

# **Pricing Information Goods for Digital Libraries**

## **Results of the Seminar aus Informationswirtschaft 4085 SS 2003**

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# **Research Findings of Pricing Information Goods for Digital Libraries: Development of a Pricing Strategy**

**Keywords:** Pricing Information, Pricing Strategy, Bundling Information Goods, Digital Libraries.

## **Abstract**

In this paper the pricing of information goods is discussed with respect to the digital library on the WU-Wien that is called epub. Digital libraries are surveyed with the key properties of their access systems. Different options of price discrimination and models of pricing are examined. This paper focuses on the economics of bundling information goods. The costs of electronic commerce in connection with digital libraries has been researched. This paper tries to derive pricing strategies for the epub out of the theoretical findings and discussions of the models depicted. The strategies are divided into bundling strategies and those with reference to target groups.

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# 1 Introduction

## 1.1 Pricing Information

There are a few basic principles that are of importance concerning the pricing of information goods as a basis for this paper. First of all the cost structure of information goods e.g. articles, e-books, CDs or movies is a special one. The cost of production is dominated by the “first-copy-costs” which means that information is produced costly but reproduced cheaply. Hence the fixed costs are large but the variable costs of reproduction are small which is a typical case of substantial economies of scale [SaVa95].

Another important point is competition and how to deal with it. The seller of information has to do everything to differentiate the product from those of other competitors. One strategy is by adding value e.g. by filtering and sorting information for customers. An important option is the strategic alliance with other vendors of similar information e.g. by creating a link to another website [SaVa95].

The third basic topic is the pricing of information products as to get the most out of the customers that want to use the information that is offered. Observation of the search queries and the click stream are an easy way to get information about customer behaviour. Thereby target groups can be defined and with further market research prices can be set at the consumer’s maximum willingness to pay. Prices on the internet can be changed instantaneously, at least in a purely technical way, if the consumers accept that, and one can sell products to each customer at different prices, if this is legally possible and included in the price strategy. The market response to price changes can be used to estimate a demand structure for the product and is therefore cheap market research. In contrast to individual customers there are also libraries that are willing to pay a higher price for the goods because they use a sharing arrangement among many users [SaVa95].

## 1.2 Definition of Digital Libraries

New technologies for storing digital information make it possible to build a large-scale service for retrieving these collections over networks in their digital form. The use of paper is obsolete because the material is stored on the computer and directly accessible and searchable [Raja02].

Digital libraries are thereafter a collection of digital information in an organized form. Additionally to the managed collection of information, there are associated services that help find the inquired information. The content can be produced by digitising physical counterparts as in pictures of objects to be stored, or by creating the initial content itself in a digital form [Raja02]. Users may be willing to pay for hotlinks to all citations in a paper, which are an additional functionality [HaOp99].

The “first copy costs” of an academic journal or more than 70% and this special form of cost structure creates special problems for pricing. Additionally the market structure is not purely competitive but a monopolistic competition. If products have the same information value, the consumer will buy only from the cheapest producer. This situation causes the survival of only a few or in extreme case only one will prevail over the rest [ShVa95].

Positive sides of digital libraries for the scholar are instantaneous access, on demand, and avoiding other costs associated with traditional libraries as there are, traveling to the library, physical duplication of the article and congestion caused by shared use [ChSi97].

### 1.3 Key properties of access systems

An important fact is the simplicity of payments. Whatever the system of managing the access to a library is, it must be simple. The intermediaries and end users must have a comprehensible and convenient way of accessing their information. It is important to find ways of limiting abuses to a reasonable extent and punish abusers but not make life complicated for every user. The right balance has to be found. The complexity behind the operations of the database should be hidden from users although the reasons for restricted access for a certain item should be possible to be acquired by an interested or better to say frustrated user. The point is that the licence system that is generated to optimal profit should be acceptable to a wide range of customers. Reasons of security should be accounted for and in the short term a few simple agreements should be operationalized [BeWa98]. “The design should be modular, flexible, and have the capacity for growth. Extensions can be made later, on the basis of practical experience.” [BeWa98]

There are a few key properties for access systems that make them acceptable to users while respecting the rights and interests of authors and publishers [BeWa98]:

- **Simplicity:** The technological and organizational adoption of an access system is better the simpler the System is. It is important to give the possibility for complex search options for advanced users. These additional options should be part of the users personal settings if possible. For the novice user a broad variety of options is not necessary and could even lead to confusion in the application of the search.
- **Privacy:** The privacy of users must not be compromised. In this context, the privacy of users has certain aspects of interest in context with pricing. When a list of subscribers is published it could be convenient to have a sort of forum or newsgroup for exchanging ideas. The fact is that this could lead to unauthorised copying of papers that should normally be paid for. On the other hand the users with the same interest have probably already some kind of network for exchanging their ideas and documents. This leads us to the direct conclusion that privacy should definitely be maintained in the interest of the payments for the digital library. To make sure that acquired documents by one party cannot be copied for another person is a main issue to be addressed.
- **Good faith:** This is to be seen in connection with the above point and states that the agreements on access to scholarly information is depending on the trust of all parties involved. Nevertheless, there has to be a reasonable amount of barriers against abuse.
- **Reasonable terms:** If the control of access to a resource is too tight it may impose inappropriate constraints on the use of it, especially in research and teaching contexts. One problem is the limiting of the system to an extent where the intuitive and curious research leads to unexpected borders of access which cannot be predicted by the makers of the agreements or the designers of the system.

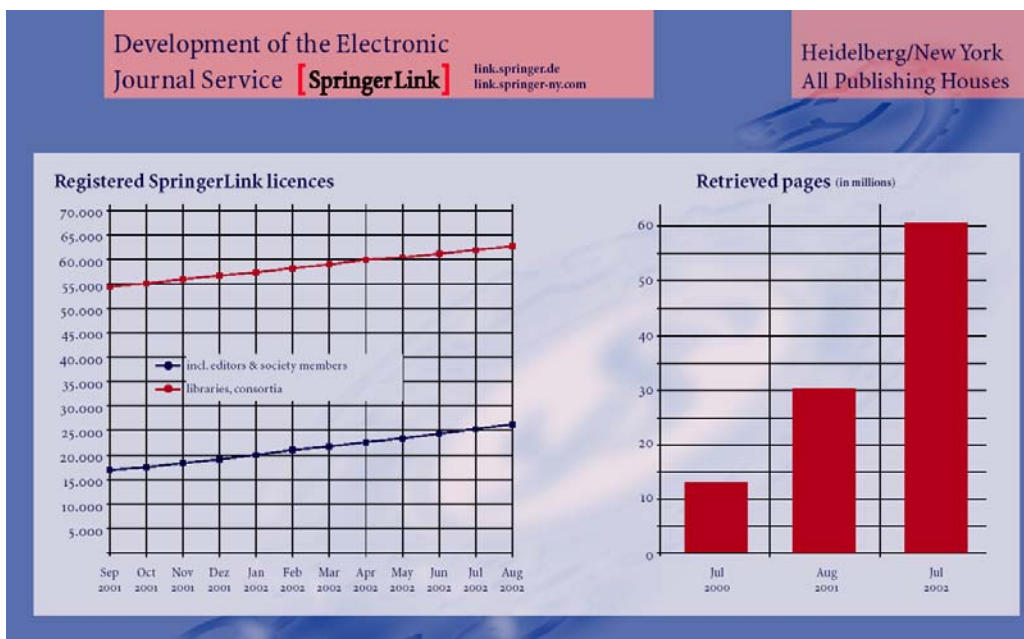
## 1.4 History and Development of Electronic Libraries

Information and knowledge has become more important than ever. Market intelligence, interest rates or scientific research has become the currency of business today as information in different forms. Content is the primary consideration for the user but the way information is priced and packaged creates new business opportunities. If information should be freely shared or strictly regulated, has become a key issue [Kent99].

One of the first important works on DL was written by Vannevar Bush. He published an article in 1945, entitled “As We May Think”, which was an elegantly written exposition of the potential that technology offers scientists to deal with information. In those days the microfilm was the most suitable technology for storing information cheaply. In the 1960s, J.C.R. Licklider was at the MIT and studied how digital computing could transform libraries. In his book, “The Library of the Future”, he described what was needed to build a truly usable DL. Interestingly he underestimated what could be achieved with huge amounts of cheap computer power and overestimated the progress that could be made with AI and natural language processing [Arms00].

Especially for a major publisher as MCB University Press, which are internationally focused as seen in Appendix C, the usage of DL is an important step in cost reduction and service of the distribution.

In the following figure from <http://www.springer.de/press/charts/link.pdf> one can see the stable growth of Electronic services of a well known publisher.



**Figure 1:** Development of the electronic journal service at SpringerLink

This indicates the growing fascination for that market and the possibilities connected with it. For the future there is a lot of potential within the integration of other related fields. The technology of DL is closely related to fields such as teleconferencing or electronic mailing [Arms00].

The sample of CAUL (Australian Academic and Research Libraries) indicates that the total number of serials subscriptions declined drastically between 1986 and 1998, while total serials expenditures increased by more than 250 percent due to monopoly powers of the publishers as seen in Appendix B [Houg02].

## **2 Different Pricing strategies and Models**

### **2.1 Price Discrimination**

A.C. Pigou the Author of “The Economics of Welfare” had developed a system that distinguished three types of differential pricing [Mans97]:

- Discrimination of the first degree: the firm knows what each consumer will pay for each amount of the product. [SaVa95] call this form also personalized pricing, where you sell to each user at a different price. In the theoretical model, it is assumed that the product cannot be resold and the maximum amount of consumers’ surplus is extracted.
- Discrimination of the second degree: This is an intermediate case. The firm does not take all of the buyers’ surplus. A medium price is charged depending on how much the consumer buys. [SaVa95] use the term versioning where users choose a version of the product that they find appropriate for them. In this case a product line has to be offered to be able to choose between different options.
- Discrimination of the third degree: [SaVa95] state that group pricing uses different prices for different groups of customers, as in student discounts. This discrimination depends on the markets where the product can be sold at a set price for each market thereby maximizing profit.

A problem can arise when the customers’ willingness to pay are heterogeneous because then fewer will buy at high prices and price discrimination is more difficult. Then we have to find a way to charge different prices for different consumers. There are many ways of price discrimination such as immediate access to information and an additional waiting time for those who pay less for the good. Another Method could be that the resolution of the electronic text could be varied [ShVa95].

The seller of information goods can detect what kind of browser the customer uses and the speed of the connection, where the correlation between a fast connection which is expensive and a high income could be made, using this as an additional basis for price discrimination [DaKa01].

Different prices may be charged for the same item, depending on who accesses the information, staff, graduate or undergraduate student. There could also be a different price depending on the time of the year, e.g. penalizing last minute studying by making articles more expensive near exam time [Dari01].

It is clear that the successful price discrimination requires a legitimate share of market power which runs contrary to the growth of price-comparison services that could erode this market power although it is not clear to what extent this effect will take place [DaKa01].

## 2.2 Pricing Models

The pricing of the information product is an important issue to the customers that want access to these products, the producers of the database and the information servers who provide the access to the database [JaKa02].

Different forms of pricing [JaKa02]:

- the customers pay with regard to the time they use the database. Still mainly used by large online servers, this pricing strategy is becoming less popular with time because it has become cumbersome to implement. About 63% of the market.
- Search-based-pricing: This method thrives on the successful search, which is defined by the consumer downloading or viewing the desired information. About 23% of the market.
- Flat-rate-pricing, is also used and is basically a subscription-based pricing strategy, where the user pays a fee for a certain period of time e.g. per month or per year. About 13% of the market.
- Hybrid pricing strategies are a combination of the methods mentioned above.

Problems with connect time pricing [JaKa02]:

1. Advanced searchers get more information in the same amount of time than naïve users that are not so professional in their search.
2. Many users structure their search in advance e.g. with additional software thereby not using the interactivity of the system while searching in the database.
3. Speeding up the system by technological advances demands constant adaptation of pricing e.g. faster modems etc.
4. It is not possible for the consumer to know how much there is to pay in advance because the more one has to search the more one pays. The consumer makes a purchase decision without the knowledge of the price he or she is going to pay.
5. A more subtle disadvantage is the following paradox. If the information provider becomes more efficient in serving the customers, they have less connection time. Ergo there is no motivation to optimize customer satisfaction.

In this paper, the Model developed by Jain and Kannan for choosing which pricing strategy to use was selected, because it explicitly incorporates the impact of uncertainty on consumers' purchase decision. Different conditions can be evaluated under which one may charge based on connect time, successful search, or offer subscription plans [JaKa02].

Consumers search a database with an estimation of the time in mind they will need to retrieve this information. We assume that  $v$  is the valuation for a unit of information that can be a page or a report. Then  $t$  is the time to retrieve this information, where we assume that  $t$  is a normally distributed random variable with mean  $\mu$  and a variance  $\sigma^2$ . The abilities of the user to search efficiently is related to the before mentioned variables. Therefore, the parameters vary across the population, which model implicitly acknowledges [JaKa02].

Furthermore, the consumer is risk averse with the following utility function  $-e^{(-ky)}$ , where  $k$  is the risk parameter and  $y$  is the surplus, which may be a random variable.

Another assumption is that the consumers' demand is inelastic. Even when this condition is relaxed most results are the same. Additionally the online server is risk neutral and pays  $c$  to the database producer. Furthermore we assume that the server is a monopolist, which fits perfectly for this paper [JaKa02].

We denote that  $F$  is the subscription fee,  $p_c$  is the connect-time fee, and  $p_s$  is the search-based fee. Thus, the consumer pays a total price of  $t$  multiplied with  $p_c$ . Another assumption is that the downloaded information in the case of a successful search is exactly the one that fits the consumers' tastes. The Valuation  $v$  varies across the population according to a continuous and twice differentiable probability distribution function  $f(v)$  [JaKa02].

The expected profits for the online server under connect-time strategy are

$$\Pi_c = \mu(p_c - c) \int_{p_c\mu + kp_c^2\sigma^2/2}^{\infty} f(v)dv$$

The other case when consumers are charged on the basis of successful searches for information goods the total profits are given by

$$\Pi_s = (p_s - \mu c) \int_{p_s}^{\infty} f(v)dv$$

With these two formulas, one can deduce a few propositions that can be useful when deciding which pricing strategy to use for different segments of the market [JaKa02].

Propositions [JaKa02]:

- The server makes higher profits by charging on successful searches when consumers vary in terms of  $v$ . This strategy removes the risk of searching and paying for not useful information and thereby even gives the risk-averse consumer an incentive to use the system. The server thereby gets a substantially larger market by charging higher prices.
- By using a search-based pricing strategy, the prices increase with  $c$  and  $\mu$ . Some examples of  $c$  are given in Appendix A.

- The connect-time-based price increases if  $c$  increases and as  $\mu$  decreases.
- Note that  $\mu$  due to technological advances decreases steadily, e.g. when consumers have faster networks or modems or when they use special software with search algorithms. Thereby they are becoming more efficient searchers, which we can assume they will become in time anyway.
- If we assume that consumers vary in terms of  $v$  and the server uses a search-based pricing, then its profit always increases if  $\mu$  decreases. A server using search-based strategy benefits when the average search time decreases because then the costs for the server are lower. In contrary to the connect-time basis where less search time does not only mean decreasing costs but also decreasing revenues.
- If consumers are highly risk averse, that means  $k$  is large, and/or there is a large uncertainty in the search process, that means  $\sigma^2$  is large, the benefit for connect-time would drop as  $\mu$  decreases. These servers may even find it counterproductive to invest in new technologies to speed up search. These developments are mostly initiated by the consumers.

The results suggest that increasing consumer sophistication and higher connection speeds will be the result of servers using search-based pricing. Other positive developments could be that these servers find it profitable to invest in technologies to make the search faster and allow faster access. In addition, the proprietor of such a database could train customers in making efficient database searches. Especially in the educational sector, this opportunity of providing introductory courses to this system via free online tutorials would be an interesting possibility of further research and implementation [JaKa02].

From the results it may be concluded that connect-time pricing should be chosen in markets where more complicated needs from high-valuation customers require more online time to search. It would also appear that in a market where high-valuation customers are expert searchers who require less time than low-valuation consumers, the server should choose the successful-search strategy [JaKa02].

The simplifying assumptions of the model primarily made will be looked at [JaKa02]:

- If the demand of the consumers is very elastic subscription plans seem to be optimal. That is because the subscription plan enables them to consume the maximum amount and not decrease consumption.
- If consumers incur waiting costs, the price rises no matter by which strategy they are charged, so it has no changing influence on the model.
- The value of the found information is not a priori known and therefore a random variable. The worth of the information can be better determined after observing it. The consumers' expertise and the quality of the search engine are important factors in the valuation.

Summarizing one could state that search-based pricing strategies show a tendency to increase due to rapid technological changes and the need to increase the size of the markets.

In addition the competition among information servers may make it necessary to choose different pricing schemes like connect-time pricing [JaKa02].

Less sophisticated users will find it profitable to choose subscription-fee pricing or search-based pricing. Professional users will find it profitable to choose connect-time pricing schemes. The database providers are holding valuable products that must make profit to stay in business. It is important that all market participants realize that [JaKa02].

### 2.3 Models for Bundling Information Goods

A multiproduct monopolist has the ability to extract higher profits when bundling goods together. Under a variety of circumstances, this strategy will be better than offering the same goods separately. Through a large number of goods bundled the statistical variance can be minimized. Thus, the prognosis of consumer behaviour is more accurate and effective pricing can be applied. The demand curve for a large number of goods with a bundling strategy is more elastic near the mean valuation of the population and more inelastic away from the mean. Profits and sales can be increased and even inefficiency is reduced, meaning less deadweight loss [BaBr99]. One important foundation has to exist in order to unbundle journals. The publishers must be able to recognise economic incentives for network-delivery of unbundled articles [ChSi97].

In the theoretical model of Microeconomics bundling is a pricing technique that can only be used by firms with monopoly power. If a customer buys one product of the firm, he or she has to buy another product as well. This procedure should be used if the following two conditions are met, when customers have quite different tastes and the firm cannot engage in price discrimination. In the simple case of two products, namely A and B, and two customers the company should prefer bundling when there is an inverse relationship between what one customer is willing to pay for product A and the other one for product B [Mans97].

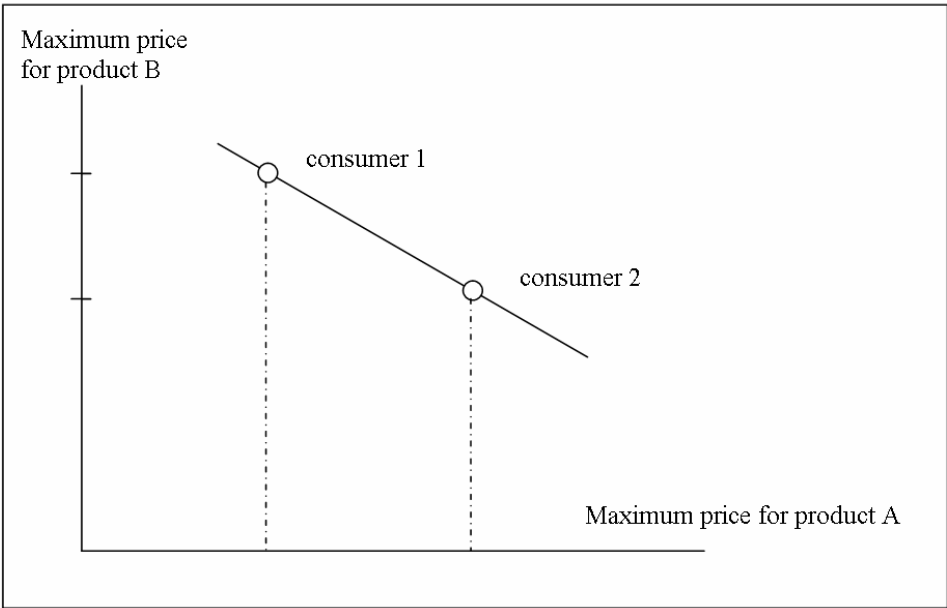


Figure 2: Inverse relationship

If the relationship is direct and the graph in the above figure has a positive slope the company will not find it profitable to bundle the products [Mans97]. A monopolist with many products chooses the bundling strategy out of two main reasons. Bundling can result in cost savings due to economies of scale on the supply side. On the demand side it is an effective tool for extracting consumer surplus [ChSi97].

The next step is to discuss a model for more products and more complex and realistic bundling scenarios as described by Bakos and Brynjolfsson.

The model assumes that marginal costs are zero and very large bundles of products will continue to be profitable even if this assumption is weakened. If marginal costs are large, the seller will usually want to increase the scattering of valuation. In other words, when a mean valuation is given, and the marginal costs are greater than that value, bundling will decrease profits. The threshold at which bundling is at risk, depends on the distribution of valuations for the individual goods. Especially with goods that have negative value for some customers e.g. advertisements and that are included in the bundle, the benefits may be eliminated even with zero marginal costs [BaBr99].

Since the costs of reproduction and distribution are constantly reduced the time and energy a user has to invest to identify an information good is becoming more important. For example the cognitive costs<sup>1</sup> of learning the commands of a spreadsheet software accounts for a substantial fraction of the price [BaBr99].

Furthermore, a common underlying variable such as consumer type could be the basis for a third-degree price discrimination strategy. If it is possible to correlate consumers' valuations for individual goods to this underlying variable, then bundling increases profits, reduces consumers' surplus and additionally reduces deadweight loss. This pricing strategy can be generalized to multiple underlying variables. Such variables could be used to segment consumers by age, sex, educational level, business use vs. academic use, if they are not limited by legal or ethical issues. If a seller still finds that consumers' valuations remain correlated to a different common variable, the segments can be split up until this residual correlation is removed [BaBr99].

Other factors that facilitate third-degree price discrimination are public key encryption, widespread computer networking, and authentication technologies that can be used to give the individual consumer rebate coupons which should be non-transferable. The amount of rebates can be a function of the underlying variables because the expected valuation for the bundle is correlated with the variables. To execute this strategy the seller must be able to charge different prices based on observable characteristics of various market segments. Consequently, consumer behaviour can be used to segment the market as already mentioned in Chapter 1.1 Pricing Information, in the last paragraph [BaBr99].

Additionally one could leave certain items out of some bundles as a way to sort customers. The seller could offer an "economy" bundle that is a subset of the "premium" bundle and by this missed bundling strategy force consumers to signal their valuations by the choice they

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<sup>1</sup> This might be the reason why free software e.g. StarOffice or OpenOffice is not so commonly used because the menu structure and the command structure differs slightly from Microsoft products. For advanced users the command structure of the formula editor might cause a problem, for not so elaborate users the simple differences in the menu structure and design are already a disturbance.

make. The seller must provide incentives to prevent strategic modification of the consumers' behaviour by mimicking low-demand consumers [BaBr99].

Empirical evidence of bundling information goods indicates the following. Microsoft for example is known for its strategic integration of external applications and functionality into its operating systems. By external we mean developed by other firms that sold the software separately e.g. in 1993, Microsoft incorporated memory management similar to Quarterdeck's QEMM software, in 1995 e-mail like Lotus's cc:mail and Web browsers that were sold separately before [BaBr99]. These facts run contrary to the often predicted unbundling of application suites that are downloaded when they are needed from the internet. The advantages of bundling software for specially targeted customer groups in combination with actual monopoly power are obvious and spawns strategic alliances with sellers of complementary products.

## 2.4 Economics of Bundling

The bundling of products is profitable because it reduces the heterogeneity of the consumers' willingness-to-pay. We can sell the product at the average willingness-to-pay which makes sense only if we are not able price discriminate. A journal for example is already a bundle of Articles which sells for a higher price than the individual articles would. Also the search costs are reduced by bundling similar articles together. This function can be provided by a search engine in a digital library [ShVa95].

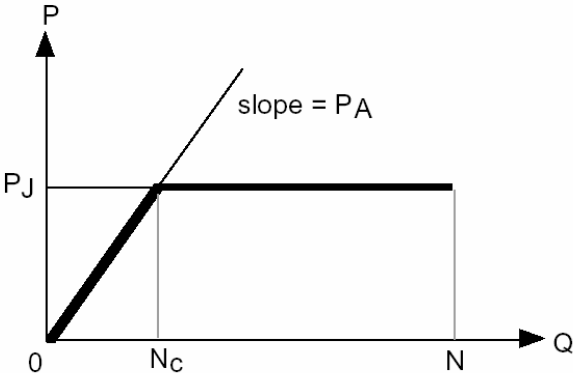
Bundling not only guarantees payment in advance, but also secures payment for low-use journals which might be otherwise cancelled by subscribing institutions [HaOp99].

Further research by Chuang and Sirbu in the domain of journal subscriptions and mixed bundling shows quite contrary results. In their paper they prove that in the academic journal context pure unbundling can outperform pure bundling [ChSi97].

The form of subscription is the traditional way to sell academic journals. In the paper-based environment this was the most economic approach, but on the other hand the demand for information can be unique, diverse and even whimsical in a scholarly environment. With their institutional subscriptions to journals the libraries at universities serve to satisfy scholars' demand for individual articles. In some cases the library is permitted to share articles with other libraries of an ILL (inter-library loan) consortium, as long as they are not copied. For these ILL items the libraries are incurring costs of up to 20 dollars, which indicates a potential market for unbundled articles not only on the individual but also on an institutional level [ChSi97].

This form of shared use is compensated by higher subscription rates for libraries than for individuals, which constitutes a price discrimination of the third degree as mentioned in chapter 2.1 Price Discrimination. For this method to be effective price discrimination requires minimal leakage across clearly demarcated market segments. In the academic journal market, institutions cannot easily disguise themselves as individual subscribers, so there is no problem in this respect. Due to the inelastic demand journal prices have risen in recent years [ChSi97].

The fundamental dilemma is to find a balance between a simple pricing schedule and profit-maximization. As mentioned in chapter 1.3 Key properties of access systems, consumers reject a complex pricing schedule and are more satisfied with a simpler model where no sub-bundles are available. In Figure 3: Total outlay vs. number of articles consumed, this simple model is depicted. The consumer has two options, either to purchase individual articles at a price of  $P_A$  per piece or the journal subscription for a price  $P_J$ .  $N$  is the number of articles consumed. This structure is reminiscent of using two-part tariffs in the nonlinear pricing literature [ChSi97].



**Figure 3: Total outlay vs. number of articles consumed**

Buyers of individual articles would probably be low-demand readers, while the joys of unlimited access to all articles are pursued by high-demand readers paying the flat fee of  $P_J$ . Two-part tariffs that are optionally chosen, can be either ex ante or ex post in their nature. In the ex ante arrangement the users have to decide prior to consumptions which group they want to join. In this case they should be able to know their expected consumption. This is critical for making the optimal decision, e.g. if a consumer chooses the “article-on-demand” group because he or she expects to read only a few articles and ends up reading more than  $N_c$  ( $=P_J/P_A$ ) he or she has to pay more than the other group. If choosing the subscriber group from the beginning, it would have been cheaper. An important consideration especially in the academic sector are those consumers with fund allocation and fixed budgeting restraints. They are reluctant to sign up for these pay-per-use arrangements because of the before mentioned uncertainty factor of the consumed amount. With an ex post approach the consumer can choose at the end of the billing period which pricing scheme to use thereby placing a predictable upper bound on the final bill [ChSi97].

As shown in the following table empirical studies indicate that the correlation of article valuations is not very high for academic journals. Over 40 percent of readers surveyed read no more than five articles per subscription period [ChSi97].

Number of Articles Read in a Journal	Proportion of Readers (%)	Cumulative Proportion of Readers (%)
1 to 5	43.60	43.60
6 to 10	34.40	78.00
11 to 15	8.21	86.21
16 to 20	5.50	91.71
21 to 25	3.37	95.08
26 to 30	1.97	97.05
31 to 40	1.23	98.28
41 to 50	0.82	99.10
more than 50	0.90	100.00

**Table 1: Distribution of number of articles read in a journal**

These findings may indicate that a payment per article is still a very good option for many users. Furthermore the details of pure bundling, pure unbundling and mixed bundling will not be discussed in detail in this paper. Only a few summarizing remarks will evaluate these additional options.

When selling goods both as a bundle and separately as individual components, where the bundle is priced at less than the sum of the components, it is called mixed bundling. This procedure is more profitable than pure bundling if the marginal cost of distributing and producing the components are not trivial and the consumers' preferences have to be in a special way [DaKa01].

As already mentioned in the above chapter bundling is a desirable option to form information goods. When a distinction is made between mixed and pure bundling, different conclusions may be drawn. Pure bundling may, under certain conditions, be inferior to pure unbundling. A thorough analysis of supply and demand of the information product in question is necessary. Especially in the case of academic journals unbundling can actually increase producer surplus. In addition to traditional subscriptions the publisher of journals should expand its on-line product by additionally selling unbundled articles separately. Via consumer self-selection the publisher can extract consumer surplus more efficiently by offering the original product bundle and components, e.g. the user buys a certain amount  $N$  of articles which he or she can choose out of the whole available lot. Other separable components to a journal could be table of content, indices, abstracts, fully searchable text, mark-up tags and other announcements [ChSi97]. "Intelligent pricing designs must take into consideration the information needs and usage behavior patterns of the journal reading population, as well as the economies-of-scale characteristics of the underlying technologies." [ChSi97].

### 3 Electronic Commerce and Digital Libraries

#### 3.1 Considerations with respect to Pricing Strategy

The following main considerations with reference to price are important. Prices should be stable over a reasonable period of time, otherwise users get confused. If possible, the price should be negotiated ahead of time. If users choose between different information servers, they should know the service and the price level they are dealing with. User query-request behaviour should be reflected by the price. What part of the service should be priced? Resources like bandwidth or CPU time or information objects in general. The services for quality of search can be priced or other performance parameters [SaNi96].

Digital libraries (DL) and electronic commerce (EC) are important areas of computer and information sciences with similar infrastructure requirements, concerned with the movement of information across global networks. DL are required to facilitate efficient interaction among librarians, knowledge producers, and information seekers where the transactional aspects of EC for purchasing and distribution of its content can be used [AdYe96].

With the help of EC systems there is the possibility to provide an array of choices with multiple levels of quality, with a promotional price associated to the item. As fewer bytes are transmitted, the cost of delivering sinks when offering just titles and abstracts of a collection of papers and low quality images [AdYe96].

The technology of DL are developing fast and with that are the financial, social and organizational frameworks. Different social conventions and different attitudes to money are brought in by the groups that are developing DL. Libraries and publishers have a long tradition of managing books, journals and other artefacts. The economic and legal frameworks for buying and selling these goods is built on this tradition that is influencing newly built DL. On the other hand there are the scientific users and computer scientists that have a quite different tradition. A few well-funded researchers had computers that were still very expensive on the first networks. They exchanged their information with colleges without payment. Informally or openly this tradition of open information still remains although the networks have grown. DL in their present form show a mixture of these two traditions when it comes to the economic framework [Arms00].

There are different forms of mechanisms that are used to share costs within institution. Different categories of users are often employed within academic institutions, e.g. undergraduate, masters, doctoral, subject disciplines, research vs. teaching vs. technical staff [Kent99].

### 3.2 Filtering and Finding Information

Consumers need the possibility to find the necessary information with an on-line facility that locates the resource that matches certain expectations and desires. Out of that reason, the following challenges for EC/DL systems emerge [AdYe96]:

- The consumers need a variety of efficient ways to search information across heterogeneous systems.
- The user interfaces should be uniform, customizable and dynamic and for a variety of common data types such as text, images, video, and audio.
- Track consumer habits to discover underlying trends by using data mining facilities.

The consumer should be able to find products using language and terminology he or she is familiar with. Matchmaking services can provide a secure bidding and negotiation system where potential buyers with specific traits and sellers can solicit bids and receive quotes. Agent technologies cannot only be useful to make providers aware of consumer needs but also enhance the consumers' attention for a provider's offerings. These software agents,

ranging from simple information filters to autonomous programs that can work in conjunction with a human user, can even negotiate the terms for a transaction autonomically [AdYe96].

### 3.3 Financial Instruments and Cost Management

On-line services mainly follow fixed cost models that are insensitive to data contents changes. Nevertheless, DL should provide an evolving cost model that adapts to types of objects provided. Providing standard based financial instruments that can be employed globally and that are secure. Examples of existing financial instruments include digital/electronic cash where digital cash is issued from a traditional banking institution in exchange for local currency. A similar model is the electronic wallet where credit card numbers are encrypted and stored on the user's local computer. The number is then transmitted to the merchant in an encrypted form. Electronic data interchange via Internet in a secure fashion by two trading partners is also possible. Additionally systems should support complex negotiation and purchasing tasks, e.g. bidding. In the model of Bidding and Negotiation the user drafts some requirements and specifications for a product and then invites appropriate providers to furnish quotes and bids. The consumer chooses the most appropriate provider [AdYe96].

DL have massive effect on the delivery mechanism and on the publishing process as well. Especially the file preparation that involves evaluation, selection, copyediting, proofreading, and typesetting is influenced. The costs of this process have not been reduced but they are shifted from the medium-skilled typesetter to the highly-paid academic for example. As a result the system-wide costs have undoubtedly been increased [Day01].

The production costs of an academic journal are an important step in setting the prices for users. It is estimated that the "first-copy" costs of an academic article are between 2000 and 4000 dollars. The marginal cost of mailing and printing a single issue of a journal is about 3 dollars. The prices for subscribers of a journal can range up to 600 dollars. Other costs are storage costs in the database, where a typical library can estimate about 25 to 40 dollars for a single issue of a journal. Using these calculations for an example of a mathematical article that is not often used, the few users have to pay up to 200 dollars for this item [Vari97]. Another continuing cost is server space and maintenance, which is about 26 dollars per article per year for a PDF file of an average journal for each posting site [Walk98].

## 4 Case Studies

In 1994 the NSF/ARPA/NASA<sup>2</sup> Digital Library Initiative<sup>3</sup> awarded grants to industry consortia and 6 universities consisting of Carnegie Mellon University, University of California, Berkeley, the University of Michigan, the University of Illinois, the University of California, Santa Barbara, and Stanford University. In the NSF Announcement the amount of 24.4 Million Dollars was announced for funding advanced research and technological

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<sup>2</sup> The National Science Foundation (NSF), the National Aeronautics and Space Administration (NASA), and the Department of Defence Advanced Research Projects Agency (ARPA).

<sup>3</sup> Details at [http://sdcd.gsfc.nasa.gov/ISTO/DLT/nsf\\_info.html](http://sdcd.gsfc.nasa.gov/ISTO/DLT/nsf_info.html).

development of DL. The project at the University of Illinois<sup>4</sup> at Urbana-Champaign concentrates on access to science and engineering journals and can be found at <http://www.grainger.uiuc.edu/dli/>. The articles are directly from the publisher in SGML format and include text, figures, tables and equations. The research focus is on scalability, functionality and building effective document indexes of DL [AdYe96].

The PEAK (Pricing Electronic Access to Knowledge) project at the University of Michigan explored three different pricing models for electronic journals. One of them was a generalized subscription in which a library purchased a bundle of 120 article “coupons” from a set of journal titles. This bundling technique and the pay-per-article approach found great acceptance among the participating libraries. It was also found that there was a substantial learning curve for users before they were using the service heavily [Dari01].

Academic journals are considered to be “must have” items that are not easily substituted for another, that’s why the market has been relatively inelastic. Thus, the profit margins in commercial academic journal publishing fall within a range of 40-60 percent on the average. Commercial publishers of print journals have extracted large profits despite the financial pressure facing libraries [HaOp99].

To bypass commercial companies it is possible to publish electronic journals by the producers of articles themselves. There has been an initiative in the US called SPARC (Scholarly Publishing and Academic Resources Coalition) which aims at facilitating publication of affordable journals, see <http://www.lib.utexas.edu/ejour/SPARC.html> [HaOp99].

The PSLI (UK Pilot Site Licence Initiative) is an example which used bundling as a pricing mechanism, where several of the publishers extracted more revenue by offering all of their titles as a single product [HaOp99].

Conventional print journals bring about 4000 dollars per article as a revenue to publishers. The quality that is perfectly adequate for most readers can be produced in an electronic environment for less than 400 dollars per article [Odly99].

ProQuest Digital Dissertations are available at <http://wwwlib.umi.com/dissertations/> and offer free access to most current abstracts and citations of Dissertations for visitors. There are 1.6 million titles in the entire database, which one needs to connect from a subscription institution. The following figure shows prices charged for the selected items, available at : <http://il.proquest.com/hp/Products/Dissertations.html>.

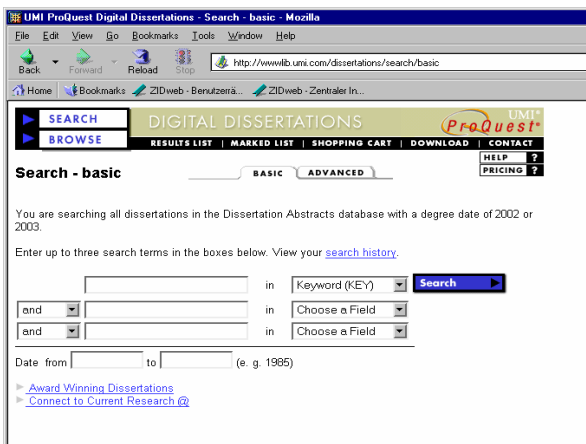
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<sup>4</sup> Partners in the project include the National Center for Supercomputing Applications (NCSA), University of Arizona, Corporation for National Research Initiatives (CNRI), Institute of Electrical and Electronic Engineers (IEEE), American Institute of Aeronautics and Astronautics (AIAA), American Physical Society, Institute of Physics, John Wiley & Sons, and U.S. News and World Report. Industrial partners include: United Technologies, Softquad, BRS/Dataware and Spyglass.

Format	Price (includes shipping)	Delivery Time
PDF (web download)	\$29.50	N/A (web download)
Unbound Paper Copy (express delivery - international only)	\$55.00	5-7 working days (courier)
Unbound Paper Copy (priority mail)	\$37.00	6-8 weeks (air mail)
Softcover Paper Copy	\$63.00	6-8 weeks
Hardcover Paper Copy	\$77.00	6-8 weeks
35mm Roll Microfilm	\$53.00	6-8 weeks
Microfiche (for titles published from 1976 forward)	\$53.00	6-8 weeks

**Table 2: UMI ProQuest Digital Dissertations – pricing information**

The different search options of a basic search and an advanced search are also available at this site. These are additional features that offer more than just the information that is stored in the database. In the basic search as seen below one can search for keywords and other two options in connection with a time span that can be chosen.



**Figure 4: UMI ProQest – basic search**

The advanced search in the following figure offers a query box where more complex questions can be stated. The keywords-fields can be filled as in the basic search but additional features are offered such as search history, a subject tree and school index.

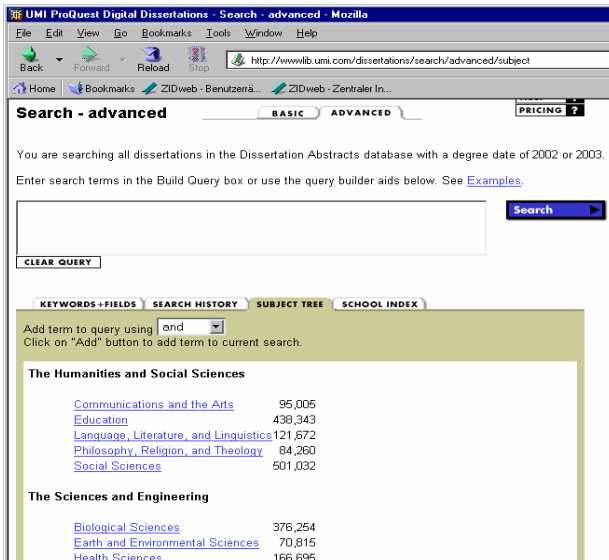


Figure 5: UMI ProQuest – advanced search

Another site is Web-Docs, which offers electronic delivery of journal articles and conference papers with less than 50 pages from the MIT Libraries. The costs are about 18 dollars per article with a surcharge for articles that are over 30 pages. The time for delivery is about 3 to 4 business days with a rush service available. The online service offers PDF documents where the articles are scanned and delivered directly to the desktop via the Web. This service is available at <http://libraries.mit.edu/docs/webdocs.html>, with a price list at the following URL: <http://libraries.mit.edu/docs/pricin.html>. The order form for articles and other documents is shown in the next figure. Payment can be done by credit card.

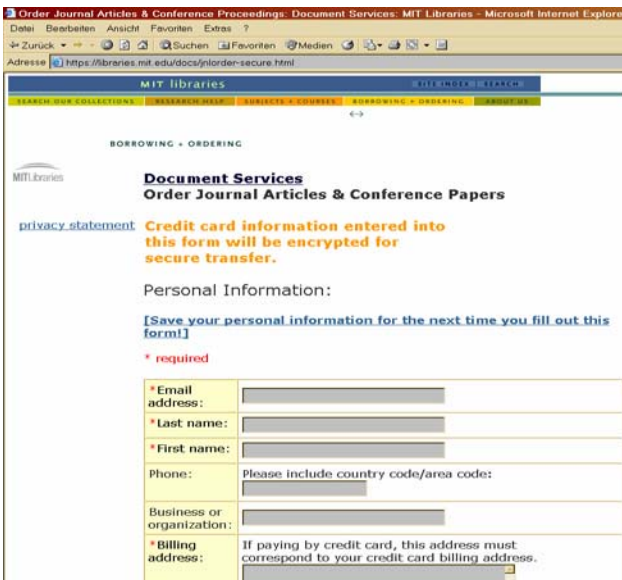


Figure 6: Order form for journal articles and conference proceedings

## 5 Methodology

The used methodology for this paper has been to collect a series of theoretical findings of the pricing of information goods and compare them with a number of practical evidence of research projects in this area. Through this aggregated overview, a pricing strategy can be

devised that leads to an optimum scheme in the future of the epub at the WU-Wien. After a trial period with feedback from potential customers, more suitable and market orientated pricing strategies can be established. There has to be more empirical research for the application of the theoretical findings in this paper.

## **6 Application of the Theoretical Findings**

### **6.1 Strategies for the Epub with Reference to Target Groups**

The definition of target groups by occupation, member status or other variables is an important step in generating pricing strategies. As a first step one can make a distinction between different groups of users by the categories as the amount of search time or downloaded information. There can be different sorts of users e.g. professional users, medium professional users, novice or naïve users, furthermore one can easily spot sporadic users and heavy users.

Furthermore the distinction between external and internal users is a significant one. Other libraries could be a possible ally for selling bundled information. Of course, the problem of competition of information servers has to be considered in this context. Companies that use the goods for the whole organization or for individual workers are a promising target group. Other independent research institutions and government agencies would be groups that could be charged at a premium price if they are reusing the information given to them in the sense of a library.

Internal users are surely the main target groups where pricing is a very difficult topic because the traditional free access to information at universities is a deeply rooted principle in contrast with pricing, which has always the argument of appreciation in the background. As mentioned above the categories for internal users developed here are the following. Students in their first part of studies could be free of charge because they probably hardly ever use the epub. In contrast for students in the second part of studies or after the introduction phase a fixed fee could be part of the semester fee. The students would need a broad variety of subjects without a too advanced search. Whereas students writing their Diploma thesis, would definitely need an advanced search engine, where they can find related papers and other documents in their area of research. In this case, a payment per article or page would be suitable, possibly sponsored by a fund as to not undermine the diversity of literature used. On the other hand, a limited access to information would develop a strong affinity to free goods on the net spawning awareness for quality information and/or a thoroughly selected bibliography.

Moving on to the more sophisticated users of academic research, the staff of the university and doctorate students are possibly the most common users of the epub. Assistants, lecturers and professors should be granted full access with the possibility of individual settings on their search engines. This would make the search more convenient and efficient since these users are professional searchers. The matter of pricing is probably only interesting when resources for full access are scarce, because they are more or less the actual producers of the information offered.

The language can be seen as a disturbance for users that causes a small problem in this concept. Of course the abstract and the summary are available in English and German but the whole paper will only be in one of the mentioned languages. As a personal experience the author might say that if you write in English especially as native speaker the affinity towards using only English literature is very high. Also the use of German literature when available with users still in education is understandable. To understand new concepts in the mother tongue is much easier than to do the same with another language.

If there is a paper available in English and in German it causes no problem in this particular respect. This case will be only possible if the paper is originally written in German because normally there are no translations if the producer of the paper has to go through the troubles of writing in a foreign language.

## 6.2 Strategies for the Epub with Respect to Bundling Strategies

Different strategies of bundling can be encountered as shown in the case studies. Especially new forms of bundling are becoming more popular with libraries that do not want all the articles or cannot afford them. As the individual user is concerned one can see a tendency towards the use of only a few articles per year for the bulk of users, in contrast to the fewer heavy users that might want a subscription base fee anyway and get better off as shown in Figure 3: Total outlay vs. number of articles consumed.

The following table shows an overview of the strategies developed for the epub with respect to the theoretical findings. The pros and cons are listed and a possible price range for the service is shown. These pros and cons of a DL provider's perspective and not of the users.

<i>Strategies</i>	<i>Suggested price range</i>	<i>Pros</i>	<i>Cons</i>
<b>Students only coupon</b>	Start bundle for free. 17 Euros per additional article and 130 Euros for the subscription.	Heavy users pay the whole subscription fee. Students are free to choose what they get.	Due to the possible change of a subscription fee after use money can be lost. Uncertainty of usage of the service.
<b>Exam period pricing</b>	Additional 5 Euros per article would be sufficient because students are known to be price sensitive.	A good average usage of the DL over the semester.	Alternative resources on the Web could be acquired.
<b>Doctoral students subscription article combination</b>	With charging up to 300 Euros the additional subscription of other DL could be realized. Including 40 free bonus articles of one's choice.	Strategic alliances to other DL and universities spawning new opportunities for promotion.	Payment is only connected with a fee. The excessive use of all the DL is hard to prohibit.

<b>New dissertations pay-per-article</b>	Per new item a payment of 12 Euros for a time span of 4 months would be suitable	Justification of the additional revenue by the additional freshness value.	Be careful with regulars that already pay a lot for the service.
<b>Group bundles by institutes</b>	The span of 4000 up to 6000 Euros per bundle per Institute per year could be possible.	Good overview which institutes work intensely together.	Restricted search options that might not be reasonable.

**Table 3: Summary of strategies**

**Students only coupon:** A strategy might be developed for students only, where the library provides a bundle of articles that can be selected by the users. Every student has a coupon of 20 articles per semester that they can freely choose from. Of course, they have the possibility to read all the abstracts and search for keywords so that they know what they get. For the rest of the articles they might need they have to pay per view. If they read more than a certain amount of articles, let us say 50, they can use the subscription fee at the end of the semester to get off cheaper than buying each article separately. Of course, the limit for the subscription fee should be chosen wisely as to get most out of the users between the free basic articles and the subscription. As a simple example the use of 37 articles should cost as much as the subscription fee. As usually done in the mobile phone business the borders for the tariffs can be chosen so that the fixed fee gets higher but the costs per minute drop. At a certain level the earlier switch to the next tariff would be better for the consumer because variable costs exceed the economies of the lower fixed costs. Therefore in our much simpler example the usage of 38 to 49 articles should be in exactly this range.

Even if consumers are aware of these economies, they would have to use more than 49 articles to get the subscription, because they have no option to choose. They are given the first 20 for free anyway. Of course, there can be other higher limits as well but that might be inappropriate in this example for students that might not use more than 70 articles per year. Which exact pricing strategy should be executed now? Let us assume the subscription fee is 130 Euros. 38 articles minus 20 free articles makes 18 articles the student has to pay per view. 130 divided by 18 makes 7.22, that leaves us with 7 Euros per article which sums up to 126 Euros for 38 articles including 20 free ones. So if a student uses 39 articles, he or she would pay 133 Euros, which is already more than the subscription fee. For 49 articles one would pay 203 Euros, which is substantially more than the subscription fee of 130 Euros. Uninformed and naïve students would thereby be punished by their lack of cost calculation knowledge.

**Exam period pricing:** Using a page preview of a few pages is not a good way of offering to students, because they could be tempted to use only the pages available for free. Whereas a higher price for new articles in the exam period would be an intelligent way to keep students from studying in the last minute or downloading the articles much earlier, thereby making sure they start their literature research earlier. The danger to this approach would be the search for cheap, similar articles on the Web, thereby undermining the standard of the education and the produced research papers. On the other hand the cheapest article might not be the worst one in every case. A major advantage of this strategy would be the better use of the DL throughout the year which prevents problems that may occur during the heavy use of many users where the scale of operations is not tested. A system that works perfectly fine with a few users might get into serious troubles when confronted with a rush of many users at the same time. Systematic problems may arise that have not been thought of before.

***Doctoral students subscription article combination:*** For students writing their diploma thesis or doctoral students that are not employed by the university, there could be a special offer of a subscription with bonus articles from other DL, where they have to pay for the subscription. With a strategic alliance to other DL this offer could be a professional way to make it easier for students to access also other libraries that charge for their services. Additionally with this strategy the transfer of information between different universities could be enhanced and the transfer of knowledge put on a digital basis.

***New dissertations pay-per-article:*** Extra profit could be made by offering new dissertations only in a pay-per-article way, so that even the subscribers have to pay an extra amount for new articles. This way additional profit could be generated. Using a bonus system for heavy users that already pay a lot for their subscriptions should be included in the price. These regulars should be treated with care and not be charged extra for services that they would take for granted due to the costs they already have.

***Group bundles by institutes:*** One pricing strategy for the epub could be that bundling is used in the sense that there are existing bundles with articles of a group that are connected. For example all the articles from the mathematical and statistical institutes are put together in a bundle and sold for a fixed price to other institutes or institutions and libraries, because some institutes may not be interested in these articles at all. Thereby the search would also be only restricted to the articles one might possibly want to have.

Another important fact is that the service of a digital library is an additional one that the students should be aware of. To inform the students of this service that is included in their semester fee could enhance the image of the university as an information provider. The following chapter provides a summary of the findings in this paper and options for further research with reference to the epub.

## **7 Summary and Further Research**

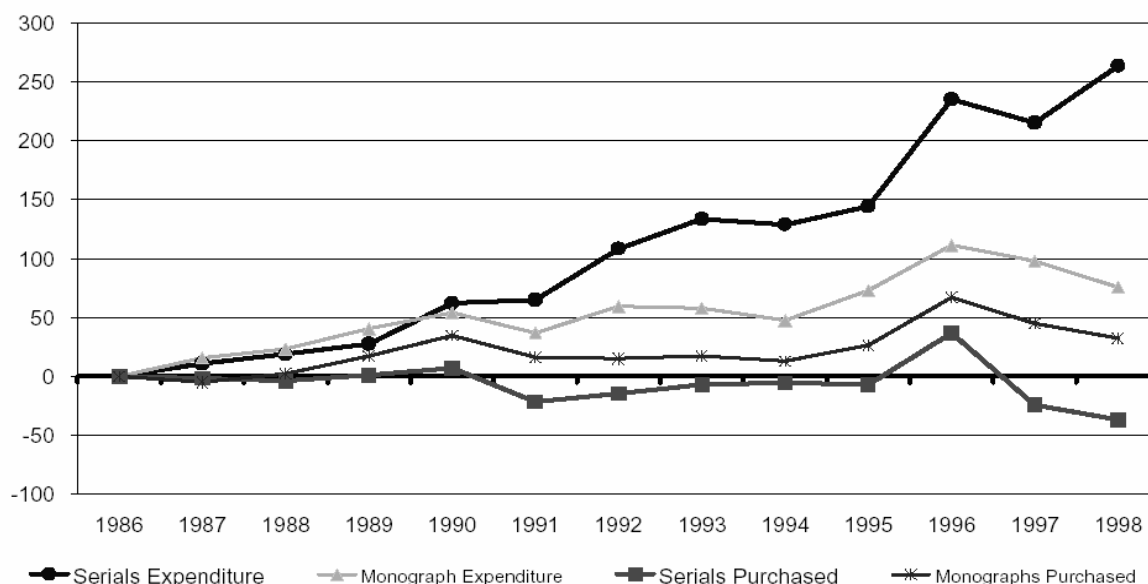
Digital libraries are important features of communication in the academic society. Pricing them in connection with electronic commerce will become a more important feature in the future. Research in the practical application of pricing schemes in this area is still rare. This has to do with the way information is traded in the academic context. Different pricing strategies and models for information goods have already been researched. Especially the different bundling strategies play an important role with respect to the publishers and the libraries using articles or journals. It is clear that for every project there has to be a trial period and market research to implement optimum pricing strategies. In the application of the theoretical findings there are a few pricing strategies that could be a possible starting point for the epub at the WU-Wien.

## Appendix A. Sample list of web-hosting service providers

Service Provider	URL	\$/MB download
AT&T Easy World Wide Web	<a href="http://www.att.com/">http://www.att.com/</a>	\$0.50
Cowboy.Net	<a href="http://cowboy.net/commercial_prices.html">http://cowboy.net/commercial_prices.html</a>	\$0.05
Citizens Internet Service	<a href="http://www.swva.net/citizen/services/webprice.html">http://www.swva.net/citizen/services/webprice.html</a>	\$1.00
DC-AdNet	<a href="http://www.dc-adnet.com/prices.htm">http://www.dc-adnet.com/prices.htm</a>	\$1.00
Internet Industries Web Hosting	<a href="http://www.industries.net/webhosting.html">http://www.industries.net/webhosting.html</a>	\$0.05
Internet Video Services' netvideo	<a href="http://www.netvideo.com/netvideo/price.html">http://www.netvideo.com/netvideo/price.html</a>	\$0.02-\$0.08
Multiboard Communications	<a href="http://www.multiboard.com/services.html">http://www.multiboard.com/services.html</a>	\$0.07-\$0.10
PreciseNet Web Site Hosting	<a href="http://www.precisenet.com/host.htm">http://www.precisenet.com/host.htm</a>	\$0.20
Pro-NetMedia Creations, Inc.	<a href="http://www.pcinc.com/pricing.htm">http://www.pcinc.com/pricing.htm</a>	\$0.25
Serview Premium Webhosting	<a href="http://serview.com/pricing.html">http://serview.com/pricing.html</a>	\$0.10
Sustance	<a href="http://www.he.net/~sustance/prices.html">http://www.he.net/~sustance/prices.html</a>	\$0.039-\$0.10

Compiled by [ChSi97] in January 1997

## Appendix B. Australian Academic and Research Libraries' content purchases and expenditures, 1986-98 (Indexed)



Source: CAUL Statistics ([www.caul.edu.au](http://www.caul.edu.au))

Source: [Houg02]

## Appendix C. MCB University Press Distribution

UK	19 per cent
Europe	25 per cent
America	20 per cent
Far East	21 per cent
Australia	7 per cent
Rest of the world	8 per cent

Source: [http://www.prestoungrange.org/core-files/archive/university\\_press/pp7to10\\_Introduction.pdf](http://www.prestoungrange.org/core-files/archive/university_press/pp7to10_Introduction.pdf)

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