

# 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.

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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 EU level according to the 12th Report on the Implementation of the Telecommunications Regulatory Package 2006.

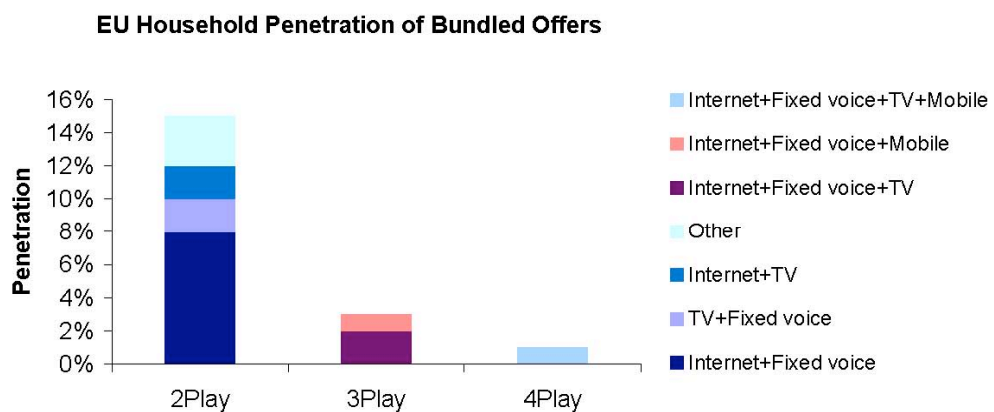


Figure 1: Bundles in the EU

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

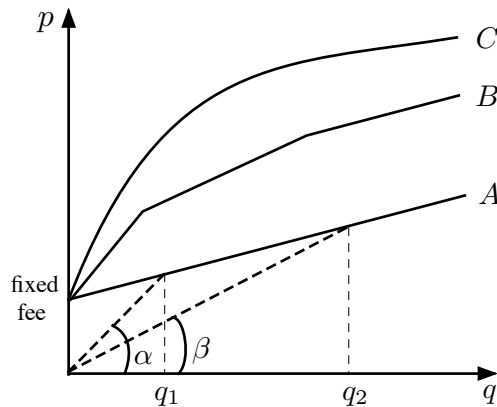


Figure 2: Non-linear prices.

*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 Philips (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 scheme, 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. The vertical intercept represents the access fee to the market (e.g. an entry fee, or a connexion fee), and the slope of the tariff represents the marginal price, and the slope of the line from the origin to a point in the tariff, the average price. That is, the average price faced by a consumer buying quantity  $q_1$  is given by (the tangent of the angle)  $\alpha$ . Similarly, the average price for a quantity  $q_2$  is given by (the tangent of the angle)  $\beta$ . 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.

## 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, only 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 maintenance of those machines or cameras and complements for those cameras. Tying can be contractual or by design. For example a telecom case 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 commercial 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.<sup>1</sup> Any intervention that takes place will 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 reach efficiencies, and (iii) bundling as a means for an anti-competitive 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, 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 between 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 €, and consumer *B* would value the bundle at 100 €. Note that the dispersion

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<sup>1</sup>See for example the DG competition discussion paper on the application of Article 82 of the Treaty of Rome.

of valuations for the bundle is smaller than 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, and (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 product 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 service 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 (1985), overcame the Chicago Critique that one monopoly rent was possible by explaining bundling how the incentives to sell more of the monopoly service through the bundle result on a business stealing effect (reducing prices and/or the rivals demand in service B) that depresses the rivals profitability and the firm profitability in the bundled service market. The exclusionary effect takes place if rivals in this second market have fixed costs which they cannot recoup 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 are 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. Accordingly, 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. Bundling should be discouraged when goods are positively correlated,

Kobayashi (2005a,b) offer 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.

Section 3 presents an example where a monopolist producing two goods de-

cides 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 main conclusion of the example is 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) characterize when the effect of pure bundling of lowering the variance of the willingness to pay 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 is when 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.<sup>2</sup>

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

Section 6 draws some conclusions in the case of telecommunications.

### **3 Bundling by a monopolist in both goods. 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.

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<sup>2</sup>Note that this second good may be sold separately by the firm (tying) or may not be sold separately by the firm (pure bundling).



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 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  $(p_1, p_2, p_b) = (p_1^m, p_2^m, p_b^m)$ .

### 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  $R_i \geq p_i$  ( $i = 1, 2$ ), and thus they buy both products.

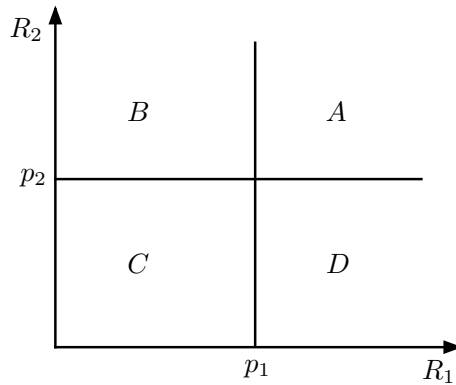


Figure 3: Market segmentation with monopoly prices.

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 thus 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 thus are excluded of the market.

### 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.

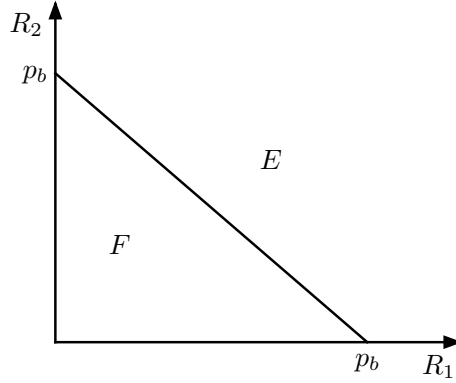


Figure 4: Market segmentation with pure bundling.

Consumers in the (open) area defined as  $G \equiv 0p_2xy p_1$  are characterized by  $R_i < p_i$ ,  $i = 1, 2, b$ . Accordingly, these are consumers that 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 access to both product 1 and also 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 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 fig-

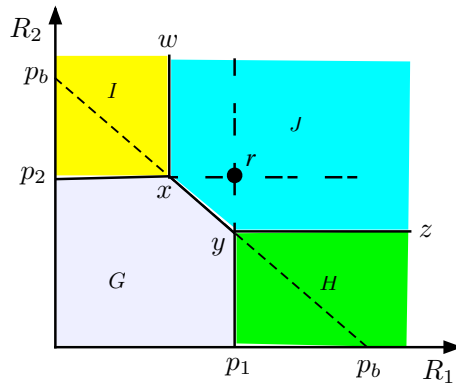


Figure 5: Market segmentation with mixed bundling.

ures 3 i 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 levels 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 only do so thus inducing 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.

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

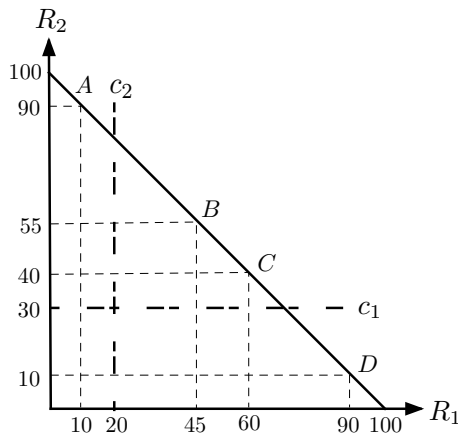


Figure 6: A numerical example.

$p_1 = 60, p_2 = 90$ , 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 a price  $p_b = 100$ . All consumers will buy, and the firm will obtain profits of 200. This strategy yields profits closer to the ones corresponding to 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 in a first degree price discrimination situation. Naturally, this situation appears more frequently the higher the marginal production 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.	$p_1$	$p_2$	$p_b$	$q_1$	$q_2$	$q_b$	$\pi$	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.<sup>3</sup>

These examples help to understand why restaurants offer closed menus together with *à la carte* menu. The same dish is more expensive when we order it isolated than within a closed menu. There are no scale economies in preparing the dishes contained in the closed menu as compared with those same dishes offered *à la carte*. Quoting Adams and Yellen (1976, p.488),

Some people value an appetizer relatively highly (soup on a cold day), 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, the mixed bundling is the strategy yielding the highest levels of profits when some consumers have reservation prices below the marginal production

<sup>3</sup>Note as commented above, that monopoly prices and mixed bundle prices do not coincide.

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 as 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 surplus from the 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 is the

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

Table 3: Highly dispersed reservation prices.

sense that consumers can be identified by their strong preference for either one product or the other.

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 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.	$p_1$	$p_2$	$p_b$	$q_1$	$q_2$	$q_b$	$\pi$	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.

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

Strat.	$p_1$	$p_2$	$p_b$	$q_1$	$q_2$	$q_b$	$\pi$	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.

goods the total willingness to pay is harmonized. This allows the firm to better extract surplus. This is illustrated with the next and last example (see 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 in a lesser degree 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.	$p_1$	$p_2$	$p_b$	$q_1$	$q_2$	$q_b$	$\pi$	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 as a means to extend its market power to related or unrelated service market by altering the market structure of these related services. These anticompetitive effects are more likely the stronger is the tie- (the tie is stronger for pure bundles, then tying and then mixed bundles).

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

Assume that a bundle is composed of product star and its complement.<sup>4</sup> 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 complement good value for consumers is  $w$ . Its market is perfectly competitive and the price is  $c$ . The star monopolist may also sell the complement at a marginal cost of  $c_m$ , which may be greater or smaller than  $c$ . There are no fixed production costs. Complementarities imply an added value of a bundle to consumers:  $\Delta > 0$ . This is, the value of the bundle is  $v + w + \Delta$ .

**(i) No bundling by the monopolist:** The price of the star product is  $v + \Delta$ . The monopolist may only sell its complement if  $c_m \leq c$ . The unit profits accrued by sales of the star product are  $v + \Delta$ , 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 rivals complement with price  $c$ . This is, if  $v + w + \Delta - P > w - c$ . Hence, the maximum price  $P$  that the monopolist may charge is  $v + c + \Delta$ , which yields a unit profit for the bundle of  $v + c + \Delta - c_m$ .

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

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<sup>4</sup>For example, think of hardware and software, or a mobile phone and its services, or a DTT decoder and the programming content of the different TV channels to which the decoder gives access.

loses out by bundling. The reason is that to extract the monopoly rents of the star product ( $v + \Delta$ ), it must fix a price of the complement of  $c$ . If the monopolist is inefficient, this implies “implicitly” selling complement 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 secondary service. 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 with complementary services.

Indeed that bundling could result in aggressive pricing, was already noted by Telser (1979), which showed that in the bundle the implicit price of a tied commodity could be smaller than its marginal cost. Consider a consumer  $i$  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 that show how bundling strategies may hinder entry in the monopoly and related markets.

Aghion and Bolton (1987), study how the penalties in the contracts with core provisions affect the market structure of the complement product. Usually, contracts with core provisions contain a penalty on the client should this client violate those provisions. 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 discount high enough to compensate the client against the loss  $D$ . This can only happen if the efficiency of the entrant is supe-

rior 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 monopolised 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 would bundle. Here 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 rivals cheaper complement. Hence, as in Whinston, precommitment is necessary for the anticompetitive effect to accrue.<sup>5</sup> Contrarily, 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. Here, price discrimination by the monopolist provides the reason for bundling (which increases profits) but also the entry deterrence effect since the discount 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 of it 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

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

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 where they 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 but that if they gave computer purchasers the choice whether or not to buy Office along with their machines, the OEM's bulk prices for Windows would rise, making their computer prices less competitive in the market. The Novell litigation is still ongoing.<sup>6</sup>

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 the Hotelling's model of horizontal differentiation, 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

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<sup>6</sup>See Civil No. JFM-05-1087.

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 as 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 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 the absence of fixed costs and a constant marginal cost of producing  $q_j$ , ( $j = 1, 2$ ) denoted by  $c_j$ . 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), using a similar model 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 work of just one of them. A classic example of this is the selling of razors at a loss and the making of profit on blades. Hence, the papers which have analysed bundling in such circumstances, study whether bundling Nash equilibria emerge 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 homogeneous goods, Bertrand pricing would take place and bundling would make no difference to this outcome. A first distinction to be made between the papers dealing with bundling and competition is whether in those 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.

Matutes and Regibeau (1988, 1992) are two classical references for the first of the two options. In both papers the authors consider a two firm setting where 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  $P_{2B}$  has a utility of  $W - P_{1A} - P_{2B} - t(i) - t(1-j)$ , where  $W$  is the willingness to pay for the services. Consumers choose their purchases to maximize utility. Figure 7 illustrates how demands look like when both firms use symmetric prices and strategies [(a) pure components pricing, (b) pure bundling and (c) mixed bundling].

In Matutes and Regibeau (1988) the authors compare the outcomes with pure bundling and with separate prices showing that pure bundling is a worse option for



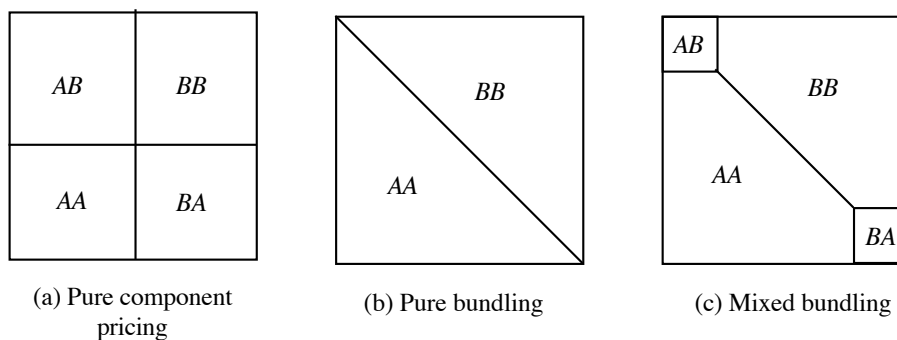


Figure 7: Demand under different pricing strategies.

both firms.<sup>7</sup> The reason is double. First, pure component pricing allows consumers to benefit from variety raising their willingness to pay and increasing demand.<sup>8</sup> In turn, this increases the firms profit. Second, there is a strategic effect which has to do with the size of the marginal consumer. With pure bundling reducing the bundle price results in more sales of product *A* and *B* (for example in Figure 7(b), this shifts the boundary of the demand region outwards for *A*). With component pricing reducing the price of a component raises this demand but also increases sales of the complement product, but here both for firm *A* or for firm *B*. Hence, there is less of an incentive to reduce prices. Component pricing softens competition and this, in turn increases firms profits. In the second paper, the authors compare the situation with pure component pricing and the situation with mixed bundling, showing that the game has a prisoner dilemma structure with a “sub-optimal” equilibrium which is that both firms engage in mixed bundling where pure component pricing would be best for both as the mixed bundling equilibrium results in lower prices for all services. In this setting if firms could precommit not to engage in bundling they would. In an example based in this paper Armstrong (2006) explains that the aggressiveness induced by mixed bundling is due to the fact that bundling makes consumers more homogeneous, raising the size of the marginal consumer.

A recent work by Thanassoulis (2007) has casted light into the effects of mixed bundling on consumer surplus and welfare by making the distinction between

<sup>7</sup>Economides (1989) generalizes the analysis for  $n$  firms.

<sup>8</sup>In the paper situations where not all the market is covered are studied.

“firm specific preferences” and “product specific preferences” and by setting 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, the papers by Matutes and Regibeau depict a situation where only “product specific preferences” exist (this is each product is differentiated as opposed to there being a brand preference which is independent of the number of products considered) and where there are no “small” consumers. Indeed, even with “small” consumers, where 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 with pure component pricing. The intuition is clear. In this situation with pure component pricing, firms compete for “small” and “large” consumers with exactly the same instruments and are unable to segment those demands. In this situation competition for large consumers yields a protective shield for small consumers. However, mixed bundling (i.e. price discrimination) undoes this protection and small consumers suffer from large prices for individual goods.

## **6 The Spanish case**

We argue next that, as the telecommunication sector in Spain is not monopolized (it is rather an oligopoly), and that competition seems to prevail in all of the markets for products susceptible to be bundled with telecommunications, we are not facing any equity issue justifying regulation. Thus, the bundling strategies used by the firms competing in the Spanish telecommunications market can only be related to technological reasons. In this sense, bundling *per se* should not be object of regulation by the Spanish telecommunications agency. This is not to say that the telecommunications itself market should not be surveiled and regulated.

## 6.1 Historical perspective

In Spain, it was the cable operators that were the first ones to have the possibility to, and did go for, bundling distinct services. Nowadays, not only these operators but also other that use other technologies currently bundle services. For instance, currently 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 carried out has taken the mixed form. 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, Telefonica offers a flat rate for national voice calls of 15 Euros per month, and also a 1Mega ADSL service at 39,07 Euros per month, for a total of 54,07 Euros per month if purchased separately. In contrast, if the bundles is purchased the price per month is 39,90 Euros per month. (These fees do not include the fixed line rental fee.). Hence, bundle purchasers 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.<sup>9</sup>

<sup>9</sup>The inclusion of international voice calls in the package has proven to be rather more difficult.

## 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 bundling of the first three products while they engage in mixed bundling as for the third. An exception is *ONO*, who offers all possible combinations of the different products.

Company	Speed	National calls	Web space	Price	TV
Arrakis	1	yes	50	58,26	no
Comunitel/Tele 2	1	yes	50	38,10	no
	3	yes	50	56,80	no
	20	yes	50	46,28	no
Euskaltel	0,3	no	25	27,84	no
	3	no	25	45,24	no
	12	no	25	87,00	no
	24	no	25	139,20	no
Jazztel	20	yes	25	32,37	no
	3	yes	25	27,70	no
	6	yes	25	48,14	yes
	1	no	25	9,98	no
ONO*	6	yes	no	58,00	no
	12	yes	no	69,60	no
	25	yes	no	87,00	no
	6	yes	no	64,35	yes*
	12	yes	no	75,95	yes*
	25	yes	no	81,50	yes*
Orange	1	yes	100	39,09	no
	6	yes	100	44,89	no
	20	yes	100	50,69	no
	2	yes	100	59,90	yes
Telefonica	1	yes	50	50,39	no
	3	yes	50	62,20	no
	3	yes	50	83,63	yes
	10	yes	50	73,89	no
	20	yes	50	189,9	no

\*"Essential" TV package. Two higher quality packages exist.

Source: <http://www.adslzone.net/comparativa.html> and published data by companies.

Table 10: Main competitors' menus of offers in Spain.

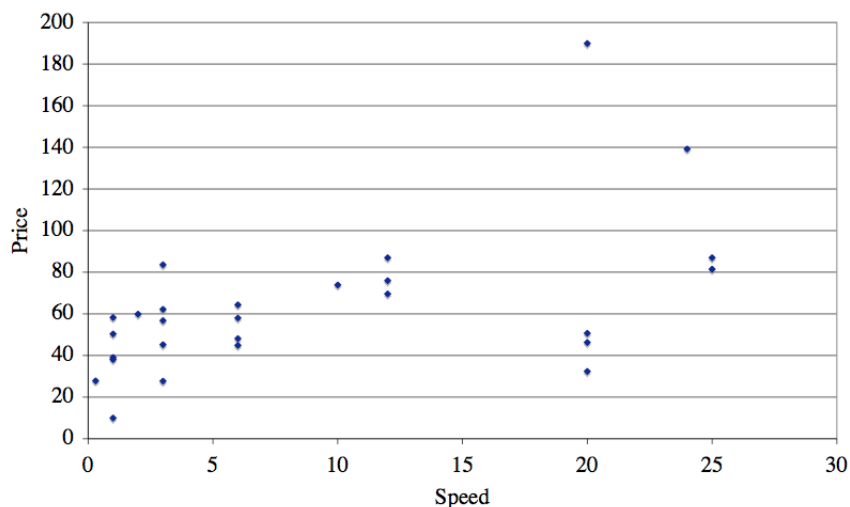


Figure 8: Speed and price in Spanish broadband telecommunications market.

Table 10 reports the main competitors' menus of offers as of September 7, 2007. We have omitted fixed entry costs like enrollment fee and the cost of the router. The broadband speed is in Mb per second, upstream. The Web space is in Mb. The price per month, in Euro, includes the monthly connection fee, the decoder monthly rental fee if TV is offered, and the VAT. The figures for *Ya.com* are not included since this company had previously been absorbed by *Orange*.

Figure 8 depicts the scatter plot of speed and price as reported in Table 10. Notice that some points represent offers including TV while other do not. Moreover, the different TV packages are not easily compared, due to the inclusion of more or less channels, pay per view conditions, and so on. Therefore, the interpretation should be done with care. As one can see, competition exists in all products and quality (speed) segments. It is therefore quite unlikely that firms are engaging in anticompetitive behavior, at least through bundling.

Although it is true that the analysis conducted in Section 3 was made under the assumption 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 *Telefonica*, who serves 61% of the market of broadband access. In particular, we have seen that the advantages of mixed bundling versus pure bundling depend on

the correlations and dispersion of tastes in the populations. 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 advantages of mixed bundling are reinforced. Of course, 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 reproduce, 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 does 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 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 dispersed: most consumers value the two goods in more or less the same way. In contrast, some consumers value the TV through the internet package a lot 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 broadband a lot it will also value calls a lot and viceversa, this would explain why these two goods are bundled without the option of separate purchase.

## **7 Concluding remarks**

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