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A Cross-Subsidy Classification Framework*

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ABSTRACT

Cross-subsidization is a frequent topic in public debates and often stigmatized in the wake of deregulation. Public monopolies increasingly find themselves operating not only in regulated markets, but in non-regulated markets where they are accused of illegally using resources from the regulated market to stifle competition. Similar anticompetitive allegations can be made against private multiservice firms with market power. However, definitions of cross-subsidization are many and this affects the debate about the issue and possible strategic motives behind cross-subsidization, its possible consequences for competition, and measures that might be taken against it. This paper organizes definitions that regulators are likely to encounter into three types involving cost transfer, temporary loss or permanent loss. Based on these distinctions, a novel classification framework is developed according to underlying motivation and consequences for competition. The four cases arising from the framework are subsequently discussed in terms of relevancy for public and private firms, and consequences for competition and welfare.

1 Introduction

The ongoing deregulation of a vast public sector, where monopolies are gradually replaced by competition, has revitalized the issue of cross-subsidization. In general debate as well as among academics, one is likely to experience differing definitions of this term. The definitions have in common the transfer of resources from a market in which the

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firm has market power to a different market. Some definitions only concern the cost side and ignore revenues. Often, these definitions involve public firms that have regulated monopolies, but also compete in non-regulated markets. By public firm we will here mean a state-owned firm, which may pursue a welfare objective or a profit objective or some combination of the two. By non-regulated market we mean a market only subject to ordinary competition regulation where the degree of competition may vary. In some instances the cross-subsidy definitions include predatory intent and attempts at transferring market power to increase long run profits. This would also make deliberate cross-subsidization relevant to private multiservice firms with significant market power in some markets. Yet other definitions will preclude a profit motive, hence making cross-susidization more of a public firm phenomenon. The variation in definitions is significant (for an appreciation of the breadth and depth of definitions, see e.g. Curien (1991), Heald (1996), or Parsons (1998)). Thus the implications for motivation and strategic behavior on the part of the firm, and for regulatory intervention on the part of the authorities, vary accordingly.

The degree of variation in cross-subsidy definitions tends to confuse the debate. In this paper, we will attempt to clarify the concept of cross-subsidization as it pertains to services,[1] and propose a useful framework for structuring the debate, particularly with respect to public policy. In section 2, three mainstream types of definitions are discussed. In section 3, we present a classification system based on these types of definitions and briefly discuss welfare implications of each. Section 4 concludes the paper.

2 *Defining cross-subsidization*

Defining cross-subsidization is no simple task. As Hancher and Buendia Sierra (1998) put it: "At the very heart of the problem of cross-subsidization lies the difficulty of definition." (p. 904). That this indeed may be a challenge to regulators is underscored by a recent project initiated by the Norwegian Competition Authority, which was to develop an operational definition of cross-subsidization and discuss regulatory actions (Fjell *et al.*, 2000).

In this section, we will look at several cross-subsidy definitions, beginning with the most general and moving towards the most restrictive. As will become clear, the distance from general to restrictive is considerable and thus has significant implications for the potentially strategic nature of cross-subsidization as well as its consequences for competition and public policy. Whereas some of the definitions will include strategic behavior such as profit motivated predatory pricing, other more

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restrictive types will preclude this. We will organize our discussion according to three types of definitions that we will refer to as the "cost-transfer" definition, the "temporary loss" definition, and the "permanent loss" definition.

2.1 "Cost transfer" definition

The most general type definition of cross-subsidization is the one in which it is sufficient that some or all of the costs pertaining to one service are transferred to another service. This appears to be the case for the EU Commission's definition: "Cross subsidization means that an undertaking allocates all or part of the costs of its activity in one product or geographic market to its activity in another product or geographic market."[2] Note that this definition does not include the revenue side or expressly make it a condition that the subsidized service is in any way loss making. As such, it is in line with the more general concept of subsidy, which may be used "to maintain incomes of producers" (Bannock *et al.*, 1998, p. 397). It also is simpler than the later definitions, which include revenues. Indeed, Hancher and Buendia Sierra (1998) refer to the Commission's definition as "deceptively simple" (p. 904).

This type of definition naturally leads to a particular focus on the accounting system and what is to be the appropriate allocation of costs. In a discussion of cross-subsidies, Heald (1996) divides cost allocation into three general approaches; FDC (fully distributed cost), stand alone cost, and incremental cost. He describes FDC as a systematic allocation of *all* costs to particular outputs, whatever the proportion of common costs and the elusiveness of cost drivers.[3] According to Heald, FDC is the approach mostly favored in regulatory discussions, which indeed seems to be confirmed by the EU Commission's definition of cross-subsidization. Stand alone cost is the (hypothetical) cost of providing a service alone, i.e. in isolation from other services. Incremental cost is the increase in total cost from adding a new service to existing ones. Sometimes "avoidable cost" is used instead of incremental cost if the relevant cost is considered to be what costs can be avoided if a service is discontinued, rather than the (hypothetical) cost of adding the service.

In its widest form then, a "cost transfer" definition would include shifting of common costs away from that prescribed by an arbitrary predetermined algorithm. The lack of objectiveness will naturally lead to a great deal of controversy. An illustration of this is the long lasting debate around FCC's (Federal Communications Commission) use of FDC in the 60s to determine whether AT&T was cross-subsidizing its TELPAK tariff for private lines, a market with competition (Temin,

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1990). "The problem with basing calculation of cross-subsidies on costs (FDC) is simply that costs are not well defined for complex, multiproduct public utility companies, such as telephone companies. . . . (T)here are many ways to calculate costs, none of them clearly dominant." (p. 355, brackets added).

However, in a more narrow form, a "cost transfer" definition could be restricted to the shifting of incremental cost. It would thus preclude the shifting of any arbitrarily allocated common costs as under FDC, but include the shifting of any increase in total costs specifically arising from adding the service(s) in question. Common costs are here defined as costs to provide a fixed capacity of service, for example occupancy costs related to providing building space, to more than one service (Moriarity, 1997).

Furthermore, the "cost transfer" types of definitions of cross-subsidization all include predatory behavior in that the subsidy can permit the firm to set price below some actual unit cost and thereby damage competition. However, the literature is not unanimous on what unit cost to use, e.g. average variable cost, marginal cost, average incremental cost or average avoidable cost (for a full discussion of predation, see e.g., Baumol, 1996). The "cost transfer" types of definitions would also include non-predatory behavior in which a regulated firm was interested in increasing its profit by maintaining prices in non-regulated markets while transferring costs from these to a regulated market where the cost increase would be matched by increases in regulated prices. Finally, the cost transfer could be used to cover up inefficiency by concealing that the regulated firm would be unable to recover costs in the non-regulated market at market prices. A rate of return regulation or cost plus regulation in the regulated market would enable the firm to recover the transferred costs through increased prices given that the regulator had insufficient information to detect the cost transfer. This latter practice would not harm competition, but would obviously harm consumers of the regulated service. A price cap regulation would prevent this form of cross-subsidy provided the cap was not set high enough to allow extraordinary profits.

Most definitions of cross-subsidization are more restrictive, however, in that they implicitly or explicitly include revenues and require that losses on one service are funded through profits from another. In the seminal paper by Faulhaber (1975), cross-susidization is indirectly defined as the absence of subsidy free prices. Two conditions need to be met for a service to have a subsidy free price. First, adding a service resulting in an incremental cost must also result in an increase in revenues that is at least as large (including any net revenue changes the added service might cause for other services due to non-zero cross-price

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elasticities). This ensures that the service does not receive a cross-subsidy. Further, revenues from the service must not exceed its stand alone cost. This ensures that the service is not a source of cross-subsidization. To eliminate the possibility of cross-subsidization, the two conditions should hold for all subsets of services provided by the firm.[4]

Depending on the time perspective and how fixed service specific costs are allocated over time (depreciation), this "Faulhaber approach" may give rise to either of the next two types of definitions that we will discuss. The first, "temporary loss" definition, takes a short run time perspective and assumes that losses may be temproary. For instance, it would be considered a loss if revenues in a year fell short of costs including depreciation, even if a reallocation of fixed costs over time could have yielded positive profits in all years. The second, "permanent loss" definition, seems to take this into account and has a time perspective of the product's entire life. It is assumed that the product on the whole is either profitable or loss making, irrespective of how revenues in some years may exceed and in other years fall short of costs allocated to that year. We now take a closer look at these two types of definitions.

2.2 *"Temporary loss" definition ("negative cash flow" definition)*

This type of cross-subsidy definition takes a short term perspective by assuming that losses may be temporary. It follows then that these short run losses may be recovered through future short run profits and that the service may actually be profitable over its life span (have a positive net present value).

One example of a "temporary loss" definition is: "Financing a loss-making line of business with profits made elsewhere. This may be motivated by private business concerns (to help establish new lines of business for example), or by public policy concern (the provision of rural bus routes at the expense of urban ones). It can be an important object of public policy to prevent it where it provides the means by which predatory pricing can occur." (Bannock *et al.*, 1998, p. 89). The temporary nature of the loss is implicit in the examples of establishing new lines of business and in providing the means for predatory pricing.[5] Both will for a period represent a net outflow of resources from the firm ("temporary loss"), which is expected to be more than recovered in the long run. For predatory pricing the recovery would happen through higher prices made possible due to reduced competition. For investment it would happen through higher prices once the market is established, through achieving economies of scale, or both.

The issue of cross-subsidization as a temporary phenomenon in the

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life cycle of a service is more clearly expressed by Gates *et al.* (1995). In a discussion of cross-subsidization pertaining to the telecommunications sector, they state that "the availability of profits from another market — regulated or non-regulated — is crucial in allowing an incumbent firm to finance its temporary losses from a predatory strategy. The predator is able to finance actual operating losses in the market in question only because it receives current profits from other markets." (p. 154). In this case, cross-subsidization is merely a means for financing predatory pricing. Gates *et al.* (1995) "define predatory pricing broadly as an attempt by a firm to reduce long-run, future competition by temporarily reducing prices." (p. 151), which coincides with our use of the term.

They further list three conditions that make cross-subsidized predation relevant. "First, the firm must find predation profitable; otherwise the ability to finance it is irrelevant. Second, the strategy must involve negative cash flows for the predator that require financing; mere economic losses are not enough. Third, the predator must have limited cash or other liquid assets with which to finance these losses, and limited access to the financial markets and bank loans; otherwise, the predation can be financed without relying on profits from the other market." (p. 154). The second condition excludes situations in which the predator can still mange to finance the cash flows, but at a lower than acceptable return to herself; i.e. at an economic loss. An example of this might be AT&T's 1965 TELPAK earned rate of return of only 0.3% as opposed to the allowed rate of 7.4% (albeit based on FDC), where TELPAK was a tariff for private lines — a market in which AT&T faced competition (Temin, 1990, p. 354–355). Also note that an ordinary, non-predatory investment with an expected positive net present value could satisfy all of the above conditions. This would be true even without satisfying the first condition of predation. However, satisfying the predation requirement would only increase the expected profitability of the investment. The "permanent loss" type of definition to be discussed later would not satisfy all three conditions.

A *possible* example of cross-subsidization according to a "temporary loss" definition is the give away of the Microsoft browser, Internet explorer, to compete against the dominant browser, Netscape. Microsoft was concerned that Netscape posed a threat to Microsoft in the operating systems market where Microsoft had a monopoly with its product, Windows (Fisher and Rubinfeld, 2000). To defend its monopoly, Microsoft "decided to price its own browser below cost when it knew that Netscape was charging for its browser and that Netscape depended on those revenues to continue to compete effectively." (p. 19). Fisher and Rubinfeld (2000) conclude that "the pricing of Micro-

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soft's browser was anticompetitive; absent any expected deleterious effects on competition, the pricing would not be profit-maximizing. Moreover, Microsoft could recoup any forgone profits associated with its anticompetitive conduct through the protection of the firm's operating systems monopoly." (p. 41). To the extent that said conduct was financed through current profits on other products, this could indeed satisfy a "temporary loss" cross-subsidy definition.

Although the "temporary loss" type of definition may seem appealing, particularly since it includes the kind of anticompetitive conduct illustrated above, it is important to caution against adopting it too readily. The very concept of a "temporary loss" is in itself questionable as a switch from accounting data to cash flow data should demonstrate that a new business venture is profitable. Similarly, if predatory pricing is successful, it will have *increased* the long run profits of the firm. Hence, by attributing a longer time perspective, one would conclude that the period of predatory pricing could be likened to the early periods of a profitable investment, i.e. an investment with a positive net present value. Thus, a "temporary loss" might be more accurately described as a negative (net) cash flow. Adopting this type of definition thus amounts to considering all negative cash flows as receipts of subsidies, which does not seem to be in line with the general notion of subsidies.

We now turn to the final and most restrictive type of definition, which takes a long run perspective.

2.3 "Permanent loss" definition ("negative net present value definition")

The "permanent loss" type of definition of cross-subsidization is the mot restrictive and has as a condition that the subsidized service must be a *permanent* loss-maker where the loss is financed via current profits from other services of the firm. As such, the definition is of a long run nature compared to the previous one. Hence, a necessary condition is that the subsidized service has a negative net present value based on a DCF (discounted cash flow) approach.[6]

One possible example of such a definition is: "The financing of an unprofitable part of an enterprise by a more profitable part. Thus a public enterprise, for example, instead of following the rule of attributing costs properly to each division to make each part of that enterprise individually accountable, will allow the profitable divisions to finance loss-making divisions. In the private sector, cross-subsidization occurs within firms that allow some of their services to be sold at less than incremental cost. To ensure maximum efficiency, firms should avoid this practice as far as possible." (Rutherford, 1992, p. 104). The per-

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manent loss perspective is here implied by the last sentence, which indirectly states that cross-subsidization is inefficient for private firms. Our assumption of a firm perspective (rather than a social perspective) of efficiency seems to be justified in that Rutherford suggests that *firms* should at their own initiative avoid the practice — not be made to avoid it through regulation. This definition thereby excludes the financing of profitable (and efficient) investments from profits generated by other services.[7]

Adopting this definition means that no profit maximizing firm would have an incentive to cross-subsidize. The definition thus excludes successful predatory pricing financed by current profits from other services, which was included under the previous two types of definitions. The earlier mentioned Microsoft case would then be excluded as a possible example of cross-subsidization. The only situation in which a profit maximizing firm like Microsoft would cross-subsidize would be inadvertently; i.e. it would be indicative of an accounting information problem. This clearly reduces the strategic motives for cross-subsidization by eliminating traditional predation. If a firm is deliberately cross-subsidizing under this type of definition, it cannot have a profit motive for doing so.

In the private sector, firms would only have limited ability to cross-subsidize by this definition, as they would continuously run the risk of being outperformed by profit maximizing competitors. For listed private firms, it would most likely also be an indication of a principal-agent problem that allowed management to pursue non-profit maximizing goals unbeknownst to the stockowners. However, for non-listed private firms with few owners, such as family businesses, the owners might place less emphasis on profitability. Deliberate cross-subsidization might then take place in the pursuit of non-profit maximizing goals such as generating goodwill in personal relations unrelated to the business, providing (unprofitable) services to charity, pursuing a scale beyond profit maximization because size is viewed as more desirable, or keeping unprofitable product lines either for sentimental reasons or being too proud to admit to a failed investment.

In the public sector, the presence of non-profit motives is frequent thereby increasing the relevancy of deliberate cross-subsidization according to a "permanent loss" definition. One example is the loss making provision of USO (universal service obligation) services. In Norway, this is the case for several sectors. The state-owned postal service, Norway Post, has a regulated monopoly on certain types of letter mail generating profits in urban areas to fund the provision of unprofitable USO services in rural areas. The profits are insufficient to cover the full loss of the USO and Norway Post also receives direct

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subsidies from the government. The partially privatized Norwegian telecommunications incumbent, Telenor, also has a USO, but currently funds this with profits from markets open to entry. In the long run, competitive pressure may erode these profits thereby necessitating a different means for funding the USO. For both Norway Post and Telenor, their licenses specifically prohibit cross-subsidization of non-regulated services. Any cross-subsidization should be strictly reserved for the provision of unprofitable services included in the USO.[8]

Distinguishing the more restrictive "permanent loss" occurrence from the "temproary loss" occurrence of cross-subsidy is a challenge as the difference is determined by the expectation with respect to future pricing and unit costs. As mentioned previously, using cross-subsidies to fund a classical predatory pricing to increase long run profits, will satisfy the "temproary loss" definition, but not the "permanent loss" definition as the latter implies that the service is expected to be unprofitable on the whole (have a negative net present value). However, determining this *ex ante* from current data is problematic.

In conclusion, this most restrictive type of cross-subsidy definition limits the reasons for cross-subsidization to either be an information problem or a non-profit motive as discussed earlier. Our focus is limited to deliberate cross-subsidization. However, cross-subsidization may also take place inadvertently, for instance due to weak management accounting systems, possibly because of managerial limitations or because they are not judged cost-effective. In other cases, the cause of inadvertent cross-subsidization might be more fundamental, as in multiservice firms with high sunk costs and low variable costs such as telecommunications. Although issues pertaining to inadvertent cross-subsidization are certainly worth developing, it is beyond the scope of this paper.

3 A Cross-subsidy classification framework

We now turn to the task of developing a framework for classifying cross-subsidies based on the definition types in the previous section. The framework is an attempt to further the understanding of the complexity of cross-subsidies and to distinguish between desirable and undesirable cases from a social perspective. It is based on two dimensions; effect on competition and motivation. If we allow for other sources than current profits from other services of the firm, the framework will have a wider application.

First, as both policy makers and economists seem to agree on the beneficial effects of competition on welfare, one of the dimensions of the classification should be the cross-subsidy's effect on competition.

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Thus, we have chosen to classify cross-subsidies according to whether the effects are predatory or non-predatory; i.e. whether they will be a threat to an efficient competitor (Baumol, 1996).

The second dimension is based on the motivation behind the cross-subsidy. The motivation is divided into profit or non-profit motive. Particularly private firms, but to an increasing extent also public firms, are measured by their profitability. Also, there are numerous private firms with market power earning extraordinary profits in some of their markets that can be used as a cross-subsidy source. For publicly traded firms, the stock market will function as an indicator of whether the management is perceived to maximize the value of the firm. However, particularly public firms may have other motives than profit, such as welfare maximization, employment, egalitarian income distribution, or the fulfillment of a USO. This will make a performance evaluation more difficult, and management of public firms may often be subject to more informal evaluation and by different criteria than their private, profit-maximizing counterparts. For instance, public management may experience being judged by the scale of their operations, thus motivating management to grow their business beyond value maximization. This could lead the public enterprise to become a fierce opponent to private firms (Sappington and Sidak, 1999). Similar problems may be found in the private sector, too, especially if salaries tend to be correlated with firm size. A heavy emphasis on cost minimization might also motivate public management to attempt to appear more efficient than is the case by concealing high costs through cost transfers from non-

TABLE 1: *A cross-subsidy classification framework*

	Profit motivated		Non-profit motivated
Predatory	• Predatory pricing (temporary low price) financed by a cost transfer/ current profits.[A,B]	Positive ← Welfare effects → Negative	• Permanent low price with revenues below incremental cost financed by cost transfer/current profits (e.g. large scale motive).[A,B,C]
Non-predatory	• Cost transfer with unaltered price in subsidized market resulting in increased gross margin.[A] • Ordinary investment financed by cost transfer/ current profits.[A,B]		• Concealing internal efficiency by transfer of costs exceeding revenues at market price (e.g. "quiet life" motive).[A,B,C] • Provision of universal service in non-profitable markets (public policy motive).[A,B,C]

[A]"Cost transfer" definition
[B]"Temporary loss" definition
[C]"Permanent loss" definition

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regulated to regulated activities. These would be examples of agency problems, which we will not discuss in depth.

The cross-subsidy classification framework based on effects on competition and type of motivation is presented in Table 1. The framework divides cross-subsidies into four cases; predatory and profit motivated, predatory and non-profit motivated, non-predatory and profit-motivated, and non-predatory and non-profit motivated. Note that parts of the framework might be irrelevant depending on the type of cross-subsidy definition assumed. Finally, the cases are ordered according to their welfare effects from positive (bottom of table) to increasingly negative (top of table).

We now briefly describe each case and touch on potential welfare implications, using effect on competition as a proxy for welfare effects. For a more complete and in-depth treatment of welfare effects of cross-subsidization, see e.g. Brennan and Palmer (1994).

3.1 Predatory and profit motivated

The first case of cross-subsidization, predatory and profit motivated, is one of the most damaging to welfare. Here, it is the goal of the firm to drive out competitors and monopolize the market, or at least to reduce competition, through predatory pricing. In this situation, cross-subsidization is simply a means of funding. As such, the only element distinguishing this type of cross-subsidy from classical predatory pricing outlawed in most countries is that the source of funding is (current) profit from other services of the firm. Although consumers gain from low prices during the period of predation, the benefit will be more than reversed during later monopoly pricing in the event that the predatory pricing is successful. There would be no adverse welfare effect in the source market for a private (non-regulated) firm, as it would maximize profits in this market, regardless of the subsequent use if these. Its ability to exploit market power as a source for cross-subsidy may however be severely hampered by the danger of entry, an argument frequently made with respect to Microsoft's alleged monopoly power in the operation systems market (see e.g. Evans and Schmalensee, 2000). However, for a public firm with access to profits from a market protected from entry by regulation, the cross-subsidy of the non-regulated market would lead to increased prices and loss of welfare in the regulated market.

Predatory and profit motivated cross-subsidization can be included both by the "cost transfer" and the "temproary loss" type of definition. To see this, consider first a firm shifting costs tacitly from a competitive market to a market with market power thereby appearing more effici-

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ent than is the case in the competitive market. By subsequently reducing prices in the competitive market to a predatory level and reducing competition, the firm might later increase prices and profits in this market. The cost shifting will serve as a funding of the predation. Both the "cost transfer" and the "temporary loss" type of definitions will encompass this behavior as the only difference here would be that the latter would include the condition that revenues temporarily fall short of actual incremental cost in the competitive market (although the cost shifting would give the appearance that this was not the case). Predatory and profit motivated cross-subsidization will not be included by a "permanent loss" definition as it requires the service to be unprofitable on the whole.

3.2 Predatory and non-profit motivated

The second case of cross-subsidization in Table 1, predatory and non-profit motivated, can possibly be as damaging to welfare as the previous case. It is also most relevant for public firms as these are more likely to follow non-profit motives. In the extreme, it could mean that management of a public firm is interested in thwarting competition by setting a low price simply because competitor's presence is considered a nuisance as it increases the pressure to be efficient. Competitors will tend to be a benchmark against which the public management will be measured, either formally by government or more informally through consumer choice and in the media. Alternatively, public firm management could be motivated by prestige from large scale of operation or, more altruistically, to provide its services affordably to as many consumers as is practically possible. Regardless of specific non-profit motive, the public firm would not be interested in increasing price to monopoly level after competitors had left the market, whereas this would be the case under predatory pricing. Instead, the public firm would continue its low price policy and finance the loss by continued cross-subsidization.

Although the underlying motivation may be difficult to observe, competition authorities will generally have to perform a thorough investigation to prove predation. The process will normally include seizure of internal documents and questioning of employees, which may uncover possible motives. Recently, the Norwegian Competition Authority investigated a public training studio due to charges by a private competitor that the public studio was subsidized and charged predatory prices. The public training studio was part of a larger sports facility, and cross-subsidy was a possibility. In a letter to the competition authority, the county raised the issue of public health and clearly saw

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the county's objective to stimulate physical exercise among its residents through its training studio as separate from any damaging effects its low pricing might have on competition.[9] A contrasting example of revealing motive is the investigative process of the before mentioned Microsoft case which indeed produced evidence of a predatory intent (Fisher and Rubinfeld, 2000).

Predatory and non-profit motivated cross-subsidization, although based on a benevolent motive, will of course still be damaging to competitors. However, it may also be damaging to consumers by reducing the range and possibly also the quality of services. For instance, in the case of the public training studio above, a more efficient or better quality private rival could be driven out of the market. In the short run, losing the private option would hurt consumers preferring this alternative. In the long run, lack of competition might reduce the quality and efficiency of the remaining public service, thus harming all consumers of the service.

As indicated in Table 1, the predatory and non-profit case could be covered under all three types of cross-subsidy definitions discussed earlier. First, the predatory behavior in the non-regulated market might be more easily concealed through cost shifting thus satisfying the "cost transfer" definition. Obviously the firm would still face the challenge of concealing the inappropriate attribution of costs. Second, given that revenues no longer covered actual incremental cost in the non-regulated market in the short run, the predatory behavior would also fulfill the conditions of the "temporary loss" definition. Third, due to the lack of intent to increase future prices and ensure long run profitability, the service in the non-regulated market would be a permanent loss maker for the firm (negative net present value) and the "permanent loss" definition would also be fulfilled.

3.3 Non-predatory and non-profit motivated

The third case of cross-subsidization in Table 1 is non-predatory and non-profit motivated. Given a non-profit motive, the third case of cross-subsidy seems more likely to be undertaken by public rather than private firms as discussed earlier. Furthermore, welfare effects may be both undesirable and desirable.

First, consider the example in Table 1 of a public firm seeking shelter from the pressures to perform by transferring some of its costs to the regulated market thereby bringing its costs in the non-regulated market in line with its competitors' costs. The cross-subsidy will allow the firm to operate at market prices in the non-regulated sector and lead a "quiet life". The welfare loss obviously comes from the ineffici-

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ency of the firm as well as from increased prices in the regulated market. In addition to a quiet life motive, appearing to be as efficient as its private competitors will also gain goodwill from the public owner. Furthermore, management can use the "efficiency" as an argument to justify a presence in the non-regulated market that may have the benefit of offering more diverse and interesting activities both to management and employees. Finally, being present in both markets would also offer the prestige of a larger scale. This example would be covered both by a "cost transfer" definition and also by a "temporary loss" definition (as actual incremental costs in the non-regulated market exceeds revenues). Given an intention of maintaining the cross-subsidy indefinitely, it would also be covered under a "permanent loss" type of definition.

The second example in Table 1 is USO funding within regulated markets, for instance the provision of rural services funded by surpluses from urban services as in telecommunications, electricity or postal services. Contrary to the other examples in Table 1, this would be a cross-subsidy stipulated by policymakers and as such be legal and non-tacit. Furthermore, the welfare effects may very well be positive. These could for instance stem from positive externalities, such as from the provision of a national telecommunications network where the value to each subscriber increases with the number of subscribers, from public good properties of a USO service, or from USO as a redistribution policy instrument (Cremer *et al.*, 2001). One might argue that these welfare effects were due to the provision of the USO services, rather than from the cross-subsidy. Even so, there might still be welfare effects from cross-subsidization due to its efficiency as a funding mechanism. In spite of efficiency losses from extracting extraordinary profits to use as a USO-funding, cross-subsidization may still be more efficient than funding by general taxation as the latter also entails efficiency losses (for a discussion of USO and USO funding, see e.g. Cremer *et al.*, 2001).

The USO example would be covered under all three types of cross-subsidy definitions. The cross-subsidy could be considered a cost shifting from rural to urban services, thus satisfying a "cost transfer" definition. As incremental costs persistently exceed incremental revenues in rural areas, the rural service would be a permanent loss maker and thus satisfy both a "temporary loss" and a "permanent loss" type definition.

3.4 Non-predatory and profit motivated

The final case of cross-subsidization in Table 1, non-predatory and profit motivated, may also have undesirable as well as desirable welfare

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effects. For an example of the former, consider a firm operating both as a regulated monopoly and in a non-regulated market. The firm is subject to rate of return regulation (or cost plus pricing), which is limited to the services of the regulated market. In the non-regulated market, the firm has no profit regulation. Under these conditions, the firm can make tacit cost transfers from the non-regulated to the regulated market without an accompanying price reduction. The increased costs in the regulated market would be accommodated by increased prices to ensure the regulated rate of return. By sustaining the original prices in the non-regulated market, the firm will increase its profit in this market without being predatory. As suggested earlier, the price increase in the regulated market will lead to a net welfare loss given that the reduction in consumer surplus in the regulated market exceeds the profit gain by the firm. However, the firm may otherwise be expected to behave efficiently such that the welfare loss is less than under the non-predatory and non-profit motivated cross-subsidy where the public firm finances internal inefficiency. This first example of non-predatory and profit motivated cross-subsidy will only be covered under a "cost transfer" type of definition, as the revenues in the non-regulated market exceed the incremental costs.

The second example in Table 1 is a traditional profit motivated and non-predatory investment into a new service, which is financed by current profits from other services. This would stimulate competition and provide additional consumer choice and as such have positive welfare effects. Although many would object to calling this a cross-subsidy, it could be covered both under a "cost transfer" and a "temporary loss" definition. The cross-subsidy could be covered under the wide "cost transfer" type of definition by using profits from a regulated market padded by cost transfers to finance the profitable investment in the non-regulated market. In principle, this would not be significantly different from the previous example regarding cost transfer from an established service. The cross-subsidy would also be covered under a "temporary loss" definition if it ran losses in the form discussed in section 2. This would be the case for most investments requiring large capital sums up front leading to high fixed (potentially sunk) costs allocated to early years with low revenues. As we mentioned in section 2, this reduces the accuracy and usefulness of "temporary loss" definitions and may contribute to confusion in the cross-subsidy debate. It also raises the more fundamental issue of whether to use an accounting or DCF approach, which we will not pursue here.

4 Conclusion

In this paper, we have attempted to reduce some of the confusion by gaining perspective on the motivation behind deliberate cross-

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subsidization and the effects on competition and welfare. We identified three broad types of cross-subsidy definitions ranging from general to more restrictive; the "cost transfer" definition, the "temporary loss" definition, and the "permanent loss" definition. Although the focus of this paper was not to endorse or discredit any particular definition, we note that the "temporary loss" definition may become unmanageable in that it potentially labels all negative cash flows as recipients of subsidies. This type of definition particularly accentuates the tension between accounting and DCF data that Heald (1996) points to. He advocates the DCF approach for businesses subject to significant life cycle effects. "Otherwise, because of life-cycle effects (reflected in peaks and troughs of investment expenditures associated with particular products and consumer groups), cost allocation exercises which focus upon accounting costs may give seriously distorted answers." (p. 69). A "permanent loss" type definition remedies this shortfall by applying a longer time horizon to determine whether the firm in the long run would be more profitable without the subsidized service. However, this type of evaluation requires the use of a "DCF appraisals which look beyond annual accounting data and which explicitly acknowledge the time dimension of cash flows." (Heald, 1996, p. 69).

Based on the three types of cross-subsidy definitions, we developed a framework for classifying cases of cross-subsidization according to underlying motivation and effect on competition. This resulted in four possible cases; predatory and profit motivated, predatory and non-profit motivated, non-predatory and non-profit motivated, and finally non-predatory and profit motivated. While competition authorities need only focus on the predatory occurrences, authorities for sector specific regulation need to be concerned with all occurrences that have negative welfare effects. The predatory types would tend to be more damaging, whether profit motivated or not. Faced with the existing multitude of cross-subsidy definitions, the appropriate starting point for the authorities seems to be to specify their goal, and subsequently to determine which definition best suits this goal in terms of describing an actual problem facing the authorities. As expressed by Heald (1996): "Analytical clarity is essential, particularly because this is a context in which language is used both imprecisely and persuasively." (p. 53). The cross-subsidy classification framework developed in this paper, should provide a better perspective and aid authorities in the search of a suitable definition.

Some topics which were only briefly touched on in this paper, but which are certainly worth developing, are the tension between accounting and DCF data particularly central to the "temporary loss" definitions, the significance of the source of funding versus the effects on

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competition and welfare of any type of service subsidization, and the issue of inadvertent cross-subsidization due to information problems. Finally, although a daunting task, an effort should be made to decide upon a precise and operational definition of cross-subsidization that can be uniformly adopted and which will serve the purpose of labeling a resource flow of significance to economics, management accounting and public policy.

NOTES

1. From a regulatory and competitive perspective, it seems more relevant to focus on cross-subsidy between services and leave out the issues of cross-subsidies between consumer groups (consumption bundles) and between individuals (anonymous equity). For literature on these types, see for instance Sharkey and Telser (1978) and Faulhaber and Levinson (1981).
2. Guidelines on the application of EEC Competition Rules in the telecommunications sector (91/C 233/02).
3. Heald (1996) considers Activity Based Costing a more sophisticated implementation of FDC. For a more detailed discussion on cost allocation, see Heald's article and Brown and Sibley (1986).
4. A comparison of FDC prices with subsidy free prices by Brown and Sibley (1986) illustrates our earlier claim that the "cost transfer" type of definition is wider than the "temporary loss" and "permanent loss" types of cross-subsidy definitions.
5. The bus routes example, however, is probably a better example of the "permanent loss" type of definition that will be discussed later.
6. A discounted cash flow analysis implies a time horizon of the life span of the service and thus includes revenues not yet earned, but which make the service profitable. A similar effect could in principle be achieved by matching the cost allocation over time to actual revenues rather than to make the allocation dependent on time itself.
7. By now it should be striking how explicit mention of the time perspective is missing from cross-subsidy definitions. Parsons (1998) states that: "With regard to the "long-run" nature of the cost calculation, the economic literature on cross-subsidization is largely silent." (p. 171). In a footnote, he adds that: "Discussions of adding or deleting a service would, however, seem to imply that a long-run cost standard. Baumol (1986, 117–19) explicitly recommends a long run standard. Also, incremental cost calculations for LECs [local exchange carriers] are almost exclusively of the long run variety." (p. 171).
8. Norwegian Post and Telecommunications Authority (http://www.npt.no/).
9. Letter by Vefsn County of March 11, 1999. Due to lack of accounting data, subsidy was not proved or rejected. The Norwegian Competition Authority decided to require separate accounting for the public training studio to remedy this. If this reveals subsidy, or cross-subsidy, then the county will have to extend the same subsidy to private competitors (decision to intervene of May 18, 1999).

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