

Bundling

Industrial Organisation Theory

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Abstract

In this paper, we look at commodity bundling and tie-in sales. Basically there are three incentives to firms to engage in bundling and tying. Tying and bundling can serve strategic purposes by deterring or impeding entry, it enables a monopolist to increase its profits by allowing price discrimination and by extending the monopoly from one market to another and finally it may be used as a quality control. We show that bundling is not always strictly preferred to the, so called, pure components strategy; neither on the grounds of profit maximisation, nor on normative grounds.

1 Introduction

As Shy (1995) describes it, bundling and tying are two marketing strategies which are nowadays prevalent in almost every field of business; cultural organizations offer seasonal tickets, in many restaurants customers have the choice to buy a complete dinner, or they can order separate dishes. Furthermore, according to Adams and Yellen (1976) it is possible that the goods included in a bundle cannot be sold separately. For example, a car can be seen as a package of luxury and transport service. Although it would be possible to "extract" the luxury component and just sell the transport service in form of a basic car, there is no market for the luxury component itself.

Before we analyse the economics behind bundling and tying, we want to give a brief definition of those two strategies. Throughout the literature there are several, slightly different, definitions for bundling and tying. Shapiro and Varian (1999, p. 73) define bundling as *"a special form of versioning in which two or more distinct products are offered as a package at a single price"*. An example for this type of bundling would be the Office Package from Microsoft, which includes several applications like a word processor, a spreadsheet and a database. Shapiro and Varian (1999, p. 74) stress, that the products of a bundle are also sold separately, because *"this is what distinguishes bundling from tying, in which the individual products are offered only in the package"*. A different definition of bundling can be found in Shy (1995, p. 362); he refers to bundling

as “a marketing method in which firms offer for sale packages containing more than one unit of the product”. This form of bundling is also called nonlinear pricing, because the units of the product are not sold at the same price. An example for this sort of bundling are quantity discounts or volume discounts. Tying, on the other hand, “refers to firms that offer for sale packages containing at least two different products” (Shy, 1995, p. 362). According to this definition, Microsoft Office would rather be considered as product tying than product bundling. Adams and Yellen (1976) have shown that, on the grounds of positive properties, all these different cases can be analyzed using a single model. Therefore we adopt Adams and Yellens notion of *commodity bundling* which comprehends both, tying and bundling. Due to convenience we will use *commodity bundling* and *bundling* as synonyms.

In this paper the main question is, why do companies engage in commodity bundling and why is it such a popular marketing strategy. As it turns out literature suggests several answers to theses questions. Martin (1994) states three possible incentives for a firm to engage in bundling. First, it can serve strategic purposes by deterring entry. This incentive will be, based on Nalebuff (2003) explained in greater detail later in this paper. Second, bundling allows the firm that has market power to increase profits. This can be achieved by using bundling as a form of price discrimination. Bundling as a means of price discrimination constitutes the main focus of many textbooks and articles like Stigler (1968), Adams and Yellen (1976), Shy (1995) and Pepall, Richards and Norman (2005). Third, according to Martin (1994, p. 441), bundling “*may make production more efficient by allowing a firm to control the quality of products used in combination with its own product*”. In order not to go beyond the scope of this paper, a detailed discussion of the third incentive is left out.

2 Bundling to increase profits - a simple model

Like we have said before, many economists argue, that firms engage bundling to increase their profits, because it allows them to discriminate prices. In this section we will formulate a simple model to analyse bundling on the grounds of its positive properties. The analysis in this section is basically based on the paper from Adams and Yellen (1976), but we will also refer to the textbooks of Pepall, Richards and Norman (2005) and Shy (1995).

We start our analysis by defining the basic assumptions of the model. Assume that there two goods (good 1, good 2) and following assumptions hold:

- (Technology) Both goods are produced at constant marginals costs (c_1 , c_2). There are no economies of scope and no fixed costs. The marginal costs of supplying a bundle equals the sum of the marginal costs of the components ($c_B = c_1 + c_2$).

- (Indivisibility) The marginal utility of a second unit of either good 1 or good 2 equals zero.
- (Independence) Each consumer has a maximum willingness R_1 for good 1 and R_2 for good 2. The maximum willingness to pay is also called the reservation price. The reservation price of the bundle equals the sum of the reservation price of the separate components ($R_B = R_1 + R_2$).

Adams and Yellen (1976) state, that the last assumption can be restrictive because it does not hold for complementary goods (e.g. nuts and bolts). Pepall, Richards and Norman (2005) argue that although this assumption might be restrictive, it helps to focus explicitly on price discrimination as a motive for bundling.

In this model a firm with monopoly power can engage one of the following strategies: *pure component strategy*, *pure bundling* and *mixed bundling*.

2.1 Pure component strategy

This constitutes the simplest pricing strategy for a monopolist who offers both goods. It is the usual monopoly pricing, where the firm sets the prices individually in each market via profit maximisation. The prices are labeled p_1^M and p_2^M respectively. With this strategy the reservation price space is split into four groups.

- (A) Consumers where: $R_1 \geq p_1^M$ and $R_2 \geq p_2^M$
- (B) Consumers where: $R_1 < p_1^M$ and $R_2 < p_2^M$
- (C) Consumers where: $R_1 \geq p_1^M$ and $R_2 < p_2^M$
- (D) Consumers where: $R_1 < p_1^M$ and $R_2 \geq p_2^M$

Therefore consumers belonging to group A buy both goods, consumers in group B buy neither good and finally consumers from group C and D only buy good 1 and respectively good 2.

2.2 Pure bundling strategy

With this strategy the firm sells the two goods available only as a package at a fixed price of p_B . The consumers have the choice to consume the bundle (that is to say good 1 *and* good 2) or to consume nothing at all. With pure bundling the firm sets the price of the bundle to be less than or equal the sum of the two monopoly prices. Therefore we can write

$$p_B \leq p_1^M + p_2^M$$

In the case of pure bundling the reservation price space is divided in two areas (A and B) as shown in figure 1.

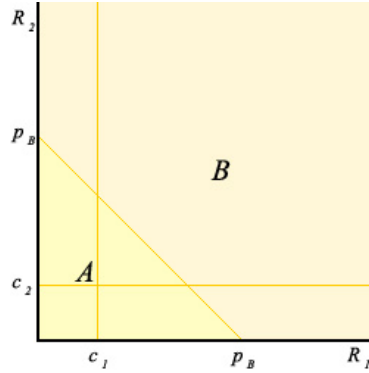


Figure 1: Pure bundling strategy. Adapted from Pepall, Richards and Norman (2005, p. 170)

The price of the bundle is illustrated as a straight line intercepting each axis at p_B . Therefore the slope of this line is -1 . For the particular groups it is true to say that

- (A) $R_1 + R_2 < p_B$
- (B) $R_1 + R_2 \geq p_B$

Therefore consumers from group A consume the bundle and consumers from group B do not. Pepall, Richards and Norman (2005) point out that pure bundling enables some consumers to buy a good for which their reservation price is less than the marginal production costs. This can also be seen in figure 1. For example all consumers in the area north of $p_B p_B$ and west of c_1 buy the package and therefore also good 1, even though their reservation price for good 1 is less than the marginal production costs of that good, saying that $R_1 < c_1$.

2.3 Mixed bundling strategy

With mixed bundling the consumers have the choice to buy the package at the price p_B or either of the goods separately at the price p_1 and respectively p_2 . In the case of mixed bundling the reservation price space looks a little bit more complex, as it can be seen in figure 2.

In figure 2 we can identify four groups of consumers which are characterized by the following properties

- (V) $R_1 < p_1$, $R_2 < p_2$ and $R_B < p_B$. Therefore consumers in this region (below *feab*) neither any of the individual goods, nor the bundle.
- (Z) $R_B \geq p_B$, $R_1 \geq p_B - p_2$ and $R_2 \geq p_B - p_1$. Therefore consumers in this region (above *head*) consume the bundle.

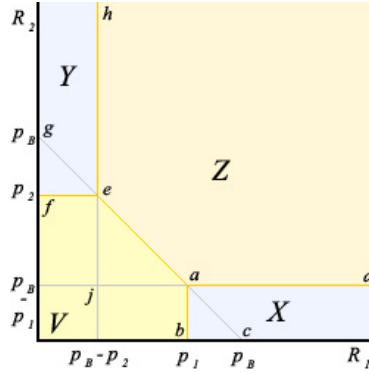


Figure 2: Mixed bundling strategy. Adapted from Pepall, Richards and Norman (2005, p. 171)

- (Y) $R_2 \geq p_2$ and $R_1 \leq p_B - p_2$. Therefore consumers in this region (above feh) consume only good 2.
- (X) $R_1 \geq p_1$ and $R_2 \leq p_B - p_1$. Therefore consumers in this region (below bad) consume only good 1.

In this case, the interesting question is when does a consumer, who values good 1 above its price (p_1), buy the bundle and when does he/she only buy good 1. The same question can be asked for good 2, but because of the fact that the reasoning is the same in both cases, we will just focus on good 1. The crucial condition whether a consumer buys the package or just good 1 is $R_2 \leq p_B - p_1$. Adams and Yellen (1976) interpret the rate-hand-side of this equation as the implicit price of good 2 facing a consumer who is already prepared to buy good 1. If the reservation price for good 2 does not exceed the implicit price of good 2 the consumer derives a higher consumer surplus by just buying good 1 compared to buying the package.

When comparing the pure component strategy with bundling (either pure or mixed) Pepall, Richards and Norman (2005) conclude that bundling will always yield higher sales. Although the monopolist's sales rise, we cannot draw the conclusion that therefore the profits of the monopolist will rise as well. Adams and Yellen (1976) give a detailed explanation under which circumstance which strategy is the superior one. In order to assess the advantageousness of the three strategies Adams and Yellen (1976) benchmark them against pure price discrimination according to the following three criteria:

- (Complete Extraction) Individual consumers do not gain any consumer surplus through the purchase.
- (Exclusion) Individuals only consume a good if they value it at least as much as it costs. That means, that the cost of that good must not exceed the reservation price of the consumer.

- (Inclusion) Any consumer who values a good more than it costs, actually also consumes that good.

Adams and Yellen (1976) show that the pure components strategy never violates the Exclusion criteria. This is because prices are never set below marginal costs. But because of the fact that a monopolist faces a downward sloping demand curve, there will always exist some consumers who gain a positive consumer surplus through their purchase. This violates the Extraction criteria. Furthermore the pure component strategy also violates inclusion. Pepall, Richards and Norman (2005) state that the superiority of pure bundling and mixed bundling over the pure components strategy mainly depends on the level of the marginal production costs and of the distribution of the consumers in the reservation price space. A detailed analysis of the advantages and disadvantages of the bundling strategies is beyond the scope of this paper, therefore we will just present an overview of the insights found by Adams and Yellen (1976). Generally speaking the gains from bundling arise from the dispersion in the consumers' willingness to pay¹.

In the case of a very elastic bundle demand curve combined with not so elastic component demand curves Adams and Yellen (1976) state that pure bundling (compared to monopoly pricing) reduces the violation of Inclusion and Extraction. As we have seen in figure 1 in section 2.2 the profitability of pure bundling suffers from the fact that some consumers who buy the bundle value one good less than it actually costs to produce. This problem, which gets bigger as the marginal production costs rise, constitutes the main defect of the pure bundling strategy. Therefore pure bundling fails on the grounds of Exclusion. In order that pure bundling is more profitable than monopoly pricing, the profit gains from a better Inclusion and Extraction must exceed the losses from less complete Exclusion. Nalebuff (2004) states that, if the marginal production costs are zero², pure bundling may extract the whole consumer surplus (just like a perfectly discriminating monopolist).

The mixed bundling strategy slightly dampens the fail in Exclusion because individuals who have consumed the whole bundle under the pure bundling strategy might cease buying the good they value below marginal production costs, but still consume the good where their reservation price exceeds the costs. Therefore Adams and Yellen (1976, p. 483) state that "*in general, whenever the exclusion requirement is violated in a pure bundling equilibrium, mixed bundling is necessarily preferred to pure bundling*". If consumers who have a high willingness to pay for the bundle have a small variance in the reservation prices for the individuals goods and vice versa, than mixed bundling enables the monopolist to extract even more consumer surplus.

¹The same reasoning is also presented in Shapiro and Varian (1999)

²This assumption is very likely to hold for products like software applications

To conclude the discussion of the positive properties of bundling, one can say that each marketing strategy has advantages and drawbacks. Furthermore Adams and Yellen (1976) show that their model can also be used to explain why companies often offer a volume discount on their products (e.g. toothpaste sold in different container sizes). Instead of defining the reservation price space by two goods, they use the reservation price for the first unit of a good as one dimension and the willingness to pay for an additional unit of the same good constitutes the other dimension.

2.4 Bundling as means to segment markets

As we have seen in the previous section, bundling can be used to discriminate prices. In order to successfully discriminate prices (charging low prices to consumers with a low willingness to pay and charging high prices to consumers with a high willingness to pay) a monopolist must be able to segment markets. That means the monopolist has to prevent that consumers buy the product in the low-price market and sell it in the high-price market (these activities are called arbitrage). Shy (1995) analyses whether a firm which operates on an international basis can increase its profits by segmenting the markets through bundling.

In an international economy it is reasonable to assume that arbitrage activities are weakened by trade barriers like quotas, tariffs and taxes. The question is whether a firm can still engage in price discrimination if markets are integrated (like it is true for the EU). Shy (1995) shows that because of differences in language, culture and location firms are still able to make arbitrage very costly to consumers. This can basically be achieved by tying local services like training or repairing to the sale of the product. Since such services can only be traded locally the monopolist can charge different prices in different countries and hence discriminate prices³.

3 Strategic incentives for bundling

In some rather recent papers⁴ Barry Nalebuff suggests that price discrimination, as described in the previous section, is by far not the only incentive for firms to engage in bundling. Furthermore Nalebuff and also Martin (1994) suggest that there also exists strategic incentives, namely the ability to impede or deter entry of competitors and the possibility to leverage the monopoly power from one market to another. The following section tries to give an overview about Nalebuff's approach to analyse the economics of bundling.

³A more formal explanation can be found in Shy (1995, p. 369-372)

⁴Namely Nalebuff (2003) and Nalebuff (2004)

3.1 Bundling as an entry barrier

As described by Nalebuff (2003) bundling is a very effective method to prevent entry of new challengers. As we have seen in the previous section the benefits of bundling as a means of price discrimination are maximised in a situation, where the two bundled goods have a perfect negative correlation in value. This benefit diminishes as the correlation of values is getting more and more positive. Nalebuff (2003) argues that the opposite is true if bundling is used to deter new entrants because *"the reason is that a one-product entrant has everything its consumers want when the valuations for A and B are negatively correlated"*. Therefore Choi and Stefanadis (2001) conclude that for perfect complements bundling completely forecloses a one-product entry.

Nalebuff's model⁵ consists of a market with two goods, labeled A and B . Consumers can only purchase one unit of A and/or one unit of B . Both goods are produced at zero marginal costs and the new challenger can enter either market A or B also producing at zero marginal costs. In general the entry decision of the new challenger depends on whether the expected profits exceed the costs of entry, which are known by all players. Nalebuff (2003, p. 7) suggests that *"if an entrant can't justify entry costs at the prevailing pre-entry prices then this is a persuasive argument not to enter the market"*. A further assumption in the model is that the incumbent sets its prices before the challenger decides whether to enter or not. After this decision the prices of the incumbent are fixed for the rest of the game.

In this model, under independent pricing, an entrant can make half of the incumbent's pre entry profits. If we assume that the entry costs for the new entrant are E , then the incumbent has to choose a price p that exhibits profits which do not exceed $2E$. Therefore Nalebuff (2003, p. 9) concludes that *"the incumbent will deter entry if $E > 1/8$ and accept entry otherwise"*.

On the other hand the monopolist could engage in bundling, by tying both goods together and selling the package at a price of 1 (which is the sum of the monopoly prices of the individual goods). Therefore it would sell to the half of the market earning profits of $1/2$. According to Nalebuff (2003) the advantage of bundling comes from the so called pure bundling effect and the bundle discount effect.

3.1.1 Pure bundling effect

This effect refers to the situation where the incumbent and the entrant take their independent pricing strategy over to the case of bundling, without carrying out any reoptimization. Nalebuff (2003) assumes that the challenger enters the market B with a price of 0.50, therefore it sells only to people whose will-

⁵Some of the assumptions made by Nalebuff have been left out, in order not to go beyond the scope of this project.

ingness to pay for B is at least 0.50 and value A at less than 0.50⁶.

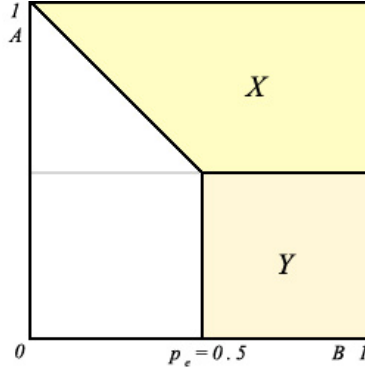


Figure 3: Pure bundling effect - market shares. Adapted from Nalebuff (2003, p. 11)

Therefore, as it can be seen in figure 3, the new entrant does not capture the whole area to the right of p_e , the challenger is limited to the half of its potential market.

3.1.2 Bundle discount effect

Another channel through which the entry of new challengers is deterred is the bundling discount effect, meaning that the monopolist sells the bundle at a discount relative to the sum of the prices of the individual goods. In this case, entry becomes even less profitable. Nalebuff (2003) says that the optimal bundle price for the monopoly, in absence of potential entrants, is about 0.80. Reducing the bundle price below 0.8 does in fact lower the profits of the monopoly but it also reduces the profits of the potential entrant but at a much faster pace.

Therefore we can say that bundling enables the monopolist to use the market power in each market to protect the other one. Network externalities as described by Shapiro and Varian (1999) and Pepall, Richards and Norman (2005) also enable monopolies to deter entry via bundling⁷.

3.2 Bundling as a way to leverage monopoly

The basic idea behind this concept is, that a monopoly operating in the markets A and B , where the market for good B is competitive, can raise its profits by lowering the monopoly price for good A and tying it to the purchase of good B

⁶Those consumers who value A more than 0.50 are better off buying the bundle.

⁷A detailed discussion of entry barriers caused by a positive feedback loop is beyond the scope of this paper and therefore left out

which is priced slightly higher than the competitive level.

Basically Nalebuff (2004) argues as follows: Assume the monopolist charges an monopoly price m for good A and good B is sold the competitive price c ⁸. Then the monopolist offers its consumers the deal to lower the monopoly price of A by ϵ , if they agree to buy B at an inflated price of $c + \delta$. The consumers who wish not to engage in that deal still may buy A at a price of m . As it can be shown, using the envelope theorem, the effect of lowering the monopoly price for good A by ϵ washes out. On the other hand according to Nalebuff (2003) the consumers have a first-order gain from paying less for A and therefore they reward the monopoly by accepting a slightly higher price for B . Furthermore Nalebuff (2003) uses a similar reasoning to show that the monopoly can extend its market share in the market for good B at almost no cost.

4 Welfare implications of bundling

So far we have looked at the incentives from a monopolist's point of view to engage in bundling. In this section we present a brief overview on some welfare implications imposed by bundling.

In order to make any propositions on the normative aspects of bundling Adams and Yellen (1976) use the following two criteria required to achieve pareto optimality:

- Commodities are distributed in a way that it is not possible for consumers to have mutual gains from trading. That means it is impossible to carry out any transaction between two consumers leaving at least one of them better off, whilst not affecting the utility of the other in a negative way.
- The firm produces enough to supply all consumers whose willingness to pay is greater or at least equal to the marginal production costs.

As it is shown in many textbooks like Varian (2003) a pure component strategy fulfills the first requirement but violates the second one. Adams and Yellen (1976) show that a mixed bundling strategy results in distributive inefficiency. Therefore on the ground of normative properties bundling is similar to imperfect price discrimination. It can be shown that, if $p_B - p_2 < c_1$ then good 1 is oversupplied. On the other hand a necessary and sufficient condition for the undersupply of good 1 is that, $p_1 > c_1$ and $p_B - p_2 > c_1$.

On the whole Adams and Yelling (1976) conclude that, *"commodity bundling generally leads to welfare losses when compared with perfect competition. But this does not imply that banning package selling per se decreases the burden of monopoly"*.

⁸which equals marginal production costs

Nevertheless, as shown by the nuts&bolts example of Pepall, Richards and Norman (2005), bundling may lead to overall welfare gains if the market for two complementary products is served by one rather than two monopolies. These gains are due to the fact that "*the merged firm understands the interaction of demands between the two products*" (Pepall, Richards and Norman 2005, p. 182).

5 Conclusion

In this paper we gave an overview about the economic theory of bundling and tying. We started with a simple model to analyse the incentives for a firm to engage in bundling. As it turned out, bundling increases the sales of a monopolist, but nevertheless it does not imply a rise in profits, when compared to monopoly pricing. The profitability of the different pricing strategies basically depends on the marginal production costs and on the dispersion of the reservation prices of the two commodities. The closer the correlation of the reservation prices converges to a perfect negative correlation the more consumer surplus can be extracted from the consumers via engaging in bundling.

Furthermore we have also shown that there are strategic incentives, meaning that bundling enables a monopolist to deter the entries of new challengers through the *pure bundling effect* and the *bundle discount effect*. In addition to this, bundling can also be used to leverage monopoly power from one market to another, although the second market might be a competitive one.

Finally we saw that bundling can lead to both an over- and an undersupply of a certain good. Therefore it can impose distributive inefficiency. Nevertheless, if two monopolists in complementary goods markets merge, bundling can also lead to efficiency gains via the prevention of double mark-ups.

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