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Bundling in Telecommunications

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Abstract

The paper offers an overview of the literature on bundling in the telecommunications sector and its application in the Spanish market. We argue that the use of bundling in the provision of services is associated to technological reasons. Therefore, there appears no need to regulate bundling activities. However, this is not to say that other related telecom markets should not be scrutinized and regulated, or that the regulator should not pay attention to other bundling-related anticompetitive practices.

Keywords: Bundling, telecommunications

JEL Classification: L10, L11, L12, L13, L41, L42

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1 Introduction

Bundling is an ubiquitous phenomenon. It is observed in many markets not only of traditional consumption goods but also in newly developed ones such as the market for information technologies (IT). Figure 1 shows the household penetration of bundled offers at the EU27 level according to the 12th Report on the Implementation of the Telecommunications Regulatory Package 2006.

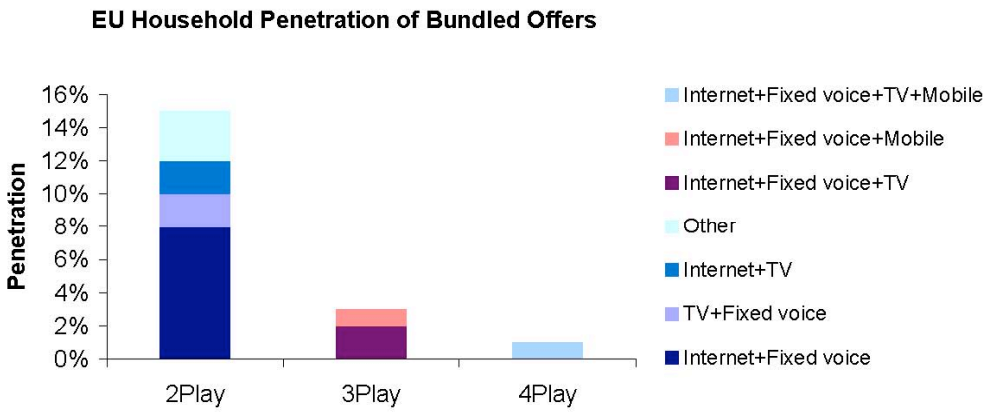


Figure 1: Bundles in the EU27

This paper aims at offering a broad view of the arguments driving firms to engage in bundling in the market for telecommunications, and of the need to regulate.

Product bundling is a marketing strategy by which a firm offering several products separately, also gives a discount to those consumers purchasing the products as a single combined product (a *package*). As we will see, bundling practices are a particular form of price discrimination.

Price discrimination generically refers to the ability of a firm to sell its products at different prices so that the *value per unit* of the product differs across consumers (see Tirole, 1988, ch.3). Pigou (1920) distinguished three types of price discrimination according to three different criteria. *First degree price discrimination* (or perfect discrimination) arises when the firm charges the price corresponding to the willingness to pay for each unit to each consumer. *Second-degree price dis-*

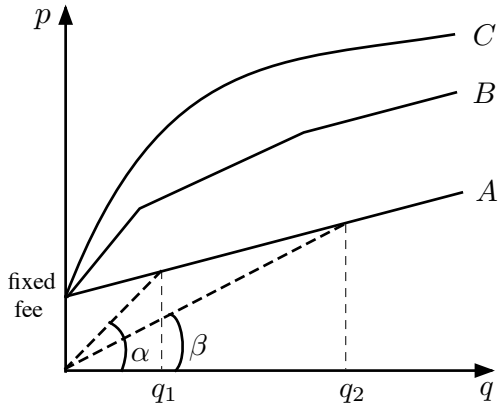


Figure 2: Non-linear prices.

crimination appears when a firm links the price to the volume bought. Finally, *third-degree price discrimination* links the price to some characteristic of the consumer (age, gender, income, etc). An extensive account of the literature on price discrimination can be found in Armstrong (2006), Phlips (1983, 1988) and Varian (1989).

Under this taxonomy, bundling practices are a manifestation of second-degree price discrimination. As prices depend on the quantity bought, they are referred to as *non-linear prices*. Under these pricing schemes, different quantities are bought at different *average* prices, thus reflecting for instance, price discounts according to volume. Figure 2 shows several pricing schedules (or *tariffs* in the jargon of industrial organization). Tariff A represents a two-part tariff. Its vertical intercept represents the access fee to the market (e.g. an entry fee, or a connexion fee), whereas its the slope represents the marginal price. The slope of the line from the origin to a point in the tariff, represents the average price. That is, the average price faced by a consumer buying quantity q_1 is given by (the tangent of the angle) α. Similarly, the average price for a quantity q_2 is given by (the tangent of the angle) β. Note that in line with the definition of second-degree price discrimination, each volume of the product entails a different average price.

Tariff B represents a four-part tariff, and tariff C represents the limit case where an infinitesimal variation of the amount bought yields a different average price.

The paper is organized as follows. Section 2 reviews the main arguments found in the literature on bundling.

Section 3 presents an example where a monopolist producing two goods decides whether to offer those products (i) separately, or (ii) in a (pure) bundle, or (iii) both (mixed bundling) assuming away efficiency and entry deterrence considerations. To simplify the comparison between the different scenarios it is assumed that the prices of the goods when sold separately remain the same under bundling. This is relaxed in a subsequent example. The example illustrates that, given a distribution of reservation prices, mixed bundling yields higher production levels as compared to pure bundling and no bundling. The relative profitability of the three strategies depends on the distribution of the reservation prices on the population of consumers. This goes in line with McAfee *et al.* (1989). Also, Fang and Norman (2006) study the case where the effect of lowering the variance of the willingness to pay (induced by pure bundling) is strong enough to dominate separate sales. The numerical example that we provide also serves the purpose to highlight the fact that the use of bundling strategies as a price discrimination device may work when the market is monopolized. The presence of competition (be it perfect or imperfect), would alleviate the equity concerns associated with price discrimination.

Section 4 is devoted to bundling and tying where only one firm can bundle the two services. This corresponds to a situation where a firm makes the purchase of one product over which it has a monopoly power (the so called tying or bundling good) conditional on the purchase of a second good.[1]

Section 5 reviews the literature on the effects of bundling when all firms can bundle services.

Section 6 draws some conclusions for the Spanish case. Spain is a good example of bundling practices in telecommunications as it is a reasonable mature market with all types of operators (incumbent, cable operators and alt-nets) and is one of the few European countries where there is good documentation on the number of clients who purchase bundled services. Section 7 concludes.

[1]Note that this second good may be sold separately by the firm (tying) or may not be sold separately by the firm (pure bundling).

2 Bundling

Product bundling is a marketing strategy that involves offering several products and/or services for sale as one combined product. This combined product is offered at a discount price, so that it is cheaper to buy the products and services as a bundle than separately. This strategy is most often found in multiproduct industries such as telecommunications, hardware and software, or fast-food. The products grouped in a bundle are often referred to as a *package*. Bundling is generally implemented when the seller thinks that the characteristics of two or more products and services are such that these products might appeal to many consumers more as a package than as individual offerings. However, as we will see, even in the absence of these complementarities, bundling can also prove to be beneficial to firms or even to increase overall welfare. For instance, internet access and telephone services are independent products in the sense that in general, enjoying internet access does not increase the enjoyment of telephone services. And yet we observe bundling of these services often.

Several notions of bundling can be distinguished. *Pure bundling* occurs when a consumer can only purchase the entire bundle or nothing, and *mixed bundling* occurs when consumers are offered a choice between the purchasing of the entire bundle or one, or both of the separate parts of the bundle.

A related concept is that of tying which refers to an intermediate situation where a firm makes conditional the purchase of a second service when a customer wishes to buy a first service. In this situation, the first service cannot be bought separately. As opposed to bundling, tying may be dynamic, for example when the purchase of future services is conditioned to the purchase of a service today. This is typical of services with aftermarkets, for example, photocopier machines and the repair and maintainance of those machines or cameras and complements for those cameras. Tying can be contractual or by design. For example tying in the telecommunications sector occurs when the purchase of access (line rental) results in the impossibility to purchase follow-on services from other companies (telephone or broadband services for example). Tying is a business practice which may have

detrimental effects on consumers and welfare and this is reflected on Article 82 (d) of the Treaty of Rome where the following is defined as an abuse of dominant position: "Making the conclusion of contracts subject to acceptance by the other parties of supplementary obligations which, by their nature or according to comercial usage, have no connection with the subject of such contracts". This clause has also been used to argue that bundling is an abuse. However, there is a common understanding that tying and bundling are common practices that may have positive effects and will only have anticompetitive consequences under certain circumstances.[2] Any intervention may only be justified after a detailed case analysis establishing such harmful effects.

Several motives to engage in bundling practices can be identified. Among them, we focus our attention in (i) bundling as a means to price discriminate, (ii) bundling as a means to achieve efficiency goals, and (iii) bundling as a means for an anticompetitive outcome. Also, bundling can be used as a tool to reduce the divergence in incentives between manufacturers and distributors among other reasons.

A first argument examines bundling by a monopolist as a *(second-degree) price discrimination tool*. Under this perspective, bundling works best when the values attached to the bundled goods are negatively correlated (see Adams and Yellen, 1976, McAfee *et al.*, 1989, and Schmalensee, 1982). That is, a consumer values one of the products of the bundle more than the other consumer, while values less the second product of the bundle. In that case, offering both products in a bundle reduces the inter-consumer variation in reservation values, allowing the seller to extract more surplus from consumers. To illustrate, think of situation with two consumers (A and B) and two goods (1 and 2). Consumer A values commodity 1 at 80 €, and commodity 2 at 25 €; in turn, consumer B values good 1 in 70 € and good 2 in 30 €. If offered separately, the seller would maximize profits at prices $p_1 = 70, p_2 = 25$ to obtain profits of 190 €. If offered the opportunity, Consumer A would be willing to buy the package with both goods at a price of 105

[2] See for example the DG competition discussion paper on the application of Article 82 of the Treaty of Rome.

€, and consumer B would value the bundle at 100 €. Note that the dispersion of valuations for the bundle is smaller than that for the separate goods. The seller can use it to its advantage by selling the package at a price of 100 € to collect profits of 200 €. The bundling strategy is also effective when valuations are independent, but gains from bundling disappear when values are positively correlated.

A second argument relates to *efficiency* reasons. This appears when firms use technologies exhibiting (some of) these characteristics: (i) economies of scale and scope in production, (ii) economies of scope in distribution, (iii) low marginal costs of bundling, or (iv) high production set-up costs. Salinger (1995) offers a cost-savings argument to justify bundling as a way to generate a more valuable product. This cost synergy is based on the higher capacity of a firm to integrate products vis-a-vis consumers. Under this perspective, bundling is typically pro-competitive and consumer friendly. As such, it usually does not call for any regulatory intervention.

A third aspect of bundling is its use as a *strategic entry deterrence tool*. Several papers have identified the economic mechanisms by which bundling can be used by a dominant firm as a tool for anticompetitive effects. Generally these papers describe a situation where a monopoly in a service market bundles this service with another one where there is some rivalry in order to leverage market power, with effects in the market for the bundled service (with some rivalry) and the bundling service (with a monopoly).

The seminal work of Whinston (1990) overcame the Chicago Critique "that only one monopoly rent was posible by explaining how bundling of service B with a monopoly service increases the incentives to sell more of the B and results on a business stealing effect" (reducing prices and/or the rivals demand in the companion service) thus reducing the rivals' profitability and increasing the firm's profitability in the bundled service market. This exclusionary effect takes place if rivals in this second market have fixed costs that cannot be recouped in the presence of the bundle. In such cases, the monopoly will use a commitment to bundling in order to induce exit (and prevent entry). Nalebuff (2004) provides a second reason why bundling may be used as a strategic entry deterrence tool in

the monopolized market. He considers a set-up where a firm with market power in two goods can, by bundling them together, make it harder for a rival with only one of those goods to enter the market. He argues that "[a]lthough price discrimination provides a reason to bundle, the gains are small compared with the gains from the entry-deterrent effect." (p.160) However, the role of the correlation of the values associated to the goods is reversed with respect to the case of price discrimination. That is, bundling is most effective as entry deterrent device when values are positively correlated. This is so because, in that case the same population of consumers is buying both goods, and a one-product entrant cannot satisfy those consumers. In contrast, when values are negatively correlated, markets for both commodities are essentially different. Therefore, a single-product entrant is able to serve the market for that product. Hence, regulators should be cautious in their appraisal of the relationship between bundled goods.

Kobayashi (2005a,b) offers a nice overview of the literature. We can quote Kobayashi (2005b) to summarize these arguments:

> In many cases where bundling is observed, the reason why separate goods are sold in a package is easily explained on efficiency grounds. This is certainly the presumptive explanation for bundling when it occurs in highly competitive markets. These efficiency based explanations also apply with equal force to the use of bundling by firms with market power. In addition, firms with market power can use bundling (...) as a price discrimination device, or as a way to internalize pricing externalities in the presence of complementary goods.
>
> However, in markets where firms can exercise monopoly power, bundling can have anticompetitive uses that may be scrutinized under the antitrust laws. (...) Because bundling can also be an efficient practice when firms possess market power, any rational antitrust evaluation of bundling must simultaneously consider both the strategic and efficiency reasons for bundling.

3 Bundling by a monopolist in both markets. An illustrative example

To illustrate some elements behind bundling decisions, consider a very simple scenario described by a monopolist producing and selling two products $1, 2$. Those goods are produced with a constant marginal cost technology without fixed costs. Denote these marginal costs by c_1 and c_2. If the monopolist decides to bundle both goods in a package composed of one unit of each good, the marginal cost of the bundle is given by $c_b = c_1 + c_2$.

Consumers have a reservation price for each good and for the bundle, denoted by R_1, R_2, and $R_b = R_1 + R_2$. The distribution of these reservation prices over the population of consumers is given and known to the firm. Each consumer buys at most, one unit of each product (i.e. one unit of product 1, or one unit of product 2, or one unit of the bundle).

Note that these assumptions exclude scale and scope economies in the production of the bundle, as well as any consumption complementarities. Therefore, if a consumer (and the firm) finds it advantageous to acquire (and offer) the bundle it is not as a consequence of these phenomena. It is also convenient to point out that (in mixed bundling) as the value of the bundle is not larger than the sum of the values of its components, the decision to offer the bundle only makes sense if it is offered at a discount price.

This example allows for considering three market strategies:

1. *No bundling*: the firm sells both products at their respective monopoly prices (p_1^m, p_2^m).

2. *Pure bundling*: the firm only offers a bundle at a profit maximizing price p_b^m.

3. *Mixed bundling*: the firm offers each good separately together with the bundle at profit maximizing prices (p_1, p_2, p_b).

In general, we should expect $p_i \neq p_i^m$ as the numerical example below shows. However, to ease comparisons, we assume that $(p_1, p_2, p_b) = (p_1^m, p_2^m, p_b^m)$.

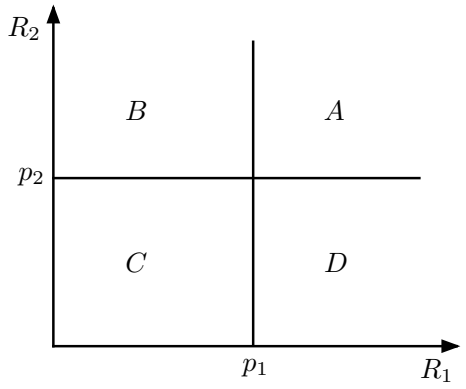


Figure 3: Market segmentation with monopoly prices.

3.1 No bundling

When the firm gives up the possibility of bundling and sells each good separately at monopoly prices, the market is segmented in four groups. As figure 3 shows, consumers in area A are endowed with reservations prices such that $R_i \geq p_i$ $(i = 1, 2)$. Thus they buy both products.

Consumers in areas B and D have one reservation price above the market price of one of the goods, and the other reservation price below the market price of the other good. Accordingly, these consumers buy only one of the products. Consumers in area B buy good 2, and consumers in area D acquire good 1.

Finally, consumers in area C are endowed with reservations prices such that $R_i \leq p_i$ $(i = 1, 2)$, and they cannot afford any of the products.

3.2 Pure bundling

Assume our monopolist decides to offer only the bundle (composed of one unit of each good) at a price p_b. Now the market is segmented in two groups as figure 4 illustrates. The price of the bundle is represented by a line with slope of -1 defining the two groups of consumers.

Consumers in area E are characterized by a reservation price above the market price of the bundle. Thus, those consumers buy the bundle. In contrast, consumers in area F cannot afford the bundle and are excluded of the market.

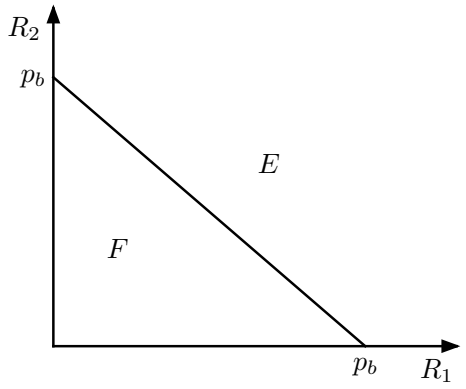


Figure 4: Market segmentation with pure bundling.

3.3 Mixed bundling

Consider now the situation where the monopolist decides to offer both goods separately together with the bundle. Assume, as commented above, $p_b < p_1 + p_2$. Figure 5 illustrates the scenario where again the space of consumers is split in four regions.

Consumers in the (open) area defined as $G \equiv 0p_2xyp_1$ are characterized by $R_i < p_i$, $i = 1, 2, b$. Accordingly, these consumers do not find it profitable to buy any of the products and thus, are expelled of the market.

The area $H \equiv p_1yz$ can be seen as formed by two triangles. Consumers in the lower triangle p_1yp_b, are characterized by $R_1 \geq p_1, R_2 < p_2$, and $R_b < p_b$. Therefore, they buy product 1. Consumers in the upper triangle p_Byz are characterized by $R_1 > p_1,\ R_2 < p_2$, and $R_1 + R_2 = R_b \geq p_b$. Therefore, they have acccess to both product 1 and to the bundle. However, these consumers in the upper triangle obtain more surplus from good 1 than from the bundle because $(R_1 - p_1) > (R_1 + R_2 - p_b)$, or $R_2 < p_b - p_1$. This is so because along the segment yz it follows that $R_2 = p_1y = p_1p_b = p_b - p_1$. Joining together both triangles, we conclude that consumers located in the area H buy product 1.

A parallel argument leads us to conclude that consumers in the area $I \equiv p_2xw$ buy good 2.

Finally, the fourth (closed) area $J \equiv wxyz$ describes those consumers buying

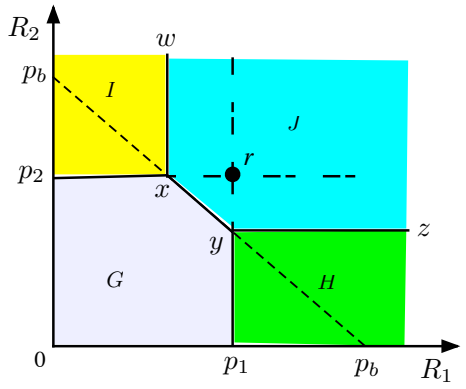


Figure 5: Market segmentation with mixed bundling.

the bundle. These are consumers satisfying $R_1 + R_2 \geq p_b$, $R_1 \leq p_b - p_2$, and $R_2 \leq p_b - p_1$. Accordingly, these consumers obtain more surplus from the consumption of the bundle than from either of the products separately.

Let us focus our attention in comparing the case of no bundling with that of mixed bundling by observing the corresponding four groups of consumers in figures 3 and 5. First we compare the sets of consumers who do not participate in the market. Area C in figure 3 is larger than the corresponding area G in figure 5. Namely, the difference is given by the triangle xry. This area accounts for those consumers that do not find it profitable to buy either good 1 or good 2, in the absence of bundling, while they find the bundle profitable when it is offered.

A similar argument also applies to areas B and D when compared with areas H and I, respectively. Some consumers that find only profitable one of the goods without bundling, have access to the bundle when it is offered, and decide to buy it instead of the corresponding single product.

Finally, consumers in area A that were already buying both goods under no bundling, when the bundle is available (those in area J) continue to buy both goods but at a lower price.

Summing up, we conclude that mixed bundling implies higher production lev-

els as compared to the situation of no bundling. When the bundle is available, some consumers that were buying product 2 (in area B) now acquire the bundle, thus implying an increase in the production of good 1. Similarly, some consumers that were buying product 1 (in area D) now acquire the bundle, thus implying an increase in the production of good 2. Finally, some consumers that were left out of the market (in area C) now have access to the bundle leading to an increase in the production of both products. Accordingly, there is an efficiency gain when moving from no bundling to mixed bundling.

The comparison between pure and mixed bundling is not as clear cut. On the one hand, some consumers (in area F) that were out of the market under pure bundling, decide to buy good 1 under mixed bundling (lower triangle in area H). Thus, an increase in production of good 1 is to be observed. However, some consumers that were buying the bundle under pure bundling (in area E), when offered the possibility of buying product 1 alone do so. This induces a reduction in the production of product 2 (upper triangle in area H). A parallel argument when comparing areas E, F and I yields an increase in the production of good 2 and a decrease in the production of product 1.

The relative profitability of the three strategies depends on the distribution of reservation prices on the consumer population.

The following numerical example illustrates some of these features.

3.4 A numerical example

Consider a firm operating in a market with four consumers A, B, C, D. Their reservation prices for the different products are given in table 1.

	R_1	R_2	R_b
A	10	90	100
B	45	55	100
C	60	40	100
D	90	10	100

Table 1: Reservation prices.

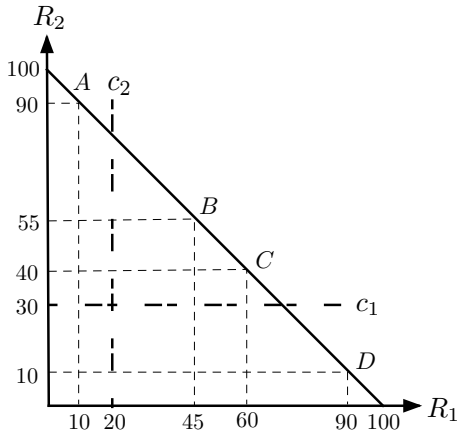


Figure 6: A numerical example.

Production is carried out under constant marginal costs $c_1 = 20$ and $c_2 = 30$. The situation is depicted in figure 6.

For future reference, note that the first best solution consists in the firm selling at the corresponding reservation prices, good 2 to consumer A, good 1 to consumer D, and both products to consumers B and C. This yields a level of profits of 230 €.

If the firm decides to follow a *no bundling strategy*, profits are maximized for $p_1 = 60, p_2 = 90$, and the associated level of profits is of 140 €. At these prices, consumer D obtains a surplus of 30 € while consumers A and B are excluded of the market of product 1. Also, consumers B, C, D are excluded of market of good 2. From the firm's viewpoint, this situation is far from the first best solution where all consumers have the opportunity to buy at least one of the products.

If the firm follows a *pure bundling strategy*, it will offer the bundle at the price $p_b = 100$ €. All consumers will buy, and the firm will obtain profits of 200 €. This strategy yields profits closer to those under first degree price discrimination (first best solution), because all consumers buy and none retains any surplus. However, even though consumers A and D have a reservation price for one of the goods below the marginal cost, they find it beneficial to consume them through the bundle. This possibility would not arise under first degree price discrimination. Naturally, this situation appears more frequently the higher the marginal produc-

tion costs. The example illustrates how total willingness to pay for the bundle is harmonized across consumers, which allows for full rent extraction by the firm. Of course, in richer situations only a fraction of the rents would be extracted through the bundle. The point we want to stress is that rent extraction is facilitated by bundling whenever consumers' willingness to pay for each product are negatively correlated (and above marginal costs). This will be further illustrated below.

Finally, if the firm uses a *mixed bundling strategy*, it has four categories to classify consumers. The firm can sell product 1 to consumer D at a price $p_1 = 90$; can sell product 2 to consumer A at a price $p_2 = 90$; and can sell the bundle to consumers B and C at a price $p_b = 100$. This strategy replicates the first best strategy, thus yielding profits of 230 €. All consumers are served, and none retains any surplus. Moreover, consumers A and D do not find it profitable to buy the product whose marginal cost is above their respective reservation prices.

Table 2 summarizes the outcome of the three strategies described reporting for each strategy, prices, quantities, profits, consumer surplus and total welfare.

Strat.	p_1	p_2	p_b	q_1	q_2	q_b	π	CS	W
no B	60	90	-	2(C,D)	1(A)	-	140	30	170
pure B	-	-	100	-	-	4	200	0	200
mixed B	90	90	100	1(D)	1(A)	2(B,C)	230	0	230

Table 2: Outcomes under the three strategies.

This example illustrates that the firm can attain the levels of profits associated to the first degree price discrimination by means of a mixed bundling strategy.[3] It also helps to understand the demand motivations why television distributors offer closed menus of bundled channels with à la carte channels. The same channel is more expensive when it is bought in isolation than in a closed menu. On the supply side, there are some scope economies in preparing a menu. Quoting Adams and Yellen (1976, p.488) who make this precise point with the example of restaurant menus,

> Some people value an appetizer relatively highly (soup on a cold day),

[3]Note as commented above, that monopoly prices and mixed bundle prices do not coincide.

others may value dessert relatively highly (Baked Alaska, unavailable at home), but all might wish to pay roughly the same amount for a complete dinner. The à la carte menu is designed to capture consumer surplus from those gastronomes with extremely high valuations of particular dishes, while the complete dinner is designed to retain those with lower variance in their reservation prices.

In general, mixed bundling is the strategy yielding the highest levels of profits when some consumers have reservation prices below the marginal production cost of one of the products. However, it should not be inferred from this example that all consumers fulfilling this characteristic will be excluded of the market of that product. Often a trade-off appears because the most profitable strategy may exclude some consumers of the market in order to minimize the surplus retained by those consumers served by the firm.

The reasoning exposed suggests that the dispersion (variance) of the reservation prices within each market segment plays an important role. In our example, consumers B and C (the ones acquiring the bundle) have similar (high) reservation prices for the individual products. It turns out that in general, the mixed bundling strategy yields higher profits than any of the two other alternative strategies when consumers having high reservation price for the bundle, also evaluate the individual goods in a similar fashion. In that case, the firm addresses the bundle to those consumers with highest preference for the bundle, and the individual products to those consumers with highest preference for the corresponding single product. In this way, the firm manages to extract the maximum level of surplus from consumers.

To further elaborate this point, we propose three variations of the example.

The first variation is shown in table 3. It shows extremely dispersed reservation prices. They are so dispersed that valuations sometimes fall below the marginal cost. This example is reminiscent of the third-degree price discrimination in the sense that consumers can be identified by their strong preference for either one product or the other.

	R_1	R_2	R_b
A	10	90	100
B	10	90	100
C	90	10	100
D	90	10	100

Table 3: Highly dispersed reservation prices.

Note that the first best solution in this case yields a welfare level of 260 €, when both goods are sold at a price of 90, consumers A and B demand product 2, while consumers C and D demand good 1. This outcome can be mimicked by the firm with a no bundling strategy, as well as with a mixed bundling strategy.

Under pure bundling, the firm sells the product to all four consumers at a price of 100 € to obtain profits of 200 €. Therefore, under an extremely dispersed distribution of reservations prices, no bundling allows for higher (highest indeed) profits than pure bundling. Table 4 summarizes.

Strat.	p_1	p_2	p_b	q_1	q_2	q_b	π	CS	W
no B	90	90	-	2(C,D)	2(A,B)	-	260	0	260
pure B	-	-	100	-	-	4	200	0	200
mixed B	90	90	100	2(C,D)	2(A,B)	-	260	0	260

Table 4: Outcomes under highly dispersed reservation prices.

The second variation is illustrated in table 5 where consumers have their reservation prices highly concentrated, but still the correlation is negative.

	R_1	R_2	R_b
A	45	55	100
B	45	55	100
C	60	40	100
D	60	40	100

Table 5: Highly concentrated but negatively correlated reservation prices.

The first best solution now is given by consumers consuming both goods, yielding welfare of 200 €. When the firm chooses the no bundling strategy, it sells product 1 at 45 €, product 2 at 55 €, and all consumers buy good 1, consumers A

and B buy good 2. The firm obtains profits of 150 €, and consumers C and D retain a surplus of 15 € each. In contrast, under pure bundling, firm serves all consumers the bundle at a price of 100 € yielding profits of 200 €. Therefore, pure bundling is now more profitable than no bundling in contrast with the previous case. Note that pure bundling yields the first best total welfare and it is appropriated by the firm. Therefore, mixed bundling cannot improve upon this situation from the firm's viewpoint. Table 6 summarizes.

Strat.	p_1	p_2	p_b	q_1	q_2	q_b	π	CS	W
no B	45	55	-	4	2(A,B)	-	150	30	180
pure B	-	-	100	-	-	4	200	0	200

Table 6: Outcomes under highly concentrated but negatively correlated reservation prices.

The last example illustrates what is in fact the optimal situation for pure bundling to dominate no bundling: the correlation of tests are negative and by bundling goods the total willingness to pay is harmonized. This allows the firm to better extract surplus. The situation is described in table 7, where reservation prices are still negatively correlated, but in a lesser degree than in the previous example. We will see now that bundling is still profitable, but less than in the previous example.

	R_1	R_2	R_b
A	51	49	100
B	51	49	100
C	49	51	100
D	49	51	100

Table 7: Highly concentrated but negatively correlated reservation prices.

Again the first best solution is given by consumers buying both goods at their reservation prices yielding profits of 200 €. If the firm does not bundle it sells good 1 at price 49 € and good 2 at also 49 €, with a profit of 192 €. Under pure bundling the firm sells the bundle at a price of 100 € and obtains 200 €. Hence again the firm cashes in the first best welfare. However, notice that the difference with the no-bundling profits is much smaller, as the lesser need for willingness to pay harmonization. Table 8 summarizes.

Strat.	p_1	p_2	p_b	q_1	q_2	q_b	π	CS	W
no B	49	49	-	4	4	-	192	8	200
pure B	-	-	100	-	-	4	200	0	200

Table 8: Outcomes under highly concentrated but negatively correlated reservation prices.

The three examples illustrate the main point: pure bundling is more profitable than no bundling as long as correlation is not so negative that some valuations fall below marginal cost.

4 Bundling by a monopolist in market A

When a firm is a monopolist in one market, it may use bundling and tying strategies as a means to extend its market power to a related or an unrelated service market. These anticompetitive effects are more likely to appear the stronger is the tie. This tie is strongest when the firm engages in pure bundling, it is weaker if the firm engages in tying, and is even weaker if the firm engages in mixed bundling.

The Chicago School has strongly criticised this view. An example with unit demands illustrates why a monopolist may not be able to increase its profit by bundling.

Assume that a bundle is composed of a product star and its complement.[4] There is a monopolist selling the star product which renders a value v to the consumer. Without loss of generality, let us assume that the marginal cost of production of the star product is zero. The value of the complement good for consumers is w. Its market is perfectly competitive and its price is c. The monopolist may also sell the complement product at a marginal cost of c_m, which may be greater or smaller than c. There are no fixed costs of production. Complementarities between both products yield an added value of the bundle to consumers of $\triangle > 0$. This is, the value of the bundle is $v + w + \triangle$.

(i) No bundling: The price of the star product is $v + \triangle$. The monopolist may only

[4]For example, think of hardaware and software, or a mobile phone ans its services, or a DTT decoder and the programming content of the different TV channels to which the decoder gives access.

sell its complement if $c_m \leq c$. The unit profits accrued by sales of the star product are $v + \triangle$, and the unit profits accrued by the sale of the complement are, zero if $c_m > c$ and $c - c_m$ otherwise.

(ii) Pure bundling: The monopolist sells the product at a price P. Consumers only purchase the bundle if it yields a higher surplus than the purchase of a rival's complement with price c. This is, if $v + w + \triangle - P > w - c$. Hence, the maximum price P that the monopolist may charge is $v + c + \triangle$, which yields a unit profit for the bundle of $v + c + \triangle - c_m$.

Clearly if $c_m \leq c$ profits of (i) and (ii) coincide. Otherwise (this is, when the monopolist is less efficient in the production of the complement good) the monopolist loses out by bundling. The reason is that to extract the monopoly rents of the star product ($v + \triangle$), it must fix a price of the complement good of c. If the monopolist is inefficient, this implies "implicitly" selling the complement product at a loss.

Examples of this sort have been used by the Chicago School to argue that leveraging of market power cannot be a reason for bundling. However, the Chicago School critique presumes a competitive market for product B, and when such assumption is dropped, the conclusion is reversed. Indeed, Whinston (1990) shows that with an oligopolistic market in the secondary good, a precommitment to bundling constitutes a "promise" of aggressive price behavior which may allow a firm to leverage market power by forcing exit of rivals in the market of the complement product. The "promise" accrues because of the incentive to discount the bundle to push sales (within the bundle) of the monopolized service. Hence, the anticompetitive effect is more likely to appear with complementary services.

Indeed that bundling could result in aggressive pricing, was already noted by Telser (1979), who showed that in the bundle the implicit price of a tied commodity could be smaller than its marginal cost. Consider a consumer combining two products in non-negative proportions. Telser (1979) shows that the volume of tied sales may yield higher profits than selling both goods separately when the slopes of the demand functions for the tied good are different.

There are also some papers showing how bundling strategies may hinder entry

both in the monopoly and the related markets.

Aghion and Bolton (1987), study how the penalties incorporated in contracts with tying clauses affect the market structure of a complement good market. These contracts incorporate a penalty if the client purchases a different brand service. According to these authors, the penalty allows the monopolist to appropriate part of the profit of an entrant in the market of the complement product when the entrant enters after the signature of the contract of the product star. Let D denote the penalty. Then, to attract a client the entrant must post a price for the complement good with a high enough discount to compensate the client against the loss D. This can only happen if the efficiency of the entrant is superior enough to that of the monopolist, that is when $c < c_m + D$. The monopolist when determining D does not know how efficient the entrant will be. Therefore, it may well happen that an entrant is more efficient than the monopolist, but not enough to compensate the consumer the penalty D. In such case, there appears an inefficiency because the entry of a more efficient competitor is blocked.

The work of Nalebuff (2004) and Carlton and Waldman (2002) identify the economic mechanisms by which bundling may prevent entry of rival firms in the monopolised market. Both papers are based on the idea that scale in the secondary market is an indispensable condition for entry in the monopolized market. For example, Carlton and Waldman (2002) model a situation where if there is no threat of entry, there is no reason why the monopolist should bundle. The monopolist only bundles to prevent entry of a rival who is more efficient in the production of a complement good. This bundling harms the monopolist in the short term as there are less sales of the rival's cheaper complement. Hence, as in Whinston (1990), precommitment is necessary for the anticompetitive effect to accrue.[5] In contrast, in Nalebuff (2004) neither service complementarities nor precommitment is necessary for entry-deterrence. In his setting the firm is a monopolist in both markets, and there is an entry threat in one of them. Price discrimination by the monopolist provides the reason for bundling (which increases profits) but also the

[5]Choi and Stefanides (2001), in a setting with perfect complements, also rely on a commitment to bundle as a means to deter entry.

entry deterrence plays a role since the discount price of the bundle reduces the potential profits of a one-market entrant.

Indeed these papers have been written to explain the Microsoft case. By some accounts, Microsoft ties together Microsoft Windows, Internet Explorer, Outlook Express and Microsoft Office. Microsoft's view is that a web browser and a mail reader are simply part of an operating system (and are included with all other personal computer operating systems). Just as the definition of a car has changed to include things that used to be separate products, such as speedometers and radios, the definition of an operating system has changed to include those formerly separate products. However, the District of Columbia Circuit Court of Appeals rejected Microsoft's claim that Internet Explorer was simply one facet of its operating system (see Beckner and Gustafson, 2001). At the same time, the court held that the tie between Windows and Internet Explorer should be analyzed under the Rule of Reason. See United States v. Microsoft, 253 F.3d 34 (D.C. Cir. 2001). As to the tying of Office, State Attorney Generals originally included a claim for harm for a market for office productivity applications in the complaint they filed. (See Complaint filed in New York v. Microsoft Corp. PP 88-95, 98, 117-19, No. 98-1233 (D.D.C. filed May 18, 1998)); the Attorney Generals abandoned that claim when filing an amended complaint. The claim was revived by Novell when alleged that computer original equipment manufacturers (OEMs) were charged less for their Windows bulk purchases if they agreed to bundle Office with every PC sold than if they gave computer purchasers the choice whether or not to buy Office along with their machines. In this latter case, the OEM's bulk prices for Windows would rise, making their computer prices less competitive in the market. The Novell litigation is still ongoing.[6]

Finally, Spector (2007), shows that a firm enjoying monopoly power in one market and being active in another oligopolistic market may find it profitable to tie products in both markets in order to facilitate collusion in the oligopolistic market. Also, Egli (2007) shows that in Hotelling's model of horizontal differentiation,

[6]See Civil No. JFM-05-1087.

firms choose not to differentiate due to the competition-softening effect of tie-in sales.

Tying of goods or services occurs when a firm makes the purchase of one product over which it has monopoly power (the so-called *tying good*) conditional on the purchase of a second good competitively provided (the *tied good*). In other words, a firm by tying goods can try to extend its market power in the market of the tying good to the market of the tied good. Tying goods is therefore a particular form of bundling with the aim of maximizing profits. It typically appears when the demands for the two goods are complementary, or when the tying good is regulated, and the regulated price is below the firm's profit maximizing price level. Then, the firm would use this strategy to increase the price of the tied good in an attempt to maximize the overall profit. Generically, tying is considered an anticompetitive strategy and thus subject to close scrutiny by the antitrust authorities. Tying may be the action of several companies, as well as the work of just one firm. A classic example of tying is the selling of razors at a loss and making the profit on the blades. References on definitions and examples of tie-in sales (and bundling) can be found in Adams and Yellen (1976), Burstein (1960, 1988), Choi (2004), and Whinston (1990).

Tying may also be a form of price discrimination: people who use more blades, for example, pay disproportionately more than those who just need a one-time shave. Though this may improve overall welfare, by giving more consumers access to the market, such price discrimination can also transfer consumer surplus to the producer. Tying may also be used with or in place of intellectual property to help protect entry into a market, encouraging innovation. Tying is often used when the supplier makes one product that is critical to many customers. By threatening to withhold that key product unless others are also purchased, the supplier can increase sales of less necessary products.

Consider a consumer i combining these two products in non-negative proportions a_{i1} and a_{i2}. Different consumers may differ in these proportions. The price

of the composite good for consumer i is thus,

$$p_B^i = a_{i1}p_1 + a_{i2}p_2,$$

where p_1 and p_2 represent the prices of the two goods. Assume also that the demand for the bundle is linear and given by,

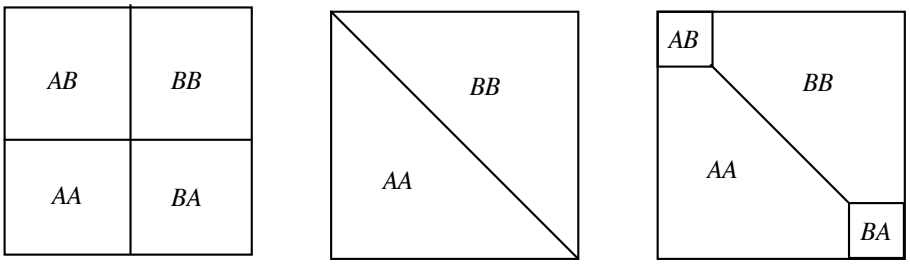
$$q_B^i = b_{0i} - b_{1i}p_B^i,$$

where $b_{0i} > 0$ and $b_{1i} > 0$.

Finally, assume a technology defined by a constant marginal cost of producing q_j, $(j = 1, 2)$ denoted by c_j, and the absence of fixed costs. This implies that from the technological point of view, tying does not imply any advantage to the firm. Therefore, only strategic reasons would justify the use of tying. With this assumptions Whinston (1990) shows, that technological precommitment to tying has important strategic effects and may allow a firm to use the leverage provided by its power in one market to foreclose another market (see Tirole, 1988 pp. 333-335).

5 Bundling when all firms can bundle services

When there are no barriers to entry in any of the bundled parts, bundling can be the action of several companies, as well as the decision of just one of them. A classic example is the selling of razons at a loss while obtaining profits on blades. The analysis in this context focusses in obtaining bundling as a Nash equilibrium strategy in competition games. Before describing the literature is worth pointing out that almost all of it deals with situations where the services to be bundled are differentiated. This is reasonable, as product homogeneity diminishes the interest of this topic. For example, if all services were a homogeneous good, Bertrand pricing would determine the market outcome and bundling would make no difference to this outcome. A first distinction among papers dealing with bundling and competition is whether the bundling decision is a pre-commitment before prices for services are chosen, or whether bundling is a marketing option in itself, chosen simultaneously with prices.



(a) Pure component pricing

(b) Pure bundling

(c) Mixed bundling

Figure 7: Demand under different pricing strategies.

Matutes and Regibeau (1988, 1992) are two classical references for the first option. In both papers the authors consider a duopoly where utility maximizer consumers are characterized by their position (i, j) in a Hotelling square of unit side with a transport cost of t. A consumer who purchases product 1 from firm A at price P_{1A} and product 2 from firm B at price P_{2B} obtains utility $W - P_{1A} - P_{2B} - t(i) - t(1 - j)$, where W is the willingness to pay for the services. Figure 7 illustrates demand distribution when both firms use symmetric prices and strategies.

Matutes and Regibeau (1988) compare the outcomes of pure bundling and separate prices to show that pure bundling is a worse option for both firms.[7] The reason is two-fold. On the one hand, pure component pricing allows consumers to benefit from variety raising their willingness to pay and increasing demand.[8] In turn, this increases firm's profits. On the other hand, there is a strategic effect related with the size of the marginal consumer. Under pure bundling reducing the bundle price results in more sales of products A and B (for example in Figure 7(b), this shifts the boundary of the demand region of A outwards). Under component pricing reducing the price of a component raises its demand but also increases sales of the complement product. Therefore, there is less of an incentive to reduce prices. Component pricing softens competition and increases firm's profits. Matutes and Regibeau (1992) compares pure component pricing and mixed

[7] Economides (1989) generalizes the analysis for n firms.

[8] In the paper situations where not all the market is covered are studied.

bundling. They show that the game has a prisoner dilemma structure with a "sub-optimal" equilibrium where both firms engage in mixed bundling. It is not optimal because pure component pricing would yield higher profits for both firms. In this setting if firms could precommit not to engage in bundling they would. Armstrong and Vickers (2006) provides an example based on Matutes and Regibeau (1992) to explain that the aggressiveness induced by mixed bundling is due to the fact that bundling makes consumers more homogeneous, thus raising the size of the marginal consumer.

A recent contribution by Thanassoulis (2007) has casted light into the effects of mixed bundling on consumer surplus and welfare by making the distinction between "firm specific preferences" and "product specific preferences" in a model where there are "small" consumers who only wish to purchase one good and "large" consumers who wish to purchase both goods.

Using this terminology, Matutes and Regibeau (1988, 1992) depict a situation where only "product specific preferences" exist (that is, each product is differentiated as opposed to a brand preference independent of the number of products considered) and where there are no "small" consumers. Indeed, even with "small" consumers (so that there are only product specific preferences), Thanassoulis obtains the same outcome as Matutes and Regibeau: mixed bundling is a dominant equilibrium of a game with a prisoner dilemma structure where both firms lose out because of the discounts. However, with "firm specific preferences" mixed bundling results in more profits for both firms with respect to the situation of pure component pricing. The intuition is simple. With pure component pricing, firms compete for "small" and "large" consumers with exactly the same instruments and are unable to segment those demands. Competition for "large" consumers yields a protective shield for "small" consumers. However, mixed bundling (i.e. price discrimination) eliminates this protection and "small" consumers suffer from large prices for individual goods.

6 The Spanish case

We argue that since fixed voice and broadband telecom retail markets in Spain are oligopolistic and competition seems to prevail in these markets there is no equity issue justifying a *per se* regulation of these bundles. This is not to say that other related telecom markets, for example upstream markets, should not be surveilled and regulated, or that the regulator should not pay attention to bundled offers in relation to other possible anticompetitive practices such as margin squeeze by the SMP firm.

There is also competition in "basic tv packages" in Spain. There exists free to air television through analogue and digital terrestrial television and these channels are included in the cable operators' offers as well as the satellite operator's. The situation with premium content is quite different. Until very recently most premium content has mainly been offered on the only satellite platform that holds most of the ownership rights. In December 2006 this platform had a revenue market share of 77,30% (see CMT Annual Report 2006). Yet, some football game rights are owned by regional and national free to air televisions. Also, from time to time cable operators have been able to negotiate the broadcasting of some sport events, independent channels, and certain independent films. *Telefónica*'s own TV experienced a substantial growth in 2006 and 2007, but by December 2006 only represented 4,16% of the total revenues of pay TV in Spain.

The addition of mobile phone services to the packages is very recent. We therefore exclude it from our analysis, although one would expect the market to develop and grow such types of all-round offers. This is precisely one of the points of the paper by Matutes and Regibeau (1992): "a firms best response to mixed bundling by a rival firm is to engage in mixed bundling".

6.1 Historical perspective

In Spain, cable operators were the first to have the possibility to bundle distinct services. Nowadays, also other operators bundle services. For instance, recent data released by the Spanish regulator (CMT) show that more than half of the ADSL sold in Spain is bundled with voice calls. Table 9 reports the number of residential

clients by type of service purchased.

Services	Clients
Only internet	665532
Only television	223841
Only phone services	9351270
Internet+Voice bundle	3526511
TV+Voice bundle	428256
TV+Internet bundle	61168
TV+Voice+Internet bundle	956530

Source: CMT Annual Report, December 2006.

Table 9: Residential clients by type of service purchased.

Although we will discuss this in more detail below, let us advance that most of the bundling is of the mixed type. This allows us to check how much discount does the purchase of the bundle bring to the consumer in each of the services. For instance, *Telefónica* offers a flat rate for national voice calls of 15 Euros per month, and also a 3Mega ADSL service at 39,07 Euros per month. These amount to a total of 54,07 Euros per month if purchased separately. Alternatively, if the bundle is purchased the price drops to 39,90 Euros per month. (These fees do not include the fixed line rental fee.). Hence, purchasers of the bundle are getting their national voice calls service almost for free.

The addition of calls to cellular phones has been added to the package just recently. We therefore exclude this from our descriptive analysis. One should expect the inclusion of this service in the bundle in the coming years. This is precisely one of the points of the paper by Matutes and Regibeau (1992): a firm's best response to mixed bundling by a rival firm is to also engage in mixed bundling.[9]

6.2 The current situation

In the Spanish market, there are several products offered through broadband telecommunications that are usually subject to bundling: broadband access, voice calls (usually restricted to national calls), web services (space), and TV. Basically, firms compete in pure bundles of the first three products while they engage in mixed

[9]The inclusion of international voice calls in the package has proven to be rather more difficult.

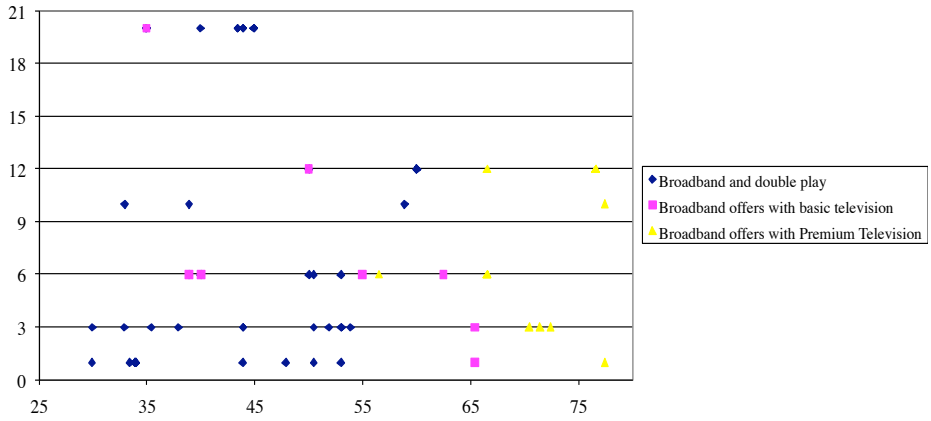


Figure 8: Broadband offers in Spain (March 2007).

bundling as for the fourth. An exception is *ONO*, a company that offers all possible combinations of the different products.

Figure 8 depicts the scatter plot of speed and price data carefully colleted by the authors from the companies' web pages (see appendix). Notice that some points represent offers including TV while others do not. Moreover, the different TV packages are not easily compared, due to different content of channels, pay per view conditions, and so on. Therefore, the interpretation should be done with care. Data suggests that competition exists in all products and quality (speed) segments.

Although the analysis conducted in Section 3 assumed that a single operator was active in the market, some of the insights gained are suggestive. After all, the Spanish market is greatly dominated by *Telefónica*, who served 56.7% of the market of broadband access in December 2007 (see CMT monthly report).

We have seen that the advantages of mixed bundling versus pure bundling depend on the correlation of values and the dispersion of tastes in the population. Namely, if some consumers value the different goods in a similar way whereas others value the goods very differently and with a very negative correlation (recall the restaurant example), then the advantages of mixed bundling are reinforced. In theory, mixed bundling dominates over pure bundling as mixed bundling allows the firm to use two more price instruments. In other words, the firm can always repro-

duce, through mixed bundling, the pure bundling demand configuration. According to this, one should always observe mixed bundling. This argument, however, does not take into account complexity and administrative issues (mixed bundling is more complex than pure bundling). Hence, it may make sense to use pure bundling when tastes over the different goods are not too negatively correlated.

Now, what do we observe in Spain? The dominant firm (*Telefónica*) mostly advertises its *duo* and *trio* packages. This is tantamount to offering a pure bundle in the broadband access and national voice calls markets while offering a partial mixed bundling menu in the broadband-plus-calls and TV markets. We say partial because while the consumer can choose not to purchase TV (if he or she opts for the *duo*), he or she cannot choose to purchase TV alone. This suggests that consumers' tastes over broadband access and calls are not too disperse: most consumers value the two goods in more or less the same way. In contrast, some consumers value highly the TV included in the internet package, while some other consumers do not value it too much. Notice that the tastes for the TV package are not to be understood as the tastes for the whole package, as most consumers have access to the main TV channels *for free* through DTT or analogical access. What is left? Mostly the thematic channels (sports, movies, and so on). It is quite likely that consumers' tastes over such channels be very dispersed. We could even reinterpret Table 1 above as follows. The reservation value R_1 would stand for the willingness to pay for the pure bundle of broadband access and calls, whereas the reservation value R_2 would stand for the willingness to pay for the thematic channels. There would be people like A, who do not value the pure bundle broadband-calls but value (some of) the thematic channels a lot; there would be people like D with exactly the opposite preferences; and there would be people like B or C who value the two more or less the same. If preferences for broadband access and calls are aligned throughout the population (in the sense that if someone values highly broadband, will also value highly calls and viceversa), this would explain why these two goods are bundled without the option of separate purchase.

7 Concluding remarks

One of the relevant issues in the economics of the telecommunications markets is the study of the consequences of the use of bundling strategies.

This paper reviews the main results of the theoretical literature both in terms of the strategic bundling of services and the normative arguments calling for regulation of the market when bundling yields anticompetitive behavior. Then, we appeal to these theoretical results to provide some insights of the Spanish telecommunications market. After describing some of its structural characteristics, we argue that although the sector is oligopolistic, competition prevails in all (sub)markets (voice calls, broadband, web services, and TV). Therefore, no equity issues arise. The use of bundling in the provision of services is seemingly associated with technological reasons.

This analysis leads us to conclude that the Spanish telecommunications regulator (*CMT*) need not regulate bundling activities. However, this is not to say that the telecommunications market should not be scrutinized and regulated.

Appendix: Data on broadband offers in Spain (March 2007)

Company	Downld speed	Includes Line	Includes rate voice	Includes basic TV	Includes Premium TV	Price offer	Line rental	Total
Orange	20 Mb	Yes	No	No	No	34.95	0.00	34.95
Orange	20 Mb	Yes	Yes	No	No	34.95	0.00	34.95
Orange	20 Mb	Yes	Yes	Yes	No	34.95	0.00	34.95
Orange	6 Mb	No	Yes	No	No	24.95	13.97	38.92
Orange	6 Mb	No	Yes	Yes	No	24.95	13.97	38.92
Orange	1 Mb	No	Yes	No	No	20.00	13.97	33.97
Jazztel	20 M	No	No	No	No	29.96	13.45	43.41
Jazztel	20 M	No	No	No	No	30.95	13.97	44.92
Jazztel	20 M	No	Yes	No	No	29.96	13.45	43.41
Jazztel	20 M	No	Yes	No	No	30.95	13.97	44.92
Jazztel	6 Mb	No	Yes	Yes	No	48.50	13.97	62.47
Jazztel	6 Mb	No	Yes	Yes	No	41.50	13.45	54.95
Jazztel	3 Mb	No	Yes	No	No	23.95	13.97	37.92
Jazztel	3 Mb	No	Yes	No	No	21.96	13.45	35.41
Jazztel	1 Mb	No	Yes	No	No	19.96	13.45	33.41
Arrakis	1 Mb	No	No	No	No	39.00	13.97	52.97
Arrakis	3 Mb	No	No	No	No	39.00	13.97	52.97
Arrakis	6 Mb	No	No	No	No	39.00	13.97	52.97
Arrakis	1 Mb	No	Yes	No	No	36.50	13.97	50.47
Arrakis	3 Mb	No	Yes	No	No	36.50	13.97	50.47
Arrakis	6 Mb	No	Yes	No	No	36.50	13.97	50.47
Ya.com	20 Mb	No	No	No	No	29.95	13.97	43.92
Ya.com	20 Mb	No	Yes	No	No	29.95	13.97	43.92
Ya.com	20 Mb	Yes	Yes	No	No	34.95	0.00	34.95
Ya.com	10 Mb	No	Yes	No	No	24.95	13.97	38.92
Ya.com	10 Mb	Yes	Yes	No	No	32.95	0.00	32.95
Ya.com	3 Mb	No	No	No	No	29.95	13.97	43.92
Ya.com	3 Mb	No	Yes	No	No	29.95	13.97	43.92
Ya.com	3 Mb	Yes	Yes	No	No	29.95	0.00	29.95
Ya.com	1 Mb	No	No	No	No	19.95	13.97	33.92
Ya.com	1 Mb	No	Yes	No	No	19.95	13.97	33.92

Company	Downld speed	Includes Line	Includes rate voice	Includes basic TV	Includes Premium TV	Price offer	Line rental	Total
Tele 2	20 Mb	Yes	Yes	No	No	39.95	0.00	39.95
Tele 2	3 Mb	No	Yes	No	No	37.90	13.97	51.87
Tele 2	3 Mb	Yes	Yes	No	No	32.90	0.00	32.90
Tele 2	1 Mb	No	Yes	No	No	33.90	13.97	47.87
Tele 2	1 Mb	Yes	Yes	No	No	29.90	0.00	29.90
Ono	6 Mb	Yes	No	No	No	40.00	0.00	40.00
Ono	6 Mb	Yes	Yes	No	No	50.00	0.00	50.00
Ono	6 Mb	Yes	No	Yes	No	40.00	0.00	40.00
Ono	6 Mb	Yes	No	Yes	Yes	56.50	0.00	56.50
Ono	6 Mb	Yes	No	Yes	Yes	66.50		66.50
Ono	6 Mb	Yes	Yes	Yes	Yes	66.50	0.00	66.50
Ono	12 Mb	Yes	No	No	No	50.00	0.00	50.00
Ono	12 Mb	Yes	Yes	No	No	60.00	0.00	60.00
Ono	12 Mb	Yes	No	Yes	No	50.00	0.00	50.00
Ono	12 Mb	Yes	No	Yes	Yes	66.50	0.00	66.50
Ono	12 Mb	Yes	Yes	No	No	60.00	0.00	60.00
Ono	12 Mb	Yes	No	Yes	Yes	76.50		76.50
Ono	12 Mb	Yes	Yes	Yes	Yes	76.50	0.00	76.50
Telefónica	10 Mb	No	Yes	No	No	44.90	13.97	58.87
Telefónica	10 Mb	No	Yes	Yes	Yes	63.40	13.97	77.37
Telefónica	3 Mb	No	No	No	No	39.07	13.97	53.04
Telefónica	3 Mb	No	Yes	No	No	39.90	13.97	53.87
Telefónica	3 Mb	Yes	Yes	Yes	No	51.40	13.97	65.37
Telefónica	3 Mb	Yes	Yes	Yes	Yes	56.40	13.97	70.37
Telefónica	3 Mb	Yes	Yes	Yes	Yes	57.40	13.97	71.37
Telefónica	3 Mb	Yes	Yes	Yes	Yes	58.40	13.97	72.37
Telefónica	1 Mb	No	Yes	No	No	29.90	13.97	43.87
Telefónica	1 Mb	No	Yes	Yes	No	51.40	13.97	65.37
Telefónica	1 Mb	No	Yes	Yes	Yes	63.40	13.97	77.37

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