clear-cut evidence concerning the gender implications of market liberalisation in Sub-Saharan Africa is remarkable. This is despite the fact that it is well known that increased trade and investment flows can have important repercussions on gender inequalities. To date, the discussion has been mainly concentrated on the manufacturing sector. While the high female-labour intensity of manufacturing export industries is well-established empirically (see, for instance, Wood, 1991; Paul-Majumder and Begum, 2000), the welfare implications for women and hence the impact on gender inequalities is less well researched.[1] Trade-related employment and the cash income earned by women could improve their status within the household, which might lead to higher individual welfare of women (and possibly of the society as a whole). In contrast, more sceptic accounts of the welfare impacts stress the precarious labour conditions for women and the increased workload that women often face when taking up a job in the export sector. On all accounts, the focus on manufacturing leads to an understatement of the importance of reforms affecting the agricultural sector, the dominant sector in most of the poorer parts of the world. This paper therefore intends to extend the "trade and gender" debate to agricultural economies by looking at the gendered consequences of cash crop market liberalisation and the subsequent increase in trade.

In order to assess trade reforms from a gender perspective, intra-household issues are of great importance as gender inequalities are embedded in the social structure of a society and are reflected in the existing intra-household allocation rules. By affecting the households' production and consumption structure, trade reforms can have an important impact upon households' resource allocation patterns and herewith on the existing gender relations.

[1] There are some notable exceptions including Newman (2002), as well as Nicita and Razzaz (2003). Quite some research effort has been dedicated to the impact of trade on the degree of gender discrimination in labour markets, in particular by examining its impact on the gender wage gap. See for example Ghiara (1999), Seguino (2000) and Berik *et al.* (2004).

However, to date the evidence on the gendered effects of cash crop market liberalisation is very scarce although there is some anecdotal evidence in various policy documents for negative effects and the exclusion of women. Furthermore, most gender analyses tend to focus on barriers to women from a static perspective and have very little to say on whether these barriers have possibly changed although some anthropological evidence points to changes in gender roles in East Africa (see for example Silberschmidt, 2001; Dolan, 2001).

We aim at filling these empirical gaps by investigating the case of coffee in Uganda, a country where thorough sector reforms have triggered a substantial supply response. The following hypotheses are put to the test: First, as coffee has traditionally been a male domain, increased income from this activity might have strengthened the male position in the household, thereby increasing gender disparities. Second, allocative inefficiency due to the non-cooperative nature of the household decision process may hinder reforms from unleashing their production efficiency-enhancing potential. Third, due to discrimination, particularly in access to land, female-headed households might have been excluded from reaping the benefits of reform.

We use data from three household surveys conducted between 1992 and 2006 to quantitatively examine these hypotheses. In order to assess changes in bargaining power related to changes in coffee income, we examine whether the share of coffee income positively (negatively) affects the expenditure shares on male (female) goods by estimating Engel curves for a number of more or less gender-specific goods. We find that the share of household income derived from coffee had some impact on household expenditure patterns in the early 1990s, but that this effect appears to have vanished by today. Thus, coffee income seems to be more equally distributed between men and women in the early 2000s. While increased income pooling indicates more cooperative household behaviour, coffee yield and in particular labour input estimations indicate that intra-household struggles over resources

for coffee production as well as agricultural gender roles still persist. Similarly, the situation of female-headed households has not improved. On the contrary, our results suggest that female-headed households are increasingly disadvantaged compared to their male counterparts principally through their constrained access to land.

The paper first provides a short review of the literature on gender roles in agriculture, intra-household resource allocation and bargaining processes that is relevant to understand the transmission channels of trade reform in the rural context. We then present the respective methodological frameworks and the empirical results. A final section concludes.

Analytical Background and Previous Findings

Analysing the gendered welfare impact of trade reforms and increased trade flows in the context of a poor agricultural economy requires an in-depth understanding of household decision processes. The unitary model of household behaviour is a useful starting point in order to specify the nature of household decision processes and its bearing on the gendered effects of trade. The key assumption of the unitary model is that "…a multiperson household has a single well-ordered preference function" (Becker, 1974: 16). In addition, the model assumes that within the household all resources (land, labour, and capital), and consequently, all production and/or incomes from factor markets are pooled. If the unitary model of household behaviour were to apply, i.e. if the household could be treated as a utility-maximising and resource-pooling unit, the gender effects of trade reforms would be negligible because all household members would benefit equally from possible efficiency improvements.

However, not surprisingly, there exists plenty of evidence against the unitary model. Especially the assumption that incomes from different household members are pooled and that, in consequence, different income sources ought not to impact the household expenditure pattern has been increasingly challenged. For instance, Hoddinott and Haddad (1995)

examine the impact of female income shares on household expenditure patterns in Côte d'Ivoire using data from the late 1980s. The study verifies a positive relation between the female income share and expenditure on food and the reverse for alcohol and tobacco expenditure, herewith rejecting the existence of income pooling. For the same country and the same period, Duflo and Udry (2004) confirm this finding and even reject perfect insurance within the household. Quisumbing and Maluccio (2003) use more recent datasets for Bangladesh, Ethiopia, Indonesia, and South Africa to test the income pooling hypothesis. They evaluate the impact of a wider range of variables, including human capital and individually-controlled assets, on expenditure allocation decisions. In all country cases, the unitary model is rejected, yet to different degrees.

These findings lend support to household models where the household's interests are not pursued via maximising a uniform welfare function. Rather, individuals have diverse preferences and household as well as individual welfare result from bargaining struggles over household resources. If individuals have diverse preferences there is no a priori reason to give up control over individually earned income. In bargaining models there is hence no supposition of income pooling within the household. On the contrary, these models allow different income sources to impact for example on the household expenditure pattern since individual incomes might proxy relative bargaining strength, as found in the above empirical studies.

Different bargaining models have been proposed in the context of household resource allocation including cooperative, also called 'collective' (Chiappori, 1992), non-cooperative (Ulph 1988; Haddad and Hoddinott, 1995; Carter and Katz 1997), and semi-cooperative approaches (Smith and Chavas, 1999; Lim *et al.*, 2007).[2] In contrast to the unitary model, cooperative household models allow household decision makers to have different preferences,

[2] Different typologies of models can be found in the literature. See Alderman *et al.* (1995) and Browning *et al.* (2006) who distinguish 'collective' (cooperative or non-cooperative) and 'unitary' models.

but still assume, as opposed to non-cooperative models, that outcomes of the bargaining process are Pareto-efficient. Pareto-efficiency under preference diversity implies that households dispose of sharing processes that enable them to negotiate adequate compensations. While these assumptions have been supported in empirical studies of developed countries (for example Bourguignon *et al.*, 1992, 1993 for France and Canada; Browning and Chiappori, 1994, for Canada; Thomas and Chen, 1994, for Taiwan), they have been rejected in the rural Sub-Saharan context by various studies. For instance, in his examination of farm households in Burkina Faso, Udry (1996) finds that female plots exhibit substantially lower yields because they are less intensively farmed. Due to diminishing returns, households could increase production, for example by reallocating inputs, primarily labour, from male to female plots. This indicates that the institutions guiding the intra-household bargaining process and, in particular, the compensation mechanisms are not adequate to yield efficient outcomes. The lack of such institutions is also documented by Jones (1983) who provides evidence from North Cameroon. Her findings suggest that married wives do not allocate enough labour to rice production due to inadequate compensation. Again, both men and women would gain if married women were compensated for allocating less time to “their” sorghum and more time to “men’s” paddy rice production. Taken together, quite some evidence has been accumulated against both Pareto-efficiency and income pooling, particularly in agrarian settings. Thus, at least partly non-cooperative behaviour within the household seems to prevail.

In Sub-Saharan Africa, efficient negotiations might be complicated by at least three factors: First, household members typically jointly contribute to agricultural production. While wages of individual household members in developed countries are easily observed, the individual marginal agricultural product is much more difficult to assess. Second, the number of tasks is much larger than in developed countries. On top of agricultural and non-agricultural activities,

it includes the labour-intensive production of a number of household public goods, such as water fetching, cooking or herding. Third, households have to negotiate under strong cultural gender roles, for example the exclusion of women from certain agricultural activities.

While empirical contributions from developing countries typically put only one of the two hypotheses to test, i.e. either income pooling or production efficiency, we consider it particularly worthwhile to think about the link between the two, especially in the Sub-Saharan setting. If women could use their relative bargaining strength to influence merely their labour allocation, while income from, say, coffee production remained controlled by men, allocative inefficiencies are likely to exacerbate when the returns to coffee cultivation increase. However, an increased dependency on the female labour input in coffee production might induce changes in the degree of coffee income pooling, thereby allowing the household to allocate female labour more efficiently.

The example highlights that intra-household processes and changes therein are of utmost importance for an evaluation of the gendered impact of trade reform (Alderman *et al.*, 1995, 1997). Yet, there are very few empirical assessments of changes in bargaining processes and gender roles. From the Sub-Saharan context, we are not aware of studies that examine such changes in intra-household bargaining processes and outcomes in response to policy shocks or socio-economic development. One of the few empirical contributions in this regard is Newman's (2002) study on the gendered impact of increased female employment in the cut flower industry in Ecuador. She reports behavioural change and finds a reallocation of the housework load by the increased bargaining power of the wives in regions where those industries are located.

For the Ugandan case, there is also very little evidence on the gendered impact of trade reform and, in particular, coffee market liberalisation although quite some "gender policy documents" with different foci have been commissioned by donors (Baden, 1993; Elson and

Evers, 1996; World Bank, 2005). Some of these documents express fears that "the economic reform programme has not only failed to reduce […] gender distortions and barriers – it has intensified many of them" (Elson and Evers, 1996: 21) although many of these statements rest on fragile empirical evidence.

It seems to be fairly well established that coffee production in Uganda relies heavily on female labour inputs in the production process while marketing and control over coffee income lie in male hands (Bantebya and Keniston, 2006; Elson and Evers, 1996; Evers and Walters, 2001; Evers and Walters, 2000; EPRC, 2007; Kasente, 1997). To some extent, men exert control over their spouses' labour, a tradition also reflected by the practice of paying a bride price (Evers and Walters, 2001). As in other Sub-Saharan countries, the strict gender division of tasks is not limited to cash crop production. The production of food crops as well as the specific tasks in the production of other crops, for example weeding, typically falls into the female domain (Kasente *et al.* 2000; Dolan, 2001). In addition, women bear the burden of housework, which, beyond domestic tasks, comprises an amount of time-consuming duties, such as water fetching or the collection of fire wood.

In light of the nature of gender relations and the above discussion of intra-household decision-making, it may be instructive to think about two scenarios when considering policy change. First, assume there is no change in intra-household decision-making; then, higher incomes from coffee may result in increased struggle over household resources. By controlling a higher share of household income, male bargaining power might even become stronger, a mechanism that would hence reinforce existing bargaining asymmetries. More income under male control may bias expenditure patterns towards higher consumption of male goods, some of which may even be harmful to other household members' welfare, such as higher alcohol and tobacco consumption. Moreover, increased male bargaining power could lead to "overutilise" female labour while male labour turns out to be relatively "underutilised". In

consequence, increased bargaining strength might result in squeezing women's labour time (Elson and Evers, 1996). More intense bargaining struggles may even cause a higher incidence of domestic violence.

Yet, in a second possible scenario instead of favouring the male position within the household, increased coffee income might increase the importance of the female participation in the production process, which might raise women's relative bargaining strength and lead household negotiations towards more equitable compensation agreements. Alternatively, other socio-economic changes, especially the increased market participation of farmers as well as the growing importance of non-agricultural income sources in rural areas in Uganda (Kappel *et al.*, 2005), may generally lead to female empowerment and cause a modification of the household allocation rules (Haddad and Reardon, 1993). Together, these different facets of possible change in household decision-making processes would tend to move households towards more cooperative behaviour, thereby increasing the likelihood of efficient bargaining outcomes. While it remains difficult to disentangle the effects of coffee market liberalisation from those of other changes for evaluating the gender impact of increased coffee income, it might be less important *why* exactly the rules change, but that they are subject to change. In the following, we empirically trace the Ugandan households' adaptation pattern during a period of remarkable economic transformation and structural change.

Household Survey Evidence from Uganda

Coffee sector deregulation was one of the core pieces of Uganda's economic reform programme of the 1990s.[3] Overall, coffee sector reforms have been judged successful in a number of studies as they have triggered a considerable supply response, which improved the living standards of coffee farming households (Baffes, 2006; Bussolo *et al.*, 2006). Whether

[3] See the chapters of Reinikka and Collier (2001) for different aspects of the reforms. Further discussions include Dijkstra and van Donge (2001) or Okidi *et al.* (2006). Details on the coffee sector reforms can be found in Akiyama (2001).

this positive account still holds when coffee sector reforms are assessed from a gender perspective will now be examined drawing upon three survey datasets: the Integrated Household Survey (IHS) of 1992/93, the Uganda National Household Survey (UNHS) of 1999/2000 and the UNHS 2005/06, which were made available by the Uganda Bureau of Statistics (UBOS). In contrast to most existing studies on gender relations, the use of these relatively comparable datasets allows us to examine behavioural change.

Moving towards cooperation and female empowerment?

Coffee income is increasingly pooled

In line with Hoddinott and Haddad's investigation on Côte d'Ivoire, we examine the impact of the coffee income share on household expenditure pattern over time. In a framework originally introduced by Working (1943), Deaton (1989) and Deaton *et al.* (1989) propose a specification for empirically testing determinants of domestic expenditure in order to reveal possible gender bias within the allocation of household resources. Given demographically separable goods, i.e. goods exclusively consumed by particular household members, a reduction in expenditures on adult goods due to the addition of boys versus girls can be used to reveal intra-household gender discrimination (Deaton *et al.*, 1989). However, as Haddad and Hoddinott (1995) illustrate, the estimation of Engel curves via assessing the differential impact of demographic groups on household expenditure patterns, a necessary prelude of Deaton's 'boy-girl-discrimination-approach', still constitutes a useful instrument for detecting gender bias.

We therefore follow Deaton's (1989, and Deaton *et al.*, 1989) specification:

$$w_i = \frac{p_i q_i}{x} = \alpha + \beta_i \ln\left(\frac{x}{n}\right) + \eta_i \ln(n) + \sum_{j=1}^{J-1} \gamma_{ij} \left(\frac{n_j}{n}\right) + \delta_i z + \lambda_i cof + u_i \qquad (1)$$

where total household expenditure is expressed as x and the number of people in the same

household as *n*. w_i is the expenditure share on good *i*, which is linearly related to the logarithm of the household per capita expenditure (see Deaton and Muellbauer, 1980), household size (see Working, 1943), and the demographic household composition, $\sum_{j=1}^{J-1}\gamma_{ij}\frac{n_j}{n}$; that is, the proportion of household members in demographic group *j*. *z* simply comprises additional information presumably influencing the overall expenditure pattern, such as the educational level of the head of the household or the "type of community" (Working, 1943: 48).

The primary variable of interest in the analysis is the household's income share out of coffee production, *cof*. As reported above, while women are greatly involved in the coffee production process (harvesting, seeding, etc.), men dominate selling activities and thus control coffee proceeds (EPRC, 2007). To capture the importance of bargaining processes beyond coffee income, we include a dummy capturing male or female 'excess education' while at the same time controlling for the educational level of head and spouse, respectively.[4] We test a range of other possible bargaining proxies that could be constructed for all survey years, including, for example, age differences between heads and spouses as well as variables related to women's age at giving birth to their first child. However, given the problems arising in the construction and qualitative adequacy of these variables,[5] it is not surprising that these alternative proxies do not yield any further insights and will therefore be disregarded in the following.

If we are less concerned with comparability between years, we can make use of particular questions asked in the surveys of 1999/2000 and 2005/06, respectively, to construct more

[4] The male/female 'excess education' variables are dummy variables which equal the value of one for those households having an educational disparity between head and spouse that exceeds a threshold of five years for males and four years for females. In case of polygamous households, the educational level of the wife with the highest educational achievement has been chosen for the calculation. Female-headed household heads are excluded. The sub-sample formation is discussed in more detail below.

[5] For instance, the Ugandan surveys do not allow assigning children to their biological mother.

convincing bargaining proxies. For 1999/2000, we have information on the inheritance rules applied in each community, i.e. we know which household or family member typically inherits the parents' (fathers' or mothers') land and other assets.[6] We aggregate this information by creating dummy variables for communities where rules exclusively favour women or men, respectively. Even more interestingly, the 2005/06 survey asks farmers: "Who mainly manages/controls the output from this parcel among the household members?"[7] Based on this question, we construct dummy variables indicating whether output (from all parcels of the household) is controlled only by the head or only by the spouse.

Expenditure functions have been estimated for each survey following Deaton's specification with minor modifications. The demographic categories have been altered following Appleton *et al.* (1999) using three age-gender sub-groups: children aged between 0 and 5, between 6 and 14, and adults aged over 15. Following the functional specification of Working and Leser, the logarithms of per capita expenditure and household size have been added. Additional variables, such as urban, regional, and month dummies have been included in the estimations to capture income fluctuations, expenditure seasonality and regional price variations.

We analyse for each survey the budget shares on tobacco and alcohol since these clearly represent male goods. Supposed female expenditure categories include women's and children's clothing. Moreover, the budget share on beef (proxied by the aggregate expenditure share on beef and goat meat) and meat (also including poultry), considered to be male expenditure items, are analysed.

For the sake of homogeneity and in order to improve comparability among different time periods, we reduced the nation-wide surveys by dropping some districts that were not covered

[6] In some communities, the community leader decides on inheritance matters.

[7] It should be noted that information is given only for parcels (27 percent of farm households have one parcel, 34 percent have two parcels, and another 21 percent have three parcels), not for plots or even crops. Maybe somewhat surprisingly, there is quite some variation in control over parcel output. In only about a third of male-headed farms all parcels are controlled only by the head, in a fifth even all parcels mainly by the spouse, and in more than 40 percent of farm households is output controlled/managed jointly.

in all the surveys as well as some additional non-coffee districts – most of the excluded are from the North.[8] The latter region has been shown to suffer from adverse agricultural conditions and to be largely de-linked from the rest of the economy. Based on these geographically reduced samples, we estimate Engel curves using three sub-samples. The first sub-sample excludes female-headed households and male-headed households lacking a female spouse. The second sub-sample concentrates on coffee farmers and excludes female-headed households. Finally, the last and preferred sub-sample combines the two other samples: it is restricted to coffee farmers while excluding female-headed coffee farmer households and male headed households lacking a female spouse. Given the relative robustness of the results across the different sub-samples, in the following only the results of the preferred sub-sample will be reported (Table 1, full results in Appendices 1-3).[9] Given the great amount of zero observations due to the non-consumption of these goods during the survey period and the resulting problems for estimating adequate demand functions, the analysis uses a form of Tobit estimation, i.e. left-censored interval estimations. The results are corrected for heteroskedasticity using robust estimates.

Turning to the key variables of interest, Table 1 highlights that the coffee income share impacts positively, and significantly, on the expenditure share of alcohol and negatively on children's and women's wear in the early 1990s, but loses its statistical and lessens its economic power for the subsequent survey years. This implies that higher proceeds from coffee have no longer been associated with a disproportionate increase in household expenditure on 'male consumption goods'. Thus, during the 1990s income from coffee has possibly been increasingly pooled.

[8] The sub-sample includes observations from the following districts: Kalangala, Kiboga, Luwero, Masaka, Mpigi, Mubende, Mukono, Rakai, Iganga, Jinja, Kamuli, Tororo, Bushenyi, Kabarole, Kibaale, and Mbarara.

[9] In addition, we checked for robustness by further restricting the sample to include only monogamous households with children. This did not alter our findings.

Table 1: Impact of coffee share and other bargaining power proxies on expenditure patterns, excerpts from Engel-curve estimations

		alcohol	tobacco	children's clothing	women's clothing	meat	beef
1992/93	coffee share	0.075	-0.031	-0.010	-0.030	0.032	0.032
		(0.039)*	(0.028)	(0.004)**	(0.012)**	(0.023)	(0.022)
	male excess education	0.041	0.015	0.001	-0.005	0.009	0.006
		(0.017)**	(0.013)	(0.002)	(0.005)	(0.012)	(0.012)
	female excess education	-0.032	-0.028	0.006	0.004	-0.014	-0.016
		(0.027)	(0.022)	(0.003)*	(0.009)	(0.019)	(0.017)
1999/2000	coffee share	0.040	-0.058	-0.006	-0.012	0.007	0.058
		(0.032)	(0.026)**	(0.005)	(0.005)**	(0.032)	(0.030)*
	male excess education	-0.005	-0.004	-0.003	0.002	0.017	0.003
		(0.013)	(0.012)	(0.002)	(0.002)	(0.013)	(0.013)
	female excess education	-0.049	-0.007	0.000	0.003	0.010	-0.013
		(0.023)**	(0.015)	(0.002)	(0.003)	(0.020)	(0.020)
2005/06	coffee share	-0.029	-0.027	-0.002	-0.002	-0.012	0.008
		(0.043)	(0.021)	(0.004)	(0.005)	(0.032)	(0.028)
	male excess education	-0.010	0.015	0.000	0.002	-0.011	-0.003
		(0.017)	(0.010)	(0.002)	(0.003)	(0.012)	(0.012)
	female excess education	-0.011	-0.011	0.009	0.002	0.039	0.017
		(0.030)	(0.015)	(0.007)	(0.003)	(0.019)**	(0.018)

Source: Authors' calculations.

Notes: Robust standards errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. Full regression results are reported in Appendices 1-3.

The 'educational excess' variables have the expected sign in most cases; yet, only four out of 32 coefficients are statistically significant at the 10 percent level. The results can be taken as an indication that relative bargaining power in terms of education does play a role in household expenditure decisions. Yet, we cannot observe a particular time trend, i.e. the nature of the bargaining process does not seem to change fundamentally.[10] In line with the results based on 'excess education', both variables constructed from the survey-year-specific information, the 'gender-biased inheritance rule dummy' for 1999/2000 and the 'output control dummy' for 2005/06, do not turn out to be significant determinants of household consumption patterns. Moreover, it should be noted that we repeated the exercise by pooling the three comparable data sets and introducing interaction terms with year dummy variables.

[10] It should be noted though that the share of female spouses who have at least five more years of schooling than the male head increases from 2.4 percent in 1992/93 to 4.3 percent in 2005/06 (for males from 8.7 to 12.0 percent).

The results (see Appendix 4) are in line with our non-pooled cross-sectional findings.

Finally, we use the information on control over output in the most recent available survey to examine whether we can detect the supposed pattern of male control over coffee income, which then would be somewhat at odds with increased income pooling. Table 2 shows the shares of farms where parcels are either all managed/controlled by the male head, by the female spouse, or jointly. We find farm households that cultivate coffee to manage/control agricultural output jointly much more frequently than non-coffee farms. We also checked whether this pattern varies with the degree of intercropping, but it does not: even output from almost pure coffee parcels typically appears to be controlled jointly.

Table 2: Control over agricultural output, 2005/06

	Control of output from all farm households' parcels		
	only male head	only female spouse	joint
No coffee	0.38	0.24	0.38
Coffeefarmer	0.33	0.15	0.52
Total	0.36	0.20	0.43

Source: Authors' calculations.

Notes: The table only considers male-headed households.

Unfortunately, comparable data is not available for earlier years, but the high share of jointly managed/controlled coffee parcels today – taken together with the income pooling results and the wide-spread perception that coffee-income is (or has been) male-controlled – may be interpreted as a sign that production modes have been subject to change.

More cooperation in coffee production?

The results from the Engel curve estimations point towards increasing coffee income pooling since the early 1990s. Consequently, one would expect household members to cooperate better in production, herewith raising production efficiency.

In order to test whether this was actually the case in Uganda, we estimate coffee yield

equations for the years 1999 and 2005.[11] The used specification combines Udry's (1996) approach for detecting output inefficiencies due to gendered plot ownership and Lim *et al.*'s (2007) analysis of the importance of female bargaining power on coffee production. Our bargaining proxies are the already introduced male and female 'excess education' variables, the proxy for gender-biased inheritance rules (for 1999/2000) and the dummies for male-head or female-spouse controlled parcels (for 2005/06). It is important to note that the 'educational excess' dummies are somewhat more problematic in the production than in the consumption context since they also reflect relative comparative advantages, for example, in non-farm activities vis-à-vis work on the field. We expect bargaining asymmetries captured by those proxies to lead to less cooperative production behaviour and inefficiencies. More specifically, the female power proxy should negatively affect coffee yields: a woman will use her bargaining power to reduce labour input into male-controlled coffee production. However, as suggested by the analysis above, men seem to have lost control over coffee income to a certain extent, which could in principle be interpreted as a change in the compensation for increased female labour input into coffee production. An improvement in the compensation rule in turn ought to render relative bargaining power less important in determining productive resource allocation, thereby increasing production efficiency. With regard to male bargaining power, the effect is theoretically ambiguous in the initial situation without income pooling, since men might use their relative strength to force or convince their spouses to contribute to production.

As in the previous estimations, we use the geographically reduced sample, which is further restricted to male heads being classified as coffee farmer and having a spouse. We first present the results of a specification that is roughly comparable across the two years. We then use the much richer information on agricultural production of the 2005/06 survey to check for

[11] Unfortunately, the 1992/93 survey does not comprise information about coffee plot size and does not allow for an estimation of yield equations.

robustness.

The results (reported in Appendix 5) illustrate that coffee output to the area devoted to its production is inversely related to plot size. While the first and second production area sixtiles positively affect output in both years of examination, the last three are associated with output declines although not in a statistically significant manner (with the third sixtile being chosen as reference category). This might be explained by decreasing returns to scale or, alternatively, by phenomena such as rigid cost structures (Udry, 1996). Additional controls include land quality, approximated by the value of the land parcel (per acre), agricultural assets, the number of male and female prime age adults, a dummy for the application of manure, the coffee area as a share of total cropped area, a dummy for intercropping, and dummies for head's and spouse's educational achievement.

Table 3: The impact of bargaining proxies on coffee yields, excerpts from yield estimations for 1999/2000 and 2005/06

	1999/2000		2005/06	
	Excess education as bargaining proxy	Gender-biased inheritance rules	Excess education as bargaining proxy	Control over output as bargaining proxy
Male more powerful	-11.8 (73.4)	118.4 (73.6)	2.4 (45.7)	-41.0 (32.5)
Female more powerful	-302.3 (110.1)***	-149.3 (64.7)**	-168.7 (68.3)**	-68.5 (39.4)*

Source: Authors' calculations.

Notes: Robust standards errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. Full regression results are reported in Appendix.

As shown in Table 3, the static effects of the bargaining proxies exactly correspond to expectations. In all estimations female bargaining power has a significant and strong negative effect on coffee yield. The effect of male bargaining power proxies is ambiguous across specifications and years and not significantly different from zero. Between 1999 and 2005, these relationships do not change fundamentally. Higher female bargaining power continues

to result in lower coffee yields.[12] Coffee production decisions are hence still influenced by bargaining proxies, which can be taken as a sign for the presence of inefficiencies.

Nonetheless, these results rest on relatively weak empirical grounds as the number of comparable control variables available in both surveys is limited. In particular, the 1999/2000 survey does not report labour input by plot, a key determinant of agricultural output. The more recent 2005/06 survey allows for a more detailed analysis since it provides information on male, female, child, and hired labour input as well as non-labour input by plot. Furthermore, farmers were asked about the share of intercropped crops while the 1999/2000 survey only ranks the crops according to relative importance. For the year 2005, we can hence estimate an 'augmented' coffee yield equation (see Appendix 6). Once we control for different types of labour input, quantity of applied manure as well as the intercropped share and the respective intercrop, the effect of female bargaining power is no longer significant. The male (control) bargaining proxy turns out be negative and significant.

The vanishing explanatory power of the female bargaining proxy can be taken as a sign that the negative impact on coffee yields identified above works through a relative under-allocation of female labour to coffee production. In order to test whether this is the case, we additionally estimate labour input equations for male, female and child labour. Certainly indicating the necessity of further research, the results (reported in Appendix 7) highlight the gendered nature of agricultural production. While intercropping with female crops, for example root and potato tubers, increases female labour inputs, intercropping with other cash crops, such as cocoa or tea, is associated with higher male labour inputs. However, even more striking is the result that female bargaining power proxied by control over production translates into lower male labour input. Vice versa this also holds for male bargaining

[12] We would not want to put too much emphasis into the strength of the effect between the two years in light of the large variations in the other coefficients, which could for example be due to differences in questionnaire design.

power.[13]

Taken together our findings on efficiency appear to be at odds with increased pooling of coffee income as bargaining, in particular over labour allocation, still appears to undermine production efficiency. Yet, we find a relatively weak impact of bargaining proxies in the 'augmented' yield equation for the most recent survey and control over coffee output is on average more equally distributed between husband and wife than control of other crops. The empirical analysis hence also gives some hints at more cooperative household behaviour in coffee production.

Finally, it should be noted that the lack of comparable agricultural production data inhibited a more rigorous assessment of change. Many empirical results from our analysis of coffee production point to persisting gender roles in agricultural production and bargaining struggles over resources within the households. Both rigid gender roles and non-cooperative behaviour are likely to cause inefficiencies and dampen the potentially positive effects of coffee market liberalisation. However, this is not to say that gender obstacles to efficiency have not been reduced.

Constraints to female farmers: Access to land is deteriorating

While the Engel curve results lead to suggest that during the past decade Uganda essentially improved its gender perspectives, the last section indicates that gender continues to constrain household production efficiency. However, beyond bargaining and resource allocation, it is important to ask in how far female farmers were able to adapt and make use of the new income opportunities generated by the coffee sector expansion.

This is of particular importance when considering that about 30 percent of Uganda's households are headed by a woman. Obviously, intra-household issues, as discussed above,

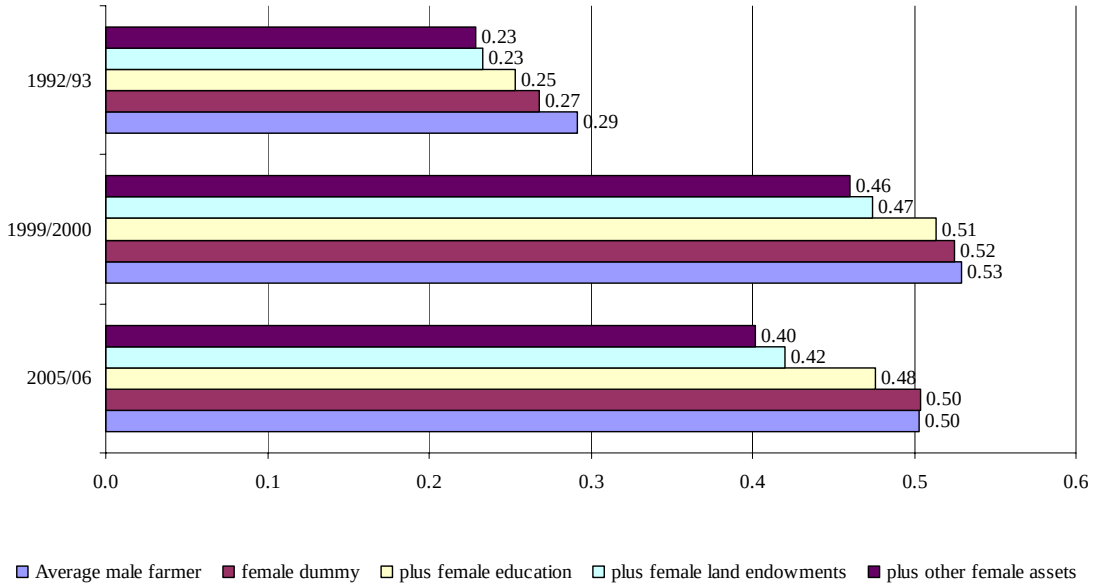
[13] Although reported in the Appendix, we would not put too much emphasis on the results based on the 'educational excess' dummies. They are likely to reflect household members' comparative advantage in tasks that is particularly relevant in the present context. In fact, the results appear to confirm this suspicion.

are less important for these households. Yet, these households represent the poorest and economically most disadvantaged groups in Sub-Saharan Africa (Baden, 1993). In agricultural settings, female-headed households tend to face special constraints, such as limited access to productive resources (for example land and credit). Many analyses confirm female discrimination due to social and institutional barriers in a specific place and time.

In order to examine whether female farmers were equally able to benefit from Uganda's coffee expansion, we draw upon a logit model, the results of which are reported in Appendix 8. The estimates for each year are then used to predict the probability of being engaged in coffee production, equipping the average male Ugandan farmer more and more with female endowments. Apart from manifesting that gender discrimination prevails in the Ugandan society, Figure 1 highlights the general coffee production increment during the 1990s: the probability of being a coffee farmer nearly doubles during that period.

In terms of gender inequalities our results are remarkable. For instance in 1992, the average male farmer had a probability of nearly 30 percent of engaging in coffee production. When we turn this male farmer female and exchange his educational level with the average female-head's, this probability declines to 25 percent. We observe a further decrease by two percentage points if we additionally endow him with the same quantity of land as his female counterparts.

Figure 1: Probability of being a coffee farmer, 1992-2005



Source: Authors' calculations.

By 2005, the land differential between male and female-headed households has increased substantially, which is reflected in the very pronounced probability decrease of six percentage points. It is noticeable that switching the sheer gender, from being a woman to being a man, does not lead to a great deviation from the average male probability; the effect even vanishes by 2005. Moreover, Figure 1 illustrates that female-headed households suffer from inequality in access to education, which constrains their participation in coffee production. These results highlight the obstacles and discrimination that female-headed households still face in entering the coffee sector and probably the entire cash crop production domain.

Conclusion

This article analyses the impact of coffee market liberalisation from a gender perspective in Uganda between 1992 and 2006. The estimation of Engel curves including the coffee income share as male bargaining proxy reveals that income has been increasingly pooled. Hence, in the Ugandan context higher proceeds from coffee did not increase male welfare disproportionately, but appear to have been shared more equally among household members.

Increased pooling of coffee income should be reflected in more cooperative behaviour in production. Yet, we cannot detect efficiency-enhancing behaviour: Bargaining proxies continue to have a negative effect on coffee yields. A more detailed analysis of coffee production for the most recent survey suggests that rigid gender roles and struggles over resources persist in the Ugandan agricultural context. These phenomena are likely to be an obstacle to agricultural growth, especially in the cash crop sector. Yet, given the strong public as well as academic perception of coffee as a "male crop", our results may also be taken as an indication that households have moved towards more cooperation and efficient compensation rules. In order to round off the gender assessment of Uganda's reforms, we investigated in how far female farmers were equally able to engage in coffee production. In contrast to our optimistic results concerning income pooling, the results from the coffee participation estimations manifest remarkable discrimination. Female household heads are considerably less likely to engage in coffee farming activities, which is increasingly due to a deterioration in access to land.

Overall, the opportunities created by liberalised markets and a growing economy appear to have provided incentives for households to move towards more cooperative consumption behaviour. However, it is likely that coffee market liberalisation alone plays only a minor role in explaining behavioural change as it is deeply embedded in the cultural and social structure of Uganda. This becomes particularly apparent in our analysis of household production processes. Therefore, one has to be prudent about drawing general conclusions from the Ugandan case, but there is no a priori proposition that cash crop liberalisation leads to a strengthening of existing bargaining asymmetries.

It has been recognised that basing policy prescriptions on the simplified unitary household model may lead to a number of policy failures especially because of its failure to account for intra-household bargaining processes (Alderman *et al.* 1997). The main policy-relevant

insight from our analysis in this regard is that *changes* in intra-household decision procedures have to be taken into account as well. For instance, if we had opted for analysing coffee market liberalisation only for the years 1992/93, we would possibly have judged its gender implications as strictly negative – and, in fact, many policy papers did. However, further analysis suggests that agricultural liberalisation has relatively quickly caused changes in the intra-household mode of resource allocation.

Finally, our results certainly do not undermine the scope for and importance of policy interventions aimed at female empowerment in Uganda. Intra-household struggles over resources seem to persist in the rural context. In addition, female discrimination is widespread, which is confirmed by our analysis of coffee-market participation of female-headed households. In particular, the analysis once more illustrates that the lack of enforceable land rights for women needs to be addressed urgently.

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Appendices

Appendix 1: Engel-curve estimates for 1992/93

	(1)	(2)	(3)	(4)	(5)	(6)
	alcohol	tobacco	children's clothing	women's clothing	meat	beef
log per capita epxenditure	-0.002	-0.007	-0.000	-0.001	0.016	0.012
	(0.008)	(0.006)	(0.001)	(0.003)	(0.007)**	(0.006)*
share of cash income	-0.098	-0.001	0.011	0.023	-0.004	0.002
	(0.039)**	(0.025)	(0.004)***	(0.012)*	(0.024)	(0.023)
log household size	-0.043	-0.007	0.004	-0.001	0.005	0.008
	(0.013)***	(0.007)	(0.002)**	(0.003)	(0.011)	(0.010)
share of fem. children 0-5	0.016	-0.013	0.024	0.006	-0.034	-0.063
	(0.049)	(0.032)	(0.008)***	(0.015)	(0.047)	(0.041)
share of fem. children 6-14	0.051	0.038	0.024	-0.010	-0.031	-0.025
	(0.049)	(0.031)	(0.008)***	(0.014)	(0.046)	(0.043)
share of male children 0-5	0.065	0.023	0.023	-0.007	-0.048	-0.053
	(0.045)	(0.029)	(0.007)***	(0.014)	(0.043)	(0.037)
share of male children 6-14	0.064	-0.027	0.012	-0.015	-0.018	-0.053
	(0.047)	(0.033)	(0.008)	(0.015)	(0.047)	(0.044)
share of male adults 15 plus	0.037	0.054	0.008	-0.006	-0.087	-0.085
	(0.071)	(0.040)	(0.010)	(0.018)	(0.055)	(0.049)*
head completed primary	-0.014	-0.019	0.001	0.006	-0.005	-0.006
	(0.013)	(0.011)*	(0.002)	(0.004)	(0.010)	(0.009)
head completed secondary or higher	0.005	-0.034	0.003	0.008	-0.009	-0.003
	(0.018)	(0.016)**	(0.003)	(0.006)	(0.015)	(0.013)
spouse completed primary	-0.020	0.002	0.001	0.002	0.016	0.010
	(0.012)*	(0.010)	(0.001)	(0.004)	(0.010)	(0.009)
spouse completed secondary or higher	-0.030	-0.002	0.001	0.011	0.010	0.013
	(0.033)	(0.023)	(0.003)	(0.008)	(0.022)	(0.020)
central	-0.018	-0.024	-0.002	-0.002	0.002	-0.018
	(0.013)	(0.011)**	(0.002)	(0.004)	(0.014)	(0.013)
east	0.003	-0.018	-0.002	0.000	-0.012	-0.026
	(0.017)	(0.012)	(0.002)	(0.005)	(0.016)	(0.016)
cofstrat	-0.009	-0.004	-0.001	0.009	0.004	0.003
	(0.020)	(0.014)	(0.003)	(0.006)	(0.016)	(0.016)
non-agricultural share	0.046	0.004	-0.005	-0.020	0.024	0.025
	(0.037)	(0.024)	(0.005)	(0.012)*	(0.025)	(0.023)
coffee share	*0.075*	*-0.031*	*-0.010*	*-0.030*	*0.032*	*0.032*
	*(0.039)**	*(0.028)*	*(0.004)***	*(0.012)***	*(0.023)*	*(0.022)*
other cash crops share	0.210	0.053	-0.000	-0.028	0.030	0.002
	(0.152)	(0.085)	(0.010)	(0.031)	(0.080)	(0.062)
male excess education	0.041	0.015	0.001	-0.005	0.009	0.006
	(0.017)**	(0.013)	(0.002)	(0.005)	(0.012)	(0.012)
female excess education	-0.032	-0.028	0.006	0.004	-0.014	-0.016
	(0.027)	(0.022)	(0.003)*	(0.009)	(0.019)	(0.017)
Constant	0.059	0.018	-0.024	0.026	-0.091	-0.055
	(0.085)	(0.061)	(0.013)*	(0.027)	(0.077)	(0.066)
Observations	458	458	458	458	458	458

Source: Authors' calculations.

Notes: Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. Month dummies omitted.

Appendix 2: Engel-curve estimates for 1999/2000

	(1)	(2)	(3)	(4)	(5)	(6)
	alcohol	tobacco	children's clothing	women's clothing	meat	beef
log per capita epxenditure	0.024	-0.004	0.001	0.003	0.073	0.064
	(0.007)***	(0.006)	(0.001)	(0.001)**	(0.008)***	(0.008)***
share of cash income	-0.042	0.024	0.014	0.022	0.018	-0.015
	(0.032)	(0.023)	(0.005)***	(0.005)***	(0.034)	(0.032)
log household size	-0.031	-0.015	0.006	-0.003	0.013	0.018
	(0.009)***	(0.008)*	(0.002)***	(0.002)*	(0.010)	(0.010)*
share of fem. children 0-5	0.037	0.032	0.018	-0.012	0.065	0.023
	(0.045)	(0.036)	(0.007)***	(0.009)	(0.050)	(0.047)
share of fem. children 6-14	0.099	0.020	0.011	-0.021	0.045	0.021
	(0.041)**	(0.034)	(0.006)*	(0.008)***	(0.048)	(0.047)
share of male children 0-5	0.085	0.021	0.016	-0.011	0.065	0.042
	(0.044)*	(0.034)	(0.007)**	(0.008)	(0.049)	(0.047)
share of male children 6-14	0.023	-0.010	0.008	-0.022	0.019	-0.024
	(0.040)	(0.032)	(0.006)	(0.008)***	(0.047)	(0.045)
share of male adults 15 plus	0.028	0.036	0.010	-0.028	-0.072	-0.079
	(0.049)	(0.037)	(0.009)	(0.009)***	(0.061)	(0.060)
head completed primary	-0.008	-0.010	0.002	-0.001	0.013	0.018
	(0.009)	(0.009)	(0.001)**	(0.001)	(0.010)	(0.009)*
head completed secondary or higher	0.002	-0.016	0.004	-0.001	-0.014	0.008
	(0.016)	(0.015)	(0.002)**	(0.002)	(0.015)	(0.015)
spouse completed primary	-0.010	-0.009	0.001	0.004	-0.005	0.005
	(0.010)	(0.008)	(0.001)	(0.002)**	(0.010)	(0.009)
spouse completed secondary or higher	-0.037	-0.033	0.000	0.005	-0.021	-0.016
	(0.021)*	(0.026)	(0.002)	(0.003)	(0.018)	(0.019)
central	-0.002	-0.032	-0.001	-0.002	0.015	-0.010
	(0.010)	(0.008)***	(0.001)	(0.002)	(0.013)	(0.012)
east	0.011	-0.025	-0.003	-0.004	0.021	-0.022
	(0.014)	(0.010)**	(0.002)*	(0.002)*	(0.015)	(0.015)
cofstrat	-0.026	0.013	0.000	0.001	-0.058	-0.037
	(0.014)*	(0.012)	(0.002)	(0.002)	(0.015)***	(0.015)**
non-agricultural share	0.065	-0.035	-0.003	-0.005	0.044	0.063
	(0.032)**	(0.024)	(0.005)	(0.005)	(0.034)	(0.032)*
coffee share	*0.040*	*-0.058*	*-0.006*	*-0.012*	*0.007*	*0.058*
	(0.032)	*(0.026)***	*(0.005)*	*(0.005)***	*(0.032)*	*(0.030)**
other cash crops share	0.063	-0.002	0.001	-0.007	0.148	0.017
	(0.119)	(0.112)	(0.015)	(0.019)	(0.152)	(0.187)
male excess education	-0.005	-0.004	-0.003	0.002	0.017	0.003
	(0.013)	(0.012)	(0.002)	(0.002)	(0.013)	(0.013)
female excess education	-0.049	-0.007	0.000	0.003	0.010	-0.013
	(0.023)**	(0.015)	(0.002)	(0.003)	(0.020)	(0.020)
constant	-0.220	0.010	-0.027	-0.002	-0.669	-0.598
	(0.070)***	(0.062)	(0.012)**	(0.014)	(0.079)***	(0.075)***
Observations	1149	1149	1149	1149	1149	1149

Source: Authors' calculations.

Notes: Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. Month dummies omitted.

Appendix 3: Engel-curve estimates for 2005/06

	(1)	(2)	(3)	(4)	(5)	(6)
	alcohol	tobacco	children's clothing	women's clothing	meat	beef
log per capita epxenditure	0.022 (0.009)**	-0.003 (0.005)	0.002 (0.001)	0.000 (0.001)	0.049 (0.007)***	0.044 (0.006)***
share of cash income	0.027 (0.037)	0.023 (0.019)	-0.003 (0.004)	0.002 (0.004)	0.017 (0.025)	0.013 (0.022)
log household size	-0.029 (0.014)**	-0.005 (0.007)	0.005 (0.001)***	-0.001 (0.002)	0.010 (0.010)	0.014 (0.010)
share of fem. children 0-5	-0.002 (0.050)	-0.015 (0.026)	0.017 (0.007)**	-0.002 (0.006)	0.128 (0.041)***	0.118 (0.040)***
share of fem. children 6-14	-0.016 (0.050)	-0.002 (0.029)	0.009 (0.006)	-0.006 (0.006)	0.121 (0.041)***	0.126 (0.040)***
share of male children 0-5	-0.094 (0.054)*	-0.003 (0.028)	0.021 (0.008)**	0.005 (0.006)	0.132 (0.044)***	0.121 (0.040)***
share of male children 6-14	0.024 (0.050)	0.029 (0.026)	0.008 (0.006)	-0.011 (0.005)**	0.089 (0.040)**	0.067 (0.037)*
share of male adults 15 plus	-0.079 (0.062)	0.011 (0.030)	0.002 (0.007)	-0.008 (0.007)	0.088 (0.045)**	0.088 (0.044)**
head completed primary	0.008 (0.012)	-0.013 (0.008)*	0.004 (0.001)***	0.001 (0.002)	0.016 (0.009)*	0.003 (0.009)
head completed secondary or higher	0.017 (0.020)	-0.009 (0.010)	0.004 (0.002)*	0.000 (0.002)	0.020 (0.013)	0.001 (0.013)
spouse completed primary	-0.029 (0.013)**	-0.009 (0.007)	0.001 (0.001)	0.005 (0.002)***	-0.017 (0.010)*	-0.008 (0.009)
spouse completed secondary or higher	-0.060 (0.027)**	0.010 (0.014)	0.008 (0.005)*	0.004 (0.002)**	-0.033 (0.016)**	-0.024 (0.015)
central	-0.014 (0.014)	0.007 (0.006)	-0.006 (0.002)***	-0.005 (0.002)***	-0.042 (0.011)***	-0.046 (0.010)***
east	-0.004 (0.015)	-0.024 (0.007)***	-0.004 (0.002)**	-0.003 (0.002)*	-0.026 (0.013)**	-0.025 (0.012)**
cofstrat	-0.024 (0.013)*	0.003 (0.006)	0.001 (0.002)	-0.001 (0.002)	0.009 (0.011)	0.008 (0.010)
non-agricultural share	-0.025 (0.036)	-0.053 (0.019)***	0.004 (0.003)	0.001 (0.003)	-0.008 (0.023)	0.012 (0.021)
coffee share	*-0.029 (0.043)*	*-0.027 (0.021)*	*-0.002 (0.004)*	*-0.002 (0.005)*	*-0.012 (0.032)*	*0.008 (0.028)*
other cash crops share	-0.272 (0.155)*	-0.021 (0.061)	-0.005 (0.011)	-0.016 (0.011)	-0.059 (0.069)	-0.113 (0.060)*
male excess education	-0.010 (0.017)	0.015 (0.010)	0.000 (0.002)	0.002 (0.003)	-0.011 (0.012)	-0.003 (0.012)
female excess education	-0.011 (0.030)	-0.011 (0.015)	0.009 (0.007)	0.002 (0.003)	0.039 (0.019)**	0.017 (0.018)
constant	-0.145 (0.097)	-0.042 (0.051)	-0.027 (0.014)*	0.011 (0.013)	-0.551 (0.081)***	-0.543 (0.072)***
Observations	893	893	893	893	893	893

Source: Authors' calculations.

Notes: Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. Month dummies omitted.

Appendix 4: Excerpts from pooled cross section Engel-curve estimates, 1992-2006

		alcohol	tobacco	children's clothing	women's clothing	meat	beef
1992/93	coffee share	0.084	-0.039	-0.012	-0.027	0.035	0.035
		(0.042)**	(0.033)	(0.005)**	(0.011)**	(0.026)	(0.025)
	male excess education	0.046	0.018	0.001	-0.005	0.013	0.009
		(0.019)**	(0.016)	(0.003)	(0.005)	(0.013)	(0.013)
	female excess education	-0.033	-0.033	0.006	0.004	-0.015	-0.019
		(0.031)	(0.025)	(0.004)*	(0.008)	(0.022)	(0.020)
1999/2000	coffee share	-0.045	-0.014	0.006	0.015	-0.027	0.018
		(0.053)	(0.040)	(0.007)	(0.012)	(0.039)	(0.037)
	male excess education	-0.015	0.025	-0.006	-0.001	0.025	0.007
		(0.038)	(0.029)	(0.004)	(0.009)	(0.028)	(0.026)
	female excess education	-0.051	-0.021	-0.004	0.007	0.002	-0.007
		(0.022)**	(0.019)	(0.003)	(0.005)	(0.018)	(0.018)
2005/06	coffee share	-0.112	0.010	0.010	0.024	-0.046	-0.026
		(0.058)*	(0.040)	(0.006)*	(0.012)**	(0.041)	(0.037)
	male excess education	0.023	0.020	0.003	-0.002	0.053	0.034
		(0.042)	(0.030)	(0.007)	(0.009)	(0.029)*	(0.027)
	female excess education	-0.056	-0.002	-0.001	0.007	-0.024	-0.013
		(0.024)**	(0.019)	(0.003)	(0.005)	(0.018)	(0.018)
	Observations	2500	2500	2500	2500	2500	2500

Source: Authors' calculations.

Notes: Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Appendix 5: Comparable coffee yield estimations for 1999/2000 and 2005/06

	1999/2000		2005/06	
	Excess education as bargaining proxy	Gender-biased inheritance rules	Excess education as bargaining proxy	Control over output as bargaining proxy
Head completed primary	-5.8	21.6	5.2	33.9
	(56.0)	(48.7)	(38.3)	(32.3)
Head completed secondary or higher	29.9	58.3	-21.4	6.6
	(93.3)	(78.0)	(55.9)	(43.9)
Spouse completed primary	96.7	59.6	42.9	24.7
	(62.3)	(55.6)	(42.2)	(38.3)
Spouse completed secondary or higher	-60.4	-112.6	64.2	35.4
	(103.2)	(92.5)	(70.7)	(60.4)
Experience	1.4	1.0	-1.3	-1.0
	(1.2)	(1.3)	(0.9)	(1.0)
Male adults	-6.0	-7.2	31.3	36.0
	(24.0)	(24.1)	(17.5)*	(18.6)*
Female adults	17.4	26.2	-1.6	-4.1
	(24.2)	(25.0)	(14.8)	(13.8)
Area under coffee sixtile 1	274.9	316.4	259.4	267.1
	(114.0)**	(108.6)***	(61.0)***	(65.2)***
Area under coffee sixtile 2	59.1	77.1	127.4	127.5
	(110.1)	(103.0)	(47.8)***	(48.6)***
Area under coffee sixtile 4	-124.1	-106.4	25.7	30.0
	(108.6)	(102.2)	(45.1)	(46.7)
Area under coffee sixtile 5	-136.9	-105.3	-38.0	-19.8
	(110.4)	(105.0)	(41.0)	(44.2)
Area under coffee sixtile 6	-189.8	-155.5	4.2	2.7
	(112.3)*	(106.3)	(51.8)	(53.1)
Land quality	12.5	9.8	15.3	16.7
	(6.6)*	(6.8)	(4.7)***	(4.8)***
Agricultural asset quartile 2	221.5	214.4	16.8	24.8
	(88.7)**	(88.2)**	(51.5)	(50.0)
Agricultural asset quartile 3	237.9	242.0	87.8	79.1
	(85.3)***	(85.5)***	(46.8)*	(47.6)*
Agricultural asset quartile 4	231.1	218.6	84.3	64.1
	(89.9)**	(88.8)**	(52.0)	(53.6)
Coffee area as share of total cropped area	-391.4	-416.8	-76.3	-95.5
	(114.3)***	(116.7)***	(59.2)	(61.0)
Plot intercropped	5.6	5.8	-129.1	-115.2
	(41.1)	(40.9)	(47.8)***	(47.5)**
Manure applied	85.6	86.9	14.8	20.9
	(76.1)	(74.7)	(37.5)	(42.0)
Male more powerful	-11.8	118.4	2.4	-41.0
	(73.4)	(73.6)	(45.7)	(32.5)
Female more powerful	-302.3	-149.3	-168.7	-68.5
	(110.1)***	(64.7)**	(68.3)**	(39.4)*
Constant	351.1	354.0	238.1	229.7
	(150.8)**	(144.3)**	(86.0)***	(83.8)***
Observations	809	810	805	801
R-squared	0.15	0.15	0.14	0.13

Source: Authors' calculations.

Notes: Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. Agricultural assets in 2005/06 include a broader class of assets.

Appendix 6: Augmented coffee yield estimation for 2005/06

	Coffee yield per acre 2005/06				
	(1)	(2)		(1)	(2)
Head completed primary	-2.0	22.6			
	(39.2)	(32.6)			
Head completed secondary	-11.3	23.2	Agricultural asset	127.9	116.4
	(58.1)	(48.4)	quartile 4	(55.9)**	(54.9)**
Head completed higher	-85.6	-42.7	Manure in kg	-0.0	-0.0
	(97.8)	(76.6)		(0.0)	(0.0)
Spouse completed primary	83.9	59.4	Coffee area a. sh. of	-129.7	-134.0
	(42.8)*	(36.1)	total cropped area	(58.3)**	(58.3)**
Spouse completed secondary	98.3	66.0	Plot intercropped	-24.4	-21.9
or higher	(70.7)	(59.9)		(49.1)	(49.7)
Male labour	0.4	0.4	Share intercropped with	-458.2	-433.3
	(0.3)	(0.3)	grains	(100.6)***	(100.3)***
Female labour	0.4	0.3	Share intercropped with	-198.5	-215.2
	(0.2)	(0.2)	beans or peas	(109.4)*	(110.9)*
Child labour	-0.4	-0.4	Share intercropped with	-340.1	-360.0
	(0.2)**	(0.2)**	other legumes	(180.9)*	(182.0)**
Hired labour	-0.0	0.0	Share intercropped with	-327.7	-338.8
	(0.1)	(0.1)	vegetables	(211.8)	(234.8)
Area under coffee sixtile 1	309.8	307.5	Share intercropped with	-364.6	-388.6
	(66.6)***	(69.2)***	cotton/tobacco	(314.3)	(313.3)
Area under coffee sixtile 2	147.0	152.0	Share intercropped with	-302.2	-300.3
	(49.0)***	(50.1)***	potato tubers	(179.5)*	(180.0)*
Area under coffee sixtile 4	24.4	33.9	Share intercropped with	-460.1	-461.8
	(47.4)	(48.7)	root tubers	(108.9)***	(112.6)***
Area under coffee sixtile 5	-37.8	-29.9	Share intercropped with	132.6	151.5
	(41.9)	(42.9)	tree fruits	(340.4)	(341.3)
Area under coffee sixtile 6	-16.7	-13.6	Share intercropped with	-414.2	-427.4
	(53.5)	(53.6)	matoke	(347.6)	(351.1)
Land quality	16.0	15.2	Share intercropped with	-819.9	-1,001.2
	(4.9)***	(4.9)***	sweet banana	(383.9)**	(371.1)***
Agricultural asset quartile 2	37.7	37.6	Share intercropped with	-591.7	-494.6
	(54.2)	(53.8)	tea/cocoa	(348.9)*	(354.5)
Agricultural asset quartile 3	112.4	104.1	Share intercropped with	-486.9	-457.7
	(50.6)**	(49.1)**	other plants	(258.0)*	(257.5)*
Male more powerful	19.9	-56.6			
	(50.0)	(33.2)*			
Female more powerful	-115.3	-43.4			
	(77.9)	(40.8)			
Constant	312.7	334.9			
	(94.3)***	(90.5)***			
Observations	804	799			
R-squared	0.19	0.18			

Source: Authors' calculations.

Notes: Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. Specification (1) uses the 'excess education' bargaining proxies and specification (2) male and female control/management of output dummies.

Appendix 7: Labour input equations

	Labour input per acre Excess education as bargaining proxy			Labour input per acre Control over output as bargaining proxy		
	male	child	female	male	child	female
Male adults	1.4 (2.1)			0.5 (2.0)		
Children between 6 and 14		4.6 (0.8)***			4.5 (0.9)***	
Female adults			7.2 (4.0)*			5.6 (3.7)
Head completed primary	4.7 (5.4)	7.4 (4.3)*	6.5 (9.8)	2.9 (4.5)	8.5 (4.0)**	6.5 (8.9)
Head completed secondary	13.7 (9.4)	7.2 (6.1)	8.2 (15.8)	12.7 (7.6)*	8.6 (5.2)*	10.8 (13.4)
Head completed higher	13.5 (16.6)	47.9 (17.5)***	40.8 (24.8)	6.7 (13.6)	47.0 (16.6)***	32.8 (20.8)
Spouse completed primary	-14.8 (5.5)***	-8.9 (4.4)**	-17.7 (10.5)*	-13.3 (4.5)***	-10.7 (4.0)***	-16.1 (9.5)*
Spouse completed secondary or higher	-23.5 (8.6)***	-6.6 (7.7)	-44.7 (18.3)**	-18.5 (6.6)***	-8.8 (6.9)	-50.6 (15.6)***
Area under coffee sixtile 1	47.4 (11.3)***	18.6 (9.3)**	162.0 (21.6)***	41.0 (10.8)***	20.8 (9.7)**	166.4 (22.3)***
Area under coffee sixtile 2	8.8 (8.8)	3.8 (7.8)	31.0 (13.2)**	5.2 (8.2)	4.0 (7.8)	32.7 (13.6)**
Area under coffee sixtile 4	-12.3 (8.2)	-6.5 (8.0)	-28.7 (14.5)**	-14.2 (7.9)*	-6.4 (8.0)	-26.8 (14.7)*
Area under coffee sixtile 5	-20.1 (8.3)**	-2.2 (7.9)	-40.2 (12.8)***	-25.0 (8.0)***	-2.3 (8.0)	-36.9 (13.1)***
Area under coffee sixtile 6	-34.5 (7.7)***	-10.0 (8.0)	-64.9 (14.9)***	-40.9 (7.6)***	-12.5 (7.8)	-61.7 (15.0)***
Coffee area as share of total cropped area	-22.7 (9.1)**	-24.5 (5.5)***	-45.7 (16.0)***	-20.0 (8.8)**	-23.9 (5.6)***	-49.5 (15.7)***
Plot intercropped	-10.0 (8.5)	2.0 (5.3)	-4.8 (17.0)	-12.7 (8.1)	1.9 (5.3)	-5.5 (16.9)
Share intercropped with grains	72.7 (17.1)***	37.3 (13.4)***	136.0 (34.8)***	72.5 (16.5)***	40.1 (13.5)***	133.5 (34.1)***
Share intercropped with beans or peas	17.7 (17.0)	31.3 (12.7)**	124.3 (31.2)***	38.5 (16.5)**	29.3 (13.1)**	100.1 (32.2)***
Share intercropped with other legumes	62.7 (29.1)**	22.8 (23.7)	286.9 (77.0)***	72.9 (27.5)***	18.1 (24.1)	283.1 (78.0)***
Share intercropped with vegetables	6.1 (40.8)	52.1 (17.9)***	81.9 (53.4)	-1.2 (36.1)	54.8 (18.9)***	76.6 (50.1)
Share intercropped with cotton/tobacco	212.2 (70.0)***	120.9 (48.0)**	252.6 (100.6)**	207.1 (75.4)***	92.3 (40.1)**	246.0 (90.3)***
Share intercropped with potato tubers	56.4 (32.2)*	47.7 (28.2)*	242.3 (65.6)***	70.4 (28.1)**	42.7 (28.8)	262.7 (74.0)***
Share intercropped with root tubers	3.1 (20.5)	29.9 (14.8)**	135.5 (37.0)***	33.7 (19.1)*	38.3 (17.0)**	119.4 (36.6)***
Share intercropped with tree fruits	171.0 (55.0)***	22.9 (44.2)	73.4 (90.5)	167.9 (54.5)***	28.4 (44.7)	62.3 (96.5)
Share intercropped with matoke	-144.2 (53.7)***	-21.7 (43.4)	-42.9 (90.8)	-125.6 (53.0)**	-29.0 (44.0)	-39.3 (97.0)
Share intercropped with sweet banana	-203.5 (63.6)***	18.5 (56.9)	-95.7 (100.0)	-197.3 (60.7)***	12.8 (56.0)	-133.9 (105.8)
Share intercropped with tea/cocoa	162.9 (46.3)***	14.7 (29.5)	68.5 (50.0)	120.3 (56.7)**	13.2 (27.7)	106.2 (56.9)*
Share intercropped with other plants	12.8 (32.6)	32.7 (25.2)	76.8 (55.3)	28.3 (32.1)	34.0 (24.9)	83.1 (54.7)
Male more powerful	-14.9 (8.6)*	-3.1 (6.6)	-8.1 (15.2)	11.7 (5.0)**	-0.2 (3.7)	-22.4 (9.2)**
Female more powerful	-2.7 (11.0)	-11.1 (6.4)*	-40.7 (18.2)**	-35.9 (6.1)***	4.0 (5.2)	14.3 (12.4)
Constant	55.7 (11.1)***	2.5 (10.0)	57.2 (23.4)**	51.5 (10.6)***	1.4 (10.6)	69.2 (23.4)***
Observations	792	799	798	784	792	791
R-squared	0.23	0.18	0.41	0.28	0.18	0.42

Source: Authors' calculations.

Notes: Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Appendix 8: Logit estimates of coffee participation

	1992/93	1999/2000	2005/06
Years of schooling	0.099	0.106	0.099
	(0.035)***	(0.028)***	(0.028)***
Years of schooling squared	-0.008	-0.011	-0.005
	(0.003)***	(0.002)***	(0.002)**
Experience	0.028	0.02	0.028
	(0.003)***	(0.002)***	(0.003)***
Land size	0.2	0.307	0.163
	(0.050)***	(0.031)***	(0.027)***
Land size squared	-0.004	-0.008	-0.002
	-0.003	(0.002)***	(0.001)***
Land quality	0.105	0.124	0.055
	(0.019)***	(0.014)***	(0.013)***
Other agricultural assets	0.047	0.072	0.054
	(0.020)**	(0.013)***	(0.016)***
Livestock assets	-0.092	-0.011	0.028
	(0.036)**	-0.012	(0.015)*
Coffee stratum	2.112	1.88	0.763
	(0.259)***	(0.178)***	(0.167)***
Female Dummy	-0.117	-0.018	0.004
	-0.118	-0.081	-0.099
Constant	-5.405	-4.356	-3.169
	(0.330)***	(0.232)***	(0.246)***
Observations	3607	5082	3209

Source: Authors' calculations.

Notes: Robust standard errors in parentheses. Marginal effects (Dummies 0 to1). * significant at 10%; ** significant at 5%; *** significant at 1%.