8-4-2008

Bundling of Information Goods - Past, Present and Future

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芽|Sprouts Working Papers on Information Systems ISSN 1535-6078

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Abstract
Bundling of information goods (such as software and digitized music or TV) is omnipresent in todayâ s business-to-consumer environment. However, a surprisingly small number of articles address this issue within the information systems science (ISS) literature. By conducting a thorough literature review on the subject, this article shows that a lionâ s share of the most important work on information technology product bundling is published outside the ISS arena. On the basis of the literature review, eight future research directions are presented.

Keywords: Bundling, Information Goods, Literature Review, Future Research Directions

Permanent URL: http://sprouts.aisnet.org/4-24

Reference: Penttinen, E. (2004). "Bundling of Information Goods - Past, Present and Future," Helsinki School of Economics, Finland . *Sprouts: Working Papers on Information Systems*, 4(24). http://sprouts.aisnet.org/4-24

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HELSINKI SCHOOL OF ECONOMICS
WORKING PAPERS
W-373

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Information Systems Science

July
2004

HELSINGIN KAUPPAKORKEAKOULU
HELSINKI SCHOOL OF ECONOMICS
WORKING PAPERS
W-373

HELSINGIN KAUPPAKORKEAKOULU
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PL 1210
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ISSN 1795-1828
ISBN 951-791-864-X (Electronic working paper)

Helsinki School of Economics -
HeSE print 2004

#|Sprouts

ABSTRACT

Bundling of information goods (such as software and digitized music or TV) is omnipresent in today's business-to-consumer environment. However, a surprisingly small number of articles address this issue within the information systems science (ISS) literature. By conducting a thorough literature review on the subject, this article shows that a lion's share of the most important work on information technology product bundling is published outside the ISS arena. On the basis of the literature review, eight future research directions are presented.

Keywords: bundling, information goods, literature review, future research directions

Acknowledgement: The author thanks professors Timo Saarinen, Virpi Tuunainen, Jonathan Palmer and Johanna Bragge for their comments. Further comments welcome.

Introduction

Companies can use bundling to pursue price discrimination (Adams and Yellen 1976; Stremersch and Tellis 2002), increase sales, and create entry barriers (Carlton and Waldman 2002; Choi and Stefanadis 2001; Nalebuff 2004). Hence, the bundling of products and services offers companies a powerful strategic tool with important economic implications. Consumers, on the other hand, in some cases prefer bundled sales over unbundled (Dewan and Freimer 2003b). Students in the school cafeteria usually appreciate the price bundling of lunch coupons (11 coupons offered for the price of 10). Jack Nicholson's character in the movie Five Easy Pieces, on the other hand, did not appreciate being forced to order a chicken salad sandwich without chicken, lettuce, or mayonnaise in order to get some toast and coffee. So, for consumers, the implications of bundling are mixed.

Recently, the bundling of information goods has emerged as an interesting topic for both the academia and practitioners. With the emergence of digital TV, bundling of TV channels is becoming an interesting area of research, not to mention the rapid development of sales and distribution of bundled digitized music over the Internet. Legal aspects of bundling of information goods have gained attention due to Microsoft's decision to bundle the Windows Media Player with its operating system. On March 24th 2004, The European Commission levied a 497,2 million euros ($612 million) fine and ordered the unbundling of Windows Media Player within 90 days (Reuters 2004).

The bundling literature, initiated by Burstein (1960) and Stigler (1963), and later formally formulated by Adams & Yellen (1976), originally seeks to contemplate why firms often sell their goods in packages: sporting and cultural organizations offer season tickets, restaurants provide complete dinners, banks offer checking, safe deposit, and travelers' check services for a single fee, and garment manufacturers sell their retailers clothing grab bags comprised of assorted styles, sizes, and colors (Adams and Yellen 1976). This original article has been the reference for numerous articles, both theoretical and empirical. After the Adams and Yellen (1976) seminal paper, the literature on bundling in the early stages was mainly economics-oriented. Recently, marketing literature has witnessed a spurt in articles devoted to the study of bundling (Venkatesh and Kamakura 2003).

For some reason, there are very few articles related to bundling in the information systems science journals. Take for example the ICIS 2003 conference where there was only one research paper [see Goh et al. (2003)] discussing information technology product bundling. A quick search of 1999-2002 ICIS conference proceedings yielded no further papers discussing this subject. A surprisingly large proportion of the most important work on IT product bundling is reported outside the ISS arena.

Therefore, the objective of this literature review is to examine the literature on bundling of information goods, and to present some avenues for future research on the subject. Information goods are defined as anything that can be digitized and distributed in their entirety over an electronic channel such as the Internet. Classic examples include software, some banking and insurance services, and news. An example of an emerging one is the film industry (both cinema and photography).

The extant literature discusses bundling mainly in the business-to-consumer context and, therefore, this study is limited to the business-to-consumer environment as well. In the business-to-business world, bundling is often used to create full-service offerings (Stremersch et al. 2001) in order to provide customer companies a single point of contact (Cristol and Sealey 1996).

The paper is organized as follows. The second section summarizes prior research on bundling. The research methodology is described in the third section. The fourth section presents the future research directions for the bundling of information goods in the form of eight research hypotheses. The conclusions are drawn in the final section.

Existing bundling literature

Prior studies

The original framework of Adams and Yellen (1976) distinguishes three alternative bundling strategies: pure component strategy (unbundled offering), pure bundling strategy (components available only in bundled form) and mixed bundling strategy (components available in bundled form as well as separately). They consider the two-good situation and analyze the different strategies in the light of consumer surplus. They find that bundling can be used by companies to extract more of the consumer's surplus. They also demonstrate that bundling can be inefficient by the Pareto standards: it can lead to oversupply or undersupply of particular goods.

This framework is extended and its assumptions relaxed in numerous articles. For example, Schmalensee (1984) relaxes the assumption of bivariate normal distribution of reservation prices to Gaussian demand and thus produces a continuum of customer segments. His findings support the view that bundling permits more efficient extraction of surplus by reducing effective buyer heterogeneity. More specifically, bundling is found to be profitable when there is a negative correlation of reservation prices and the mixed bundling strategy found to combine the advantages of pure bundling and unbundled sales. Lewbel (1985) introduces substitutes and complements and discusses the degree of substitutability or complementarity. He finds that a monopolist may find it most profitable to offer the goods only as a bundle, even if they are (imperfect) substitutes, or to not bundle the goods, even if they are complements. Eppen et al. (1991) provide a practitioner-oriented paper and show how to reduce costs, to expand the market and to improve product performance by bundling. Optimal bundle pricing is discussed in Hanson and Martin (1990). They formulate the bundle pricing problem as a disjunctive program (that is, a customer will buy nothing, or buy bundle one, or buy bundle two, … , or buy bundle *L*) that can be solved using mixed 0/1 integer linear programming.

More recently, Stremersch and Tellis (2002) provide a synthesis of strategic bundling in marketing and articulate the different bundling strategies. It adds the bundling focus to the Adams and Yellen (1976) framework: either price or product. Price bundling is defined as the sale of two or more separate products as a package at a discount, without any integration of the products (e.g. variety pack of cereals). Product bundling is the integration and sale of two or more separate products at any price (e.g. multimedia PC). (Stremersch and Tellis 2002) The following figure presents the different bundling strategies[1].

		Focus	
		Price	**Product**
Form	**Unbundling**	**X** **Y**	
	Pure bundling	**X⊕Y**	**X⊗Y**
	Mixed bundling	**X⊕Y** **X** **Y**	**X⊗Y** **X** **Y**

Figure 1. Classification of Bundling Strategies (Stremersch & Tellis 2002)

[1] The symbol ⊕ translates as a non-integrated bundled offering (price bundling) and the ⊗ symbol as an integrated bundled offering (product bundling).

Bundling of Information Goods

The original article of Adams and Yellen (1976) makes the following assumptions: (A1) The marginal cost of supplying each good separately is invariant with respect to output, and the marginal cost of supplying the two goods in a bundle is the sum of the component costs, (A2) the marginal utility of a second unit of either commodity is zero, and (A3) the reservation price for a package comprised of one unit of each commodity is equal to the sum of their separate reservation prices. Now, in the case of information goods, contrary to the Adams and Yellen framework, the marginal cost (A1) of supplying information goods is very close to zero. Marginal utility (A2) of a second unit of either commodity, on the other hand, remains zero. The third assumption is somewhat problematic. For this, we use the Stremersch and Tellis (2002) framework and posit that the reservation price for a bundle depends on the level of integration of the two information goods. This will be elaborated in the future research-proposition eight.

There are several articles discussing the bundling of information goods. The bundling of a large number of information goods is discussed in Bakos and Brynjolfsson (1999). They show by statistical techniques that a menu of different bundles aimed at each market segment makes traditional price discrimination strategies more powerful. Bundling and competition on the Internet is discussed in Bakos and Brynjolfsson (2000). Using a model with fully rational and informed consumers, they use the Law of Large Numbers to show that a seller typically can extract more value from each item of information goods when it is part of a bundle than when it is sold separately. Because of the predictive value of bundling (the fact that it is easier for a seller to predict how a consumer will value a collection of goods than it is to value any item individually), large aggregators will often be more profitable than small aggregators, including sellers of single goods (Bakos and Brynjolfsson 2000).

The bundling of e-Banking services is discussed in Altinkemer (2001) where he calls for flexible, adjustable e-Banking service bundles, and *"usage patterns that may be shared with customers, with the bank acting as an information manager, helping customers choose optimal bundles"*. The (un)bundling of digitized music over the Internet is discussed in Altinkemer and Bandyopadhyay (2000). Thatcher and Clemons (2000) present pure bundling strategy as a means for insurance companies to attain universal coverage for insurance contracts.

Related to digital TV, optimizing television program schedules is discussed by Danaher and Mawhinney (2001), bundling subscription TV channels by Chae (1992) and the 1992 Cable Act in the U.S. by Crawford (2000). The Cable Act limited cable prices for most types of cable service and imposed must-carry and retransmission consent regulations. Crawford (2000) found no evidence of benefits to households from the Cable Act. Of greater importance is the control that cable systems have over (1) what programming to offer, (2) how to bundle that programming into services, and (3) how to price those services.

The legality of pure bundling a complementary product (e.g. Internet browser) to a core product (e.g. operating system) in the presence of monopoly power is discussed e.g. in Stremersch and Tellis (2002). The case of Microsoft is thoroughly discussed in the literature [studies in economics include Carlton and Waldman (2002), Choi and Stefanadis (2001), Choi (1996) and Nalebuff (2004), in marketing Stremersch and Tellis (2002), and in information systems science Lee (2000) and Dewan and Freimer (2003b)].

Methodology

This study is a literature review. According to Watson (2001), for a specific MIS topic, a review article ideally should (1) survey and synthesize prior research, (2) identify the relationships between key concepts, (3) identify gaps in MIS knowledge and (4) set directions and priorities for future research. We focus on identifying gaps in ISS research and presenting a set of proposals for future

research. Hart (1998) defines literature review as the selection of available documents on the topic and the effective evaluation of these documents in relation to the research being proposed.

The gathering of relevant literature consisted of two phases. In the first phase, we identified the most relevant articles from the economics, marketing and management domains. The second phase comprised of a search of articles on bundling within the ISS journals. After having identified the relevant literature, we analyzed the different research streams and generated eight directions for future research.

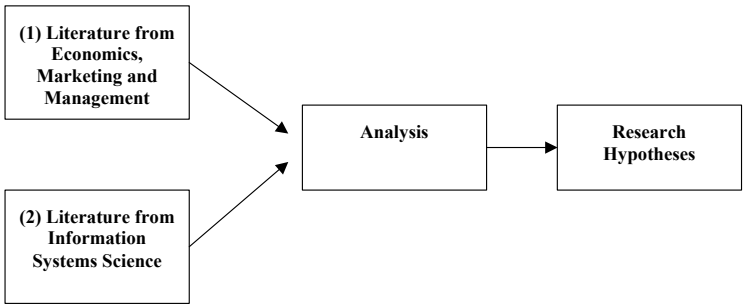

Figure 2. Research framework

Selection of the papers – Phase One

By using the ISI Web of Science's Cited Reference Search, we were able to identify articles citing the seminal article of Adams and Yellen (1976). We extracted a total of 110 articles from a wide array of journals (see Appendix 1 for details). From this initial set of articles, we chose to focus on the following journals: *Rand Journal of Economics, Quarterly Journal of Economics, Management Science, Journal of Business, Journal of Marketing Research, Marketing Science, Journal of Marketing* and *International Journal of Industrial Organization* as these journals had the largest number of hits in our initial set (total 37).

To complete the set of articles, we conducted a search on the EBSCO database within these journals with keywords "bundle" and "bundling" (e.g. task bundling and characteristic bundles omitted). This search yielded 16 additional articles which did not cite Adams and Yellen (1976). Also, we subtracted six articles citing Adams and Yellen (1976) since they did not discuss bundling. This resulted in the final set of 47 papers. A quick review of these papers is presented in Appendix 2.

Table 1. Distribution of Papers by Journals in Phase 1

Type	Abbr.	Journal	No. of art.
Economics	RJE	Rand Journal of Economics	6
	QJE	Quarterly Journal of Economics	5
Marketing	JMR	Journal of Marketing Research	8
	MarS	Marketing Science	4
	JM	Journal of Marketing	5
Management	MS	Management Science	7
	JB	Journal of Business	6
	IJIO	International Journal of Industrial Organization	6
		TOTAL	47

Selection of the papers – Phase Two

After having identified the relevant literature outside the ISS journals, we turned to ISS and conducted a search within the top ranked ISS journals by Mylonopoulos and Theoharakis (2001). We used the keywords "bundling" and "bundle" and conducted the search on the EBSCO database for *MIS*

Quarterly, Communications of the ACM, Information Systems Research, Journal of Management Information Systems and Journal of Organizational Computing and Electronic Commerce. We used Elsevier Science Direct for *Information & Management* and Palgrave MacMillan for the *European Journal of Information Systems*.

Because a complete review is not confined to one research methodology, one set of journals, or one geographic region (Webster and Watson 2002), we decided to broaden the scope to include recent ICIS and HICSS conference proceedings and journals that were not listed in Mylonopoulos and Theoharakis (2001). This search provided us with additional articles that were added to the set of articles on bundling within the ISS journals. A quick review of these articles is given in Appendix 3.

Table 2. Distribution of Papers by ISS Journals

Abbr.	Journal	No. of art.
MISQ	MIS Quarterly	1
ISR	Information Systems Research	1
CACM	Communications of the ACM	1
JMIS	Journal of Management Information Systems	3
IM	Information & Management	1
EJIS	European Journal of Information Systems	1
JOCEC	Journal of Organizational Computing and Electronic Commerce	1
ICIS	International Conference on Information Systems	1
HICSS	Hawaii International Conference on System Sciences	4
	TOTAL	14

After having identified the relevant literature for our study, we read through the articles and noted everything related to information goods bundling. This acted as the starting point for our analysis.

Future Research Directions

We observed a large number of cases discussing information technology products in the economics, marketing and management literature. Simple statistics of the articles reveal that the bundling of information technology products was discussed in 20 of the 47 articles (see Appendix 2). The special case of information goods bundling was discussed in 11 papers. These papers mainly addressed the bundling of personal computer components (IT products) and the bundling of software (information goods) such as an internet browser with an operating system. So, as a general comment on the illustrative cases of bundling, we can state that if season tickets and restaurant menus are the traditional examples of bundling (Adams and Yellen 1976; Kinberg et al. 1980), today's articles use PC systems and software bundling (Carlton and Waldman 2002; Choi 1996; Chung and Rao 2003; Nalebuff 2004; van Ackere and Reyniers 1995).

Our search through the journals and conferences specialized in information systems science provided only 14 articles discussing bundling. The objective of this literature review is to present some promising research avenues. Most of the following research proposals address the special case of information goods and are formulated from the seller's point of view.

Identifying the lead product in the bundle

The original article by Adams and Yellen (1976) begins with the following examples: season tickets, restaurants providing complete dinners, and banks offering checking, safe deposit, and travelers' check services for a single fee. These are all bundles of distinctive products and services, but is there a lead product to be identified? In the case of season tickets, the lead product may be somewhat difficult to define (although there might be some popular play that might act as the lead product). For

restaurants, the main course is often the lead product to which appetizers and desserts are bundled. In the case of banking services, the checking clearly steps out as a lead product and safe deposit and travelers' checks as bundled products and services.

Kotler (1999) presents three levels of product: core product, actual product and augmented product. Core product includes the core benefit or service. Actual product includes packaging, brand name, quality level, design and features. Augmented product includes installation, delivery and credit, warranty and after-sales service. He sees the product as more than a simple set of tangible features. When developing products, marketers first must identify the core consumer needs and then design the actual product and find ways to augment it in order to create the bundle of benefits that will best satisfy the consumers. (Kotler 1999) We argue that the lead product in a bundle is the product that provides the core benefit or service.

Now, in the case of information goods, how can we identify lead products and secondary products? Let us first consider the case of Microsoft. It has bundled different office software (word-processing, spreadsheet and presentation tools) into one package (MS Office) and, on the other hand, it has bundled its Internet browser together with the operating system. The extant literature provides rather thorough analysis of the economic implications of this type of bundling [see e.g. Carlton and Waldman (2002), Choi and Stefanadis (2001), Choi (1996) and Nalebuff (2004)]. In the first example, the lead product is different for different consumers. Some consumers mainly need word-processing, and spreadsheet comes as a useful supplement. Some consumers work with presentation tools and need word-processing on the side. In the second example, Microsoft has tied its Internet browser with its operating system. Therefore, the lead product is the operating system.

Another way to identify the lead product is to look at consumers' reservation prices. For example, in the case of digital TV and bundling of TV channels, a consumer usually is interested in a specific channel and looks for bundles in which this channel is included. Hence, this consumer has a higher reservation price for this channel than for other channels.

> *Hypothesis 1: Within a homogeneous category of products (such as TV channels or software component bundles) a consumer's reservation price is higher for the lead product than for a secondary bundled product.*

As observed above, the distinction between the bundle's lead product and secondary products should not be static, but dynamic. For example, today, Microsoft is bundling internet browser to its operating system, but tomorrow the internet browser may become the lead product to which complementary products are bundled. Therefore, we call for a clear conceptualization regarding the composition of the bundle. How can a firm analyze whether they are in the business of providing the lead product or a bundled product?

There are articles that make the distinction between the different products in a bundle. For example, Carlton and Waldman (2002) do talk about tying products and tied products to distinguish the product which is bundled to the main product. We next proceed to discuss tying vs. bundling.

Tying vs. bundling within complementary products

The seminal article by Adams and Yellen (1976) distinguishes three alternative bundling strategies: pure components, pure bundling and mixed bundling (see the second section for details). On the other hand, the economics literature often uses the term of tying which is defined as the practice when the seller of product A refuses to sell A to a consumer unless the consumer also purchases B (A being the tying product and B the tied product). This definition is very close to pure bundling with the exception that here, we can distinguish between the tying product and the tied product. Carlton and Waldman (2002) show how a monopolist can use tying to preserve its monopoly position and to transfer

monopoly power from the primary market to a newly emerging market. Tying may make the prospects of entry less certain, discouraging the incumbent's rivals from investing and innovating. In these circumstances, tying may lead to lower consumer and total economic welfare (Choi and Stefanadis 2001). Related to innovation and bundling, Choi (1996) analyzes the effect of bundling on innovation when the considerations of R&D competition are central to the bundling decision.

Most of the discussion of the Microsoft case is concerned with the future impact of bundling on the pace of innovation, whereas the literature on the leverage theory of tying is mainly preoccupied with the consequences of tying to price competition (Choi 1996). It is alleged that even though bundling might benefit consumers in the short term, as soon as Microsoft eliminates the competition, it will stop innovating (Choi 1996). In a recent article, Nalebuff (2004) asks "since not all of its products are best-of-breed, how does Microsoft gain an advantage by selling its office products as a bundle?" Synergies between MS Office applications, the commonality of commands and a single helpdesk number are listed as intuitive answers. However, the article shows that even when these synergistic gains are absent, a monopolist concerned about competition would have a strong incentive to sell these products as a bundle rather than individually. The reason is that bundling is a credible tool to protect a multigood monopolist against entry. (Nalebuff 2004)

On one hand, companies of today are specializing in providing the market with one specific product component. The practitioner-oriented term "killer application" describes the product that is superior in quality and kills the competition. On the other hand, pure bundling strategy (or tying) gives companies the opportunity to bundle multiple products and thus pursue price discrimination. When there are two firms, one providing a lead product (such as an operating system) and the other providing a complementary product (e.g. a virus protection program), should these firms partner and provide their products as a joint bundle?

Hypothesis 2a: It is optimal for a lead product firm to partner or merge with a complementary product firm and thus pursue pure bundling (in other words tying)

Hypothesis 2b: It is optimal for a complementary product firm to partner with a lead product firm and thus pursue pure bundling (in other words tying)

Similarly, Carlton and Waldman (2002) discuss that such a merger may help the monopolist preserve its monopoly by eliminating a potential rival who has a strong incentive to enter the primary market.

Bundling updates and subscription-based systems: Bundling longitudinally

Bundling future updates to a software is becoming common practice. Take for example the virus protection software firms such as F-Secure which is not selling one single virus protection program but selling the bundle of the program and updates to the program as a year(s)-lasting subscription.

The bundling of (e.g. software) updates to products is mainly an issue of price bundling. The software and updates are often price bundled so that the price of the bundle is less than the individual component prices. Tellis (1986) discusses different pricing strategies and lists price bundling as a strategy for product line pricing. He gives examples such as packages of stereo equipment and option bundles on automobiles. However, in Stremersch and Tellis (2002) terms, these are in fact product bundles (if the stereo equipment is integrated and obviously the options on automobiles are integrated). Similarly, the update of a software is integrated to the product so that the update is often automatically done on the Internet.

For prior research on this subject, bundling of a large number of information goods is discussed by Bakos and Brynjolfsson (1999), introducing multiple editions of the same software by Raghunathan (2000), and pricing of information products on online servers by Jain and Kannan (2002), but this issue of bundling updates to software programs has received surprisingly little attention. Gundepudi et

al. (2001) discuss forward buying vs. spot buying of information goods and find that when the firm is a price-setter, we show that its optimal strategy is to always offer both forward buying (bundling update and e.g. virus protection program) and spot buying (unbundling) in order to price discriminate between the two kinds of consumers.

This problem relates to the discussion on trade-ins (discounts to existing customers) and introductory offers (discounts to new customers) (van Ackere and Reyniers 1995). As an example of discounts to existing customers, they mention that software updates are only available to new users at a very high price.

Hypothesis 3: Bundling future updates to software is more profitable to a software firm than selling software and updates separately

How to use bundling to stop software piracy?

Software piracy is the illegal act of copying software for any reason, other than backup, without explicit permission from and compensation to the copyright holder (Gopal and Sanders 1998). Givon and Mahajan (1995) state that instead of destroying shadow diffusion of a software, firms whose products are subject to piracy may be well advised to examine marketing mix mechanisms that can facilitate the conversion of shadow diffusion into legal diffusion. These mechanisms may include differential pricing strategies, limited and self-destructing software codes, bundling of software, sharing of software (shareware), installation of software in the hardware itself, software clubs, and self-help software books (Givon and Mahajan 1995). Gopal and Gupta (2002) show that bundling results in a level of piracy that is always less than the piracy level of one of the products of the bundle. However, they find that it is possible to trade off the piracy level of one product for overall higher profits, i.e., a seller can derive higher profits even with higher levels of piracy from one of the products in the bundle.

Hypothesis 4: Bundling of software or digitized music can be used to prevent piracy in these industries

Differences in bundling products vs. bundling services

Kotler (1999, 7) defines products as *"anything that can be offered to a market for attention, acquisition, use, or consumption that might satisfy a want or need. It includes physical objects, services, persons, places, organizations, and ideas."* A service is *"any activity or benefit that one party can offer to another that is essentially intangible and does not result in the ownership of anything."* Services are traditionally related to concepts such as intangibility, inseparability of consumption and production, variability, and perishability (Rust et al. 1996).

In the case of information goods, we define these goods to be products (services) if they are perceived as products (services) in the concrete world as well. For example, banking services are considered to be services in the world of bricks and mortar. Therefore, the resulting e-banking services are seen here as services too. Similarly, a music CD is something a consumer buys from e.g. department store and sees it as a product. Hence, digitized music distributed over the Internet is defined here to be a product.

Are there differences in bundling information products and services? These differences can be examined through the investigation of the technologies required in the transaction, marketing mix components, and consumer preferences.

Hypothesis 5: Information technology product bundling differs from information technology service bundling

How to bundle information?

Consumers have access to an increasingly large range of channels providing them with information such as news and weather services. These channels include e.g. mobile phone, digitized TV, electronic newspapers via Internet and car navigation systems. Recent changes in media technology and delivery make it increasingly possible for magazines to unbundle their readership by publishing customized editions that are sold to specific reader segments (Koschat and Putsis Jr. 2002, 263). Koschat and Putsis Jr. (2002) discuss the bundling of advertising rates and continue *"...electronic delivery of magazines has the potential to take unbundling to its final level, namely, offering editions that in their advertising content are customized to individual readers"*.

Bakos and Brynjolfsson (1999) found that when different market segments differ in their valuations for goods, simple bundling will no longer be optimal, and that in these situations, firms should offer a menu of different bundles aimed at each market segment.

Hypothesis 6a: When bundling information (such as news and weather services), offering consumers individual bundles of information is more profitable than simple bundling of information

Hypothesis 6b: When bundling information, offering individual bundles of information is more profitable than offering a menu of different bundles

Positive vs. negative effects of bundling

Bundling and unbundling of products and services have positive and negative effects for consumers. For some students, it is very convenient to purchase a packet of 10 lunch coupons at the school cafeteria and even get one coupon for free (example of price bundling). But bundling may have negative consequences as well. Take for example the movie Five Easy Pieces where Jack Nicholson enters a diner to purchase some toast and coffee. The waitress informs him that toast alone is not available. Nicholson is forced to order a chicken salad sandwich without chicken, lettuce, or mayonnaise.[2]

For future research, it would be interesting to explore the positive and negative effects of e.g. the unbundling of digitized music for consumers.

Hypothesis 7: Positive effects of unbundling of information goods (such as the digitized music) outweigh the negative effects for consumers

Consumer's reservation price for the bundle of information goods

As discussed in chapter two, the Adams and Yellen (1976) framework assumes that the reservation price for a package comprised of one unit of each commodity is equal to the sum of their separate reservation prices. Does this hold for information goods? For this, we use the (Stremersch and Tellis 2002) framework and posit that the consumer's reservation price for a bundle depends on the level of integration of the two information goods. They define price bundling as the sale of two or more products as a package at a discount, without any integration of the products. Product bundling, on the other hand, refers to the integration of two or more products. As examples, they name a variety pack of cereals (price bundling) and a multimedia PC (product bundling).

Hypothesis 8: When two information goods are product bundled, the consumer's reservation price for the bundle is greater than in the case of information goods price bundling

[2] The illustrative example is from Adams and Yellen (1976)

Concluding Remarks

The bundling of products and services offers firms a powerful strategic tool to create entry barriers, pursue price discrimination and increase sales. The literature on bundling is very wide. This paper provides a literature review on bundling of information technology products and services, namely information goods. Following a rigorous method, 47 articles in eight economics, marketing and management journals were selected. In addition, a search within the information systems science journals and conference proceedings yielded 14 articles. Together, these 61 articles provided the basis for the review.

The contributions of the paper are comprised of future research directions. Eight interesting topics are presented in the form of research hypotheses. They address the different aspects of information goods bundling: the bundling of software, the (un)bundling of information and music and the bundling of TV channels.

Table 3. Summary of the hypotheses

Hypothesis	Proposed methodology	Applications
H1: Within a homogeneous category of products, a consumer's reservation price is higher for the lead product than for a secondary bundled product.	Quantitative survey, experimental laboratory test with students	Software, TV channels
H2a and b: It is optimal for a lead product firm to partner or merge with a complementary product firm and thus pursue pure bundling (in other words tying), or vice versa	Game theoretic approach	Software
H3: Bundling future updates to software is more profitable than selling software and updates separately	Game theoretic approach	Software
H4: Bundling of software or digitized music can be used to prevent piracy in these industries	Game theoretic approach	Software, digitized music
H5: Information technology product bundling differs from information technology service bundling	Qualitative approach	Software, banking services
H6a and b: When bundling information (such as news and weather services), offering consumers individual bundles of information is more profitable than simple bundling of information or offering a menu of different bundles	Quantitative survey	Digitized newspapers, weather services
H7: Positive effects of unbundling of some information goods (such as digitized music) outweigh the negative effects for consumers	Qualitative approach	Digitized music
H8: When two information technology products are product bundled, the consumer's reservation price for the bundle is greater than in the case of information goods price bundling	Quantitative survey	PCs, information (news and e.g. weather services)

APPENDIX 1: Distribution of articles citing "Adams and Yellen (1976) Commodity Bundling and the Burden of Monopoly. *Quarterly Journal of Economics* 90(3)"[3]

Economics (53)	Rand Journal of Economics (6), Journal of Economic Theory (4), Quarterly Journal of Economics (3), Journal of Industrial Economics (3), Economic Inquiry (3), Economica (3), Econometrica (2), Amercian Economic Review (2), Economics Letters (2), Review of Economic Studies (2), Amercian Journal of Agricultural Economics (2), Review of Economics and Statistics (2), Journal of Economics and Business (2), Economic Theory (2) Information Economics and Policy (1), Journal of Economic Behavior & Organization (1), Journal of Development Economics (1), Applied Economics (1), Oxford Economic Papers – New Series (1), Oxford Review of Economic Policy (1), Journal of Economic Dynamics & Control (1), Journal of Economic Perspectives (1), Journal of Economics & Management Strategy (1), Journal of Comparative Economics (1), Journal of Law & Economics (1), Journal of Transport Economics and Policy (1), Cahiers Economiques de Bruxelles (1), Journal of Institutional and Theoretical Economics – Zeitschrift fur die Gesamte Staatswissenschaft (1), Canadian Journal of Economics – Revue Canadienne d'Economique (1)
Marketing (16)	Journal of Marketing Research (5), Marketing Science (6), Journal of Marketing (4), Marketing Letters (1)
Management (18)	Management Science (6), Journal of Business (4), Journal of Business Research (2), Journal of Management Studies (1), Decision Sciences (1), Journal of Retailing (1), Advances in Consumer Research (1), Journal of Consumer Research (1), Journal of Consumer Psychology (1), Journal of Consumer Affairs (1)
Industrial Organization (6)	International Journal of Industrial Organization (3), Industrial Marketing Management (1) International Journal of Service Industry Management (1), Review of Industrial Organization (1)
Information Systems Science (1)	Journal of Organizational Computing and Electronic Commerce (1)
Other (16)	Journal of Applied Psychology (1), Research Policy (1), Library Trends (1), Antitrust Law Journal (1), Long Range Planning (1), Transportation Research Part E-Logistics and Transportation Review (1), Geneva Papers on Risk and Insurance Theory (1), Annals of Operations Research (1), Library Acquisitions – Practice and Theory (1), Energy Policy (1), International Journal of Law and Psychiatry (1), Journal of Risk and Insurance (1), Annals of Tourism Research (1), Public Choice (1), Manchester School (1), Proceedings of the National Academy of Sciences of the USA (1)

[3] Data from the ISI Web of Science Cited Reference Search (May 2004)

APPENDIX 2: A quick review of papers selected in phase one.[4]

Journal

(citation)	methodology	application (if mentioned)	IT products and services

RAND Journal of Economics (6)

(van Ackere and Reyniers 1995)	two-period model	PCs, software updates	yes
(Alger 1999)	model with two types of consumers	e.g. quantity discounts	no
(DeGraba and Mohammed 1999)	mathematical model	rock concert season tickets	no
(Choi and Stefanadis 2001)	three-stage game	Microsoft	yes
(Carlton and Waldman 2002)	two-period model	Microsoft	yes
(Biglaiser and Ma 2003)	model with a continuum of consumers	health and education markets	no

Quarterly Journal of Economics (5)

(Adams and Yellen 1976)	two-good model	variety of goods in packages	no
(Mackay and Weaver 1983)	mathematical model of a political market	budgetary mix	no
(McAfee et al. 1989)	AY two-good model	- - -	no
(Choi 1996)	model of pre-emptive innovation	Microsoft	yes
(Nalebuff 2004)	game-theoretic model	Microsoft	yes

Journal of Marketing Research (8)

(Wilson and Weiss 1990)	normative model	industrial systems	no
(Venkatesh and Mahajan 1993)	model + survey	season tickets	no
(Yadav and Monroe 1993)	laboratory experiment	luggage sets	no
(Ansari and Siddarth 1996)	model	season tickets for events	no
(Simonin and Ruth 1998)	conceptual model + survey	personal computers, software	(yes)
(Soman and Gourville 2001)	regression model + empiria	ski tickets and passes	no
(Koschat and Putsis Jr. 2002)	regression model	magazine advertising rates	yes
(Chung and Rao 2003)	comparability-based balance model	personal computers	(yes)

Marketing Science (4)

(Lutz and Padmanabhan 1995)	game-theoretic model + illustrative example	warranties on different products	no
(Venkatesh and Mahajan 1997)	model + survey	PC + Intel processor, diet soft drink + NutraSweet	(yes)
(Bakos and Brynjolfsson 2000)	model + Law of Large Numbers	information goods	yes
(Jedidi et al. 2003)	model + experimental studies	automobile options, information goods	(yes)

[4] AY refers to Adams, William and Janet Yellen (1976), "Commodity Bundling and the Burden Of Monopoly," Quarterly Journal of Economics, 90 (3), 475.
"yes" indicates a discussion on information goods; "(yes)" indicates that IT products in general such as PC + software are discussed; "no" means that no IT products are discussed in that specific article.

Journal of Marketing (5)

(Tellis 1986)	literature review + classification	movie bundles	(yes)
(Guiltinan 1987)	normative framework	banks, health clubs, hotels	no
(Mulhern and Leone 1991)	theoretical framework + empirical results	retail	no
(Stremersch and Tellis 2002)	literature review + propositions	Microsoft	yes
(Shocker et al. 2004)	literature review + future research directions	wireless telephones and PDAs	(yes)

Management Science (7)

(Kinberg et al. 1980)	model	season tickets	no
(Hanson and Martin 1990)	mixed integer linear model + computational testing	multiple software modules	(yes)
(Kohli and Park 1994)	model + numerical example	manufacturing	no
(Bakos and Brynjolfsson 1999)	model + statistical techniques	large number of information goods	yes
(Ernst and Kouvelis 1999)	model + computational study	packaged goods (shampoo + conditioner), computer kits	(yes)
(Fisher and Ittner 1999)	empirical analysis	automobile option bundling	no
(Anderson 2002)	game-theoretic model	assembly of gas grills	no

Journal of Business (6)

(Goldberg et al. 1984)	hybrid conjoint model	hotel amenities	no
(Schmalensee 1984)	AY model with Gaussian demand	- - -	no
(Gerstner and Hess 1987)	model + empirical results	package size	no
(Salinger 1995)	graphical analysis	- - -	no
(Chen 1997)	equilibrium model	credit card issuers, computer firms	(yes)
(Venkatesh and Kamakura 2003)	analytical model	complements and substitutes	no

International Journal of Industrial Organization (6)

(Lewbel 1985)	AY model with complements and substitutes	- - -	no
(Chae 1992)	model + numerical examples	subscription TV channels	yes
(Anderson and Leruth 1993)	game-theoretic model	stereo system	no
(Costa and Dierickx 2002)	model	quality-improving innovations	no
(Liao and Tauman 2002)	game-theoretic model	firms producing a CD player and a set of speakers	no
(Choi 2003)	model	Microsoft (W95 and IE)	yes

APPENDIX 3: A quick review of papers selected in phase two.[5]

ISS Journals and Conference Proceedings (14)

MISQ	(Grover and Ramanlal 1999)	discusses bundling as a means to create captive buyer networks that can sustain higher prices	-
ISR	(Kraemer and Dedrick 1998)	briefly cites the application software as increasing-returns business and mentions Microsoft's bundling strategy as a way to extend its dominant market position	-
CACM	(Altinkemer 2001)	discusses the role of bundling in the evolution of e-banking	-
JMIS	(Thatcher and Clemons 2000)	discusses pure bundling strategy as a means to maximize consumer participation in the individual health insurance market	-
	(West Jr. 2000)	presents the effect of information product bundling on pricing and competition in the public sector as an important future research topic	-
	(Dewan and Freimer 2003b)	discusses software bundles and consumer valuations	-
I&M	(Gallaugher et al. 2001)	provides empirical validation of theoretical research on product bundling	-
EJIS	(Lee 2000)	shows that bundling a supplemental good with a base good is the optimal strategy of the base good monopolist (such as Microsoft) who also supplies supplemental goods	-
JOCEC	(Altinkemer and Bandyopadhyay 2000)	discusses bundling and distribution of digitized music over the Internet	AY
ICIS	(Goh et al. 2003)	discusses information technology product bundling in the presence of complementarities, quality uncertainty and network effects	-
HICSS	(Gopal and Gupta 2002)	shows that bundling results in a level of piracy that is always less than the piracy level of one of the products of the bundle	-
	(Airiau et al. 2003)	states that an automated agent, that can take user preferences and budgetary constraints and can strategically bid on behalf of a user, can significantly enhance user profit and satisfaction	-

[5] MISQ (MIS Quarterly), ISR (Information Systems Research), CACM (Communications of the ACM), JMIS (Journal of Management Information Systems), I&M (Information & Management), EJIS (European Journal of Information Systems), JOCEC (Journal of Organizational Computing and Electronic Commerce), ICIS (International Conference on Information Systems), HICSS (Hawaii International Conference on System Sciences)
Last column refers to any citations to the seminal paper by Adams, William and Janet Yellen (1976), "Commodity Bundling and the Burden Of Monopoly," Quarterly Journal of Economics, 90 (3), 475.

	(Dewan and Freimer 2003a)	shows that it is possible for the consumers to benefit from bundling of add-ins and base software as the price of the bundled software is often much less than the sum of prices of the base software and add-ins	-
	(Bhargava and Feng 2004)	proposes different possible explanations for why firms might willfully create barriers to entry for customers by pursuing a pure – rather than mixed – bundling strategy where the bundle contains one feature that is negatively valued by a customer segment	AY

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