Why Do Cooperatives Fail?
Big versus Small in Ghanaian Cocoa Producers' Societies, 1930-36

Chiara Cazzuffi* and Alexander Moradi*,**

* University of Sussex
** CSAE

Keywords: cooperatives, firm survival, collective action problems, Ghana
JEL: J54, N57, Q13

Abstract
Using a complete panel of Ghanaian cocoa producers' societies in the 1930s, we investigate whether group interaction problems threatened i) capital accumulation, ii) cocoa sales and iii) cooperative survival as membership size increased. We find evidence of group interaction problems. The net effect, however, is positive indicating gains from economies of scale as cooperatives expanded their membership.

Acknowledgements
We thank Michael Lipton, Andy McKay, Måns Söderbom, Roman Studer and Francis Teal for their comments. We also thank Nadia Weigh for valuable research assistance during her Junior Research Associate Bursary kindly sponsored by Douglas Kruse.

1. Motivation

Cooperatives are thought to represent an effective institution for solving the problems that small farmers face in developing countries (ILO et al., 2008). Farmers join efforts and pool their resources; in turn, cooperatives provide various services to their members. Cooperatives may undertake marketing, which let the farmers achieve higher prices as compared to a situation of intermediaries with quasi-monopsonistic powers (Chirwa et al., 2005; Hussi & Murphy, 1993). They may also provide access to inputs and capital, means of risk reduction and sharing, and an institutionalised framework of knowledge sharing. Overall, the most important reason for the formation of cooperatives is the economies of scale that farmers are not able to realise individually.

The literature on collective action, starting from Olson (1965), emphasises instead negative effects of group size. Collective action, and shared ownership, both present coordination problems, and encourage the inefficient use of resources, if society members do not take into account the costs that their use will incur on the society as a whole. Small groups may be better equipped to overcome this problem, as better information and social sanctions help to ensure cooperation and thus offset negative effects from profit-sharing and free-riding. Larger groups, in contrast, may find this more difficult: monitoring is more costly and social sanctions are less effective.

At a certain point, group interaction problems may outweigh gains from economies of scale. If so, the relationship between the number of society members and efficiency follows an inverted U pattern, implying that an optimum size exists for cooperatives. Nevertheless, institutional design can mitigate group interaction problems. Ostrom (2005) and Ahn et al (2009), for example, pointed to entry and exit rules influencing behaviour and minimising free-rider problems, thereby improving the efficiency of collective action even in large groups. Thus, there may not necessarily be any relationship between group size and the viability of cooperatives.

Ghana's cocoa cooperatives provide an interesting case for analysing the role that group size can play in cooperatives. In the period under study, Ghana was the world's leading producer of cocoa with the crop entirely produced by small farmers; cooperatives were a new institution fostered by the British colonial administration; farmers had little or no prior experience in cooperatives. This element of exogeneity in cooperative formation allows us to explore more clearly the determinants of cooperative success.

The paper is structured as follows. Section 2 gives background information on the cooperatives in Ghana in the 1930s. Section 3 describes the data. Section 4 and 5 presents available evidence on free-rider problems in capital accumulation and marketing of cocoa. In section 6 we explain survival of cooperatives testing the impact of membership size as well as other covariates including lack of capital, competition and transport costs. Section 7 concludes.

2. Background

Cooperatives in Ghana were not an indigenously grown institution, but were introduced by the colonial administration.[1] The aim was to improve cocoa quality and yields, and to reduce the indebtedness of cocoa farmers (Department of Agriculture. Gold Coast, 1931). The Cooperative Societies Ordinance No. 4 of 1931 set the legal

[1] Concepts of cooperation existed in the country in various forms and was known as "Nwoboa" among farmers in the Akan speaking communities (Department of Cooperatives, 1990).

framework for cooperatives and laid down the rights and liabilities of society members.[2]

The generally accepted unit was the village; members had to occupy land within the area of the village (Department of Agriculture. Gold Coast, 1931). Officers of the Department of Agriculture sought the support of chiefs and visited villages to explain the aims and rules of cooperative organisations. The targeting of villages followed somewhat peculiar rules.[3] Preference was given to the big, easily reachable villages along the main roads, which is indeed clearly visible on a map (Figure 1). Moreover, the Department of Agriculture concentrated their activities on a few areas and expanded in waves to all areas in Ghana’s cocoa belt. Lacking prior experience, the idea of cooperatives met suspicion and the forming of cooperatives had a clear trial character, e.g. 44 of the 499 societies existed for just one season.

The cooperatives were dual-purpose organisations providing marketing as well as thrift and loan facilities. As far as marketing is concerned, cooperatives collected the dried and fermented cocoa beans in the society’s store (Shephard, 1936, p. 48). After two weeks or more, when a sufficient quantity has been accumulated, the District Agricultural Officer analysed samples and certified the purity (percentage of mouldy, germinated, slaty, weevilly, and defective cocoa beans) if it exceeded 95%.[4] The cocoa was offered to cocoa-buying firms in the nearest large buying centre. Sealed tenders were received, considered and accepted by the Committee of the society. The cocoa was delivered, cash obtained and finally distributed to members.

---

[2] The Ordinance of 1931 was substantially revised in 1937.

[3] Due to the lack of agricultural survey data, it is impossible to compare the distribution of cooperatives with the general population of cocoa farmers. For a general description, see Hill (1963).

[4] Patterson (1933, p.11) reported a purity of 97.3% and 89.3% for cooperative and ordinary cocoa respectively in the 1931/32 season. The difference, however, decreased in the mid-1930s, largely due to a rise in the general standard of purity (Nowell, 1938, p. 42).

The market was characterised by oligopsonistic structures: 10 European firms shipped 90% of the cocoa exported in 1933/34 (Nowell, 1938, p. 191).[5] Cooperatives did not challenge their position during our study period, but were merely by-passing intermediaries/ cocoa brokers.

Paterson (1934: 241) reported that, on average, cooperatives obtained a price by about one shilling per load (60 lb) higher than the general local price. Cooperatives deducted a fee of six pence per load to cover operating costs. Thus, in principle, cooperative farmers were left with a meagre 6% mark up over the Gold Coast producer price (which ranged between 8.3 and 9.1 shillings in the 1931-33 period). Nevertheless, cooperatives may have delivered higher revenues by using correct measurement scales, unlike cocoa brokers whose opportunistic behaviour in weighing farmers' cocoa was often reported.

Thrift and loan services were often identified as the main reason why farmers joined the cooperative. Loans were given for various purposes, usually for periods of a few months (Table 1).[6] The 1931 Ordinance required that the rate of interest on loans must not exceed 10% per annum, which was significantly less than the 50% to 100% what money lenders or cocoa brokers implicitly charged (Austin, 2005). Lending represented a significant activity in the cooperatives; in the 1934/35 season, for example, the ratio of loans to share-capital amounted 0.36.

Obviously, services were only provided to members. Costs of becoming a member for most societies included an entrance fee of one shilling and subscription of

[5] Twelve cocoa-buying firms, which accounted for 95% of cocoa exports, did indeed collude and entered a buying agreement in 1937, to which Ghanaian cocoa growers responded with a producers' strike (Austin, 1988).

[6] The average value of loan was 41.9 and 31.3 shillings in the years 1933/34 and 1934/35 respectively (Paterson, 1935, p. 9). This compares with an average wage of day labourer of approximately 1.25 shillings per day (Gold Coast, 1931).

at least five shares of one shilling each. Members also bear higher production costs to meet the higher quality requirements for cooperative graded cocoa.

Table 2 shows the development of the cooperative movement in Ghana. Cooperative societies mushroomed after the enactment of the 1931 Ordinance. Between 1929 and 1932, the number of societies increased 14-fold, and the number of members increased 10-fold. By then, cooperative societies marketed 2% of the cocoa that was exported from Ghanaian ports. After 1933, cooperatives went through a phase of consolidation. The share capital per member (in real terms), however, steadily increased from £0.7 in 1931 to £1.9 in 1936.

The tensions between economies of scale and loyalty problems received much attention from contemporary observers. In the 1931/32 report, for example, A. W. Paterson, director of the Agricultural Department at that time, stated that ‘when the main purpose of a society is the handling and sale of some readily realisable crop, it would appear obvious that the larger society should be more efficient. It must not be lost sight of, however, that it is the efficiency of management together with the loyalty of members that either makes or breaks any society’ (Paterson, 1933, p.3). Expulsions of ‘useless’ and ‘undesirable’ members were mentioned in almost every audit report from 1933/34 on (Paterson, 1935: 4; Scott, 1934: 2).

3. Data

Our core data is derived from balance sheets and statement of accounts published in annual audit reports by the Department of Agriculture (Paterson, various years). These reports list the name of each society, date of formation, location, number of members, paid up capital, revenue and quantity of cocoa sold, profit/losses, reserves and dividends. Each society’s books were audited by trained agricultural officers of the Department of Agriculture, so that we can assume a good comparability of the figures. Overall, we have data of all 500 societies that existed in the period 1930-36 and that sold cocoa, 119 of which exited in the period 1930-36.[7]

We supplemented the data with background information of the villages where the cooperatives were operating. Data on infrastructure at that time (distance to roads, railroads, ports) is readily available on contemporary road maps (Survey Headquarters Accra, 1937). Maps also exist for soil classifications (Ghana Department of Soil and Land Use Survey, 1958) and monthly rainfall available as a panel of 0.5 degree grid resolution from CRU TS 2.1 (Mitchell et al., 2004). We digitised these maps and, using the geographic coordinates of the villages as identifier, merged the information with the core data set. In addition, population estimates were retrieved from the 1931 Census (Gold Coast Census Office & Cardinall, 1932). We found the geographic location of 444 villages and identified 428 villages in the Census, or about 89% and 86% of the societies respectively. Alternative spellings of village names and popularity of certain place names are the main reasons for attrition.

4. Capital accumulation and membership

Cooperative firms mobilize capital primarily through retained earnings and through members' purchase of shares. Recent literature has emphasised how the vaguely defined nature of property rights in cooperative firms may contribute to capital mobilization problems among members. According to Cook (1995) and Iliopoulos (2005), a vague definition of property rights in traditional cooperatives arises from the combination of open membership, lack of a market for ownership

[7] Discrepancies with figures in Table 1 can be explained by societies that have not started to sell cocoa. Figures on the number of societies and members, and paid up capital from our data set are ca. 1%-5% lower than in Table 1.

rights and equally distributed voting rights between members, three characteristics that Ghanaian cocoa cooperatives also met.[8]

Open membership may impede capital accumulation by exacerbating free-rider problems: existing members cannot appropriate the full value of the benefits deriving from the investments they have funded (Iliopoulos, 2005: 16). This problem may become more serious, the larger the society is. Moreover, lack of a market for ownership rights, combined with equally distributed voting rights, may give rise to horizon problems. Because members cannot sell their ownership rights at a price that reflects the performance of the cooperative, they find it unprofitable to invest in long-term projects which generate returns over a period which is longer than the investor's own time horizon (Furubotn & Pejovic, 1970) [9] Heterogeneity in membership characteristics and preferences with respect to investments is likely to increase with the size of the society.

We test for the influence of group size on shared capital *C*. We model nonlinearities in the relationship using number of members *M* and its log:[10]

(1) $$\ln(C/M)_i = \alpha + \beta_1 \ln M_i + \beta_2 M_i + \varepsilon_i$$

If $\beta_1>0$ and $\beta_2<0$, the relationship follows an inverted U pattern (though not necessarily across the observed data).

[8] Section 13 of the 1931 Cooperative Ordinance laid down the principle of one man, one vote in the affairs of the society; section 14 restricted the transfer of shares to members of the cooperative. Note however that the share price does not reflect the good or bad performance of the cooperative, it is just kept in real terms.

[9] In the case of Ghanaian societies, free-rider tendencies may be further exacerbated by the trial character of the cooperatives, as a short time horizon of members, further discourages investment in capital from members.

[10] Nonlinearities are typically modelled using the variable and its square root (or its squared form). We prefer the log specification. The specification allows for a concave function including an inverted U pattern. Should the member variable turn out to be insignificant, however, coefficients in the log-log specification can be conveniently interpreted as elasticities. Conclusions do not change when using third or higher degree polynomials.

We start the analysis with a pure cross-section of cooperatives *i* where variables measure the condition in the first year of existence. Under the most parsimonious specification as in equation (1), we find indeed an inverted U relationship (column (1), Table 3). The positive effect levels off after cooperatives have reached a membership size of about 20, and each member contributes about 10 shillings of capital on average. In contrast, the capital per member ratio of the largest 10% cooperatives (>25 members) is equivalent to that of the median cooperative (with 11-13 members), ca. 8 shillings on average (Figure 2).

Certainly, the ability of farmers to contribute capital depended upon their wealth. We can partly control for wealth (and indeed capital taking the form of mature cocoa trees), as cocoa cultivation started on highly suitable soils in the Eastern region and then moved westwards (Hill, 1963). When including soil quality as a proxy for wealth and capital accumulation in the older cocoa-growing areas, and controlling for the cooperatives' year of formation and district fixed effects, membership size becomes insignificant (column (2), Table 3).

Finally, we run a 2SLS to account for possible endogeneities. Our instrumental variable is the village population aged 15 to 45. All other things equal, cooperatives draw more members from a larger pool of farmers in more populated villages. As indicated by the high F-value in the First Stage regression, our instrument is strong.[11] The point estimate for membership, however, remains small and insignificant (column (3), Table 3).[12]

To understand the dynamics of capital accumulation, we use the panel data. In the first two specifications we rerun the regression models from the cross-section above. The inverted U relationship between members and capital per member is more

[11] As a rule of thumb, an F-value lower than 10 points to a weak instrument (Staiger & Stock, 1997).
[12] Unfortunately, non-linear transformations of the IV are not suited to identify the non-linearity.

pronounced than in the pure cross-section (columns (1), Table 4).[13] The upward sloping part is steeper and the maximum shifted to the right (to a membership of 30). Moreover, we find an inverted U pattern even when including soil quality, year of formation and district fixed effects (columns (2), Table 4). This result, however, should be treated with care. Shared capital and membership both follow a trend (see section 2). As the trend of the former surpasses the latter, we might obtain a spurious, inverted U-type relationship. Moreover, cooperatives differ in many important respects, e.g. in by-laws and institutional solutions mitigating free-riding problems (and allowing cooperatives to grow in membership), external conditions such as access to land and the indebtedness of the farming population from which members are drawn. Confounding factors of this sort are likely to influence both capital and membership.

We address those issues by applying panel estimation techniques. We estimate equation

$$(2) \qquad \ln(C/M)_{it} = \beta_1 \ln M_{it} + \beta_2 M_{it} + \lambda AGE_{it} + \eta_i + \delta_t + \varepsilon_{it}$$

where η_i are society fixed effects capturing any unobserved, time-invariant heterogeneity between cooperatives i;[14] δ_t are time dummies; AGE_{it} are dummy variables for the age of cooperative i at time t (in years).

Under this specification we find β_1<0 and β_2>0 (column (3), Table 4). Thus, capital per member falls with membership though the negative effect diminishes gradually in larger cooperatives. Coefficients of AGE_{it} and δ_t describe a very interesting pattern of capital accumulation. Newly created cooperatives had a lower

[13] An F-Test rejects the null that coefficients of members and log members are equal in the panel and cross-section (p-value<0.0001).

[14] Hausman tests reject random effects models in favour of fixed effects (p-value<0.001). Note that fixed effects essentially remove all societies that existed for one year only from our analysis.

capital per member ratio than established ones, but they were able to catch up within two years (Figure 3). Survivorship bias does not drive this result; the pattern does not change when restricting the analysis to societies that survived at least five years (coefficients not reported to save space).[15]

Next, we extend the model by including lagged variables:

$$(3) \qquad \ln(C/M)_{it} = \beta_1 \ln M_{it} + \beta_2 M_{it} + X'_{it-1}\rho + \lambda AGE_{it} + \eta_i + \delta_t + \varepsilon_{it}$$

where X_{it-1} is a vector of lagged variables including profits, dividends and the dependent variable *C/M*. Profits are expected to have a positive effect on members' contribution to society's shared capital: profitability signals viability of the cooperative and stimulates further investment from members. The effects dividends can have are not so clear. On the one hand, dividend payments could indicate that the cooperative ran out of viable investment opportunities, so that additions to the capital base are not required. On the other hand, and probably more reasonable in the Ghanaian context, dividends could indicate cooperatives that honour the right of society members to any surplus income generated by the cooperative and this should encourage loyalty and commitment to the society.[16] Finally, we allow capital accumulation to follow an AR(1) process.

Estimating equation (3) we again find that individual contributions to shared capital significantly decrease as membership size increases (column (4), Table 4). There is no evidence of an inverted-U or U-type relationship as β_2 is not significantly different from 0. Excluding $\beta_2 M_{it}$ from the model, results indicate that a 1% increase

[15] Survivorship influences levels not the trends. We analyse exits of cooperatives in section 0.
[16] By-laws often regulated that a certain proportion of the profits had to be paid into the reserve fund. In our sample, we find two modes at 0 and 0.2-0.25 for 18% and 37% of the profit-making societies.

in the membership size lowered capital per member by 0.23%. This result is consistent with the free riding hypothesis.

Other interpretations, however, are possible. For example, it may reflect a particular pattern of membership expansion, where larger, wealthier farmers join first, and smaller farmers follow later on. Large farmers may have sufficient liquidity to pay the membership fee and to purchase shares, and may arguably be less risk averse than smaller farmers who shy away from this new business form. This story is backed by reports that many cocoa farmers were indebted. Thus, one way for cooperative societies to keep expanding their capital base may have been to allow in also smaller farmers, in spite of the fact that they would be able to subscribe fewer shares only.

We address this issue by modelling time trends that capture any society-specific membership expansion patterns such as the acceptance of ever less wealthy farmers.[17] This is done by interacting society fixed effects with the cooperative's age $\overline{AGE}_{it}$ in years (0, 1, 2, …, 7):

(4) $$\ln(C/M)_{it} = \beta_1 \ln M_{it} + \beta_2 M_{it} + X'_{it-1}\rho + \eta_i + \delta_t + \eta_i \overline{AGE}_{it} + \varepsilon_{it}$$

The coefficient for membership size is negative and highly significant (column (4), Table 4). The estimate of β_1 is also much larger than previously. This further supports the hypothesis that an influx of new members, e.g. above cooperative specific trends, increases free-riding problems, leading to a decline in the individual contributions to shared capital.

Certainly, for the society it is not so much capital per member but the total amount of capital raised what matters. Estimates of β_1 are negative, but always less

[17] The available instrumental variable does not vary over time and can therefore not be used.

than unity, which implies that share capital indeed increased with membership size. Nevertheless, our results suggest that this came at a price.

5. Evidence on loyalty

The cooperative societies faced problems inherent to their organisation. To start with, members could default on loans. Unfortunately, we do not have detailed information about repayment discipline.[18] Institutional solutions existed to keep up repayment discipline: Members could only take out loans in excess of their share capital on the guarantee of two other members who had unallocated share capital. At the end of the 1934/35 season only 7.9% of outstanding and granted loans in 1934 were reported overdue (Paterson, 1935).[19]

Cooperative members were required to sell their cocoa through the society. The Department of Agriculture considered quantities of illicit cocoa sales to be substantial pointing to the large number of society members selling no cocoa at all through their society (the frequency ranged between 20-30% in the period under study) and assuming that other members only marketed a portion of their crops cooperatively (Shephard, 1936, p. 51). Average cocoa bean production per farmer was estimated at one ton. A cooperative farmer, in contrast, sold less, ca. 0.55 ton on average in the 1930-1936 period; average sales per cooperative member increased over time however (Table 2).

An important impediment was probably that members had pledged their cocoa farms or were bound by forward contracts. However, even if farmers were free to sell, disincentives existed. Cooperative farmers had to wait about two to three weeks to receive payments – at a time of the year when farmers usually ran low on money

[18] Insofar as defaults resulted in capital losses, we treated them in the section before.
[19] Exits of societies with high defaults could have improved the standing of the surviving cooperatives.

(Shephard, 1936, p. 48). Cocoa brokers, in contrast, paid on the spot. Moreover, reports of contemporaries indicated that the slightly higher price of cooperative branded cocoa may not have justified the costs to achieve the required quality (Nowell, 1938, p. 43; Shephard, 1936, p. 38).

Disloyal members created negative externalities: they delayed the collection of cocoa sufficient to warrant an invitation for tenders and therewith increased the time that cooperative farmers had to wait for payment. They might also have affected income of others, if a premium was obtained for bulk quantity or if average costs were decreasing with quantity.

Selling to other buyers was a breach of society rules; members could be expelled from the society and faced a financial penalty for every load of cocoa sold illicitly. However, shirking is not easily observable. In line with the literature on collective action, we hypothesise that group size plays a role: smaller cooperatives may have an information advantage, in that it is more difficult to hide illicit cocoa sales from fellow members.

In the analysis we face the same problem as the cooperatives in that we do not observe shirking directly (Shephard, 1936, p. 51).[20] What we observe, however, are cocoa sales to the societies (in metric tons). Our strategy is therefore to use cocoa sales *S*, expressed in per member terms, as dependent variable and test for the influence of membership numbers *M*:

$$(5) \qquad \ln(S/M)_{it} = \beta_1 \ln M_{it} + \beta_2 M_{it} + X'_{it}\gamma + \lambda AGE_{it} + \eta_i + \delta_t + \varepsilon_{it}$$

[20] Even if such data as illicit cocoa sales were available, it would probably not represent an accurate reflection of the extent of shirking anyway.

where X is a vector of control variables; η_i are society fixed effects; δ_t are time dummies; *AGE* are dummy variables for the age of cooperative gradually added to the model as in the section before.

In the absence of shirking, the supply of cocoa to the cooperative should equal the aggregate supply of the individual cocoa farmers. Therefore, our set of controls is derived from the supply function: cocoa price, soil quality within a 5 km radius of the village, shared capital (as it could be used for loans to pay the wage bill; it makes shirking also more difficult as the society gets a clearer idea of the production scale of the farmer), monthly rainfalls, and transport infrastructure (Ali, 1969; Hattink et al., 1998; Zuidemaa et al., 2005).[21] What simplifies the analysis is that cocoa is a perennial crop. The Amelonado Forastero type of cocoa trees, predominant in Ghana at that time, took around five to six years before a first increase in yield occurred with a second increase in yield in the ninth or tenth year. Thus, we can rule out any effect of cooperatives on the members' choice of growing new trees on cocoa sales during our period of study.

Without any controls, we find cocoa sales per members to follow an inverted U relationship, with a maximum reached at ca. 40 members (column (1), Table 5). With controls particularly shared capital and year dummies, the relationship between membership and cocoa sales is weaker, and rather follows a log-log linear pattern (column (2), Table 5). When we introduce cooperative fixed-effects, the impact of membership on cocoa sales per member is substantially larger (column (3), Table 5). Under a specification with lagged capital and cocoa sales per member, we obtain similar results (column (4), Table 5).

[21] The cocoa price was derived by dividing the cooperative's revenues from cocoa sales by the quantity of cocoa sold.

Like in the previous section, we are concerned that certain patterns of membership expansion influence cocoa sales per member which are largely unrelated to free riding problems or economies of scale. Firstly, larger, wealthier farmers may have joined the cooperative first. If true, cocoa sales per member fall with membership. Secondly, cooperatives were indeed replacing cocoa brokers but farmers were initially bound, e.g. by forward contracts. As trends may differ across societies, we add society-specific age trends to our model. We find a positive impact of membership turning only slightly negative in cooperatives with more than 50 members (column (6), Table 5). In fact, we can simplify and assume a log-log linear relationship. Then, a 1% increase in membership increases sales per member by 0.57%.

Overall, we find a positive impact of membership on cocoa sales per member, especially for the small sizes within most Ghanaian cocoa producing cooperatives operated (Figure 2). We conclude that economies of scale outweighed free riding problems with respect to cocoa sales.

6. Determinants of Exits

We finally analyse the role of membership in the survival of cooperatives. Our definition of 'exit' includes societies that were disbanded, dissolved or liquidated.[22] Between 1930 and 1936, 107 out of the 499 cooperatives in our sample, or 21%, ceased to operate and exited the market. Cooperatives were at particular high risk of exiting within the first two years of operation: 37% and 25% of exits happened within the first and second year respectively (Figure 4).

[22] Mergers are considered exits too. However, we only know of four societies that merged with a neighbouring unit in 1936 (Steemson, 1938, p. 4).

We use a Cox proportional hazard model to explore the determinants of cooperative exit:[23]

$$\text{(6)} \qquad \mathrm{h(t)} = \mathrm{h}_0\mathrm{(t)}\exp\{\beta_0 + \beta_1 \ln M + \beta_2 M + \beta_3 M_{\min} + \mathrm{X}'\gamma\}$$

where *h(t)* is the hazard rate at time *t*; $h_0(t)$ is the baseline hazard rate function; M_{min} is a dummy variable indicating a cooperative with less than 10 members; *X* is a vector of controls gradually added to the regression.

Again, membership size *M* is the variable of interest. We add M_{min} as the 1931 Cooperative Ordinance set a minimum membership criterion, whereby societies with less than 10 members would be disbanded. The rule, however, was not strictly enforced, as the colonial authorities sought to promote the formation of cooperatives and to convince farmers by example of the advantages of cooperatives.[24] Our set of control variables includes typical determinants of firm survival and exit such as firm size (in terms of capital, revenues), profitability, market attributes, and aggregate economic conditions (Agarwal & Gort, 1996).[25]

Note that explanatory variables do not measure conditions at the time of exit. Audit reports were published at the end of each cocoa growing season; exits occurred afterwards. This means that the data is lagged by anything from one day to one year prior to the exit. We report coefficients in the form of hazard ratios: estimates larger than 1 imply a higher risk of exit, and vice versa for estimates smaller than 1.

Estimating equation (6) with year and district fixed effects as the only controls we find no evidence for an inverted-U relationship between membership size and

[23] Specification tests using Schoenfeld residuals show no evidence that our specifications violate the proportional-hazards assumption.
[24] Over the period under observation, 23% of failed societies were not complying with the minimum membership requirement at the moment of exit. We also experimented with a variable indicating the number of members at the first year of existence, but it was never significant.
[25] Using French data Pérotin (2006) found pattern and determinants of cooperative firm exit to be not significantly different from those of capitalist firms.

survival. Cooperatives with less than 10 members are significantly more likely to exit, but beyond that, the hazard rate is merely decreasing with membership size (column (1), Table 6).

Capital and cocoa sales are likely to be crucial determinants of cooperative survival. We know from the previous sections that membership influences both cocoa sales (positively) and capital per member (negatively). Thus, in the next specification, we add those two variables to see whether membership has any additional effect beyond (columns (2), Table 6). While higher cocoa sales and capital per member significantly reduce hazard rates, we find the effect of membership size on survival essentially unchanged (compare columns (3) and (4), Table 6).

The positive effect of membership size on survival could be primarily a result of its positive effect on the total amount of cocoa sales and shared capital. We test this idea by re-estimating the model without expressing the variables in per member terms. The hypothesis is indeed supported by the data (columns (5), Table 6): falling below the minimum membership requirement still increases the likelihood of exit, but the other two variables of membership are jointly insignificant (p-value: 0.70). We come to the same result when adding more controls to the model (column (6), Table 6).

Coefficients of the additional covariates are in line with what one would expect: survival is a positive function of the price that the cooperatives obtained from the cocoa-buying firms and additions to reserves. Only the negative impact of profitability on survival is counterintuitive at first sight. However, it is not the purpose of cooperatives to be profitable - in contrast to capitalist firms. For example, in our context, cooperatives could make a profit by lowering the price passed on to their members (Shephard, 1936, p. 57). As we included cooperative revenues in our regression, this is what “profits” is likely to be picking up, if marketing generates the bulk of revenue and marketing costs are relatively homogenous across societies. It is quite reasonable that cooperatives benefit their members most by passing on any surplus directly to the members who market their cocoa through their society rather than seeking and distributing the rents through other channels.

Our findings are robust to a series of robustness checks (results not reported here to save space). We used dummy variables (up to 10 categories) for membership size; we tested for the influence of membership size at the first year of existence; we also estimated a Weibull duration model, which fits the data well.

7. Bigger is Better

We investigated the role of group size on cooperative performance. On the one hand, a large membership base will help to realise economies of scale. On the other hand, it can create group interaction problems.

During the phase of cooperative formation and consolidation that characterised Ghanaian cocoa producer societies of the 1930s, we found that membership size had a negative effect on per capita subscriptions; though by expanding membership cooperatives could increase their capital base in the aggregate. Despite of contemporary reports on frequent shirking in cocoa sales, we found that sales per member were actually increasing with membership. Exclusions of disloyal members could well have contributed to this result. In a survival analysis, we found that a larger membership improved the chances of cooperative survival.

We do not claim that group interaction problems were not present or costly, what we can conclude however is that positive effects of membership expansion outweighed negative ones. The size at which Ghanaian cooperatives were operating was still sufficiently small to be able to benefit from an increase in membership size.

While Ghanaian cooperatives were not held back by free-rider problems, cooperative marketing failed to achieve a large volume in the 1930s. To blame is the general environment under which the cooperatives operated. One factor was certainly the misled emphasis on purity of cocoa beans imposed by the Department of Agriculture. Historically, the cooperative brand failed in the market. It nevertheless increased production costs of cooperative farmers. After World War II, for example, when the emphasis was changed and cooperatives were allowed buying commissions, their market share rapidly rose to one third. In the 1930s, the main advantage of membership could well have been the credit and banking facilities offered by the cooperatives. Lending represented a significant activity and loans had to come from shared capital. Shared capital is also a strong predictor of cocoa sales, and cooperative survival. However, such overall conditions affected all societies but cannot explain why certain cooperatives thrived.

Table 1 Loans granted to farmers by cocoa marketing societies, 1934/35

Number	Amount (in £)	Percentage of total amount	Purpose for which granted
1,748	2,437	71.6	Expenses of cultivation (labour)
166	275	8.1	Maintenance expenses (household)
44	159	4.7	Purchase of farm or land
57	114	3.4	Old debts
43	107	3.1	Building expenses
23	97	2.9	Redemption of mortgage farms
37	54	1.6	Hospital fees
24	52	1.5	Education expenses
17	38	1.1	Funeral expenses
17	70	2.0	Other
2,176	3,405	100.0	Total

Source: Appendix L, Audit report 1934/35 (Paterson, 1935).

Table 2 Development of Ghanaian Cocoa Cooperative Societies, 1929-1943

Year	Number of societies	Number of members	Capital (£)	Capital (in constant 1931 prices)	Cooperative cocoa (in tons)	Cooperative cocoa as percentage of total cocoa exports
1929	27	724			355	0.2
1930	40	949			619	0.2
1931	270	4,847	3,353	3,353	2,248	0.9
1932	390	7,905	5,754	5,808	4,217	1.8
1933	414	8,744	7,528	7,323	4,084	1.7
1934	417	8,975	9,632	9,161	5,956	2.2
1935	398	8,721	12,983	11,625	6,384	2.0
1936	398	9,663	24,150	18,658	7,879	3.3
1937	385	9,711	26,422	23,173	404	0.2
1938	371	9,399	28,299	23,749	9,404	3.3
1939	353	8,689			4,000	1.8
1940						
1941	265	6,375	21,562	11,254	9,924	7.9
1942	253	6,149	22,424	11,426	9,446	5.0
1943	254	6,439	24,575	12,118	11,420	5.5

Source: Agricultural cooperative societies annual audit reports (Paterson, various years) and annual reports of the Department of Agriculture (various years). Price deflator and total cocoa export were taken from Viton (1955).

Table 3 Determinants of raising capital (cross section, first year of existence)

	(1)	(2)	(3)
Number of cooperative members			
Ln(Members)	0.592***	0.274	-0.029
	(3.495)	(1.332)	(-0.089)
Members	-0.022*	-0.018	
	(-1.935)	(-1.538)	
Cocoa soil classifications within 5km radius of the village (in %)			
Soil class I		0.920***	0.931***
		(3.433)	(3.242)
Soil class II		0.414*	0.435**
		(1.894)	(2.008)
Soil class III		0.202*	0.300**
		(1.666)	(2.424)
Year of formation FE		Yes	Yes
District FE		Yes	Yes
IV Relevance tests for Ln(Village population aged 15 to 45)			
Shea Partial R^2			0.082
F(1, 322)			25.57
Anderson canon. corr. LR statistic			29.67
Observations	438	390	347
R^2-adj.	0.017	0.235	0.251

Note: The dependent variable is the logarithm of share capital per member (in £). Estimator in (1) and (2) is OLS; estimator in (3) is 2SLS; all regressions include a constant; robust t-statistics/z-statistics in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table 4 Determinants of capital accumulation (panel)

	(1)	(2)	(3)	(4)	(5)
Number of cooperative members					
Ln(Members)	0.816***	0.697***	-0.217**	-0.279***	-0.725**
	(11.25)	(5.784)	(-2.416)	(-2.721)	(-5.177)
Members	-0.010***	-0.015***	0.006*	0.002	-0.004
	(-4.038)	(-3.214)	(1.772)	(0.536)	(0.720)
Cocoa soil classifications within 5km radius of the village (in %)					
Soil class I		0.734*			
		(1.888)			
Soil class II		0.503***			
		(4.932)			
Soil class III		0.367***			
		(5.484)			
Profit, dividends (in £)					
Profits per member (in t-1)				0.122**	0.049
				(2.185)	(0.553)
Dividends per member (in t-1)				0.440*	0.047
				(1.796)	(0.161)
Ln(Capital per member) in t-1				0.259***	-0.099*
				(8.578)	(-1.919)
Year of formation FE		Yes			
District FE		Yes			
Age FE			Yes	Yes	
Year FE			Yes	Yes	Yes
Society FE			Yes	Yes	Yes
Society FE*Age trends					Yes
N Observations	1855	1673	1855	1303	1303
N cooperatives	494	440	494	432	432
R^2-adj.	0.114	0.249	0.829	0.914	0.962

Note: The dependent variable is the logarithm of share capital per member (in £). Estimator is OLS; all regressions include a constant; robust t-statistics in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table 5 Determinants of cocoa sales per member

	(1)	(2)	(3)	(4)	(5)
Number of cooperative members					
Ln(Members)	0.403***	0.224**	0.655***	0.591***	1.162**
	(5.436)	(2.142)	(4.205)	(2.752)	(2.252)
Members	-0.009***	-0.003	-0.012**	-0.006	-0.023*
	(-3.556)	(-0.767)	(-2.230)	(-0.987)	(-1.660)
Ln(Cooperative cocoa price)		-0.382	-0.307	0.251	0.155
		(-1.470)	(0.306)	(0.716)	(0.332)
Cocoa soil classifications in 5km radius (in %)					
Soil class I		0.467			
		(1.631)			
Soil class II		0.157*			
		(1.845)			
Soil class III		-0.049			
		(-0.759)			
Transport (Distance in km)					
Distance to road class I		-0.009***			
		(-2.774)			
Distance to railroad		0.003*			
		(1.710)			
Distance to cocoa buying centre		-0.002			
		(-0.484)			
Distance to port		-0.003*			
		(-1.771)			
Share capital (in £)					
Ln(Capital per member)		0.724***	0.548***	0.812***	0.810***
		(22.12)	(11.31)	(10.85)	(4.854)
Ln(Capital per member) in t-1				-0.074	0.044
				(-1.170)	(0.396)
Ln(Cocoa sales per member) in t-1				-0.133***	-0.435***
				(-2.842)	(-8.411)
Rainfall 0.5 x 0.5 grid		Yes	Yes	Yes	Yes
Year of formation FE		Yes			
District FE		Yes			
Age FE		Yes	Yes	Yes	
Year FE		Yes	Yes	Yes	Yes
Society FE			Yes	Yes	Yes
Society FE*Age Trends					Yes
N observations	1800	1606	1618	1186	1186
N cooperatives	489	429	432	389	389
R^2-adj.	0.015	0.473	0.652	0.708	0.804

Note: The dependent variable is the logarithm of cocoa sales per member. Estimator is OLS; all regressions include a constant; robust t-statistics in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table 6 Determinants of exits of cooperatives

	(1)	(2)	(3)	(4)	(5)	(6)
Number of cooperative members						
Members<10 (1=Yes)	2.028*	2.442*	2.192**	2.467**	2.442*	2.505*
	(1.833)	(1.912)	(2.158)	(2.231)	(1.912)	(1.958)
Ln(Members)	0.209**	0.356	0.279***	0.368***	1.244	1.156
	(-2.380)	(-1.492)	(-3.730)	(-3.038)	(0.299)	(0.180)
Members	1.017	1.002			1.002	0.999
	(0.466)	(0.054)			(0.054)	(-0.019)
Share capital (in £)						
Ln(Capital per member)		0.587***		0.587***		
		(-2.911)		(-2.952)		
Ln(Capital)					0.587***	0.675**
					(-2.911)	(-1.979)
Revenues						
Ln(Cocoa sales per member)		0.488***		0.488***		
		(-6.158)		(-6.180)		
Ln(Cocoa sales)					0.488***	0.451***
					(-6.158)	(-6.180)
Ln(Cooperative price)						0.054**
						(-2.398)
Profits, Reserves, Dividends (in £)						
Profits						1.051**
						(1.989)
Additions to reserves						0.331**
						(-1.964)
Infrastructure (Distances in km)						
Distance to road class I						0.974
						(-1.043)
Distance to railroad						0.998
						(-0.249)
Distance to port						0.996
						(-0.418)
Distance to cocoa buying centre						0.983
						(-0.641)
District FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N Failed cooperatives	89	78	89	78	78	74
N Cooperatives	443	432	443	432	432	428

Note: Estimator is duration model; coefficients are hazard ratios; robust z-values in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Figure 1: Map of Ghanaian Cocoa Producers' Societies

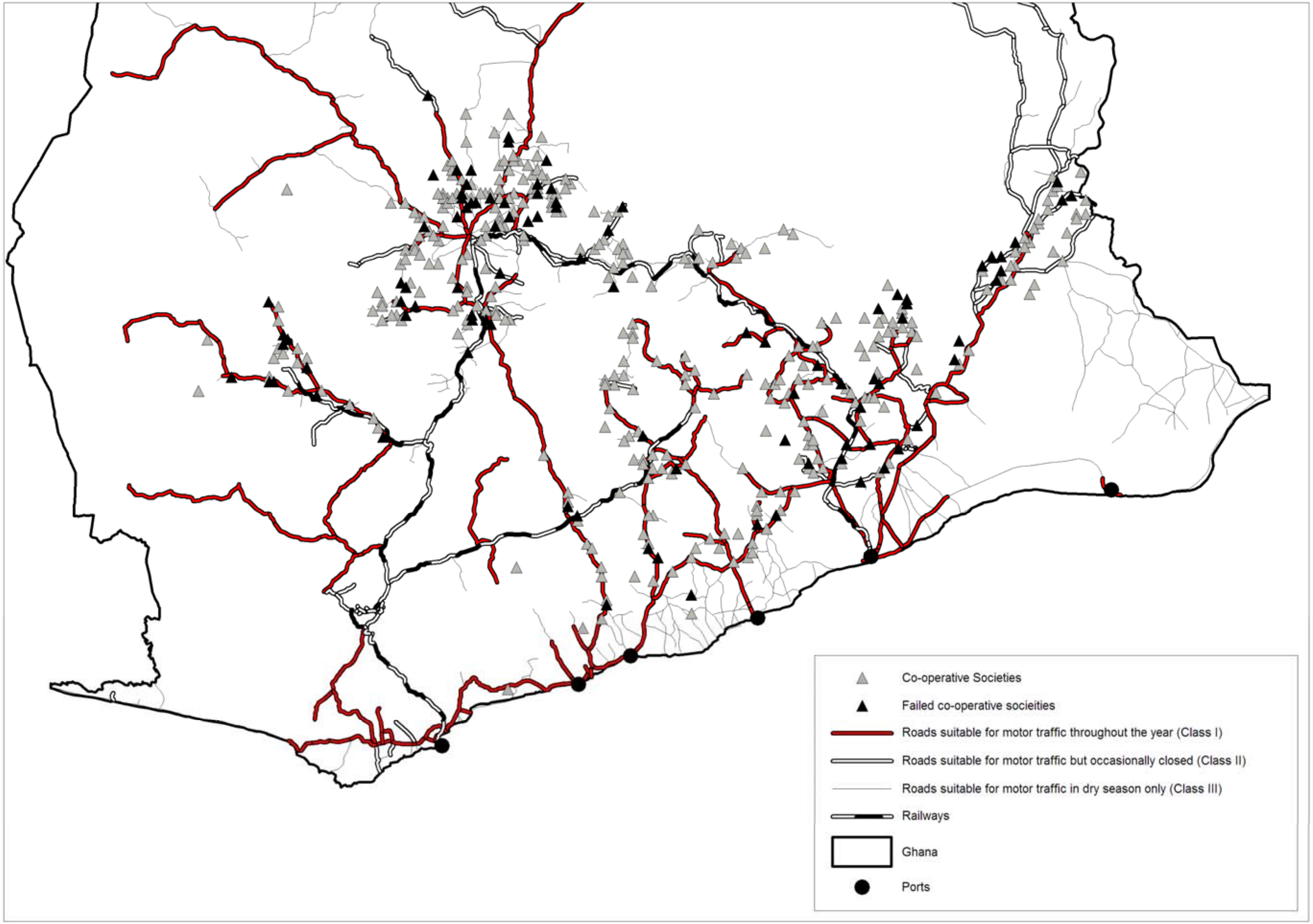
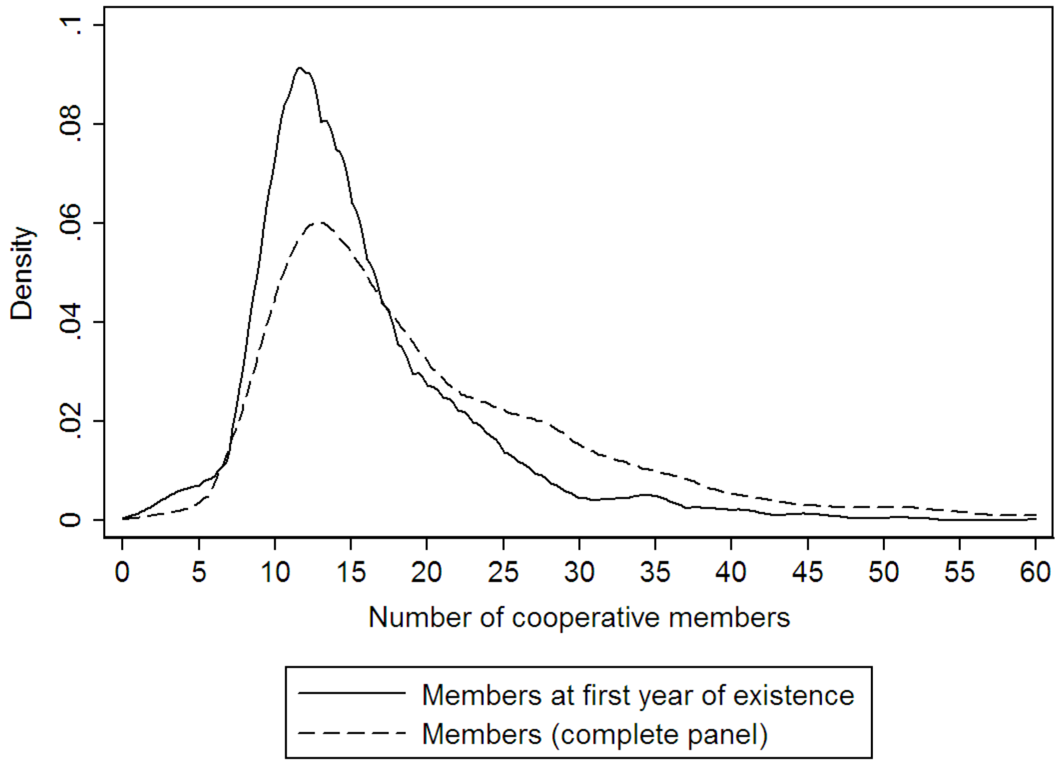
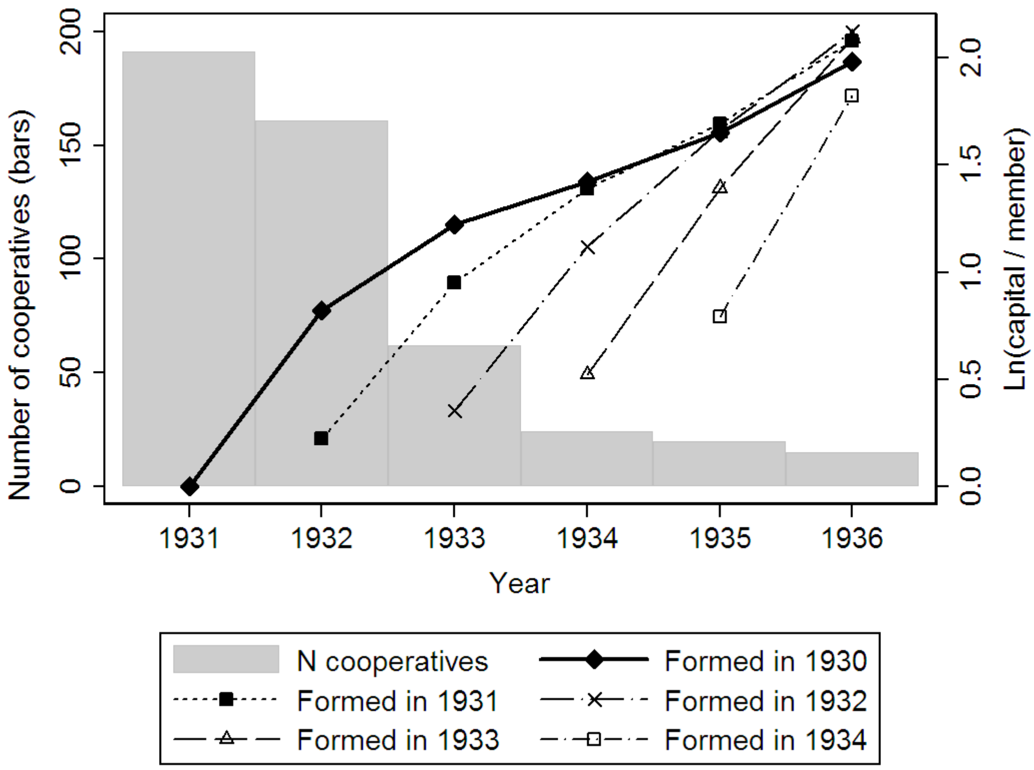


Figure 2: Membership size of cooperatives (kernel density plots)



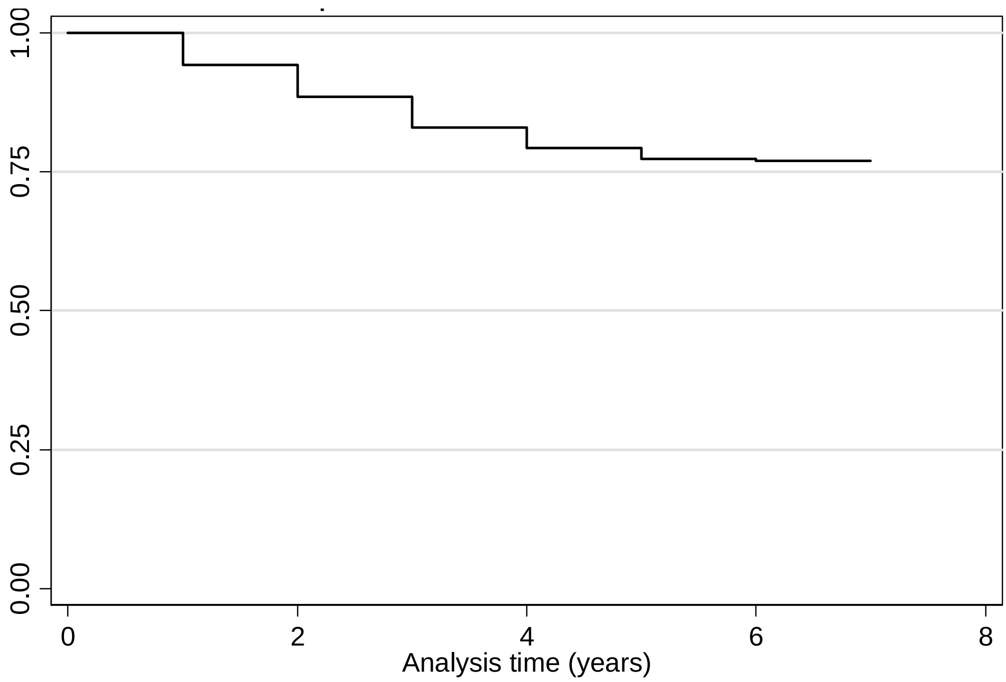
Note: For a better readability, the graph is truncated at a membership size of 60. Membership numbers at the first year of existence ranged between 2 and 62 (mean: 15.6; sd: 7.2); figures for the panel range between 2 and 150 (mean: 20.6; sd: 13.1).

Figure 3: Capital accumulation - predicted effect of year and age of cooperative



Note: Based on results in column (3), Table 4. A cooperative formed in 1930 was chosen as reference.

Figure 4: Kaplan-Meier survival estimates



Note: The Kaplan-Meier survivor function estimates the probability of cooperatives surviving longer than time *t.*

References

Agarwal, R., & Gort, M. (1996). The Evolution of Markets and Entry, Exit and Survival of Firms. *The Review of Economics and Statistics, 78*(3), 489-498.

Ahn, T. K., Isaac, M., & Salmon, T. (2009). Coming and Going: Experiments on Endogenous Group Sizes for Excludable Public Goods. *Journal of Public Economics, 93*(1-2), 336-351.

Ali, F. M. (1969). Effects of Rainfall on Yield of Cocoa in Ghana. *Experimental Agriculture, 5*, 209–213.

Austin, G. (1988). Capitalists and Chiefs in the Cocoa Hold-Ups in South Asante, 1927-1938. *International Journal of African Historical Studies, 21*(1), 63-95.

Austin, G. (2005). *Labour, Land, and Capital in Ghana: From Slavery to Free Labour in Asante, 1807-1956*. Rochester, NY: University of Rochester Press.

Chirwa, E., Dorward, A., Kachule, R., Kumwenda, I., Kydd, J., Poole, N., et al. (2005). Walking Tightropes: Supporting Farmer Organizations for Market Access. *Natural Resource Perspectives, 99*.

Co-Operative Societies Ordinance No. 4, (1931).

Cook, M. (1995). The Future of U.S. Agricultural Cooperatives: A Neo-Institutional Approach. *American Journal of Agricultural Economics, 77*(5), 1153-1159.

Department of Agriculture. Gold Coast. (1931). *Year-Book 1930*. Accra: Government Printer.

Department of Agriculture. Gold Coast. (various years). *Annual Report of the Department of Agriculture*. Accra: Government Printer.

Department of Cooperatives. (1990). *History of Ghana Cooperatives: 1928-1985*. Accra: Nsamankow Press.

Furubotn, E., & Pejovic, S. (1970). Property Rights and the Behaviour of the Firm in a Socialist State. *Zeitschrift für Nationalökonomie, 30*(5), 431-454.

Ghana Department of Soil and Land Use Survey (Cartographer). (1958). *Southern Ghana: Classification of Cocoa Soils. Map 2*

Gold Coast. (1931). *Blue Book*. Accra: Government Printer.

Gold Coast Census Office, & Cardinall, A. W. (1932). *The Gold Coast, 1931: A Review of Conditions in the Gold Coast in 1931 as Compared with Those of 1921, Based on Figures and Facts Collected by the Chief Census Officer of 1931*. Government Printer: Accra.

Hattink, W., Heerink, N., & Thijssen, G. (1998). Supply Response of Cocoa in Ghana: A Farm-Level Profit Function Analysis. *Journal of African Economies, 7*(3), 424-444.

Hill, P. (1963). *The Migrant Cocoa-Farmers of Southern Ghana: A Study in Rural Capitalism*. Cambridge: Cambridge University Press.

Hussi, P., & Murphy, J. (1993). The Development of Cooperatives and Other Rural Organizations. *World Bank Technical Paper*.

Iliopoulos, C. (2005). New Generation Cooperatives: The Potential of an Innovative Institutional Arrangement for Mediterranean Food Supply Chains. *New Medit, 4*(1), 14-20.

ILO, Develtere, P., Pollet, I., & Wanyama, F. O. (2008). *Cooperating out of Poverty*. Geneva: International Labour Office.

Mitchell, T. D., Carter, T. R., Jones, P. D., Hulme, M., & New, M. (2004). *A Comprehensive Set of High-Resolution Grids of Monthly Climate for Europe and the Globe: The Observed Record (1901-2000) and 16 Scenarios (2001-2100)*.

Nowell, W. (1938). *Report of the Commission on the Marketing of West African Cocoa*. London: His Majesty's Stationery Office.

Olson, M. (1965). *The Logic of Collective Action: Public Goods and the Theory of Groups*. Cambridge, Mass.,: Harvard University Press.

Ostrom, E. (2005). *Understanding Institutional Diversity*. Princeton: Princeton University Press.

Paterson, A. W. (1933). *Annual Audit Report, 1931-32*. Accra: Government Printer.

Paterson, A. W. (1934). The Cooperative Societies Movement Applied to the Problems of the Gold Coast Cacao Industry. *Tropical Agriculture (Trinidad), 11*(9), 240-243.

Paterson, A. W. (1935). *Annual Audit Report, 1934-35*. Accra: Department of Agriculture, Gold Coast.

Paterson, A. W. (various years). *Annual Audit Report*. Accra: Department of Agriculture, Gold Coast.

Pérotin, V. (2006). Entry, Exit, and the Business Cycle: Are Cooperatives Different? *Journal of Comparative Economics, 34*(2), 295-316.

Scott, J. L. (1934). *Agricultural Co-Operative Societies Annual Audit Report, 1933-34*. Accra: Government Printer.

Shephard, C. Y. (1936). *Report on the Economics of Peasant Agriculture in the Gold Coast*. Accra: Government Printer.

Staiger, D., & Stock, J. H. (1997). Instrumental Variables Regression with Weak Instruments. *Econometrica, 65*(3), 557-586.

Steemson, B. T. (1938). *Agriculturual Co-Operative Societies Annual Audit Report 1936-37*. Accra: Government Printer.

Survey Headquarters Accra (Cartographer). (1937). *Road Map of the Gold Coast. Southern Sheet*

Viton, A. (1955). *Cacao: A Review of Current Trends in Production, Price, and Consumption* (Vol. 27). Rome: Food and Agricultural Organization of the United Nations.

Zuidemaa, P. A., Leffelaara, P. A., Gerritsmaa, W., Mommera, L., & Antena, N. P. R. (2005). A Physiological Production Model for Cocoa (Theobroma Cacao): Model Presentation, Validation and Application. *Agricultural Systems, 84*(2), 195-225.