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Abstract

Bundling and non-linear pricing are popular price-discrimination techniques for offering paid content products. In this paper we analyze the different kinds of non-linear pricing strategies that are observable in the paid content market and the relationship between non-linear pricing and bundling. Another goal of our empirical analysis is to show which design of non-linear pricing leads to a high demand for large bundles, thus maximising revenues and profits.

Our results show that companies maximize their profits with non-linear priced paid content products only if the bundles or pricing schemes are designed correctly in order to induce consumers to increase purchasing activity. This should be done by concentrating on the quantity provided to the consumers, as consumers seem to respond more to a change in quantity than to a reduction in the price. As the marginal cost of digital content or services is generally small or even zero, increasing quantity at a lower price per unit is a feasible strategy.

Keywords: *non-linear pricing, bundling, block tariffs, paid content, information goods*

1. Introduction

In electronic markets digital information goods were distributed free to consumers for many years. Content providers achieved their revenues through advertisement. After the consolidation of the Internet boom in 2001 and the decline of advertisement revenues many companies changed their business models and started to sell information goods -

goods which had been available for free until then. This change in content providers strategy required a change in consumer behaviour, as consumers were now requested to pay for digital content, instead of receiving it for free.

Paid content products are a special form of information goods ((Shapiro & Varian, 1999); (Varian, 1998), (Clarke, 2000); (Brandtweiner, 2000)) and are counted among digital products ((Whinston, Stahl, & Choi, 1997); Clarke, 2000; Brandtweiner, 2000:37). Shapiro and Varian (1999: 3) define the term information good very broadly: "Essentially, anything that can be digitised - encoded as a stream of bits - is information. [....] Baseball scores, books, databases, magazines, movies, music, stock quotes, and Web pages are all information goods" (Shapiro, Varian 1999:3). Based on the definition provided by Whinston et al. (1997:61 f.) anything that can be send or received over the Internet has the potential to be a digital product: "Information is a primary example of a digital product, for example knowledge-based goods that can be digitised and transferred over a digital network" (Whinston et al. 1997:61 f). In this paper the term paid content is used as the non-free sale and distribution of information-based content products.

According to Varian (1998), information goods have three main properties that would seem to present difficulties in market transactions: (i) information goods are experience goods ("You must experience an information good before you know what it is") (ii) they have economies of scale ("Information typically has a high fixed cost of production but a low marginal cost of reproduction") and (iii) they have the characteristics of public goods ("Information goods are typically non-rival and sometimes nonexcludable") (Varian, 1998).

Therefore in order to sell information goods as paid content it is essential to develop strategies to eliminate these market transaction difficulties. Especially due to the paid content's zero or near zero marginal cost characteristic the paid content market structure is not competitive and suppliers are likely to gain market power, sometimes acquiring a natural monopoly. This market power enables suppliers to discriminate (Varian, 2001) among consumers, according to their willingness to pay by using price discrimination techniques.

Non-linear pricing is a popular price-discrimination technique (Sundararajan, 2003) and has been analysed extensively in the context of electricity and long-distance telephone markets (Wilson, 1993). Sundararajan (2002) shows that in information markets firms are most likely to profit from low pay per click pricing, "but as these markets mature, the optimal pricing mix should include a wider range of usage-based pricing options" (Sundararajan 2002).

1.1 Research Questions

This leads to the following research questions: Which kind of non-linear pricing is observable in the paid content market? Which relationship exists between non-linear pricing and bundling? Which non-linear pricing strategy leads to a high demand for large bundles, which will maximise revenues and profits?

The paper is organized as follows. The next section gives an overview of the literature to non-linear pricing and bundling theories. Based on these theories, we examine the non-linear pricing behaviour of suppliers and consumers' purchasing behaviour using a new set of empiric data. In the final section we discuss the impact of our empirical findings on existing theories and the implications of these empirical findings.

2. Related Literature

Non-linear pricing has been discussed extensively. As a generic term, it refers to any case where a tariff is not strictly proportional to the quantity purchased (Wilson 1993:4). A two-part tariff is the simplest example of a non-linear tariff, in which the customer pays an initial fixed fee for the first unit (often justified as a subscription, access, or installation charge) plus a smaller constant price for each additional unit. According to Wilson (1993:5) the term non-linear pricing is usually restricted to tariffs that are offered on the same terms to all customers. Thus, each customer pays the same marginal price. Several kinds of non-linear tariffs are shown in Figure 1.

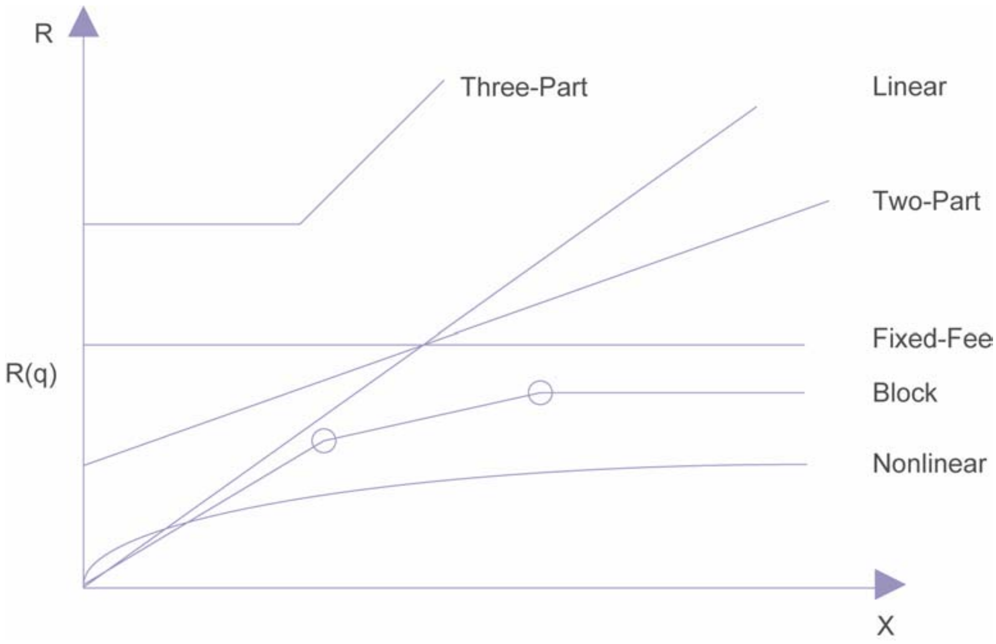

Figure 1: Several kinds of non-linear tariffs (source Whinston 1993:5)

In the following the most relevant articles and approaches to non-linear pricing will be presented chronologically.

Oi (1971) considers a profit-maximizing Disneyland monopoly which sets prices for admission to the park and for individual rides. The park`s costs are assumed to vary only with the number of rides taken, while households derive utility only from rides, not from being in the park. If all households were identical, the optimal policy would be to sell rides at marginal cost and to set the admission fee so as to convert all the consumers' surplus into profit (Schmalensee, 1981). Therefore Oi (1971), Feldstein (1972) and Ng and Weisser (1974) have examined optimal two-part-pricing policies.

Schmalensee (1981) presented the implications of customer diversity and other market attributes for optimal pricing policies of two-part pricing arrangements. He also compares the welfare properties of single-price and two-part tariff monopoly equilibria and discusses the potential welfare gains from tying contracts.

Goldman et al. (1984) consider optimal non-uniform pricing schedules, where the price depends upon the quantity purchased. They characterize situations in which upward or downward discontinuities in pricing schedules are optimal.

Wilson (1993) shows that in constructing a non-linear tariff for a profit-maximizing monopoly firm the customers demand profile is used, because the advantages of non-linear pricing stem from consumer heterogenity. For a profit-maximizing firm, the schedule of marginal prices is derived by optimising the price charged for each increment in the purchase size. With modifications, this principle applies also to access fees and multipart tariffs (Wilson 1993:19).

According to Armstrong (1996) the main results of previous work on the single-product non-linear pricing have been (i) discovering ways to solve the optimal tariff question; (ii) showing that in many cases the firm will wish to differentiate fully among its customers, so that customers with different tastes buy different quantities; (iii) showing that those customers with the strongest preferences for a particular good are served efficiently, with others being served smaller quantities than would be efficient in a world with full information, and (iv) showing that in many cases it is optimal for the firm to offer quantity discounts, so that the marginal price for a unit of the good decreases with the total quantity purchased. Armstrong (1996) analyses the multiproduct non-linear pricing problem. The results presented show that in a wide variety of situations the firm found it optimal to exclude some low-demand consumers from the market. He also derives a class of cases that allow an explicit solution by using a multivariate form of “integration by parts”.

The work most closely related to our research is an article by Sundararajan (2002), in which he analyses optimal pricing for information goods under incomplete information, when both unlimited-usage (fixed-fee) pricing and usage-based pricing are feasible. He shows formal, that the optimal usage-based pricing schedule is independent of the value of the fixed-fee. He also presents a procedure for determining the optimal combination of fixed-fee and non-linear usage-based contracts. In contrast to Wilson (1993) whose findings show under similar assumptions that the optimal monopoly pricing structure is purely usage-based, Sundararajan (2002) incorporates administration costs (e.g. for monitoring usage, billing …) and shows that when there are no marginal production costs from additional usage, a purely usage-based pricing scheme is not optimal.

3. Non-linear Pricing through Bundling and Block Tarifs

Though technically possible, selling digital products separately is not always a profit-maximising strategy. Bundling, which is a special form of price discrimination, can be a more efficient way to sell digital products. According to Bakos and Brynjolfsson (1999), the reason for that can be derived graphically from a standard demand function.

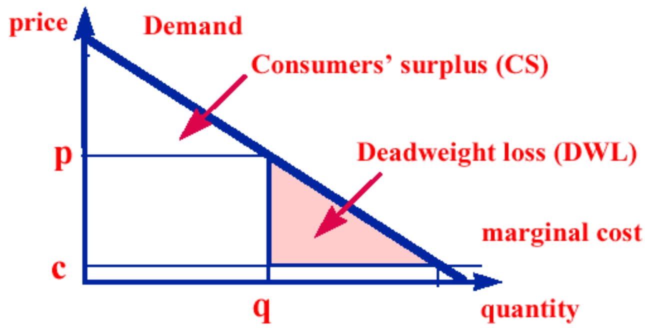

Figure 2:

Using a standard one product demand function, the consumer surplus and the deadweight loss can be easily derived. The deadweight loss could be avoided only if the price were set equal to marginal cost, which is, as already described not optimal or even feasible in a market for digital goods with prices near or equal zero. Any price set above the marginal cost, however, creates a deadweight loss.

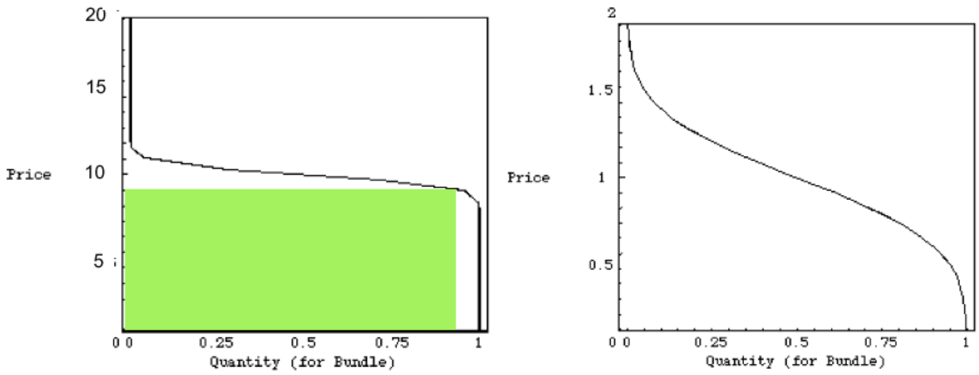

Figure 3:

Bundling provides a way of solving this dilemma. Looking at the demand function for a two product bundle, with each of the products being valued independently by consumers on a scale from [0;1] e.g. setting the price accordingly, the following effect on the demand curve can be observed. The bundle of the two goods is being valued on a scale of [0;2]. The area below the combined demand curve equals the two areas below each of the single product demand curves, but the slope changes, being more elastic around the median and less elastic at each end of the interval. Adding more products to this bundle expands this effect, as can be seen in a 20 product bundle demand curve. With more products being added to the bundle, the median utility for consumers is concentrated around the median price of the bundle. An optimal pricing strategy can be derived from this effect, which is described in detail by Bakos and Brynjolfsson (1999), who show that the profit derived from bundling diverse goods grows the bigger a bundle is, because "the law of large numbers assures that the distribution for the valuation of the bundle has an increasing fraction of consumers with "moderate" valuations near the mean of the underlying distribution, […] the demand curve becomes more elastic near the mean and less elastic away from the mean" (Bakos, Brynjolfsson 1999:5).

An alternative view is provided by Wilson (1993), who construes non-linear pricing as an instance of bundling, if products are non-diverse. "Products are said to be bundled if the charge for a purchase of several products in combination is less than the sum of the charges for the components. Bundling applies to products that are diverse, but if the "products" are units of the same generic commodity then the effect is the same as non-linear pricing. That is, for a bundle of two units a customer is charged less than twice the charge for a single unit" (Wilson 1993:88).

Bundling therefore enables merchants to optimise their pricing strategies in order to maximise profits. Adding more products to a bundle simplifies setting the optimal price, overcoming problems of imperfect information on consumer preferences.

Furthermore the bundling approach can be compared with a block-tariff and block pricing, where the price per unit declines with the quantity purchased by a particular customer (quantity discounts). An example of a block tariff is illustrated in Figure 4. According to Klein and Loebbecke (1999), block pricing and quantity discounts tend to result in greater revenues, because heavy users pay prices which are closer to marginal cost. "However, it does not convert all consumer surplus into profit like it is the case with perfect personalization, where the number of blocks would equal the number of customers" (Klein, Loebecke 1999).

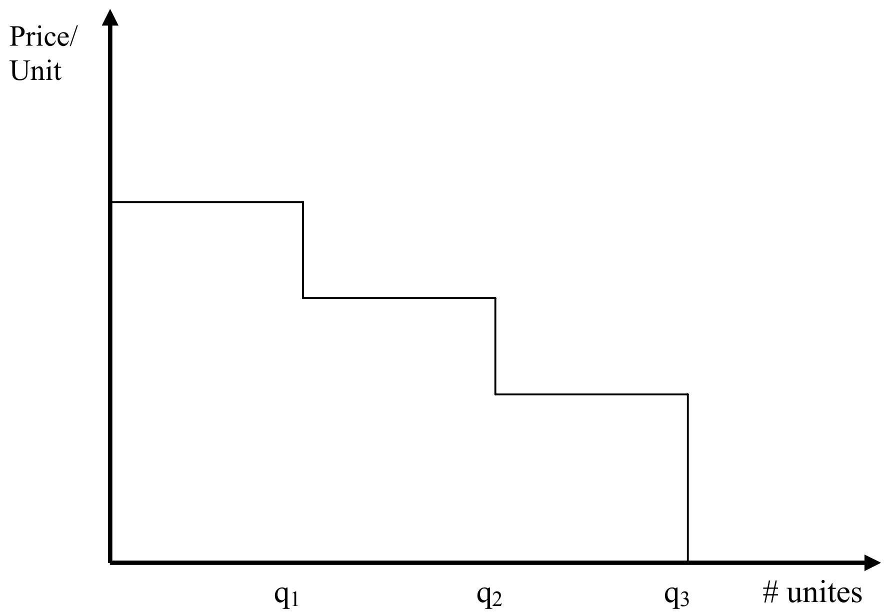

Figure 4: Block Tariff

Shapiro and Varian (1998) illustrate the relation between the bundling approach and non-linear pricing considering music songs as an example, where the first song would cost $1.20 and each additional song would cost $1. Under this price system two heterogeneous consumers with different musical tastes would choose two songs and the supplier would end up with $4.40, just as if the supplier had bundled the products. "This example shows that quantity discounts can play the same role as bundling. In fact, quantity discounts can be thought of as a generalized form of bundling and are useful for much the same reasons that bundling is useful" (Shapiro, Varian 1998:78).

According to theory, bundling reduces the variations in heterogeneous consumers' willingness to pay. The aggregation of complementary goods can increase suppliers' revenues if (through the aggregation) the variation across customers in their willingness to pay decreases. Non-linear pricing can also be used to allow consumers to build their own bundles. As bundling quantity discounts can increase usage and revenue at the same time (Shapiro, Varian 1998:81).

Empirical evidence about non-linear pricing and the increase of usage and revenues was shown in a report on the PEAK Experiment. MacKie-Mason et al. (1999) show that institutions that could purchase generalized subscription tokens tended to purchase more tokens than they needed to cover all demand for articles by their users; i.e., they didn't run out of tokens. This means, that institutions purchased more tokens at a lower price per token than they needed, because bigger bundles are relatively cheaper (because of the quantity discount). It is cheaper for institutions to purchase biggers quantities of tokens to reduce the risk of having to purchase additional access on a per-article basis.

Reflecting these theoretical approaches, bundling and non-linear pricing is strongly interrelated. Both, bundling as a device of product differentiation and non-linear pricing as an instrument for price differentiation have the goal of skimming consumer surplus. Based on the model established by Bakos and Brynjolfsson (1999) and Wilson's (1993) observations the following hypothesis can be derived: Suppliers of paid content products should design non-linear block tariffs so that consumers choose larger bundles more frequently than smaller bundles - analogous to bundling theories.

4. Empirical Analysis of Non-Linear Pricing of Paid Content

In the paid content market non-linear pricing is mostly implemented in the form of block tariffs, using parameters such as time, number of coins or quantity of products (e.g. the number of SMS). Block tariffs in the paid content market are provided for example by suppliers who use subscription pricing models and offer their users one month, six months and twelve months subscriptions, with a decreasing price per month for each subscription segment.

The following section presents the results of a quantitative analysis, in which the block tariffs of more than 50 suppliers of paid content were analysed.

4.1 Data

The hypotheses for non-linear pricing of paid content on electronic markets were tested on a set of data from the German payment provider FIRSTGATE, which is the leading micropayment provider in Germany, with 2500 suppliers of paid content and paid services and 2.5 million registered users.

A sub sample of 55 suppliers was drawn for the empirical analysis. The criteria for the selection of suppliers was based on the requirement that each supplier priced their paid content products with a non-linear block tariff.

This sub sample consist of 352´460 purchase transactions made by 161´750 customers in the period January 2003 to December 2003, representing all the suppliers purchase transactions in the given period.

4.2 Methodology and Results

Analysis of the data was performed in several steps. First, we computed the absolute and relative distribution of the number of suppliers according to the chosen number of segments of the non-linear block tariff. Based on this distribution, the percentage of suppliers with increasing and decreasing number of purchase transactions in higher price quantity segments was calculated.

Table 1 shows that more than 50% of the suppliers chose a non-linear block tariff with three segments. Only 20% of the suppliers had designed their tariff with more than 3 segments. Table 2 also shows only 28% of the suppliers are experiencing higher number of purchase transactions for the high price quantity segments then for the loweprice segments. This means that for two thirds of the suppliers the non-linear block tariffs are designed in such a way that most of the consumers choose the smallest quantity with the highest price per unit.

Table 1: Distribution of the number of suppliers according the choosen number of segments

Supplier's number of segments	Number of Suppliers (absolut)	Number of Suppliers (relative)	Percentage of suppliers with increasing number of purchase transactions in higher price-quantity segments	Percentage of suppliers with decreasing number of purchase transactions in higher price-quantity segments
2 segments	16	29.09	0.250	0.750
3 segments	28	50.91	0.222	0.777
4 segments	7	12.73	0.429	0.571
5 segments	4	3.64	0.250	0.750
Average			0.288	0.712

Table 2 shows the distribution of the most frequently demanded segments of the non-linear block tariffs among the suppliers observed. The values show that only a few suppliers design their block tariffs in such a way, that most consumers would choose the biggest quantity or bundle with the smallest price per unit. The tariffs of most of the suppliers induce the consumer to choose the smallest quantity or bundle with the highest price per unit.

Table 2: Segments with the most purchase transactions

Supplier's number of segments	(smallest quantity - highest price per unit)			(biggest quantity - smallest price per unit)	
	1	2	3	4	5
2 segments	12	4			
3 segments	21	5	1		
4 segments	3	3	0	1	
5 segments	1	2	1	0	0

In order to analyse the reason for this consumer behaviour, we computed the difference of the price per unit between two tariff segments that featured higher resp. lower purchases for higher price segments. The percentage quotation in Table 3 shows that suppliers with high numbers of purchase transactions in higher price-quantity segments reduce the price per unit between two price segments (-38% on the average) much more than suppliers with small numbers of purchase transactions in higher price-quantity segments (-16,3% on the average). The difference between the price-cutting per unit by suppliers featuring high purchase figures and that by suppliers with low purchase figures in the last column of Table 4 shows that a reduction of an additional 21.7% in prices leads to an increasing demand for high priced segments. Hence, consumers seem to be attracted to buying larger quantities only if the reduction in price per unit is substantial.

Table 3: Influence of price-per-unit alteration on demand behaviour at non-linear tariffs

Supplier's number of segments	Percentage of suppliers with an increasing number of purchase transactions in higher segments	relative alteration of the price per unit between two tariff segments with an increasing number of purchase transactions	Percentage of suppliers with an decreasing number of purchase transactions in higher segments	relative alteration of the price per unit between two tariff segments with an decreasing number of purchase transactions	Difference of the price-cutting per unit between suppliers with increasing and suppliers with decreasing number of purchase transactions
2 segments	25.0%	-56.1%	75.0%	-34.2%	21.8%
3 segments	22.2%	-27.2%	77.7%	-15.7%	11.5%
4 segments	42.9%	-13.6%	57.1%	-7.5%	6.1%
5 segments	25.0%	-55.3%	75.0%	-8.0%	47.3%
Average	28.8%	-38.0%	71.2%	-16.3%	21.7%

For a detailed analysis of consumer reaction to the diffent price segments offered we calculated the difference in quantity provided and the difference in price between two price segments. These values show the influence of the relative change of the quantity and the influence of the relative change of the price on the number of purchase transactions between two segments.

Table 4:

	Relative alteration of the **quantity** between two segments (average)	Relative alteration of the **price** between two segments (average)	Relative alteration of the **price per unit** between two segments (average)
Decreasing number of purchase transaction between two segments	4.96	2.96	0.83
Increasing number of purchase transaction between two segments	7.77	2.38	0.66

Table 4 shows that for high priced segments with a weak consumer adoption rate the quantity or the bundle size increases by a factor of 4,96 compared to the lower priced segment offered. For segments featuring a strong consumer adoption rate, the quantity or the bundle size increases by a factor of 7,77 compared to the lower priced segment offered. In comparison, the change in price between two segments is on the average much smaller. For segments with a weak consumer adoption rate the price rises by a factor of 2,96 compared to the lower priced segment offered. For segments with strong consumer adoption rate, prices increased by a factor of 2,38 compared to the lower priced segment offered.

The difference in the change of quantity and the change in price between price segments shows that the change in price has less influence on the consumers buying decision than the change in quantity. Therefore the consumers' choice depends more on the change of quantity between two bundles than on the change of price between two bundles. This result is important, as the marginal cost of paid content is near zero.

For analysing the direction and magnitude of the influence of changes in price and quantity, several correlation coefficients were computed. In Table 5, the correlation coefficients between the relative alteration of the quantity, price, price per unit, the alteration of the quantity in comparison to the alteration of the price and the relative change of the number of purchase transactions between two segments are listed.

Table 5 shows that the correlation coefficient between the relative change in quantity and the difference in number of purchase transactions between two segments is positive, but that the correlation coefficient between the relative change in price, as well as the price per unit between two segments is negative. Therefore, a larger change in quantity between two segments leads to an increased number of purchase transactions in high priced segments with bigger bundles. In contrast, a larger change in price, or price per unit, between two segments leads to a decrease in number of purchase transactions in high priced segments with large quantities.

Table 5: Correlation Coefficients

correlation coefficient	Relative alteration of the quantity between two segments	Relative alteration of the price between two segments	Relative alteration of the price per unit between two segments
Relative change of the number of purchase transactions	0.1491	-0.0290	-0.0804

In order to analyse the significance of these relationships an ANOVA was computed. The "Analysis of Variance" is a method, which analyses the effect of one or several independent variables (e.g. the relative alteration of the quantity or price between two segments) in relation to one dependent variable (e.g. relative change of the number of purchase transactions) (Backhaus, Erichson, & Plinke, 2003). In order to analyse the impact of the relative change in quantity or price or price per unit between two segments on the dependent variable (relative change in the number of purchase transactions) we computed a one-way ANOVA. The results are presented in Table 6 to Table 9 in Appendix 1.

As shown in Table 7 and Table 8 a highly significant influence of the relative alteration of quantity and price on the relative change of the number of purchase transactions can be identified. The model was applied to 107 observations (see Table 7 and Table 8) and the R^2 of the model is more than 0.6, which is an indicator for high significance.

In Table 9 an even more significant influence of the type of bundling on revenue could be identified ($R^2 = 0.99$). These statistics fully support the hypothesis that the relative change in quantity between two segments is positive and that the relative alteration of the price and price per unit between two segments is negative correlated in relation to changes of the number of purchase transactions in high priced segments.

To answer the research question not only the influence, but also the kind, of interrelation is of interest. The kind of interrelation was analysed by a multiple non-linear regression, which helps to analyse the influence of the relative alteration of the quantity, price and price per unit between two segments, as well as the influence of the number of tarif segments on the relative alteration in the number of purchase transactions between two segments. The multiple regression fits a model of a dependent variable on a list of independent variables. In our case the dependend variable is the relative change in the number of purchase transactions and the independent variables are the relative change of the quantity, price and price per unit between two segments and the number of tarif segments.

The multiple regression shows that a quadratic regression model fits the interrelation of the dependent and independent variables best:

$$\mathbf{Y} = \beta_0 + \beta_1 \mathbf{X}_1 + \beta_2 \mathbf{X}_1^2 + \beta_3 \mathbf{X}_2 + \varepsilon$$

Y is the relative alteration in the number of purchase transactions, X_1 is the relative alteration of the quantity, price and price per unit and X_2 the number of tarif segments.

Table 9 to Table 11 show the results of the multiple regression analysis. The significance of the regression analysis differs explicitly in Tabel 9, Table 10 and Table 11. The quadratic interrelation between the relative change in the number of purchase transactions and the relative change in the quantity is highly significant ($R^2 = 0.92$). But the significance of the quadratic model regression with the relative change in the price is rather low ($R^2 = 0.11$). Between the relative change in the number of purchase transactions and the relative change of the price there is no quadratic or linear relation observable.

The quadratic coefficient in Table 9 shows that the number of purchase transactions grows disproportionately to the change in the quantity between two segments. This means for non-linear pricing of Paid Content that the change in quantity between two tarif segments leads to a disproportionately higher demand in the segment with the larger bundle. This result verifies the result in Table 4.

In the following section the empirical results will be discussed in the context of the hypothesis and the theoretical approaches.

5. Discussion and Implications

According to the bundling interpretation of non-linear pricing (Wilson 1993:88) - who construes non-linear pricing as a form of bundling if products are non-diverse – our hypothesis stated that suppliers of paid content products should design non-linear block tariffs in such a way that consumers choose larger bundles more frequently than smaller bundles - complying to standard bundling theory. Buth the results in the previous section show that most consumers choose the bundle with the smallest quantity and the highest price per unit. Only a minority of the suppliers design their non-linear block tariff in a way that creates stronger demand for high priced bundles with larger quantities than for low priced bundles with smaller quantities. Therefor the current behaviour of the majority of suppliers does not comply with our hypothesis. However we were able to identify consumer behaviour that is compliant to bundling and pricing theory we referred to in the beginning of this article. In order to answer the research question about the optimal design of non-linear pricing leading to a high demand of large bundles, thus maximising revenue and profit, we analyzed the interrelationship of demand for non-linear priced paid content goods and the price per unit. Using our set of data, we were able to identify the following relationship between change in quantity and price for bundles:

- The larger the increase in size of the bundle between two segments the stronger the demand and the number of purchase transactions for high priced segments
- The smaller the increase in price and price per unit between two segments the stronger the demand and the number of purchase transactions in high priced segments
- Block tariffs that are successfully inducing consumers to buy high prices segments feature a strong change in quantity but rather a minor increase in price. In fact, the change in price seems to be have only little effect on the consumer descision.. The demand increases for higher priced segments if the bundle size grows by more than a factor of seven (on the average) between two segments. In general, the demand and the number of purchase transactions in a segment depend more on the change of the quantity and less on the change of the price.
- Increases in demand and purchase transactions in high priced segments with block tariffs is positively correlated with the total number segments offered by the supplier.

Therefore, only when the design of a non-linear block tariff is focusing on changes in quantity between two segments consumers choose larger bundles more frequently than smaller bundles. This is compliant to bundling theories. Because of the marginal cost characteristics of digital paid content products increasing the quantity in the block tariff should result in higher demand for high priced segments (but lower prices per unit), which seems to be profit maximising.

As presented in this paper from a theoretical point of view, bundling and non-linear pricing are closely related. The purpose of bundling, as well as that of non-linear block pricing, is to skim consumer surplus. But the empirical results in the last section show that “the law of large numbers” does not apply for non-linear pricing in the same way as for bundling. The differences in consumer behaviour can be explained by differences between the two price differentiation methods (Brandweiner 2001:109; Simon 1992):

- A strong prerequisite for the application of bundling as a pricing method is the heterogeneity of the demand. Non-linear pricing is also applicable if the demand is homogeneous
- Bundling is mainly applicable for consumers’ “buy / not buy” decisions. Bundling of paid content products leads to an increase in “buy” decisions compared to when digital products are sold separately. Non-linear (block tariff) pricing has a minor influence on these “buy / not buy” decisions.
- In contrast, non-linear (block tariff) pricing is mainly applicable to the “quantity-decision” of consumers. Non-linear pricing influences what quantity of the products a consumer will purchase and not the general “buy / not buy” decisions.

In addition to bundling theory, another possible interpretation of the consumer behaviour examined, presented in the previous section’s empirical analysis, could be derived from investment theories, especially option-pricing theories. In most cases, consumers do not use the whole bundle of digital paid content immediately after purchase; usage is distributed over future periods. Thus, from a consumers perspective, buying the bundle is an investment associated with uncertainty. This uncertainty grows with both the amount to be paid and the quantity of the bundle. The consumers’ decision to choose a larger bundle comprises a trade-off between flexibility to spend the money alternatively and the economic potential to save on a per unit basis. Therefore, by consuming a smaller bundle the consumer gets the option and flexibility to consume a smaller quantity and spend money on other goods instead. According to option theories, the difference in price per unit between two segments is equivalent to the price which the consumer pays for flexibility for future consumption. The higher the difference in the number of purchase transactions and the difference in the prices per unit between two segments, the higher is the influence of the consumers risk aversion and thus the higher is the willingness to pay for flexibility. The relative change of the price per unit between two segments in Table 5 shows that consumers prefer smaller bundles with higher prices per unit and thus higher flexibility in their future spending descision if the (average) reduction of the price per unit is 17% between two segments. But if the supplier cuts prices per unit by 44%, consumers choose larger bundles and sacrifice flexibility in favor of saving costs. These results show that consumers are rather risk averse when it comes to digital contents or services.

6. Conclusions

We showed that companies are able to maximize profits when selling digital content or services by providing different bundles to consumers or appyling non-linear pricing schemes. However, these bundles or pricing schemes need to designed correctly in order to induce consumers to increase their spendings. This should be done by concentrating on the quantity provided to the consumer, as the consumer seems to respond more to a change in quantity than a reduction in the per-unit-price. As marginal costs of digital contents or services is generally small or even zero, increasing quantity at a lower per-unit-price is a feasible strategy.

We showed as well that only few of the suppliers we examined follow our proposed strategy. They should therefore redesign their paid content and service offer according to present pricing theory.

For future research, option pricing theories should be applied for further analysis of the paid content and service market.

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Appendix 1

Table 6: Anova: Impact of the quantity-changes on the change of the number of transactions

Number of observations = 107			R-squared = 0.6053		
Root MSE = 6.1456			Adj R-squared = 0.3847		
Source	Partial SS	Df	MS	F	Prob > F
Model	3938.75136	38	103.651352	2.74	0.0001
Quantity-changes	3938.75136	38	103.651352	2.74	0.0001
Residual	2568.25503	68	37.7684563		
Total	6507.00639	106	61.3868527		

Table 7: Anova: Impact of the price-changes on the change of the number of transactions

Number of observations = 107			R-squared = 0.6134		
Root MSE = 9.00829			Adj R-squared = -0.3219		
Source	Partial SS	Df	MS	F	Prob > F
Model	3991.38122	75	53.2184162	0.66	0.9291
Price-change	3991.38122	75	53.2184162	0.66	0.9291
Residual	2515.62517	31	81.1491991		
Total	6507.00639	106	61.3868527		

Table 8: Anova: Impact of the price-per-unit-changes on the change of the number of transactions

Number of observations = 107			R-squared = 0.9915		
Root MSE = 1.43343			Adj R-squared = 0.9680		
Source	Partial SS	Df	MS	F	Prob > F
Model	6436.82326	74	86.9840981	42.33	0.0000
Price-per-unit-change	6436.82326	74	86.9840981	42.33	0.0000
Residual	55.477358	27	2.05471696		
Total	6492.30062	101	64.2802042		

Appendix 2

Table 9: Regression analysis: dependency of the change of the number of purchase transactions on the quantity changes

Source	SS	df	MS		
Model	1553.141	3	517.713		Number of obs. = 107 F(3, 103) = 400.69 Prob > F = 0.0000
Residual	121.4527	103	1.29205		R-squared = 0.9275 Adj R-squared = 0.9252
Total	1674.594	106	17.263		Root MSE = 1.1367
change of the number of purchase transactions	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]
Quantity-changes	0.0149078	0.013073	1.14	0.257	-0.01104 0.0408647
Quantity-changes ²	0.000047	0.000017	2.79	0.006	0.00001 0.0000804
Segment	0.1765785	0.149894	1.18	0.242	-0.12104 0.4741984
_cons	0.2768845	0.438635	0.63	0.529	-0.59403 1.147806

Table 10: Regression analysis: dependency of the change of the number of purchase transactions on the price changes

Source	SS	df	MS		Number of obs.	=	107
Model	6.7655	3	2.2551		F(3, 103)	=	3.95
Residual	53.063	103	0.5705 8		Prob > F	=	0.0106
					R-squared	=	0.1131
Total	45.420	106	0. 62322		Adj R-squared	=	0.0845
					Root MSE	=	0.75537
change of the number of purchase transactions	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]		
price change	-0.428464	0.16655	-2.57	0.012	-0.759214		-0.097713
price change ²	0.0267642	0.01316	2.03	0.045	0.0006		0.052898
Segment	0.012684	0.09621	0.13	0.895	-0.178374		0.203742
_cons	1.44060	0.42998	3.35	0.001	0.586736		2.2944

Table 11: Regression analysis: dependency of the change of the number of purchase transactions on the price-per-unit-changes

Source	SS	df	MS		Number of obs.	=	107
Model	14.013	3	4.6711		F(3, 103)	=	13.24
Residual	31.4068	103	0.35288		Prob > F	=	0.0000
Total	45.420	106	0.4937		R-squared	=	0.3085
					Adj R-squared	=	0.2852
					Root MSE	=	.59404
change of the number of purchase transactions	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]		
price-per-unit-change	-2.771	0.56143	-4.94	0.000	-3.88		-1.6557
price-per-unit-change ²	0.8604	0.29725	2.89	0.005	0.2698		1.4510
Segment	0.0824	0.0781	1.06	0.294	-0.0727		0.23768
_cons	2.0593	0.3048	6.75	0.000	1.4535		2.6651