The horizon problem reconsidered

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Abstract
This paper challenges the general view in the literature that cooperatives underinvest, because some members will exit the cooperative before the full benefits from their investments are harvested (the horizon problem). This paper demonstrates that full equity redemption will solve the horizon problem. The majority of members will, however, bias the exit payment to their own advantage. This will lead to overinvestment. Thus, the main finding in this paper is that if there is a horizon problem, it will lead to overinvestment – not underinvestment.

Keywords: cooperatives, investment incentives, financial structure
JEL code: D23, J54, P13

Section 1: Introduction

One of the important challenges for cooperatives is the ability to raise sufficient capital. In the agribusiness sector, the industrialization of agriculture, merger waves and increased *R&D* have led to bigger cooperative firms financed by fewer farmers. This development creates new challenges for the traditional cooperatives.

The literature argues that the ability to raise capital is one of the weaknesses of the cooperative organizational form. The literature lists a number of problems that will lead to underinvestment in cooperatives. One of the most important of these problems is the *horizon problem*.

Cook (1995) summarizes the literature on the horizontal problem in this way:

> *"The horizon problem occurs when a member's residual claim on the net income generated by an asset is shorter than the productive life of that asset. […] The horizon problem creates an investment environment in which there is a disincentive for members to contribute to growth opportunities. […] Consequently, there is a pressure on the board of directors and management to accelerate equity redemption at the expense of retained earnings."*

This paper challenges the standard view in the literature that the horizon problem leads to underinvestment in cooperatives. The main finding in this paper is that if there is a horizon problem, it will most likely lead to overinvestment – not underinvestment.

The standard view of the horizon problem also suggests that compensating the members exiting the cooperative for their investments (exit payment) will improve the investment incentives in cooperatives. This view is, however, too simple. Basically the problem of determining an exit payment is zero sum game. The exit payment is paid by the continuing members. Therefore it is not obvious that redemption of equity to exiting members will improve investment incentives.

There are two main differences between the standard approach to the horizon problem and the approach in this paper. First, we analyze how an exit payment will affect the *exiting* members and the *continuing* members. The standard approach only focuses on the exiting members. Second, this paper focuses on the incentives of the majority in the cooperative. The standard approach uses the investment incentives for the exiting members as a benchmark for the investment level in the cooperative. However, this gives a wrong picture, because investments are decided by the majority and not by the exiting members.

This paper does not suggest that there will not be underinvestment in cooperatives, per se. The paper only claims that the horizon problem will not lead to underinvestment in cooperatives. In fact, the horizon problem may actually induce overinvestment. However, there may be many other problems leading to underinvestment in cooperatives.

Cook (1995) defines five problems caused by vaguely defined property rights in traditional cooperatives: Free Rider Problem, Horizon Problem, Portfolio Problem, Control Problem and Influence Costs. These problems are caused by the lack of a market for cooperative shares.

Free Rider Problems emerge, when individuals (new members, existing members, or outsiders) harvest benefits from investments, which they have not (fully) contributed to. The Portfolio Problem occurs, because the cooperative's investment portfolio may not match the preference of each member. Since there is no market for equity shares, the member cannot withdraw and reallocate the investment. The Control Problem is the problem of ensuring that the management follows the interests of the owners. In a cooperative, this problem is enhanced as there is no market for cooperative shares that provides market pressure on the management. Influence Costs are especially a problem in organizations (e.g. heterogeneous cooperatives) where the members have different interests. Influence costs include costs consumed in the decision process and distortions caused by special interests.

A large literature has expanded on how these problems affect cooperative behavior. However, only a small part of the literature is based on formal modeling. This makes it difficult to distinguish precisely between the five problems. In particular, the Horizon Problem and the Free Rider Problem are often mixed together in the literature, which creates some confusion.

This paper only analyzes the horizon problem, but it uses the distinction between the Free Rider Problem and the Horizon Problem defined in the literature (see e.g. Cook, 1995). There is no free-riding in our model, because no new members can enter the cooperative and because all members contribute fully to the investment. Hence, we avoid mixing the two problems.

The role of exit payment or equity redemption has been addressed specifically in various articles.

Hansmann (1999) discusses redemption policies. He argues that most cooperatives do not redeem the equity in full upon retirement, because the internal politics of the firm weigh against full equity redemption. Full redemption will benefit members who are going to retire shortly, while the members who are not retiring have an interest in a low redemption. The reason for this is that the benefits to the continuing members from a low redemption (the saved redemption) falls immediately, while their disadvantage in receiving a low redemption upon their own retirement, will not occur for many years.

Rey and Tirole (2001) also analyze the problem of entry payments and exit payments in cooperatives. They develop a model of a cooperative with a constant member base, i.e. the number of members exiting the cooperative is equal to the number of members entering the cooperative. They show that there are first best investment incentives in a cooperatives with free entry and exit[1] (i.e. no exit payment). However, the equilibrium found by Rey and Tirole is not subgame perfect. Rey and Tirole do not allow the cooperative to change the redemption policy once the cooperative has been started – e.g. by charging an entry payment from new members even though the present members have not paid an entry payment themselves.

Hansmann (1999) raises a new problem in relation to exit payment. He points out that a full redemption may encourage too much exit. If there are economies of scale, exit will impose a negative externality on the continuing members. With full redemption of equity, the members do not take this into account, when they decide whether to exit or not.

Holmström (1999) adds another argument against full equity redemption. He argues that, over-pricing exit can be devastating for the cooperative, because it may encourage strategic exit, if the exit payment exceeds the expected payoff from continued membership. Thus, Holmström concludes that *"Strategic exit and bankruptcy favor conservative pricing [of exit]* [2]*"*.

Rey and Tirole (2000) expand these arguments in a formal model. They demonstrate that cooperatives are fragile institutions because member exit may start a snow-balling effect. They also discuss the optimal level of loyalty in cooperatives.

This paper does not include the problem of strategic exit where members exit the cooperative to avoid being the "last man on the boat". In our model exit is exogenous in the sense that it is not influenced by the successfulness of the cooperative. Hence, in our model exit is solely determined by external factors such as new outside opportunities, age, health, or the member may be forced out of business, etc.

The remainder of this paper is structured as follows. Section 2 discusses redemption policies in practices. This discussion is based on the current debate in leading Danish agricultural cooperatives. Section 3 introduces the model. Section 4 analyzes the horizon problem in a homogenous cooperative and Section 5 analyzes the horizon problem in a heterogeneous cooperative. Finally, Section 6 concludes the paper.

Section 2: Redemption policies in practice

Cooperatives meet the challenge of raising more capital in different ways. Some cooperatives choose to use the New Generation Cooperative model with closed membership and tradable production rights, etc[3]. Other cooperatives make more modest adjustments to the traditional cooperative model.

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[1] However, they also show that the founders of a such a cooperative (i.e. the first generation) have incentive to underinvest.

[2] Holmström (1999) p. 408.

[3] See Cook and Iliopoulos (1999) or Fulton (2001) for a description of the New Generation Cooperative model.

In Denmark, traditional cooperatives have been characterized by free entry and exit, and unallocated equity obtained through retained earnings – i.e. no redemption of equity (Federation of Danish Cooperatives, 1998). Members lost their share of the equity, when they exited the cooperative. This model has actually proven to be quite successful, for instance one of Europe's biggest dairy companies, Arla Foods, does not pay out equity to exiting members.

Many cooperatives in the Danish agribusiness sector have modified the financial structure of their cooperative. In particular, a number of leading cooperatives have allocated some of the equity to member accounts, while other big cooperatives, including Arla, are considering introducing allocated equity. The equity on the member accounts is paid out, when a member exits the cooperative.

Section 3: Model

In this paper, we use a simple model to analyze how the redemption policy affect investment incentives in a cooperative. In particular, we analyze how the compensation to members exiting the cooperative, affect the incentives to invest.

We consider a cooperative with N members, who have to decide whether or not to make a joint investment at the cost I. For simplicity, we normalize N so that $N=1$.

The investment decision is made, knowing that some members will exit the cooperative before the payoff falls. The decision about exiting the cooperative can be caused by internal or external factors. We use a survival rate s to model the exit. Hence, with probability $(1-s)$ a member will exit the cooperative before the payoff falls[4].

When members exit the cooperative before the payoff falls, they may receive a compensation, which we refer to as *exit payment X*. The amount on the personal equity account corresponds to X in our model.

The members make the decision about the exit payment before they make the investment decision. Hence, the exit payment cannot depend on the success of the investment. This is an important assumption. There are three strong arguments supporting this assumption. First, the cooperative is not valued (i.e. priced) on the market, as there are no tradable ownership rights. Therefore, the value of the cooperative and thus the equity is determined through accounting procedures in stead of market evaluation. Second, the success and the expected payoffs may be non-verifiable before the payoffs actually fall. Third, adjustments in the personal equity may cause double taxation. In Denmark, increases in the amounts on the personal equity accounts would be considered as personal income and both the cooperative and the members would be taxed (Federation of Danish Cooperatives, 1999).

The payoff from the investment may depend on the number of members remaining in the cooperative (N_t), when the payoff falls. If the cooperative makes a purely financial investment, e.g. buys stocks, the payoff is independent of the number of members in the cooperative. On the other hand, if the cooperative invests in marketing or in a processing plant, the payoff will depend on the number of members in the cooperative. Both types of

[4] Using a survival rate to model the exit from the cooperative reflects that members can change their decision to exit the cooperative at any point in time. Therefore, it would be inappropriate to use a model imposing a fixed retirement date on the members.

investments are covered in our model. In principle, the expected payoff depends on the number of members, $V = V(N_t)$. However, our results do not depend on the functional form of $V(N_t)$. We therefore suppress N_t to simplify the presentation.

Section 4: Homogenous cooperative

First we consider a homogeneous cooperative where all members have the same survival rate *s*. The total payoff in this situation is $V-(1-s)X$, which gives a payment to each remaining member of $\frac{V}{s}-\frac{1-s}{s}X$. The members foresee this and they will support the investment if

$$s\left(\frac{V}{s}-\frac{1-s}{s}X\right)+(1-s)X \geq I \Leftrightarrow V \geq I \qquad (1)$$

This shows that the members will support an investment if, and only if, it is profitable. This ist he first best investment level. We can thus conclude:

Proposition 1: *in a homogenous cooperative all members support the first best investment level, regardless of the exit payment and the survival rate.*

This means that there is no horizon problem in a homogeneous cooperative. The intuition behind this result is simple. The risk of exogenous exit means that some members will not get their share of the payoff. The flipside of the coin is that there more is left for the continuing members. In other words, the exit merely transforms the setup into a lottery. The lottery is a fair odds lottery, since all members have the same survival rate. With risk neutral members, this does not influence the value of the investment.

Section 5: Heterogeneous cooperatives

We now turn to a cooperative with heterogeneous members. For simplicity, we assume that there are only two types of members, certain members and uncertain members.

We introduce heterogeneity in the model by assuming that a fraction, α , of the members face no risk of exogenous exit and have a survival rate of *1*. We refer to this group as the *certain members*. The rest of the members, $1-\alpha$, may exit the cooperative before the pay-off falls and have a survival rate below one, i.e. *s<1*. We refer to this group as *uncertain members*. The model can be interpreted as a model of generational conflict, if one thinks of certain members as young members and uncertain members as old members.

The total payoff to continuing members in the heterogeneous cooperative is $V-(1-\alpha)(1-s)X$. Hence, the payment to each of the certain member is

$$\frac{V-(1-\alpha)(1-s)X}{1-(1-\alpha)(1-s)} = \frac{V-X}{\alpha+s(1-\alpha)}+X\ . \qquad (2)$$

The investment cost ist he same for certain and uncertain members. The certain members will therefore support an investment if

$$\frac{V-X}{\alpha+s(1-\alpha)}+X\geq I \qquad (3)$$

If there is no exit payment, $X=0$, certain members will support some unprofitable investments with *I*>*V*. This is because the investment cost threshold given by (3), below which all investments are supported, is higher than the expected value of the investment. To see this, observe that the number of remaining members, $\alpha+s(1-\alpha)$, is less than *1*.

There are two reasons why, the certain members are willing to overinvest if *X=0*. First, exit of uncertain members leaves more payoff to the certain members, i.e. there will be a transfer of payoff from the uncertain to the certain members. This is easiest to see if we assume that the total payoff is independent of the number of members, $V(N_t)=K$. Second, the certain members do not take into account the pay-off that is lost because some uncertain members exit the cooperative. Exit of uncertain members may reduces the expected total payoff. To see this, assume that the payoff depends linearly on the number of members, such that $V(N_t)=vN_t=v(1-s)$. Exit of uncertain members will reduces the expected total payoff from v to $v(1-s)$, but the certain members are willing to support any investment with $I\leq v$.

To give the certain members incentives to support the first best investment level, the exit payment must be equal to the investment costs – i.e. *full redemption*[5], i.e.

$$X=I. \qquad (4)$$

An alternative solution is to set the exit payment equal to the expected payoff[6]. This result is not surprising since, in principle, this is the way ownership is valued on the stock market or at a market for tradable delivery rights.

Now we turn to the uncertain members, who will support an investment if

[5] Proof: when *X=I* the expected payment to the certain members is $\frac{V}{\alpha+s(1-\alpha)}+I\left(1-\frac{1}{\alpha+s(1-\alpha)}\right)=\frac{V-I}{\alpha+s(1-\alpha)}+I$. Hence, the certain members will support the investment if and only if $V\geq I$.

[6] Proof: when *X*=V the certain members will get an expected payment of $\frac{V}{\alpha+s(1-\alpha)}+V\left(1-\frac{1}{\alpha+s(1-\alpha)}\right)=V$. Hence, the certain members will support the investment only if $V\geq I$.

$$s\left(\frac{V-X}{\alpha+s(1-\alpha)}+X\right)+(1-s)X \geq I$$
$$\Leftrightarrow \frac{s(V-X)}{\alpha+s(1-\alpha)}+X \geq I \tag{5}$$

If there is no exit payment (*X=0),* the uncertain members will not support all profitable investments[7]. The reason for this is that the exogenous exit implies a transfer of payoff from uncertain to certain members.

Again, the uncertain members will have incentive to support the first best investment level, if the exit payment is equal to the expected pay-off[8] or equal to the investment costs

$$X=V. \tag{6}$$

We summarize these findings in Proposition 2.

Proposition 2: *in a heterogeneous cooperative, the horizon problem can be solved either by full equity redemption, i.e. setting the exit payment equal to the investment costs, or by setting the exit payment equal to the expected payoff from the investment.*

A closer look at the investment criteria for certain and uncertain members reveals an interesting finding.

A low exit payment means that the investment threshold for the certain members will be high[9]. Hence, the lower the exit payment, the more costly investments will be supported by the certain members. The reason is that the certain (continuing) members will pay less to the exiting members, thus obtaining a higher payment for themselves. Hence, if the certain members hold the majority, they have incentive to set a low exit payment, $X<V$. This gives the certain members incentive to support some unprofitable investments with $I>V$.

On the other hand, a high exit payment means that the investment threshold for the uncertain members will be high. The higher the exit payment, the more costly investments will be supported by the uncertain members. The reason is that a high exit payment implies a transfer from certain members to uncertain members, due to the exogenous exit. If the

[7] Note that $\frac{s}{\alpha+s(1-\alpha)}=\frac{s}{s+\alpha(1-s)}<1$.

[8] Proof: If $X=V$ the uncertain members will get an $\frac{s(V-X)}{\alpha+s(1-\alpha)}+X=V \Leftrightarrow X=V$.

[9] The investment threshold defined by formula (2) will decrease as X increases because $\frac{1}{\alpha+s(1-\alpha)}<1$.

uncertain members hold the majority, they have incentive to set a high exit payment, $X>V$. This gives the uncertain members incentive to support unprofitable investments with $I>V$.

Hence, we have the following result

Proposition 3: *in a heterogeneous cooperative, the majority will bias the exit payment to their own advantage. This may lead to overinvestment.*

This result contradicts the general view that cooperatives suffer from underinvestment due to horizon problems. The result is, however, not that surprising, if one follows the logic in Hansmann (1999) that the exiting members are exploited by the majority. This will give the majority incentive to increase the equity to obtain an even larger transfer of equity from the exiting members.

The result means that horizon problems cannot explain underinvestment in cooperatives. Instead, underinvestment must be explained by other problems, e.g. free rider problems, portfolio problems, or limited access to capital.

There are two important comments to be made about the result that the majority will distort the exit payment and induce overinvestment in cooperatives.

First, the overinvestment $(I>V)$ is not individually rational for the minority members. The minority members are better off if they do not participate in these investments. However, investment decisions cannot be seen in isolation. A member can only avoid participating in an investment if he exits the cooperative – and this may impose greater losses than staying and participate in an unprofitable investment.

Second, a high exit payment ($X>V$) implies de-capitalization of the cooperative. Hence, our model suggests that cooperatives dominated by uncertain members (perhaps old members) will tend to de-capitalize. This is not surprising from a theoretical perspective, because de-capitalization is in fact a completely rational for these members – they have no incentive to give up equity to the continuing members. However, the de-capitalization is not in the interest of the management who will push for unallocated equity (low redemption) to ensure capital accumulation. This conflict is analyzed in Murray (1983a, 1983b).

Section 6: Conclusion

The ability to raise sufficient capital is an important issue for cooperatives. This paper analyzes how compensation to members exiting the cooperative, affects the incentives to invest in a cooperative.

The literature points to a number of general problems that reduce the incentive to invest in a cooperative. One of these problems is the horizon problem, which states that cooperatives will under invest, because the members evaluate investment according to a shorter horizon than the economic lifetime of the investment. The problem is that the members expect that some of the payoff will fall after they have exited the cooperative.

This paper shows that this view is incorrect. In a cooperative with homogenous members, the horizon problem only transforms the investment problem into a fair odds lottery with the same expected payoff, because the members do not know ex ante who will exit the cooperative before the payoff falls. The horizon problem can easily be solved in a cooperative with heterogeneous members by full redemption such that the members are compensated for their investment costs when they exit the cooperative. The majority will, however, bias the exit payment to their own advantage. This will lead to *overinvestment*.

This means that horizon problems cannot explain problems of underinvestment in cooperatives. Instead underinvestment must be explained by other factors, e.g. free rider problems. This suggests that the literature needs to distinguish more precisely between free rider and horizon problems.

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