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MEMBERSHIP SIZE AND COOPERATIVE PERFORMANCE: EVIDENCE FROM GHANAIAN COCOA PRODUCERS' SOCIETIES, 1930–36

Chiara Cazzuffi and Alexander Moradi[1]

ABSTRACT

Using a complete panel of Ghanaian cocoa producers' societies in the 1930s, we investigate whether group interaction problems threatened (1) capital accumulation, (2) cocoa sales and (3) 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.

Keywords: Cooperatives, firm survival, collective action problems, Ghana

JEL classification: J54, N57, Q13

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 lets farmers achieve higher prices as compared to a situation of intermediaries with quasi-monopsonistic powers (Chirwa et al. 2005; Hussi and 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.

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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. Smaller 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 (Fulton and Adamowicz 1993; Hardin 1982; Staatz 1983). Larger groups, in contrast, may find this more difficult: monitoring members' commitment is more costly and social sanctions are less effective.

At a certain point, therefore, 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. Hart and Moore (1996), for instance, found that as cooperative size increases and size of business and preferences become more heterogeneous among members, the cooperative form of organisation becomes relatively less efficient than an investor oriented firm.[2] Nevertheless, institutional design can mitigate group interaction problems. Ostrom (2005) and Ahn, Isaac, and Salmon (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.

Within this framework we analyse the role that group size can play in cooperatives and we study the period of formation of Ghanaian cocoa cooperatives. In the 1930s, 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 cooperative organisation. This element of exogeneity in cooperative formation allows us to explore more clearly the determinants of cooperative success.

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, 3).

2 Hart and Moore (1996) use the term "efficient" in a formal way: outcome *x* is more efficient than outcome *y* if the total pie (total benefits minus total costs) enjoyed by users and owners is larger under *x* than under *y*.

Expulsions of "useless" and "undesirable" members were mentioned in almost every audit report from 1933/34 on (Paterson 1935, 4; Scott 1934, 2).

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

2. BACKGROUND

In the 1930s Ghana was the world's leading producer of cocoa with the crop entirely produced by small farmers.[3] Cocoa was the backbone of Ghana's economy accounting for 60 to 80% of total exports and representing a substantial source of income for farmers as well as the colonial government.[4]

The market was dominated by a few European firms that shipped the bulk of the crop to the overseas market.[5] The merchant firms relied on a complicated network of brokerage: 38,500 African brokers, sub-brokers and petty-brokers acted as middlemen.[6] They bought the cocoa beans from farmers and brought the crop to cocoa buying stations from where it was transported by rail and lorry to the ports for export.

The colonial government, especially the Agriculture Department, long feared that cocoa from Ghana might eventually lose its market because of inadequate quality control (Austin 2005, 300). The brokerage system was considered the main culprit. Brokers competed for quantity; they did not engage with farmers explaining to them the best practices to prepare the cocoa beans before marketing them. Moreover, brokers offered advances to farmers (on payment of an interest), which was argued to remove the incentive to produce quality. In a response to this, the colonial administration began to actively promote cooperative organisations in 1929.[7] The aim was to improve cocoa quality and yields, and to reduce the

3 For convenience we use the name "Ghana". Cocoa was grown in parts of the Gold Coast Colony, Ashanti, and the British Togoland (see Figure 1). These territories plus the Northern Territories became Ghana on independence.

4 Jedwab (2010) estimated cocoa income going to farmers during the Great Depression at 200 millions (in 2000 dollars).

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 number of brokers was given by Nowell 1938, 29.

7 Thus, cocoa cooperatives were not an indigenously grown institution. Concepts of cooperation, however, existed in various forms such as reciprocal labour arrangements between members of hamlets, known as "Nwoboa" in the Akan speaking communities (Austin 2005, 313–14; Department of Cooperatives 1990).

indebtedness of cocoa farmers, by selling directly to the European firms, bypassing intermediaries and cocoa brokers (Department of Agriculture, Gold Coast 1931).[8]

The Cooperative Societies Ordinance No. 4 of 1931 set the legal framework for cooperatives and laid down the rights and liabilities of society members.[9] The generally accepted unit was the village; members had to occupy land within the area of the village. 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.[10] 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, 48). After two weeks or more, when a sufficient quantity had 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%.[11] 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.

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, usually six pence per load, to cover operating costs.[12] Thus, in principle, cooperative farmers were left with a meagre 6% mark up over

8 The Department of Agriculture certified the higher purity of cocoa sold by cooperatives. The creation of a (cooperative) "brand" can be indeed considered the textbook solution to quality problems – provided that there are information problems (the quality of the beans cannot be observed) and buyers value quality to an extent that the premium price covers the costs of producers. The latter can be doubted in the context of Ghanaian cooperatives, 1930s.

9 The Ordinance of 1931 was revised in 1937, adding provisions for the formation of second-tier cooperatives.

10 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.

11 Patterson (1933, 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, 42).

12 The fee varied. More efficient cooperatives charged a lower fee, which ultimately benefitted their members.

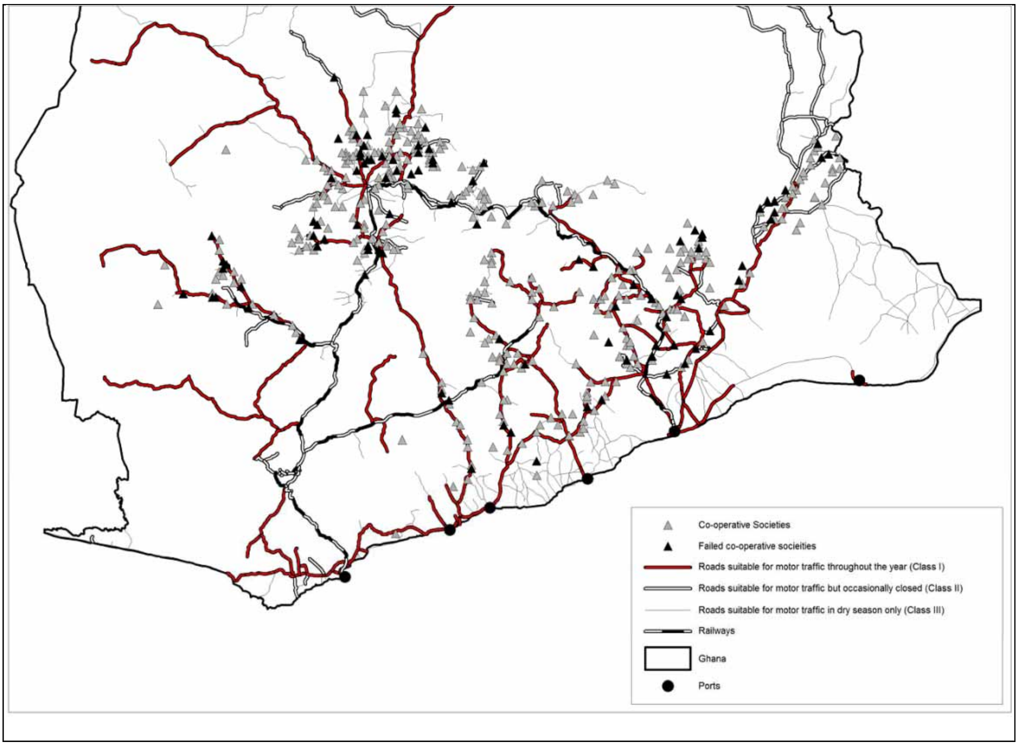

Figure 1: Map of Ghanaian cocoa producers' societies

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 incomes to farmers by using correct measurement scales and having lower transaction costs, unlike cocoa brokers who were said to pay lower-than-market prices, and to use doctored scales (Southall 1978).[13]

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).[14] 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% that money lenders or cocoa brokers implicitly charged. 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.

13 Bauer (1954) argued that brokers could not exercise market power over prices because of the high number of brokers and low barriers to entry. Austin (2005) explored and largely confirmed this argument for Ashanti.

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

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).

Services were only provided to members. Costs of becoming a member for most societies included an entrance fee of one shilling and subscription of at least five shares of one shilling each. Share capital was not a function of suppliers' throughput. Members also bore 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. It was only after World War II when cooperatives received a preferential buying licence from the state-owned Cocoa Marketing Board that cooperatives marketed a third of the total crop (Green and Hymer 1966).

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, 1932–38). 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

Table 2: Development of Ghanaian cocoa cooperative societies, 1929–43

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 (1929–1943). Price deflator and total cocoa export were taken from Viton (1955).

in the period 1930–36 and *that sold cocoa*, 119 of which exited in the period 1930–36.[15]

We supplemented the data with background information on 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 and Cardinall 1932). We found the geographic location of 444 villages and identified

15 Figures on the number of societies, cooperative members, and paid up capital from our data set are ca. 1–5% lower than those reported in Table 2. This discrepancy can be explained by societies that have not started to sell cocoa, which we excluded from our dataset.

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

Voluntary shared capital contributions from members are a crucial way for cooperatives to mobilise capital and to grow. However, members typically have little incentive to contribute capital to the cooperatives beyond the required subscription (Caves and Petersen 1986; Fulton et al 1995; Lerman and Parliament 1993). The reason is that members receive a share of cooperative surplus which is proportional to the quantity marketed through the cooperative – irrespective of the equity invested. Recent literature has emphasised how the vaguely defined nature of property rights in cooperative firms contribute to this kind of capital mobilisation problem. According to Cook (1995) and Iliopoulos (2005) a vague definition of property rights arises from the combination of open membership, lack of a market for ownership rights and equally distributed voting rights among members, three characteristics that Ghanaian cocoa cooperatives also shared.[16]

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 and Pejovic 1970).[17] Heterogeneity in membership characteristics and preferences with respect to investments is likely to increase with the size of the society.

Capital requirements of Ghanaian cocoa cooperatives included purchase or rent of a store, scales, bags and transport for cocoa delivery. Their thrift and loan facilities provided an incentive for members to contribute shared capital proportionately, but not in excess to, their estimated borrowing needs: members could borrow proportionally to their shared capital contributions, and could only

16 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 that the share price does not reflect the performance of the cooperative; it is just kept in real terms.

17 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.

take out loans in excess on the guarantee of two other members with unallocated shared capital.

We investigate collective action problems in capital accumulation by testing for the effect of group size on shared capital *C*. We model nonlinearities in the relationship using number of cooperative members *M* and its log:[18]

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

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

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. 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[19] 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 drew 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.[20] The point estimate for membership, however, remains small and insignificant (column (3), Table 3).[21]

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

18 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. Moreover, should the member variable turn out to be insignificant, coefficients in the log-log specification can be conveniently interpreted as elasticities. Conclusions do not change when using third or higher degree polynomials.

19 Soil class I is the best soil for growing cocoa. Our soil class I, II, III variables measure the percentage of each type of soil in a 5km radius of the village cooperative.

20 As a rule of thumb, an F-value lower than 10 points to a weak instrument (Staiger and Stock 1997).

21 Unfortunately, non-linear transformations of our IV are not suited to identify the non-linearity.

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.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

member is more pronounced than in the pure cross-section (column (1), Table 4).[22] 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 (column (2), Table 4). This result, however, should be treated with care. Shared capital and

22 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).

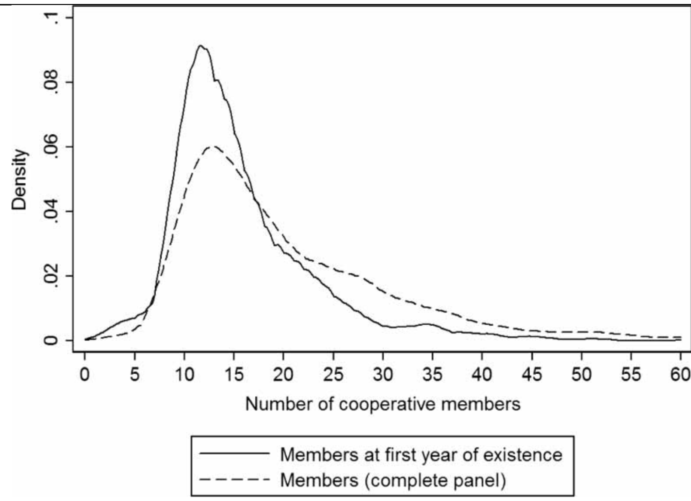

Figure 2: Membership size of cooperatives (kernel density plots)
Note: For a better readability, the graph is truncated at a membership size of 60. Membership numbers at the first year of existence ranged between 2 and 62 (mean: 15.6; sd: 7.2); figures for the panel range between 2 and 150 (mean: 20.6;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

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 (allowing cooperatives to grow in membership), external conditions such as access to land and 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 the equation

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

where η_i are society fixed effects capturing any unobserved, time-invariant heterogeneity between cooperatives i; δ_t are time dummies; AGE_{it} are dummy variables for the age of cooperative i at time t.[23]

Under this specification we find $\beta_1 < 0$ and $\beta_2 > 0$ (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 capital per member ratio than established ones, but they were able to catch up, on average within two years (Figure 3). Survivorship bias does not seem to

23 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.

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.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

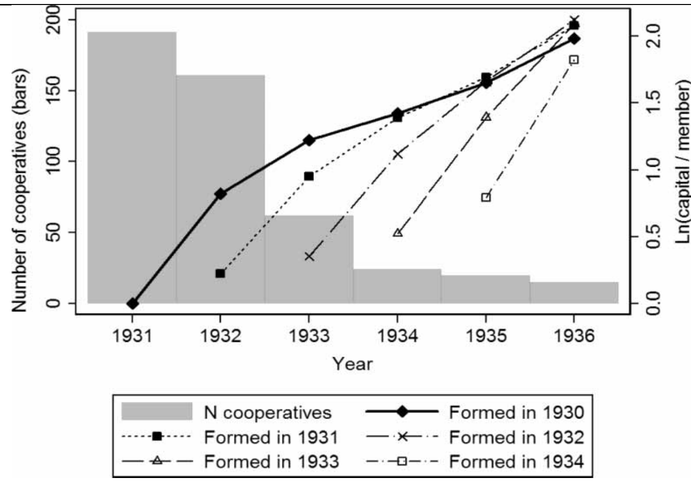

Figure 3: Capital accumulation – predicted effect of year and age of cooperative
Note: Based on results in column (3), Table 4. A cooperative formed in 1930 was chosen as reference.

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).[24]

Next, we extend the model by including lagged variables to control for the timing of information that may be relevant for the decision to contribute shared capital:

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

where X_{it-1} is a vector of lagged variables including profits, dividends and the dependent variable *C*/*M*. We expect profits in the previous year to have a positive effect on members' contribution to society's shared capital: past 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, thus stimulating further investment in the following year.[25] Finally, we allow capital accumulation to follow an AR(1) process.

24 Survivorship influences levels not the trends. We analyse exits of cooperatives in section 6.

25 By-laws often regulated that a certain proportion of the profits could not be distributed to members in the form of dividends, but had to be paid into the reserve fund. In our sample, we find two modes in the reserve additions to profit ratio, one at 0 and another one at the 0.2–0.25 interval for 18% and 37% of the profit-making societies respectively.

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. When excluding $\beta_2 M_{it}$ from the model, results indicate that a 1% increase 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 had 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 smaller farmers, in spite of the fact that they would be able to subscribe to fewer shares only. Moreover, members could have "taxed themselves" buying more shares for, say, the first and second year of a presumably small cooperative to fund the initial capital requirements; as the cooperative is established and capital requirements level off, so do members' contributions.

We address this issue by modelling time trends that capture any society-specific membership expansion patterns such as the acceptance of smaller and ever less wealthy farmers.[26] This is done by interacting society fixed effects with the cooperative's age $\overline{AGE}_{it}$ in years (0, 1, 2, ..., 7):

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

We find the coefficient for membership size negative and highly significant (column (5), 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 than unity, which implies that total 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. 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.

26 The available instrumental variable does not vary over time and therefore cannot be used.

Though we do not have detailed information about repayment discipline, it does not seem to have been a huge problem: at the end of the 1934/35 season only 7.9% of outstanding and granted loans in 1934 were reported overdue (Paterson 1935).[27]

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 (about 20–30% in the period under study) and assuming that other members only marketed a portion of their crops cooperatively (Shephard 1936, 51). Average cocoa bean production per farmer was estimated at one ton. A cooperative farmer, in contrast, sold less, ca. 0.57 ton on average in the 1930–36 period: average sales per cooperative member increased over time however, from a low in 0.46 tons in 1933 to 0.81 tons in 1936 (Table 2).[28]

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 (Shephard 1936, 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, 43; Shephard 1936, 38). Members, however, still found it attractive to join the cooperative and pay the entrance fee and initial capital subscription, if only to access the thrift and loan facilities.

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 had a higher degree of member commitment and an information advantage, in that it is more difficult to hide illicit cocoa sales from fellow members.

27 Exits of societies with high defaults could have improved the standing of the surviving cooperatives.

28 The lower than average sales of cooperative farmers can be considered evidence of illicit cocoa sales only if cooperative farmers did not differ much from the underlying farmer population. This does not need to be true. Modern cooperatives, for example, find it difficult to attract larger producers, presumably because large producers can obtain adequate marketing arrangements without resorting to collective action. Unfortunately, we do not have sufficient information on cooperative and general farmers' individual cocoa sales. The strong upward trend in cooperative sales per member, however, is at odds with this argument.

In the analysis we face the same problem as the cooperatives in that we do not observe shirking directly (Shephard 1936, 51).[29] 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*:

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

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 (with class I being the best soil quality), 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, Heerink, and Thijssen 1998; Zuidemaa et al. 2005).[30] 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 member 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, again following an inverted U (column (3), Table 5). The turning point is reached at 55 members, but only few cooperatives in our sample have more members than this. Under a specification with lagged capital and cocoa sales per member, the turning point moves to the right at ca. 100 members (column (4), Table 5).

Like in the previous section, we are concerned that certain patterns of membership expansion may influence cocoa sales per member while being 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

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

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

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)

Table 5 (*Continued*)

	(1)	(2)	(3)	(4)	(5)
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

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 (5), 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 which 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.[31] 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

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

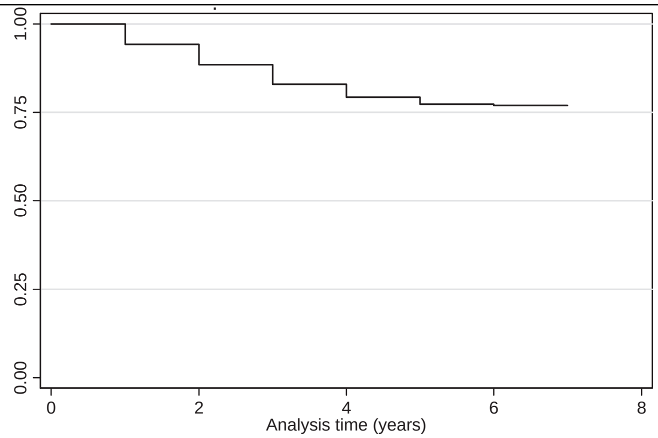

Figure 4: Kaplan-Meier survival estimates
Note: The Kaplan-Meier survivor function estimates the probability of cooperatives surviving longer than time *t*.

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).

We use a Cox proportional hazard model to explore the determinants of cooperative exit:[32]

$$h(t) = h_0(t)\exp\{\beta_0 + \beta_1 \ln M + \beta_2 M + \beta_3 M_{\min} + X'\gamma\} \quad (6)$$

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.[33] 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 and Gort 1996).[34]

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

32 Specification tests using Schoenfeld residuals show no evidence that our specifications violate the proportional-hazards assumption.

33 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.

34 Using French data, Pérotin (2006) found pattern and determinants of cooperative firm exit to be not significantly different from those of capitalist firms.

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. We hypothesise a U-relationship between risk of exit and membership size. This requires $\beta_1 < 1$ and $\beta_2 > 1$ in equation (6). Estimating equation (6) with year and district fixed effects as the only controls we find no evidence of a U-relationship between membership size and exit. 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). We test this further by re-estimating the equation using a linear relationship between membership and risk of exit, and find this confirmed (column (2), 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 its effect via cocoa sales and capital contributions (column (3), 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, although statistically not significant. We estimate the equation again expressing the relationship between membership and risk of exit in linear terms, and confirm that risk of exit significantly decreases with membership size (column (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 (column (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).

Results for the other covariates are in line with what one would expect. Cooperative survival is a positive function of the price that the cooperatives obtained from the cocoa-buying firms. Cooperatives that add capital to their reserves are less likely to exit. Only the negative impact of profits on survival is counterintuitive at first sight. However, maximisation of cooperative profit and profit retention is not necessarily the objective of cooperative firms. Instead cooperatives often seek to maximise their members' welfare, that is the maximisation of joint cooperative and members' profit (Cotterill 1987). In our context, profits could be increased by lowering the price paid to members (Shephard 1936, 57). Large profits at the end of the cocoa season may also mean that the cooperative is not redistributing its surplus to members. Squeesing cocoa prices paid to members and not redistributing profits among members may both discourage members' commitment and loyalty to the cooperative, thereby

Table 6: Determinants of exits of cooperatives

	(1)	(2)	(3)	(4)	(5)	(6)
Number of cooperative members						
Members < 10 (1 = Yes)	2.028*	2.192**	2.442*	2.467**	2.442*	2.505*
	(1.833)	(2.158)	(1.912)	(2.231)	(1.912)	(1.958)
Ln(Members)	0.209**	0.279***	0.356	0.368***	1.244	1.156
	(−2.380)	(−3.730)	(−1.492)	(−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)

Table 6 (*Continued*)

	(1)	(2)	(3)	(4)	(5)	(6)
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	89	78	78	78	74
N Cooperatives	443	443	432	432	432	428

Note: Estimator is duration model; coefficients are hazard ratios: estimates larger than 1 imply a higher risk of exit, and vice versa for estimates smaller than 1; robust z-values in parentheses.
***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

negatively affecting its survival chances. This is what "profits" is likely to be picking up in our regression.[35]

Our findings are robust to a series of robustness checks (results not reported here to save space). We tested for the influence of membership size at the first year of existence; we used dummy variables (up to 10 categories) for membership size; 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 can help to realise economies of scale. On the other hand, it can create group interaction problems.

For 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; nevertheless, by expanding membership cooperatives could increase their total capital base. Despite of contemporary reports of frequent shirking in cocoa sales, we found that sales per member actually increased 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 also found that shared capital was a strong predictor 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.

Ghanaian cooperatives were not held back by free-rider problems, though in the aggregate they failed to achieve a large market share in the 1930s. One reason was certainly the misled emphasis on purity of cocoa beans imposed by the Department of Agriculture. This increased production costs of cooperative farmers; because European cocoa buying firms did not value the higher purity, cooperative branded cocoa failed to obtain a satisfactory premium on the market. After World War II, when the emphasis on quality was reduced and cooperatives became licensed buying agents, their market share rapidly rose to one third. Arguably, this first decade of experimenting with the cooperative form may have allowed members and managers to build up the necessary experience and learning by doing, and thus contributed to the improved performance of cooperatives on the market in later years.

35 For a contemporary example see Banerjee et al. (2001) on sugar cooperatives in India. They highlight how inequality in members' landholdings favours rent-seeking within the cooperative and influences the choice of retaining cooperative profits, which are then captured by richer members.

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