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EXPOSING AGRICULTURAL COOPERATIVES TO COMPETITION

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Exposing agricultural cooperatives to competition.

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Abstract

We examine the optimal regulation of agricultural markets when farmers have organized their activity in a cooperative which is the monopoly supplier of an upstream product and which competes with a single rival firm in selling a homogenous downstream product. The rival's marginal cost is private information and therefore the rival expects to earn an information rent.

We show that the optimal access price discriminates against the private rival because rent is more valuable in the cooperative than in the private firm, and the regulator therefore sacrifices some cost efficiency in order to shift rents. Thus, while competition will benefit farmers, consumers and tax payers, the extent of competition should optimally be somewhat limited.

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1 Introduction

For various reasons, most developed countries support their domestic agriculture. In addition to direct government support, farmer-owned marketing cooperatives have been allowed to operate as cartels to increase the farmers' market revenues. The historical-political background for this way of organizing the industry is the farm bankruptcy crisis in the 1930s. Weak farmers wanted control over a larger part of the value chain in order to avoid being exploited by strong food-processing firms, and the political climate was ready to grant farmers this control.[1]

Today, the marketing cooperatives' combined market shares in the farm input market vary by country and by food category, and are generally highest in the northern European countries and in the dairy sector. At one extreme is the dairy sector in the Nordic countries in which a few marketing cooperatives with limited geographical overlap have a combined market share of more than 90 percent. But also in countries like the Netherlands and Germany, individual dairy cooperatives might enjoy considerable market power as a result of their market position.[2]

Although there is no doubt that the powerful cooperatives have contributed to a wanted increase in the farmers' incomes, the lack of competition might lead us to worry that some big cooperatives lack incentives to run their activities efficiently. By being shielded from competition, the cooperatives may for instance have too weak incentives to innovate by introducing new products or new cost-saving processes.

[1] The efficient scale in farming is much smaller than in the food-processing industry. Thus, individual farmers risk being exploited if their products are purchased by investor-owned corporates. This is because of the large amount of capital tied up in farm equipment, and because there may only be one potential buyer in the relevant market. One way of avoiding this is to form cooperatives. See, e.g., Rogers and Sexton (1994) for a discussion of the arguments for cooperatives. Another rationale for agricultural cooperatives is given by Bogetoft (2005). He argues that when farmers have private information about their cost conditions, a cooperative may under certain circumstances be the socially optimal organization. Buccirossi, Marette and Schiavina (2002) provides evidence for farmers being the weakest link of the entire chain, given the degree of concentration in the upstream and downstream industries in Europe.

[2] See Bergman (1997) for a detailed study of agricultural cooperatives in selected European countries and the US.

Since the 1980s we have seen growing political interest in exposing agricultural cooperatives to competition, and these markets have been somewhat opened up in recent years. In the Norwegian milk sector, for instance, some degree of competition has been achieved in two ways: besides selling their milk to the national milk cooperative, dairymen can now sell their milk to independent processors/distributors. And the national milk cooperative, in addition to processing and distributing the milk and milk products, is now required to also sell raw milk to independent processors/distributors which do not have any dairymen under contract. The latter situation is the topic of this paper.

We examine the optimal regulation of agricultural markets when the farmers have organized their activity in a cooperative which is the monopoly supplier of an upstream product (say, raw milk) and which competes with a single rival firm in selling a homogenous downstream product (say, cheese). The rival's costs are private information and because of this information asymmetry, the rival expects to earn an information rent. We assume that a fully deregulated market would result in too few farms from a social perspective, primarily because agricultural activities are associated with positive externalities such as food security and landscape preservation.[3] The regulator controls three instruments: the lump-sum transfer to the farms, the access price and the upstream production quota. The regulator's problem is thus partly an access pricing problem and partly a question of striking the right balance between funding the farmers by direct transfers or by raising prices.

The policy instruments included in our model are consistent with the Common Agricultural Policy (CAP) in the EU. The consumer prices are maintained at a high level using intervention prices and export subsidies, and, for the dairy sector, by restricting aggregate production using farm-level production quotas. Also, since the CAP reform in 2003, the bulk of direct payments is not coupled to production but given as a single farm payment. However, it is expected that further reforms of the CAP will result in reduced price support and a quota abolition.

We present two findings. First, we show that exposing the monopoly cooperative to competition will benefit farmers, consumers and tax payers, which is perhaps

[3] See e.g. Brunstad et al (2005) for an examination of multifunctionality of agriculture.

not very surprising. The possibility of a more efficient rival firm's entering the marketplace brings the expected downstream costs down. Consequently, the optimal total quota increases and the optimal number of farmers increases. This latter result is a consequence of, as we assume, increasing variable unit costs at the farm level.[4]

Second — and more importantly — we show that the optimal access price discriminates against the rival firm because the regulator optimally trades off some cost efficiency (which calls for a non-discriminatory access price) to reduce the socially costly transfer to the farms (which calls for a discriminatory access price). Thus, we argue that while it is optimal to expose the monopoly cooperative to increased competition downstream, the extent of such competition should under certain circumstances be somewhat limited.

We study the effects of competition in a model in which there is only one potential rival. In the concluding section we discuss alternative descriptions and argue that our discrimination result may hold also with more competition among rivals, while it disappears if the rivals compete away all rent.

The paper is organized as follows: In section 2, we give a brief presentation of access price theory and show how our model relates to this strand of literature. In section 3, we describe the formal model. In section 4 and 5, we solve the regulator's optimization problem assuming information symmetry and information asymmetry, respectively. In section 6, we present our conclusions.

2 Access price theory

The problem of one-way access pricing has been addressed by many economists,[5] and some of them have, like we have, examined how asymmetries in the market and lack of regulatory tools result in the need for *asymmetric access pricing*—that is,

[4]The increasing variable unit cost may be due to for example limited productive land, the need to invest in new capital as the farm grows, limitations on the number of cattle set by the authorities to prevent diseases from spreading or other diseconomies of scale. Consequently, for each upstream product quota, there exists a unique number of farms which minimizes the aggregate farm level costs–and vice versa.

[5]See Armstrong and Sappington (2005) for an overview on access pricing.

setting the access price above or below the level that gives an entrant access on equal terms. However, in both the academic and political debate, the emphasis has clearly been on the need to subsidize access prices to counteract the impact of imperfect downstream competition or to induce entry.

Ideally, when public funds are socially costly, the optimal prices for a regulated firm are Ramsey prices. And the access price should, like the monopolist's retail price, participate in the coverage of the fixed cost. In real life, regulators are often advised to secure supply *on equal terms* to downstream competitors. That is, the terms of access should ensure that a rival producer of the downstream product can enter the market if and only if that producer is at least as efficient as the monopolist. This is the logic behind the influential Efficient Component Pricing Rule (ECPR) which was first proposed by Willig (1979).[6]

Laffont and Tirole (2000) show that the ECPR will be consistent with optimal Ramsey prices under the following full symmetry assumptions: symmetric costs of providing access; demand symmetry in the downstream market; cost symmetry in the downstream market; and, absence of market power for the rival firm.

One important deviation from ECPR occurs when the rival firm possesses market power and charges a price for its downstream product which exceeds the socially optimal price.[7] Ideally, if entry is socially desirable, the regulator should use a lump-sum transfer (tax or subsidy) to bring the rival firm's rent to the right level, and set the access price so as to obtain the right Ramsey prices downstream. That is, the access price should be *subsidized* so as to offset the excessive mark-up imposed by the competitor. This result is shown in Laffont and Tirole (2000) under information symmetry and in Lewis and Sappington (1999) in a situation in which the single

[6] See Baumol (1983), Baumol (1993), Baumol and Sidak (1994a, 1994b), and Armstrong (2002, section 2.3.1) for a further discussion of the ECPR.

[7] Other deviations from the ECPR are examined by Laffont and Tirole (1994) and Economides and White (1995) who show that if the monopoly (rival firm) has captive customers or is more cost efficient, the ECPR may give a too high (low) access price. Other contributions worth mentioning are: Economides and White (1998), Larson and Lehman (1997), Laffont, Rey and Tirole (1998), Larson (1998) and Armstrong and Vickers (1998).

entrant possesses private information on its marginal cost.[8]

Our analysis is perhaps most closely related to that of Lewis and Sappington (1999). Like them we consider a situation in which the regulator does not know the marginal cost of the singel rival firm and in which the access price is set so as to balance conflicting goals. However, in our setting the products are homogenous and the downstream market is regulated; so, there is no need to subsidize the access price. Rather, the access price in our model should be set so as to balance cost-efficient entry and rent extraction. Thus, we reach the opposite result to Lewis and Sappington: the access price should be set so as to discriminate against the rival.

It might seem that providing the regulator with another instrument would alter the conclusion in our paper. In Lewis and Sappington's paper the regulator offers the rival a two-part access tariff: a lump-sum fee and a unit charge; the regulator uses the lump-sum fee to extract the rival's rent, and uses the unit charge to obtain the right prices of the two differentiated products. In our setting, with homogenous products, both parts of the tariff would only affect the rival's entry decision but not the Ramsey price on the downstream product. Thus, it would still be optimal to set the terms of access so that they discriminate against the rival in a trade-off between cost-efficiency and rent extraction.

3 The model

Consider an agricultural sector with N identical risk neutral farmers that produce a total quantity x of an upstream product (say, raw milk). Their aggregate cost is given by

$$C = C(N, x), \tag{1}$$

[8] An interesting observation made by Economides and White (1998) is "*If the conditions under which the ECPR would be efficient are present, its application is redundant; if they are absent, its application would be a mistake (as compared with a more optimal Ramsey rule).*"

which is twice differentiable, increasing in x and convex.[9] Moreover, it is reasonable to assume that $C_{Nx} < 0$, while C may be increasing or decreasing in N, depending on the level of production x: we assume that $C_N < 0$ for low N and $C_N > 0$ for high N.[10]

The farmers have organized their marketing activity in a cooperative which is the monopoly supplier of the upstream product and which competes with a single rival firm in selling a homogenous downstream product (say, cheese).[11] The inverse consumer demand function is given by $p = p(x)$. Downstream production can be undertaken by the cooperative, a private rival, or a combination. We refer to the cooperative as firm 1 and the rival as firm 2. For simplicity, we assume constant returns to scale: constant marginal costs and no fixed costs. Moreover, units are normalized in the sense that it takes one unit of the upstream product to produce one unit of the downstream product. The downstream production cost functions are given by:

$$C_1 = (a + b)x_1 \tag{2}$$

$$C_2 = (\alpha + \beta)x_2 \tag{3}$$

where x_1 and x_2 are the respective production volumes ($x = x_1 + x_2$); a and α are the prices of the upstream product; and b and β are the downstream marginal costs. Thus, α is the access price on the upstream product controlled by the cooperative, while a is the internal transfer price between the farmers and the cooperative.

We will abstract from principal-agent problems between the farmers and the cooperative, thereby assuming that farms' income from the market is equal to their payment for the upstream products plus the cooperative's net profit. In addition, the farms receive a lump-sum transfer from the government. Without loss of generality, we can then impose a break-even constraint on the cooperative, thereby pinning

[9]That is, $C_x > 0$, $C_{xx} > 0$, $C_{NN} > 0$ and $C_{xx}C_{NN} > (C_{Nx})^2$, where subscripts denote partial derivatives.

[10]See Linnerud and Vagstad (2008) for a more detailed description of an agricultural sector satisfying these assumptions.

[11]This demand function is assumed to satisfy the usual regularity conditions $p'(x) < 0$ and $2p'(x) + xp''(x) < 0$.

down the transfer price $a = p(x) - b$. The rival firm's profit π is given by

$$\pi = (p - \alpha - \beta)\, x_2. \tag{4}$$

There is free entry and exit of farmers, implying that any farmer's rent will be dissipated. The government maximizes a social welfare function given by

$$W = V(N) + CS + \pi - (1 + \lambda)T \tag{5}$$

where $V(N)$ is the social value of the externality associated with agricultural activity, $CS = \int_0^x p(z)dz - xp(x)$ is the consumers' surplus, and the social costs of the transfers T are given by $(1 + \lambda)T$ due to distortive taxation. V is assumed to be increasing and concave.

The regulator does not know β, only its distribution $F(\beta)$ in which $\beta \in \left[\underline{\beta}, \bar{\beta}\right]$ and $d\left[F(\beta)/f(\beta)\right]/d\beta > 0$. The last condition is known as the monotone hazard rate condition, and is satisfied by most commonly used distributions.[12] Furthermore, b is common knowledge, and $b \in \left\langle \underline{\beta}, \bar{\beta} \right\rangle$. Let

$$\beta^* \equiv p - \alpha \tag{6}$$

denote *the margin* left to the rival to cover its downstream marginal cost β. Since the products are homogenous, the access price will only determine whether the rival enters the market and not how much it chooses to process. Thus, the determination of the access price, α, and the margin, β^*, are equivalent, and we will focus on the latter in the following. Note that the rival is secured access on equal terms according to ECPR when $\beta^* = b$ and is discriminated against when $\beta^* < b$.

The timing in the model is as follows:

1. The rival firm learns its downstream marginal cost β.

2. The regulator sets the values of x, β^* and T.[13]

[12] The monotone hazard rate condition is satisfied by the following distributions: uniform, normal, logistic, chi-quared, exponential and Laplace. See Bagnoli and Bergström (1989) for a more complete list.

[13] The social welfare loss stemming from information asymmetry could be reduced by

3. The number of farmers is adjusted (by entry and exit) until the remaining active farmers expect to break even.

4. The cooperative buys a quantity x/N from each farm.

5. The rival processes a quantity according to the following decision rule:

$$x_2 = \begin{cases} x & \text{if } \beta^* \geq \beta \\ 0 & \text{if } \beta^* < \beta \end{cases}.$$

6. The cooperative processes the residual supply, $x_1 = x - x_2$.

The downstream decision rules at steps 5 and 6 may appear unnatural. However, the rival will not enter unless $\beta \leq \beta^*$, and it can be intuitively understood that it does not make any sense for the regulator to set $\beta^* > b$. If so, then the rival is favored in the sense that entry is encouraged even if the rival has a small cost disadvantage. Increasing the access charge will then lead to increased cost efficiency as well as shifting rent from the rival to the cooperative. Both these effects are wanted. Consequently, in any equilibrium it must be the case that $\beta^* < b$, with strict inequality due to the desirability of rent shifting for $\lambda > 0$. If the rival enters, the cooperative will be better off (by an amount equal to $b - \beta^* > 0$ per unit) letting the rival produce the downstream product. If, the rival firm does not enter, the cooperative will be better off producing the downstream product than choosing not to, as long as $b < p$. Therefore steps 5 and 6 describe the outcome of profit maximizing strategies for the rival and the cooperative, respectively.

The farmers' decision rule is described at step 3. A potential farmer observes the terms set by the regulator and chooses to enter (and join the cooperative) if the expected rent is non-negative.[14] For a given x, T and β^*, the expected rent

alternatively using a screening technique: The rival chooses from a menu of contracts $\{x(\beta), \beta^*(\beta), T(\beta)\}$; the contracts are designed so that it is optimal for the rival to reveal its true marginal cost β. The solution to this optimization problem is given in Linnerud and Vagstad (2008). Since the screening technique requires a contract between the regulator and the unregulated downstream competitor, it seems less political feasible.

[14] This decision rule implies that the farmers have an outside opportunity with a rent equal to zero.

of the farms is a function of the number of farms. If the expected rent is positive (negative), the farmers will enter (exit) until the expected rent equals zero - which as a result of the regulator's choice of transfer, T, secures an optimal number of farms.[15]

Uncertainty about the rival's cost, β, will lead to uncertainty about farmers market revenues. It may seem unrealistic to assume that the entry/exit decisions of farmers will not be revised when the farmers observe the entry decision of the rival at step 5. Note, however, that the outcome of the model would not be altered if at step 2 the regulator announced the optimal number of farms, N, promising that the transfer would equal $C(x, N) - (\alpha - a)\, x$ if the rival entered and $C(x, N) - (p - b - a)\, x$ if it did not.

The regulator's decision rule is described at step 2. The regulator maximizes expected social welfare conditional on the upstream and downstream decision rules. While the regulator will ensure that the income requirement of an optimal number of farms is met, the regulator will only induce the rival firm to enter the market if it has a marginal cost equal to or below the margin β^*.

4 The information symmetry benchmark

When the government has all relevant information it can dictate the market outcome. The quantity, x, should be processed as cheaply as possible. Also, the rival firm's rent should be extracted, so as to reduce the socially costly transfer to the farmers.

Proposition 1 *Under full information, the margin will be given by* $\beta^* = \min\{b, \beta\}$.[16]

[15] Alternatively, the cooperative will restrict the number of members so that $R_1(N) = 0$ and introduce marketable delivery rights. This is in accordance with the increasingly popular New Generation Cooperative (NGC) model. See for example Harris, Stefanson and Fulton (1997) and Nilsson (1997). Because our farms are indentical, they will choose to produce the same amount under this system, irrespective of how the delivery rights are initially allocated.

[16] More precisely, when $\beta > b$ the access price should be set so that $p - \alpha < \beta$. This condition is satisfied by $p - \alpha = b$.

In the full information benchmark, the rival should be active if and only if it has a cost advantage over the cooperative. Equal treatment of the cooperative and the rival by means of an equal margin to cover the marginal refining cost, $\beta^* = b$, yields cost-efficient production but a too high transfer, T, if the rival has a cost advantage. In this sense Proposition 1 advocated discrimination against the rival. However, the optimal policy can also be regarded non-discriminatory, since it involves letting the most efficient firm do all the production and charging an access price that extracts all surplus.

Note that the optimal margin β^* ensures cost-efficient entry as well as zero rent to the rival firm. Also, since the terms of access result in cost-efficient production, the optimal price level will reflect the most efficient producer's marginal cost:

Proposition 2 *Under full information, the optimal quantity, x, will depend on the downstream marginal cost of the active producer, and is determined by the familiar Ramsey formula:*

$$\frac{p - C_x - \min\{b, \beta\}}{p} = \frac{\lambda}{1+\lambda}\frac{1}{\eta}$$

where $\eta = -\frac{\partial x}{\partial p}\frac{p}{x}$ is the demand elasticity.

From Propositions 1 and 2 we have that competition between the two downstream producers may contribute to a lower price and a higher total quota. From the welfare function we have that the optimal number of farms must satisfy

$$V_N - (1+\lambda)C_N = 0.$$

As we vary x, this first order condition must hold as an identity. Since costs are convex and V is concave by assumption, it defines N as a function of x, with derivative given by

$$N_x = \frac{(1+\lambda)C_{Nx}}{V_{NN} - (1+\lambda)C_{NN}} > 0.$$

Since competition leads to an increase in x which in turn leads to an increase in N, it should be is fair to say that also the interests of the farmers are best served by exposing the cooperative to competition.

It should be noted that the optimal number of farms is determined by the optimal output, and vice versa. Thus, these variables should be determined simultaneously.

If the number of farms increases, for example due to a decrease in the fixed cost of setting up a farm, the marginal cost of production, C_x, decreases. This gives rise to a lower output price, or equivalently a higher total quota.[17]

Finally, note how a low social cost of public funds results in a high optimal number of farms. When λ is close to 0, the optimal funding of farms involves a high transfer and a competitive price.

5 Regulation under information asymmetry

We now consider the changes in optimal regulation that arise when the rival firm is privately informed about its marginal cost. In this setting the regulator will choose a unique margin, β^*, which is independent of the actual downstream marginal cost, β. Thus, the margin β^* can be interpreted as the rival's *cut-off type*; that is, the rival processes the whole quantity x if $\beta \in \left[\underline{\beta}, \beta^*\right]$, and nothing if $\beta \in \left(\beta^*, \bar{\beta}\right]$.

The regulator chooses β^*, x, and T so as to maximize expected social welfare (function arguments are suppressed for sake of clarity) given by

$$\begin{aligned} & V + CS + (1+\lambda)\left[(p-b)\,x - C\right] \\ & + \int_{\underline{\beta}}^{\beta^*} \left\{(1+\lambda)\,(b-\beta)\,x - \lambda\pi\right\} dF\left(\beta\right), \end{aligned} \tag{7}$$

subject to the rival's individual rationality constraint $\pi \geq 0$.[18] The first line in (7) equals the expected social welfare if the cooperative is alone in the market. The second line equals the change in expected welfare due to potential entry, and consists of the social value of the expected cost reduction minus the social cost of the rival's expected rent.

A rational rival will produce if and only if its margin β^* covers its marginal costs

[17] It can be shown that convexity of C, concavity of V and concavity of $[p(x)x]$ together with the monotone hazard rate are sufficient conditions for the optimal solution to be uniquely characterized by the first order conditions of the welfare maximization problem.

[18] Implicit in this choice set is an assumption that x is the same whether or not the rival becomes active. This is mainly for expositional reasons – if we had allowed x to depend on the active processor our results would become more messy without altering any of the qualitative conclusions.

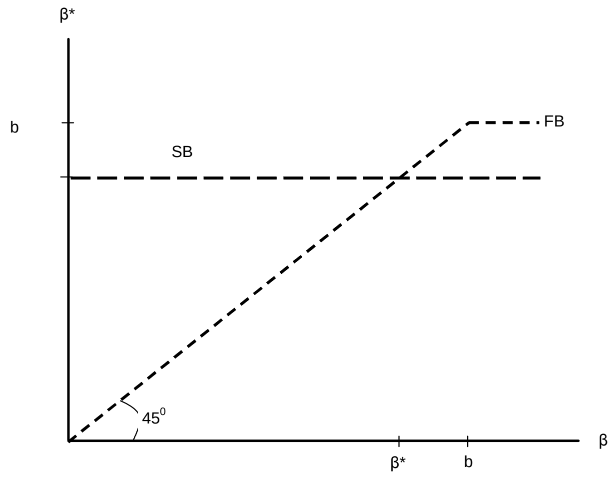

Figure 1: Margins. First-best (FB) margins yield cost-efficient production and no rent to the rival. When uncertainty is introduced, the second-best (SB) margin is unique and the rival earns an expected positive rent.

β. Moreover, if it produces, it produces all. This means that expected welfare can be written

$$\begin{aligned} W &= V(N) + \left(\int_0^x p(z)dz - xp(x) \right) + (1+\lambda)\left[(p(x)-b)x - C(N,x)\right] \\ &\quad + \int_{\underline{\beta}}^{\beta^*} \left\{(1+\lambda)(b-\beta)x - \lambda\left(\beta^* - \beta\right)x\right\} dF(\beta) \end{aligned}$$

with no further constraints. The following two Propositions are now easily derived from the first-order conditions of this maximization problem.

First, the optimal margin, β^*, is independent of N and x, and is only influenced by the trade-off between extracting the rival's rent and achieving cost-efficient production.

Proposition 3 *Under information asymmetry, the optimal margin is given by*

$$\beta^* = b - \frac{\lambda}{1+\lambda}\frac{F(\beta^*)}{f(\beta^*)}.$$

The margin (or the cut-off type) β^* is set so as to balance the expected social cost of leaving a positive rent to the rival against the expected social cost of preventing a cost-efficient rival from being active. As in the full information case, the terms of access should be set so as to discriminate against a cost-efficient rival, that is $\beta^* < b$. In contrast to the full information case, the rival will earn a positive rent for $\beta \in \left[\underline{\beta}, \beta^*\right)$ and be excluded when $\beta \in (\beta^*, b]$. Consider the case in which the rival has a marginal cost which is strictly lower than the cooperative's marginal cost, $\beta < b$. In this case it would be optimal to let the independent firm process the whole quantity x. This is achieved, if $\beta^* = b$. The regulator can, however, do better. Decreasing the margin somewhat, the socially costly transfers to the farms are reduced at the cost of a small increase in the likelihood that a more efficient rival is prevented from entering the market. The regulator will decrease the margin until these costs are equal on the margin. This trade-off is illustrated in figure 1. Under information asymmetry, the rival will earn a per unit profit equal to the the difference between the second-best and first-best margin. The regulator can extract part of this profit by setting a lower margin, but only at the cost of increasing the probability that a more efficient rival is cut off.

Second, the optimal quantity, x, is determined by the adjusted Ramsey formula given in Proposition 4.

Proposition 4 *Under information asymmetry, the optimal quantity, x, is determined by the following adjusted Ramsey formula*

$$\frac{p - C_x - B^D}{p} = \frac{\lambda}{1+\lambda}\frac{1}{\eta}$$

where $B^D = (1 - F(\beta^*))b + F(\beta^*)\beta^* - \frac{1}{1+\lambda}\int_{\underline{\beta}}^{\beta^*} (\beta^* - \beta)\, dF(\beta)$ *is the expected social marginal cost of downstream production.*

The possibility of the rival's entering the market lowers the price in two ways. First, the expected marginal cost of downstream production, as seen from the farmers' and the cooperative's perspectives, is reduced from b to a probability weighted average of b and β^*, that is, $(1 - F(\beta^*))b + F(\beta^*)\beta^*$. Second, the rival's expected

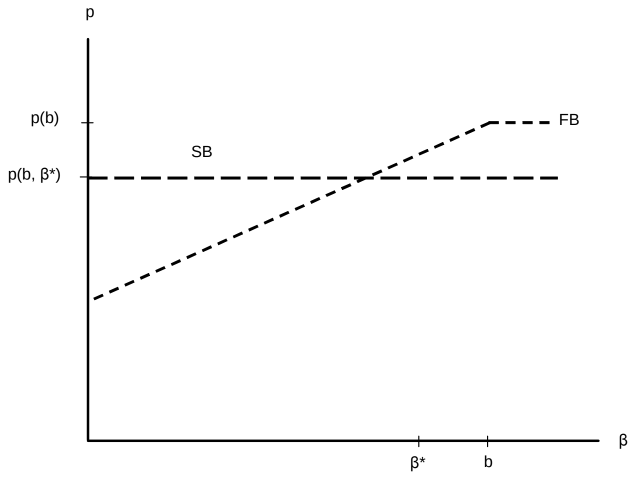

Figure 2: Prices. First-best (FB) Ramsey prices give optimal mixes of prices and transfers. When uncertainty is introduced, the second-best (SB) Ramsey price will be above the expected first-best price.

rent is positive, implying that the social marginal cost is even lower. Since an increase in the rival's expected mark-up results in an increase in the transfer to the cooperative, the rival's expected mark-up is discounted by the social cost of public funds.

It is clear that the mere possibility of a more efficient rival entering the marketplace brings the consumer price down relative to a situation in which the cooperative faces no possible competition. The lower price is achieved by setting a higher upstream product quota which is optimally produced by a higher number of farms. Thus, competition will benefit farmers, consumers and taxpayers.

The second line of (7) can be rewritten as

$$\left(\int_{\underline{\beta}}^{\beta^*} (\beta^* - \beta) dF(\beta) + (1 + \lambda)(b - \beta^*) F(\beta^*) \right) x, \tag{8}$$

which better reflects the trade-off between rent-extraction and cost efficiency. Setting a high margin, β^*, on one hand increases the rival's expected rent and the probability that a more efficient rival will enter the market, but on the other hand decreases the expected rent extraction and thus increases the need for a socially costly transfer to the farms. The optimal margin is set so that these two effects balance on the margin. Consequently, when the margin is set at its optimal value, the expected social marginal cost of downstream production, B^D, is minimized and the expected consumer price reaches its lowest value.

The price level and the degree of price discrimination against the rival depend on the extent to which rent is more valuable in the cooperative than in the rival firm. In our model this is modelled using the social cost of public funding, λ.[19] The following Corollaries gives the implications of extreme values of λ.

Corollary 1 *If* $\lambda = 0$, $\beta^* = b$ *and* $\frac{p-C_x-b}{p} = -\int_{\underline{\beta}}^{b} \frac{b-\beta}{p} dF(\beta) < 0$.

Corollary 1 says that ECPR should only be applied when the society attaches an equal value to rent in the cooperative and rent in the rival firm, for example due to no efficiency losses from taxation. In this case the price on the downstream product should be set below the marginal costs of the farms and the cooperative.

Corollary 2 *If* $\lambda \to \infty$, β^* *solves* $\beta^* = b - \frac{F(\beta^*)}{f(\beta^*)}$. *Moreover,*

$$\frac{p - C_x - B^D}{p} = \frac{1}{\eta}$$

where $B^D = (1 - F(\beta^*))b + F(\beta^*)\beta^*$.

The first part of Corollary 2 essentially says that for high values of $\lambda \to \infty$, the rival will be more severely discriminated against. This is intuitive, since the social value of the rival's rent is then much lower than of the cooperative's (i.e. the farmers') rent. The second part states that when $\lambda \to \infty$, the farmers should act as a monopolist. This will by definition maximize market revenues and thereby minimize the government transfers, which are extremely costly in this case.

6 Conclusion

In this paper we have derived the optimal way of opening up the downstream activities of an agricultural cooperative for competition. We have shown that exposing

[19]It could also have been modelled by assuming that the regulator has access to limited budgets for the agricultural sector, or simply by assuming that society care more about the cooperative than the rival firm (which is perhaps owned by foreigners).

the monopoly cooperative to competition in a cautious way will benefit farmers, consumers and tax payers. We have also shown that the optimal access price typically discriminates against the private rival because rent is socially more valuable in the cooperative than in the private firm, and the regulator therefore sacrifices some cost efficiency in order to shift rents.

The extent to which discrimination ought to be applied will depend on the social cost of public funds, and will thus vary across time and countries. The social cost of public funds is affected by the country's institutions and macroeconomic characteristics, and can be treated as exogenous to any regulated sector. Laffont (2005, pp.1-2) suggests that λ may be approximately 0.3 in developed countries, and well above 1 in less developed countries. Countries with a high funding cost should optimally support their farmers by using price support measures and limit the extent of competition by setting a discriminatory access price. Countries with low funding costs, should optimally choose to fund a high number of farms using direct transfers and promote competition by setting a less discrimatory access price. This provides an economic rationale for why EU CAP over time has changed focus from price support to direct transfer support and why it has gradually opened up for competition. However, as the eastern enlargement has resulted in more heterogeneity accross member states, the CAP should perhaps open up for more country-specific policies.

As mentioned in the Introduction, the discriminatory access result hinges on the assumption of imperfect competition among potential rivals — with two or more equally efficient entrants, their rent is competed away and it is therefore no conflict between rent extraction and cost efficiency. Perhaps it will be more realistic to assume that the potential rivals have different costs. Suppose there are n potential rivals, each with private information about their individual marginal cost β_i which are independently drawn from the same distribution $F(.)$ as before.[20] First consider an English auction for the right to be the only producer. We may for instance ask the potential rivals to bid their required margins, promising to award the production

[20]The following reasoning is largely based on Laffont and Tirole (1987), who has an elaborate analysis of the benefits and costs of combining auctions with additional rent-extracting measures.

contract to the one who bids the smallest margin. Let $\beta_{(m)}$ denote the m-th lowest of the β_i. Then standard auction theory logic leads to the conclusion that the firm with $\beta_i = \beta_{(1)}$ will outbid the others and win, and earn a per-unit rent of $\beta_{(2)} - \beta_{(1)}$. If all rivals are equally efficient, they will earn no rent. When the bidders are different, the auctioneer can typically do better, however. Then it can be shown that the optimal auction involves awarding the production rights to the lowest bid as long as this bid is not greater than β^*, where β^* is as described in Proposition 3. With many potential rivals, this mechanism will sometimes yield the same result as the simple auction, it may lead to situations in which entry of a rival that is more efficient than the cooperative is blocked, and it may lead to situations in which an efficient rival produces but his rent is reduced. As before, β^* is set to balance the latter two considerations. Moreover, also as before, the optimal mechanism discriminates against the potential rivals.

Other assumptions may also be relaxed without fundamentally altering the conclusions in our paper. First, even if product differentiation increases the social value of entry, discriminatory access pricing will still be optimal for reasonably close substitutes. For example, our model may be relevant for the medium-range value-added markets of mostly undifferentiated cheeses and fresh milk. According to Bekkum and Nilsson (2000), these markets are the most likely to be heavily dominated by domestic cooperatives also in the future. They argue that if the milk quota is abolished, the higher value added markets of restricted size, such as deserts, specialized cheeses, professional markets etc., will be dominated by investor-owned firms. At the bottom end of the market, such as milk powder and butter, it is likely that international competition will be considerable. The world market parties will find it difficult to enter the medium-range value-added markets for cost reasons, whereas investor-owned firms will not be interested either.

Second, a quota abolition will not alter our conclusion that the terms of access should be set so as to discriminate against the rival. Consider the EU dairy market. Should the milk quota system be abolished, one would expect farmers to want to increase their production. Under common arrangements of intake obligations, cooperatives would have to buy an increasing volume of milk, which in turn would result in lower prices on dairy products.[21] Alternatively, the cooperatives could choose a value-added strategy where it restricts the milk intake by imposing a system of delivery rights. Refering to our model, a price set below the optimal one, should be met by an increase in transfer–and vice versa. More importantly, however, the optimal margin β^* should not be altered. Thus, a decrease (increase) in price, p, should be accommodated by an equal decrease (increase) in access price, α.

Finally, our model is motivated by an example from the agricultural sector. The conclusions with respect to access pricing may, however, be applicable to other settings in which the government wants to keep an activity under public control while exposing part of it to competition.

[21] Ooms and Peerlings (2005) estimate that the EU dairy reforms will for Netherland result in a decrease in milk price of 21 per cent and a decrease in dairy profits of 22 per cent. EU direct payments will only compensate for roughly 53 per cent of this fall in profit, according to their model.

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