Pricing of movies on demand

An empirical analysis of revenue implications of selected pricing techniques applied to movie rental via TV provider

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Preface

The work on this project was an exciting and highly educational process. During the course of it I enjoyed help and support of a number of bright people to whom I owe my sincere gratitude.

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Executive summary

This empirical study explores revenue implications of different pricing techniques applied to movie rental via TV-provider (movie on demand). The problem statement is:

What is the optimal pricing technique for movies on demand? How much of the area under demand curve can be captured by sophisticated pricing?

The method used is quantitative research based on the data (12 726 individual movie valuations obtained from 479 participants) gathered in the survey conducted among Norwegian customers of a large international provider of TV-services (Canal Digital DTH). The collected data was fitted into a parametric distribution. Thereafter a dataset containing valuation data from 5000 simulated individuals was created. The dataset was used to compare revenue implications of such pricing alternatives as uniform pricing, component pricing, bundling and two-part tariff. The results of the study show that two-part tariff performs best of all the alternatives listed above. It allows producer to capture almost 60% of the area under demand curve. Such pricing techniques as component pricing and various forms of bundling do not raise producer surplus over 43%. In addition, this study discovered that customers have statistically significant different consumption patterns when it comes to movie rental. The consumption patterns differ by age, gender, the age of children in the household.

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1. Introduction

1.1 Report background

1.1.1 What is video on demand?

The last decade has brought changes into the way we consume TV-services. New technologies, such as development of digital cable, HD (high definition) have brought higher demands for quality of TV-products. A fierce competition among both TV-content producers and TV-service providers challenges the last to re-invent themselves and look for new ways to offer TV-products to their customers. On top of this, many customers opt to download pirated content. This activity has been made possible on a large scale by net-based technologies such as torrents[1] and widely available online storage sites (http://www.economist.com/node/21543548). In response to the developing technology opportunity, competition and customer preferences, video on demand has appeared as an innovative way of providing TV-services. TV-based video on-demand includes a range of entertaining TV and video services that enables a customer to choose a movie or a TV show from a library of titles, start watching at any time, and pause/fast-forward/rewind as if they were watching a DVD. In telecommunication industry video on demand is denoted as a vast video library connected directly to one's own television via a very high capacity electronic pipeline (Cermak, 1996). Stankeviciute (2004) points out that this type of services makes television a personalized medium so that a person does not depend on the broadcasters' schedule.

Video on demand has existed since the early 90s. The first commercially viable video on demand service emerged in Hong Kong around 1990, but didn't succeed (Stankeviciute, 2004). Most of the information one can find about video on demand concerns USA. The first "near video on-demand" trial there took place in 1992. This service would allow customers to choose time and date for watching a program or movie which was advertised particularly for this purpose. That is, the customer could not choose any movie or show from the library,

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[1] Torrents are used for downloading/sharing data via, for instance, BitTorrent (bittorrent.org). A torrent contains data about the location of different pieces of the target file. Torrents divide the target file into small information chunks and in this way are able to download a large file quickly from an unlimited number of different hosts (http://bittorrent.org).

but was restricted to choose or not to choose the movie or show which was available for an additional payment during particular period of time. In 1994, video on demand in its present state came to the market. Unfortunately, the cost of infrastructure proved too high to support video on demand as a stand-alone service (Ludwigson, 2002). Moreover, the number of users was rather limited. However, the widespread use of the Internet catalyzed use of video on demand. Launch of the first complete video on demand in USA is dated to 1999 (Stankeviciute, 2004). The launch of video on demand was later on followed by European providers. Since mid-2000 video on demand services have been available to European consumers via both PC and TV. The European video on demand industry has been particularly dynamic over the past ten years. According to 2009 data, on-demand views of paid content range from 1.5 to 3 per month per user (Meyer, 2009).

The data presented by Meyer (2009) refers to video on demand in general. There are three most common formats for TV-based video on demand. Those are free video on demand, subscription- and pay-per-view video on demand. Free video on demand is offered as a part of TV-packages and does not require additional payment. Subscription video on demand implies an additional fee over a period of time for a particular quantity of TV-content provided on demand. Finally, pay-per-view video on demand implies a small fee for a program/movie selected by a customer.

The TV-based video on demand service is available from BSkyB[2], FOXTEL[3], Telia, Viasat, Get, to name only a few. Among the leading providers of Internet-based video on demand are USA-based Netflix Inc. and Hulu.com. Netflix Inc. offers both flat rate online video rental in the United States and on demand video streaming over the Internet in the United States, Canada, Latin America, the Caribbean, United Kingdom and Ireland. Hulu.com is a website offering ad-supported on demand streaming video of TV shows and movies from several leading networks and studios in the United States. These services are at present offered only to users in Japan, the United States and its overseas territories.

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[2] British Sky Broadcasting Group is a public satellite broadcasting company operating in the United Kingdom and Ireland.

[3] FOXTEL is an Australian pay television company, operating cable, direct broadcast satellite television and IPTV services.

In other words, video on demand is gaining its place in the market. However, its revenue generating potential is debatable. It was long perceived as value-add for the existing customers rather than an independent revenue generator (Carey, 1999). On the other hand, Meyer (2009) predicts a rapid growth of the revenues from TV-based video on demand in the medium term.

The most well known video on demand products are movies and TV-shows. In this study I will focus on movies provided on demand via TV.

1.1.2 Movie on demand in Norway

To my knowledge there is no available statistics showing the dynamics of on demand television services in Norway. However, a study conducted in 2007 in Germany, France, Italy, Spain and the UK (Meyer, 2009) has shown that the annual average growth rate for on demand TV had been 41% in the period from 2005 to 2007. DVD rental during the same period had been decreasing by 14% on average. In Norway, DVD rental has decreased from by 9,9% in the same period (http://medienorge.uib.no). While the decrease correlates with mainland Europe consumption of video on demand, the fall in rental may also reflect more illegal downloading, or the fact that DVD prices have dropped. Also, an increasing number of consumers may prefer to buy Blu-Rays rather than DVDs.

In Norway video on demand has been provided for almost 10 years. The major players on TV-market, such as (Altibox, Canal Digital, Get, RiksTV, Viasat) offer different forms of this service. The price differs depending on the quality (high-definition vs. ordinary) and popularity of the movie. The price for a movie on demand varies from NOK 39 to NOK 79 with some exceptions. Table 1 (Appendix 3) displays prices by selected providers of the movie rental on demand (both TV- and internet based). Viasat offers a month of chosen movies on demand (as a part of TV-subscription) for NOK 99. Moreover, this provider makes on demand services available on Apple devices. Swedish Voddler started operating in the Norwegian market in 2010. It is a commercial video on demand service providing both new and older movies. While the new movies are available only through subscription or pay-per-view, the older and less popular ones are offered for free with advertisements. In October 2011 Voddler launched a premium service offering access to around 4000 movie titles for NOK 79 per month.

One can conclude that providers apply uniform/component[4] pricing and bundling when setting prices for their products. The practice of setting the price to NOK 39 or NOK 29 instead of NOK 40 or NOK 30 respectively is known as psychological pricing. Besides, it seems that the providers of movies on demand practice market-based pricing. DVD distributors and DVD rental are their main competitors. Indeed, Cermak (1996) notes that video on demand have the strongest competitive relationship with rental video (Cermak, 1996). On the other hand, Meyer (2009) points out that DVD purchase is a major competitor to TV-based video on demand. While both rental and on demand offer a product for one-time consumption, DVD purchase offers in principle indefinite consumption, enabling the customer to watch the movie several times. Purchase is more reasonable, for instance, in families with small children, who like to watch the same movie several times. On the other hand, it is also a normal practice to buy a movie to watch it once. It is particularly relevant for rather older movies, when sales price is not very different from rental price. However, the nature of consumption taken into consideration, DVD rental seems to be a closer competitor to video on demand.

Competitions in the market together with high fixed costs create a number of challenged for TV services provided on demand.

1.1.3 Challenges of video on demand

It is possible to identify three most significant challenges faced by video on demand industry. Firstly, it is the novelty of the product compared to its main competitors. Indeed, the survey conducted as a part of this study revealed that most of TV customers are still unfamiliar with video on demand (see Chapter 3). At the same time, the competitive products such as DVD rental and DVD purchase are well known and widely used. So, even though home TV-based movie rental seems so much more convenient than any other alternative, its place in the market is still not significant (Stankevichute, 2004). Indeed, in 2011 Norwegian TV provider Altibox (Lyse) made known that it rents out 6 movies on average per subscriber per year (private source).

Secondly, there is a challenge of deriving profit from selling movies on demand. It leads to the question of the right business model for this type of services. Thus, Jagannathan,

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[4] See section 1.6 Terminology for definitions of uniform pricing and component pricing.

Srinivasan, Nayak, Almeroth and Hofmann (2002) point out that in spite of the interest in video on demand, commercial efforts have not been successful. The lack of a good business model is named as a possible reason (Jagannathan et al. 2002, Basu and Little 2000). Also Stankeviciute (2004) notes the challenge of earning money by selling video on demand . She singles out several components of the problem. Firstly, there is a question of how to attract advertisers to invest ad dollars into this type of service. At the same time there is a problem that engaging of advertisers might reduce the attractiveness of the service to the customers. As a result, dollars gained from advertisers would reduce the revenue from the customers. Secondly, there is an issue of release windows. Release window denotes a period of time when a distribution channel has the exclusive right to sell the movie. Thus, normally a movie is first shown in the cinema while no other viewing is available for approximately 3 months. After a short break when the movie is not available at all it becomes available for home use, typically rental first, followed by sales. After that the movie is available as TV-based video on demand service. Only after that it will appear first on the pay cable, basic cable and finally will be available for broadcasting over the most basic channels (http://www.economist.com). For video on demand providers it means that people could have seen the movie in the cinema or on DVD before it is available as video on demand and might no longer be interested in it.

Finally, the available information about consumption of video on demand is rather limited. It is difficult to find consumption statistics. The information about sales volumes and revenue generated is not always available, which makes it difficult to conduct a research on actual business data. Moreover, the customers' expected consumption of this service and their willingness to pay is rather difficult to reveal. The industry seems to undertake a trial and error method to gradually find the optimal solution.

1.2 Relevance

The phenomenon of video on demand is relatively new. During the last decades it has been attracting research interest (Jagannathan et al.2002, Cermak 1996, Meyer 2009, Basu and Little 2000). However, the number of studies concerning pricing approaches to providing these services is rather limited. As pointed out earlier, it is difficult to reveal the customers' expected consumption and their willingness to pay for video on demand services. This information is, however, of particular importance for price-setting decisions.

The present study provides an empirical look at the problem of pricing of on demand services. The survey executed as a part of this study reveals consumers' preferences for movie rental and movie consumption in general. Furthermore, the survey reveals customers' willingness to pay for movies on demand. Thus, the aim of the research is two-folded. First and foremost, as determined in the problem statement, the aim is to find the optimal pricing alternative for movies on demand. The second goal is to get additional information about consumers' preferences and prospective demand for the services by means of a customer survey.

This study is important as a contribution to the research on pricing of such innovative services as TV-based video on demand. Of course, the challenges of video on demand are far from limited to the correct pricing of the movies. The challenges also include composition of the on demand product as well as defining the business model. But the aspect of pricing is an important element in the discussion of the correct business model for deriving profit from selling this type of services.

1.3 Problem statement

The problem statement is as follows:

What is the optimal pricing technique for movies on demand? How much of the area under demand curve can be captured by sophisticated pricing?

This problem statement will be addressed in three steps. Firstly, a selected number of pricing techniques will be studied theoretically. Secondly, the results of the survey conducted among the customers of a large international provider of TV services will be presented and discussed. The purpose of the survey was to elicit customers' willingness to pay for movies on demand. The data obtained in the survey will be analyzed by applying several pricing techniques. Finally, main findings will be identified and discussed.

1.4 About the study

This study is inspired by the work of Shiller and Waldfogel (2009) "Music for a Song: An Empirical Look at Uniform Pricing and its Alternatives". The subject of this academic work is digital music, rather than video. Shiller and Waldfogel explore the profit and welfare

implications of various pricing alternatives, including song-specific pricing, various forms of bundling, two-part tariff, nonlinear pricing, and third-degree price discrimination. They use survey-based data on students' valuations of popular songs.

The current study adopts the methodology of the work mentioned above. The data for the research was collected with the help of an online survey. The raw data was thereafter fitted into a parametric distribution. Then a dataset containing valuation data from 5000 simulated individuals was created. Further analysis was conducted on the simulated data. However, there are several differences between the work by Shiller and Waldfogel and the current study. Firstly, a different target group was chosen. While Shiller and Waldfogel performed their survey among students, the respondents of the current study were customers of a large provider of TV services, Canal Digital DTH. Secondly, the questions of the survey were adapted to the subject of the study, which are movies. For example, I included poster pictures in order to present the products (movies) visually. Furthermore, the movie titles where divided into categories so that each respondent could choose a category he/she was most interested in. For comparison, Shiller and Waldfogel suggested a list of 50 the same song titles to all the respondents. Thirdly, while analysing pricing alternatives I limited this study to uniform pricing, component pricing, product bundling and two-part tariff. As mentioned above, the study by Shiller and Waldfogel also includes nonlinear pricing and third-degree price discrimination. My choice to limit the number of alternatives is based on the practical considerations. That is, such alternatives as nonlinear pricing or third-degree price discrimination would be difficult to implement in the case of this study.

1.5 Structure

The current study has six chapters, but can be divided into three main parts. Part one (Chapters 1-2) contains the introduction, aims of the study as well as the theoretical perspectives relevant for pricing alternatives used in this study. In part two (Chapters 3-4) the research methodology is explained. It includes the description of survey design and execution. The general results of the survey are presented in detail after explanation of the assumptions behind the questionnaire. Presentation of the results is followed by analysis of the data. Initially, the process of fitting the data into parametric distribution is explained. Thereafter, the application of different pricing techniques is presented. The last and third part (Chapters 5-6) includes discussion, conclusions and limitations. In discussion, the findings

are evaluated in the light of the theory presented in the study. At the same time, the research methodology is examined critically. Conclusions sum up the main findings and outline possibilities for the further research, while the limitations refine the scope of the study. Finally, figures and tables as well as output and commands from statistical software (MINITAB and STATA) are presented in the Appendix.

1.6 Terminology

The purpose of this section is to explain the use of terminology in the study. It seems necessary for the following reason. Some of the notions used here were adopted from other works and it would be reasonable to clarify their original meaning. Some of the terms are known to have a wider meaning (or several meanings) then intended in this study. Hence, there is a need to specify the meaning in which they are used here. Finally, some of the terms are applied interchangeably in the literature. In this section I present those I've chosen to use in the study, so as to limit confusion.

Uniform pricing: a term adopted from the work by Shiller and Waldfogel (2009). It denotes the practice of charging the same price to all customers for the same product. The price is the same regardless of the quantity purchased.

Component pricing: a term adopted from the work by Chu, Chenguan, Leslie, and Sorenson (2009). They define component pricing as a pricing alternative under which a firm sets different prices to each of the products. For instance, the practice of component pricing would be to set a different price to each movie title. For the record, the same term is used in the work by Shiller and Waldfogel (2009).

Individual movie valuations: individual movie valuation (or willingness to pay) denotes the amount a respondent states as the amount he/she is willing to pay for a movie.

Pricing techniques or pricing alternatives: Uniform pricing, component pricing, bundling and two-part tariff are the pricing techniques I focus on in this study. In the literature one finds the following terms: *pricing approaches, pricing schemes* and *pricing models*, *pricing strategies*, *pricing methods* and *pricing techniques*. These terms are sometimes used interchangeably. I consider *pricing technique* an appropriate term for the current study. According to Longman Dictionary of Contemporary English (2003) *technique* denotes "a

special way of doing something". Thus, in the current study *pricing technique* signifies a special way of setting prices. In order to make the use of terminology clear I am going to use the notion *pricing techniques* or *pricing alternatives* referring to uniform pricing, component pricing, bundling and two-part tariff.

2. Theoretical perspective

The aim of this chapter is to provide theoretical framework for this study. The theoretical aspects of pricing are quite extensive. They include microeconomic, strategic and marketing perspectives as well as mathematical modelling approaches to price setting. In this study I focus on the microeconomic aspect of pricing . That is, the breakdown of the area under demand curve is of special interest, producer surplus share in particular. Further, the study focuses on the impact different pricing alternatives have on this breakdown.

This chapter will provide theoretical perspective for addressing the problem statement:

Which pricing technique is optimal for movies on demand? How much of the area under demand curve can be captured by sophisticated pricing?

Firstly, I present the general aspects of pricing. Thereafter I suggest a closer look at the following pricing techniques: uniform pricing, component pricing, bundling, and two-part tariff.

2.1 Pricing: an introduction

Economic theory treats price in a wide sense of the word. It refers both to the amount charged for goods or services sold and salary as the price for labor. I will here focus on the price as consideration for the goods and services.

Further, microeconomics describes how the prices are determined. It focuses particularly on the interaction of supply and demand. The theory asserts that in a free market economy the price is set so that it equates the quantity supplied with the quantity demanded. The discussion about price as an interaction of supply and demand leads inevitably to the question of its impact on the benefits of the parties, i.e. producer surplus and consumer surplus. Producer surplus for a firm, as defined by Pindyk and Rubinfeld (2005), is the difference between the market price of the goods and the marginal cost of their production. Consumer surplus is denoted as the difference between what a customer is willing to pay and what he/she actually pays. In case there is net loss of any of the surpluses (or both) one states dead weight loss. One often talks about external factors which influence the breakdown of

the surplus, such as government controls, taxes or subsidies. Since this is not directly relevant to the current study I choose to skip this topic.

As market conditions are normally far from equilibrium, it is natural that producers are interested to capture as much of the consumer surplus as possible. But in this situation single price is not good enough. One should charge different prices to different customers in order to transfer customer surplus to the producer. This practice of charging different prices for the same product is known as price discrimination. There are known three main types of it: first-, second-, and third-degree price discrimination. First-degree price discrimination implies charging each customer his/her reservation price, that is, the maximum price he/she is willing to pay. Implementing of this type of price discrimination would be rather difficult in practice. Second-degree price discrimination implies charging different price dependent on the quantity of goods purchased. Quantity discount is a well-known example of this. Finally, third-degree price discrimination means charging different price to different customer groups. Student or senior discounts are the examples of this type of price discrimination. In addition, there are other ways of appropriating customer surplus. Among them one normally mentions such techniques as two-part tariff and product bundling. Two-part tariff implies using an initial fee (so called hookup fee) for the access to the product, and the usage fee for the direct use of the products or services. Bundling normally denotes practice of selling two or more goods together for one price. I will return to two-part tariff and product bundling later in this chapter.

So far I've been focusing on the microeconomic aspects of pricing. Now I would like to examine some practical approaches to price setting. Traditionally one distinguishes three approaches to pricing: cost-plus, market based and value based (Phillips, 2005). Under cost-plus approach the price is determined by adding a surcharge to the cost of product. Market based pricing relies on the prices of competitors for determining the own price. Value based pricing relies on the customers value of the product for setting the price. Cost-plus is based on cost accounting while the other two have a very close connection to marketing.

The companies often combine the approaches mentioned above. While doing so they choose a pricing strategy to achieve their goals, for instance to increase their revenue, expand market share and so on. The pricing strategy might change in different points of time. Price discrimination, mentioned over in this chapter is often referred to as a pricing strategy.

Finally, I will introduce the pricing technique which is used as a benchmark in this study. Uniform pricing denotes charging the same price for the same product (Shiller and Waldfogel, 2009). Any of the pricing approaches mentioned above could be applied here: cost-plus, market or value based. This technique represents the simplest pricing structure which does not take into consideration customer preferences and different reservation prices.

In the next sections I will examine the selected pricing alternatives: uniform pricing, product bundling and two-part tariff.

2.2 Pricing alternatives

2.2.1   Uniform pricing and component pricing

As mentioned above, uniform pricing is perhaps one of the simplest pricing techniques. It implies charging the same price for the same product to all the customers. Uniform price assures linear relationship between revenue and quantities sold. It is therefore easy to use this pricing technique in models. It is normally the default option in microeconomic models. The purpose of such models is typically to find a profit-maximizing price for a single price monopoly.

Uniform pricing is also widely used in practice. But with uniform pricing in mind one should distinguish between homogeneous and heterogeneous (or differentiated) goods. In the first case one considers charging the same price for the identical goods, while in the second case the same price is set for goods which are different from each other. The practice of applying uniform pricing to differentiated goods has been criticized in the literature. Thus, Orbach and Einav (2007) studied use of uniform pricing in the movie theatres. That is, they considered movies differentiated goods. Orbach and Einav presented demand patterns for different movies as differentiated goods and suggested corresponding ticket pricing policies. They conclude that the use of uniform pricing is unreasonable when the goods are heterogeneous.

Orbach and Einav are not alone in their criticism of uniform pricing as applied to heterogenous goods. McMillan (2007) criticised the use of uniform pricing in retail. Such researchers as Mitchell and Vogelsang (2001), Shiller and Waldfogel (2009) refer to a number of studies proving that a larger part of consumer surplus can be appropriated by using more sophisticated alternatives to this pricing technique. It seems reasonable because

taking into consideration consumer preferences and reservation prices would allow extracting more of consumer surplus. One could argue that any type of price discrimination would increase producer surplus, compared to the uniform pricing. It would do so by capturing some of the consumer surplus which was not available under uniform pricing. It seems a reasonable claim as long as the revenue-maximizing uniform price stays the lowest limit for pricing decisions. For instance, if a customer's reservation price is higher than the revenue-maximizing uniform price, there is a potential to capture more revenue from this customer. For this reason he/she should be identified and charged a different (higher) price. If, however, a sophisticated pricing scenario results in charging a set of prices starting from below the revenue-maximizing uniform price, it might lead to loosing of the customer surplus available under uniform pricing. For instance, this could happen if customers or customer groups are poorly differentiated and the mechanism of charging them different prices does not work. Consumers would then choose the lowest price and even more of customer surplus would go lost for the producer. However, the design of sophisticated pricing schemes including price discrimination is aimed at extracting more consumer surplus by charging more to the customers who have a reservation price higher than the revenue-maximizing uniform price. It is therefore not likely that the producer would go below uniform price while designing the scheme. There are numerous alternatives to the uniform pricing which are designed to appropriate more of consumer surplus.

One of the simplest alternative to the uniform pricing is component pricing. The concept of component pricing is normally used in several meanings. It denotes, among other meanings, a practice of valuing a product according to the value of its components (http://www.websters-online-dictionary.org). In this study, however, I'm going to use the definition by Chu, Chenguan, Leslie, and Sorenson (2009). They determine component pricing as a pricing alternative when a firm sets different prices on each of the products. To understand in which way it is different to uniform pricing one should think of such products as online music, movie rental or movie purchase. One could charge all the songs/movies a single price. However, there is also an option of charging a different price for each of the songs/movies. The last option would be component pricing. Shiller and Waldfogel (2009) point out that uniform pricing is a constrained special case of component pricing. That is, it could be considered a case of component pricing where all the prices should be the same. Thus, component pricing per definition should not perform worse than its constrained alternative.

However, component pricing would still belong to the simple pricing techniques. In the next section I will take a look at product bundling which has long been claimed to perform better than simple uniform pricing.

2.2.2 Product bundling

Bundling was considered an alternative to uniform pricing already in 1963 (Stigler, 1963). It is known as the strategy of offering several products or services for a single price (Odlyzko, 2001). One distinguishes pure bundling and mixed bundling. Pure bundling is conventionally defined as selling products only as a package (Pindyk and Rubinfeld, 2009). Mixed bundling, however, allows selling both as package and individually. Bundling is normally used in industries where customers have heterogeneous demands and when the firm cannot price discriminate. In the last case the reason can be the lack of knowledge about customer preferences or difficulties in differentiating customer groups.

Bundling was suggested by Stigler (1963) who discussed block booking[5] of the movies. Adams and Yellen (1976) introduced mixed bundling and proved that it performs better than pure bundling. It is emphasized that for bundling to succeed, the demand for the products sold in a bundle should be negatively correlated (Stigler 1963, Adams and Yellen 1976, Pindyk and Rubinfeld, 2009). However, Schmalensee (1984) showed that bundling can be an optimal pricing alternative even when correlation between reservation prices in the population is not negative. Furthermore, McAfee, McMillan and Whinston (1989) considered a model for multiproduct oligopoly and proved that bundling is always an optimal strategy as long as reservation values are independently distributed in the population of consumers.

Bundling has been proved the optimal pricing technique for the low marginal cost products when consumers have the same probability distribution for reservation values (Bakos and Brynjolfsson, 1999). Further, Hitt and Chen (2003) studied the problem of bundling in the situation when customers have different willingness to pay (heterogeneous demand). They explored the concept of customized bundling, that is, a type of bundling which gives

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[5] Block booking - a practice among motion picture distributors of contracting with an exhibitor to show a predetermined series of films (http://dictionary.reference.com/). In other words it implies selling several movies as a unit instead of allowing exhibitor to choose the movies they wish to show.

consumers the right to choose a number of goods from a larger set to a fixed price. The researchers proved this type of bundling to be an efficient pricing alternative in the situations where consumers have heterogeneous preferences.

In the next two sections I will discuss two types of bundling, i.e. pure bundling and mixed bundling. I will thereafter discuss a special version of bundling, denoted by Shiller and Waldfogel (2009) as bundle-size pricing.

2.2.2.1 Pure Bundling

Pure bundling is the basic bundling alternative which offers two or more products only as a package. A two-product bundle was suggested by Stigler (1963) who pointed out that negative correlations in customers' reservation prices allow a seller to capture more revenue. As mentioned before, Schmalensee (1984) later showed that pure bundling can increase revenue even when reservation prices are positively correlated.

The studies by Stigler and Schmalensee considered bundles consisting of two products. Later there was done a research on multiproduct bundles (Bakos and Brynjolfsson, 1999). Bakos and Brynjolfsson conducted a study on information goods (such as software, music photographs, video clips and research reports) with a multiproduct monopolist in mind. The researchers argued that bundling of a large quantity of unrelated informational goods can substantially increase profits. They also pointed out the favourability of this alternative because large bundles increase customer valuation of the unit. Among others who worked on bundling of information goods was Fishburn (2000). He noticed that bundling is particularly relevant for this type of goods because of negligible marginal cost. Fishburn notes that while uniform pricing seems to be the alternative used by newcomers in the market, bundling is likely to be chosen by the established producers of information goods. Furthermore, Bakos and Brynjolfsson (2000) argue that aggregation strategies including bundling will both increase profits and contribute to the distribution of the information goods as long as the marginal cost is low and consumer groups do not differ systematically in their valuations of the products.

Numerous studies indicate that bundling is a favourable strategy for low-cost goods. Negative correlation of demands for the goods offered in bundle is also a desirable condition. However, if these conditions do not hold a possible solution could still be found in mixed bundling.

2.2.2.2   Mixed Bundling

While pure bundling offers two or more goods only as a package, mixed bundling denotes a choice between buying a bundle and buying goods separately. Economic literature points out advantages of mixed bundling compared to pure bundling. Indeed, Pindyk and Rubinfeld (2009) consider mixed bundling an ideal strategy when demands are only somewhat negatively correlated and /or when marginal production costs are significant. Furthermore, Adams and Yellen (1979) who introduced this bundling alternative, proved it to be more profitable than either pure bundling or product-specific pricing. Schmalensee (1984), in his turn, concludes that "mixed bundling combines advantages of both pure bundling and unbundled sales, and it's generally strictly more profitable than either".

The examples of this bundling alternative can be found, among other industries, in sport or retail. Thus, one could buy a season ticket or tickets to individual football game. Computers can be offered with bundled software; hardware and software can also be sold separately (Perloff, 2003).

Bundling as a pricing technique allows more variations than pure bundling and mixed bundling. One of its particular variants, bundle-size pricing, is presented in the next section.

2.2.2.3   Bundle-size pricing

Bundle-size pricing was introduced by Chu et al. (2009). This type of bundling involves setting different prices for bundles of different size. In other words, it can be considered a variant of mixed bundling which offers bundles of different size alongside with the possibility of buying goods separately. The study by Chu et al. (2009) suggests a pricing scheme under which, for instance, for a company with three goods, one price is set for the purchase of a single good, a second price for the purchase of any two goods, and a third price for purchasing all three. The study argues that this pricing alternative is more profitable than component pricing mentioned above. Furthermore, Chu et al. (2009) shows that it tends to attain nearly the same level of profits as mixed bundling in a broad range of demand and cost scenarios. Indeed, the flexibility of this alternative indicates that it has a potential to extract more consumer surplus than its less sophisticated alternatives.

Some similarities with bundling can also be found in the pricing technique discussed in the next section, namely two-part tariff.

2.2.3   Two-part tariff

The pricing alternative discussed in this section can be considered a special case of pure bundling. Two-part tariff implies a form of pricing in which consumers are charged both a hookup (entry) fee T and a per-unit price (usage fee) p (Pyndik and Rubinfeld, 2009). Thus, a two-part tariff with $p=0$ would correspond to pure bundling described earlier. Two-part tariff is also sometimes referred to as nonlinear pricing. Thus, Mitchell and Vogelsang (2001) include description of two-part tariff into the section where they consider nonlinear tariffs. Moreover, they refer to it as the simplest example of nonlinear tariff. It makes sense, provided the definition of nonlinear pricing given by Wilson (1993). With the term "nonlinear pricing" he refers to any case in which the tariff is not strictly proportional to the quantity purchased. Obviously, the two-part tariff is not strictly proportional to the quantity purchased. Of course, one might argue that with a low entrance fee and large quantity of the purchased goods and services, a two part tariff can be almost proportional to the quantity purchased or at least close to it. In any case, this is a form of price discrimination, as pointed out by Pindyk and Rubinfeld (2009). As mentioned in the introduction to this chapter, price discrimination implies charging different prices for the same product. This is exactly what happens while using two-part tariff. Even though entrance fee and the unit price is the same for all customers, the amount paid for each unit in fact varies with the number of units purchased. That is why one of the main challenges of this pricing alternative is to set the hookup fee and the per-unit price correctly. The size of the fees depends on the customer consumption and it is important to set the fees so that one gets as much of the surplus of large customers as possible at the same as small customers are still willing to pay for the products.

This type of price discrimination occurs in partially or fully monopolistic markets or in the markets where consumers are uncertain about their future demand (Heyes, 1987). Among the most typical areas of application of two-part tariffs one could name sports clubs, amusement parks and cellular phone services.

2.3 Conclusive remarks

In this chapter I have presented selected theoretical concepts of pricing. Initially a number of key microeconomic aspects were discussed. After that the pricing alternatives relevant for

this study were presented. I started off with uniform pricing and moved towards more sophisticated techniques such as bundling and two-part tariff. The intuition which follows from the presented theory indicates that such pricing alternatives as bundling (mixed bundling and bundle-size pricing in particular) and two-part tariff have a potential to perform significantly better than uniform pricing. In the next sections of this study I will test this intuition on the survey data. In addition, I will explore the quantitative implication of the alternatives. That is, I will assess the size of the potential gain while using alternative pricing techniques and find which pricing alternative performs best (on the survey data) with respect to the potential revenue.

3. Research methodology

The purpose of this chapter is to present the research methodology of the current study. Firstly, the research design is described. Then the information gathering technique is presented in detail. Finally, the results of information gathering are presented and discussed.

3.1 Research design

Research design is the general plan of how to answer the research question (Saunders, Lewis, and Thornhill, 2009). One can choose between two approaches to the research: inductive and deductive. The first one involves development of a theory as a result of the observation of empirical data. Deductive approach, on the contrary, tests theory against the empirical data. In the current study I exploit deductive approach. That is, I test the intuition of economic theory against the empirical data gathered in the survey.

Furthermore, one distinguishes the following purposes of a study: exploratory, descriptive, and explanatory. Explanatory studies establish casual relationships between variables. Exploratory studies seek new insights into phenomena. Descriptive studies focus on portraying of an object, but do not necessarily go far to draw conclusions. Such a study can be a part of an explanatory or exploratory study. The current study has an exploratory purpose as it focuses on the new insights into pricing of information goods.

As for collecting and analysing of the empirical data, one can choose between quantitative and qualitative techniques. The choice depends on whether one exploits an analytical approach to understand a few controlled variables or a systematic approach to understand many variables in a complex situation (Salomon, 1991). Qualitative methods provide detailed information about a limited number of persons or cases and rely on non-numerical data. Quantitative methods, however, often include surveys and are especially suitable to estimate reactions of a large number of people, identify similarities, differences and causal relationships based on the answers. To answer the research question of the current study it's important that I rely on quantitative data. The purpose of this study is to quantify revenue implications of different pricing alternatives and find the optimal one. It makes the analysis dependent on the quantitative data as well as quantitative analysing procedures.

Quantitative data can be obtained in various ways. Most often, those ways are experiment or survey (Saunders, 2009). To gather the data necessary to give a quantitative answer to the research question of the current study I have chosen to use a survey. Survey involves structured gathering of data from a sizeable population. Data collected by the survey is standardized and thus allows easy comparison. Moreover, it is suitable for producing models of the relationships between variables. Since I am interested in modelling revenue implications of different pricing techniques, a survey suits the purpose of my study. Furthermore, a survey is normally associated with a deductive approach and tends to be used for exploratory research (Saunders, 2009). As mentioned above, a deductive approach as well as an exploratory purpose has been chosen for answering the research question of the current study.

3.2 Information gathering

The purpose of information gathering in this study is to reveal the customers' willingness to pay for rental of selected movies via TV provider. Willingness to pay reflects the amount a customer is willing to offer to buy a product or a service (Horowitz and McConnel, 2002). This concept has been studied for about 30 years (Nysveen and Pedersen, 2004). Werthenbroch and Skiera (2002) describe the following methods to estimate willingness to pay: the transaction method, the Vickrey auction method; the Becker, DeGroot and Marschak's (BDM) method, amd the survey method.

Under the transaction method, the price is manipulated, and the respondents choose to buy the product or not for each alternative of the price. The Vickrey auction method, in turn, is based on the auction principle, where respondents take part in a sealed-bid auction and the respondent with highest bid has to buy the product. The BDM method reveals willingness to pay at the point of purchase (Werthenbroch and Skiera, 2002).

Finally, the survey method includes three alternative approaches. It can be: 1) based on conjoint analysis; 2) based on contingent valuation with a close-ended approach; 3) based on contingent valuation with an open ended approach. Under conjoint analysis several product attributes (price, quality etc.) are manipulated and the respondents are asked to rank the alternatives. Under contingent valuation with a close-ended approach the respondents choose to buy a product or not when the price is given. Applying an open ended approach means

that the respondents are asked to state their willingness to pay for a given product (Werthenbroch and Skiera, 2002).

For this study I have chosen a survey method with an open ended approach. This choice was made for the following reasons. Firstly, using an open ended approach makes sure that the respondents state their own reservation price without being influenced by given alternatives. Secondly, survey method is relatively simple and inexpensive to perform. Weaknesses and possible pitfalls of the method will be addressed in Chapter 5.

3.3 Survey

The survey was conducted during the weeks 19-21 in 2011. To perform the survey, I've used Internet-based service Questback (www.questback.no) which allows creating and managing online surveys. Respondents were asked to participate in the survey by invitation text sent to their e-mail addresses. The respondents were offered an incentive. Those who chose to participate in the survey were offered a possibility to win a payment-free month on their TV subscription. The respondents were encouraged to leave their e-mail addresses in case they wanted to participate in random drawing of the winner of the payment-free month. 352 respondents left their e-mail addresses. After the survey was closed, three respondents were chosen randomly to be rewarded by a payment-free month on their TV subscription. Norwegian was used as the survey language since all of the respondents were customers of a Norwegian TV provider and residing in Norway.

3.3.1 Target group

For the survey there was chosen a random selection of subscribers to television services. The customer information was kindly provided by a large international telecommunication company (Canal Digital DTH). This study is being performed in cooperation with this company. The ambition was therefore to get a representative selection for the customer base of Canal Digital DTH.

3.3.2 Questionnaire

The purpose of the survey was to elicit respondents' willingness to pay for movie rental via their TV provider. The respondents were presented a number of movie titles. Each movie title was accompanied by a poster picture of the respective movie and a short description of

the plot. There was also given a short information about the director, starring actors, production company and the year of release. The survey included 75 movie titles. The titles were divided into five categories: action, comedy, drama, family, and thriller. Each category included 15 titles. The respondents were asked to choose the category they were most interested in. It was also possible to choose several categories. Participants was given the following guidance:

I neste del blir det presentert en rekke filmtitler. Filmtitlene er delt inn i 5 kategorier. Velg kategorien du er interessert i. Det er mulig å velge flere kategorier.

NB! En kategori inneholder 15 filmtitler og det tar ca. 10-13 min. å gå gjennom disse. Velger du flere kategorier, kan det ta lengre tid å besvare undersøkelsen.

Du er bedt om å angi det MAKSIMALE beløpet (i NOK) du er villig til å betale for å LEIE denne filmen direkte til din TV fra en LOVLIG kilde. Tenk deg at du ikke eier denne filmen og at den blir tilgjengelig med en gang du vil se den.

Skriv hvor mye filmen er verdt for DEG, ikke beløpet du tenker er rettferdig eller vanlig å betale.

Hvis du ikke er interessert i å se denne filmen skriv 0.

I have obtained 12 726 observations of individual movie valuations, 7 382 of which were zeros (58%). It gives 12 726 - 7 382 = 5 344 positive individual valuations.

To make sure the stated willingness to pay was correct I included several control questions. Firstly, the respondents were asked about their preferred way of watching movies. The respondents were suggested the following alternatives: cinema, DVD/Blue-ray purchase, DVD/Blue-ray rental, paid streaming from the Internet, free downloading from the Internet, video on demand by TV provider, ordinary television (relatively old movies broadcasted free of charge, as opposed to paid movie channel or on demand rental). If, for instance, a respondent stated that his/her preferred way to watch movies was ordinary television, there was a reason to believe that the stated willingness to pay for movies on demand would be overestimated.

Secondly, the respondents were asked how often they: 1) go to the movies, 2) buy movies on DVD/Blue-ray, 3) rent movies on DVD/Blue-ray, 4) rent movies via their TV provider. The answers to these questions were used to double check the answers about preferred way of watching movies. That is, if a respondent, for instance, stated that his/her preferred way of watching movies was DVD/Blue-ray rental, it was made sure that the respective person stated that he/she rents movies at least as often as he/she goes to the cinema or buys DVD/Blue-ray. No major discrepancies were noticed in the data, that is, the above stated was correct for all the answers.

In addition, the respondents were asked how much on average they spend monthly on: 1) cinema, 2) DVD/Blue-ray purchase, 3) movie rental. This information was used to form an idea about the general level of spending on movie consumption of the respective person. The stated willingness to pay of every respondent was compared to the stated monthly level of spending. In case of obvious discrepancies the stated willingness to pay was deemed overestimated. Thus, I removed observations obtained from 9 respondents (240 individual movie valuations) from the set as the stated willingness to pay was contradicting the stated level of spending on the movie consumption. These respondents stated that they would be willing to pay NOK 100 to NOK 250 for selected movie titles while the average monthly expenditure on purchase as well as rent of DVD/Blue-ray was stated below NOK 100 or zero. In addition, these respondents reported that they seldom buy movies on DVD/Blue-ray, seldom or never rent movies. All this indicates that the willingness to pay in these cases is most probably overstated.

The survey contained general questions concerning TV consumption of the respondents, such as number of channels they were subscribers to and frequency of TV watching per day. The respondents were also explicitly asked whether they have ever used video on demand service by their TV provider. For those who answered this question negatively it was followed by the question about their intention to use these services in future. These questions were included because the answers to them were of interest for the company. At the questionnaire respondents were asked to answer general questions about their age, sex, income, quantity and age of children (if any). The survey questions are presented in Appendix 1.

3.3.2.1 Choice of movie titles

As mentioned before, the movie titles included in the survey consisted of 75 titles divided into 5 categories: action, comedy, drama, family and thriller. Each of the categories contained 15 titles. Approximately five of those were movies shown in the cinema at the moment when the survey was executed. Another five were recent DVD/blue-ray releases; the last five were selected among the movies released within the time span of 1-2 years back from the moment of survey. Movies released after 2009 were not included into the list. This choice was based on the following reasoning. Firstly, the demand for the movie rental is believed to be driven by the new movies. That is why the potential buyers would be interested in newer releases they haven't seen before. Secondly, in most cases a movie is a product which is normally consumed once. There are, of course, cases when favourite movies are being re-watched several times (for instance, movies and cartoons for children). It is, however, reasonable to think that in these cases one would prefer to acquire a copy of the respective movie rather than rent it several times. It is therefore natural to assume that the willingness to pay for a second or third viewing would be considerably lower. Choosing the resent movies would assure that a larger number of respondents had not yet had a chance to see the movie they were interested in and would therefore state their reservation price.

Even though the choice of movies was limited by the time of release, the number of possible title candidates was still very large. To further limit this number I've used movie ratings from the following sources: IMDb, Filmweb and Flixter. IMDb (Internet Movie Database) is an online database of information related to movies, television shows, actors, video games and visual entertainment media in general. IMDb is considered to be the world's largest movie database. The website www.imdb.no provides independent movie ratings (on the scale from 1 to 10) by the numerous users of the database. This source is widely used to find information about movies as well as other users' opinion on the respective movies. Filmweb is a Norwegian website dedicated to movies. It presents movies currently shown in the cinema, supplied with reviews, pictures and trailers. It is also possible to use this site to order movie tickets and give ratings to the movies on the scale from 1 to 6. Flixter is an international (created in USA) user-based movie site. Its purpose is mostly to allow users sharing movie ratings, pictures and contact other users with similar movie tastes.

While selecting movie titles for the survey I gave the main weight to the ratings by Filmweb since it is a Norwegian site which presents the most urgent movies to the local market. The

ratings were compared to the ratings by IMDb to make sure that the chosen movies scored high in both databases. In the cases when Filmweb provided the same rating for more movies than could be included in the survey, the ones with higher IMDb ratings were chosen. For example, while choosing the last movie title for the category *action* I found two movies with the same Filmweb rating of 4.35. However, one of them had an IMDb rating of 7.2 while the other one only 6. The movie with IMDb rating of 7.2 was included into the movie list. Flixter ratings were used mostly to compare with the previous two sources and confirm the popularity of the movie in question. The list of movie titles is presented in the Table 2 (Appendix 3).

In the survey the movies were listed in a random order irrespectively of the release date. This was done to avoid possible effect of the presentation order on the expressed willingness to pay. That is, chronological presentation of the kind "from the oldest to the newest" or vice versa could have influenced perception of the movies' value. The random order of presentation would help to avoid this effect.

3.3.3   Description of the data

The invitation to answer the questionnaire was send to 9 897 subscribers. 36 e-mail addresses were rejected as non-valid. The number of possible participants was thereby reduced to 9 861. I got 479 answers to the questionnaire, which gives 479 / 9897 * 100% = 4.84% of the subscribers whom the invitation was sent to. I've received 61 e-mails from the subscribers who did not wish to answer the questionnaire or did not have time for that. These respondents were not taken out from the selection as the same could apply to more persons other than those who wrote the e-mails. These observations were therefore treated as refusals to answer.

Table 3 (Appendix 3) displays detailed description of the selection. Here I will limit the description to a short summary. Most of the respondents report to be seldom movie-consumers. Only around 11% of them go to the cinema 1-2 times a month or more often. Around 25% buy DVD/Blue-ray 1-2 times a month or more often and only 10% rent movies 1-2 times a month or more frequently. Only 20% of respondents mention movie rental among their favourite way of movie consumption. This would explain the high number of zeros in the individual movie valuations. 7% report movie rental via TV-provider among their favourite ways of movie consumption.

Further, the movie preferences differ between categories. More than 55% of respondents chose *action* while *family* was chosen only by 15% of respondents. An interesting observation is that category *family* got the highest average valuation per movie. It could be explained by higher willingness to pay within the respective target group (presumably young parents). On the other hand, it could be an error due to the fewer observations (compare 423 positive individual movie valuation within category *family* to 1824 positive individual movie valuations within category *action*).

As for the general characteristics of the selection, I will shortly describe age, sex, income and age of children (if any). Over 56% of the respondents are in the age group above 45. 79% are men, and only 21% are women. 47% of the respondents are in the middle income group (NOK 400 000-NOK 800 000 per year). 34% are in the income group above NOK 800 000 per year and 19% are below NOK 400 000 per year. 81% of the respondents have children. 21% of them have children aged under 6, 25% have children aged 6 to 11, 23% have children aged 12 to 15.

3.3.3.1 Movie valuations

After removal of the observations with overstated willingness to pay (see section 3.3.3) the number of individual valuations was reduced to 5207. The valuations vary from NOK 1 to NOK 159, while the average value is NOK 37.34. The highest valuation on average was obtained by the family movie "Gråtass får en ny venn" (46.77) and the lowest was given to the thriller "The ghost writer" (30.81). One can see that the inter-movie differences in valuations are not very large.

The valuations cluster around "round numbers" like 25, 50 and so on. The 25th percentile of the distribution of valuations is NOK 20. The median and 75th percentile valuations are respectively NOK 35 and NOK 50. Table 4 (Appendix 3) shows the average movie valuation and median as well as selected percentile valuations. It's easy to notice that the valuations over NOK 60 and the valuations over NOK 100 constitute only 10% and 5% of the data respectively.

Movie valuations are positively correlated. With 15 movie titles in each category there are 105 (=15*14/2) pairwise movie correlations. The mean correlation for the category *action* is 0.77 (see Figure 5 in Appendix 2). Table 5 (Appendix 3) presents average pairwise correlations for all categories. As discussed in Chapter 2, product correlations indicate to

which extent such pricing alternative as bundling has a potential to increase revenue compared to uniform pricing. That is, if the products are negatively correlated, bundling performs better. In the case of the current study the pairwise movie correlations are positive and quite high[6].

The valuations differ both across respondents and across movies. Figure 6 (Appendix 2) presents distribution of cumulative valuations both on raw and parametric[7] data. For instance, the figure shows that 25th percentile valuation for top 5 movies is about NOK 100, while mean is almost NOK 200. Valuations on parametric data are lower[8]. The curves become flatter as the number of movies increases. It means that respondents are willing to pay considerably more for the movies they value most highly. The figures show substantial differences in valuations across individuals. A regression of individual valuations on both movies and individual effect gives R-squared of 1.0% (0.8%). A regression on individual effects yields R-squared of 0.6% (0.6%) while R-squared from the regression on movie effects is 0.3% (0.3%). Even though the explanatory power of the regressions is very low, it seems that variation in valuations is higher across individuals[9].

3.3.3.2 Reliability and validity of data

A natural concern is to which extent the chosen data gathering technique produces consistent findings. The first question which should be addressed here is whether the data is reasonable. Shiller and Waldfogel (2009) express a concern about the relevance of the survey results to the pricing decision. They point out that one should specifically consider the survey wording and how it affects the response. Also, the familiarity of the evaluated object is important. It is typically easier to evaluate a product one is familiar with.

The exact text of the survey questions was presented in the section 3.3.2. The respondents were explicitly asked to state their own valuation of the respective movie, not the market price or the amount they think it should cost. Each movie title was presented on a separate

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[6] The correlations test was run on logs of positive individual movie valuations.

[7] See section 4.1.2 Parametric estimation for description of fitting the data into parametric distribution.

[8] For these figures the valuations within every respondent were sorted from largest to smallest. Then the cumulative valuation was calculated for every respondent. Thereafter 25th, 50th and 75th percentile valuations were found across all the respondents for each quantity of songs.

[9] The regression was run on the log values of positive valuations.

web-page, accompanied with a poster picture, summary of the plot and information about the movie. The respondents were asked to evaluate a familiar item (a movie) they are used to consume daily and not something they can't imagine the value of. Finally, I listed movie titles in a random order to avoid possible effects of the presentation order on the outcome (for instance: the order "from the newest to the oldest" or vice versa). Furthermore, a visual inspection of the data indicates that the result is reasonable. The average stated willingness to pay fluctuates around NOK 40 which is consistent with the current market price for TV- and Internet-based movie rental (see Table 1 in Appendix 3).

The next step is to check the validity of the gathered data. According to Saunders et al. (2009) validity shows whether the findings are really about what they appear to be about. One distinguishes internal validity and external validity. Internal validity refers to the extent to which the findings reflect the relationship between variables. External validity says something about how general the results are, that is, whether the findings may be applicable to other research settings (Saunders et al., 2009).

It is often difficult to find a direct indicator of validity of the data, which is also the case in the current study. However, it is possible to find indicators which would prove it indirectly. One possibility would be to compare the stated movie valuations with the sales numbers for the respective movies. Unfortunately, it is difficult to find a reliable source of detailed information about revenue these movies have generated through different channels of distribution. Besides, the movies have different time of release, so the comparison of the generated revenue would reflect different time span for the movies with different date of release. In other words, it does not seem correct to compare the revenue generated by "Avatar" in 2 years with the revenue generated by "Black Swan" in several months.

Comparing the stated movie valuation with the official movie ratings would give another indirect indicator of the validity of the data. The survey has shown that a considerable part of the respondents use movie reviews and ratings provided in the media while selecting a movie to watch (33.6%). That is why I have chosen correlation of the stated movie valuation with the rating of each movie as an indirect indicator of data's validity. That is, if gathered data indeed reflects the respondents' movie preferences, a higher willingness to pay would be stated for a movie rated higher.

The next step was to choose the source of rating information. It was mentioned earlier that Filmweb and IMDb were used to select the movies for the survey. But choosing only one of these sources for correlation test would not be right. The use of ratings by only Filmweb is not enough as it uses the scale of 1 to 6 so that some movies have the same ranking. Using the rating by only IMDb would not be entirely correct either. The reason is that it is an international movie database which does not necessarily reflect all the nuances of the Norwegian market. Thus, I summed up the scores by Filmweb and IMDb and used the aggregated scores to test the correlation between ratings and willingness to pay for the respective movies[10]. The average willingness to pay for each movie was calculated. Pearson correlation for the whole set of movies is 0.321 (p-value 0.005). Even though the correlation coefficient doesn't seem to be especially high, one can state a statistically significant positive correlation between movie ratings and willingness to pay stated by the respondents. In other words, indeed, it seems that the respondents are willing to pay more for the movies with higher ratings. The detailed results of the test are presented in Table 7 (Appendix 3).

3.4 Statistical tests

In this section I will use the obtained data to test a number of statistical hypotheses. The data obtained in the survey contains information about movie consumption patterns. Naturally, one is interested in revealing tendencies in consumption patterns (if there is any). Statistical analysis of the data, in my opinion, would serve at least two purposes. Firstly, it gives an idea about the survey participants thus strengthening (or weakening) the reliability of the dataset. Secondly, it might be helpful for understanding the effect different pricing techniques have on the potential revenue (see Chapter 4). Besides, it would help to learn more about the consumer and define the target groups and pricing strategies based on the customer preferences.

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[10] IMDb rating was not available for two movies ("Gråtass får en ny venn" and "UMEÅ4ever"). To produce a score comparable with the aggregated score for the rest of the movies I first found the average IMDb score by summing up the scores and dividing the sum by 73 (the number of movies for which the score was available). Thereafter this average score was added to the Filmweb score for these two movies ("Gråtass får en ny venn" and "UMEÅ4ever"). Thus, for these movies the rating was determined by Filmweb only.

3.4.1 Hypotheses

The following hypotheses were tested:

H1: The frequency of movie rental is independent of gender.

H2: The amount spent on movie rental is independent of gender.

H3: The stated willingness to pay is independent of gender.

H4: The choice of movie category is independent of gender.

H5: The frequency of movie rental is independent of age.

H6: The amount spent on the movie rental is independent of age

H7: The stated willingness to pay is independent of age.

H8: The choice of movie category is independent of age.

H9: The frequency of movie rental is independent of the age of children (i.e. the age of children in the household has no effect on the frequency of movie rental by their parents).

H10: The amount spent on movie rental is independent of the age of children (i.e. the age of children in the household has no effect on the amount spent by their parents on movie rental).

H11: The stated willingness to pay is independent of the age of children (i.e. the age of children in the household has no effect on the willingness to pay of their parents).

The choice of hypotheses is determined by the interest to reveal the factors which influence the stated willingness to pay for the movies on demand.

3.4.2 Chi-squared test

Chi-squared test of a contingency table was chosen for testing the hypotheses listed in the previous section. This test is normally used to determine that two nominal variables are related and to infer that the differences exist among two or more populations of nominal variables (Keller, 2005). The values of nominal variable are categories.

The contingency table contains values of two nominal variables. For example, the table used to test hypothesis 1 would contain values *man/woman* in the columns and *often/seldom/never* in the rows. The test statistics measures the similarity of the expected and observed frequencies:

$$\chi^2 = \sum_{i=1}^{k} \frac{(f_i - e_i)^2}{e_i},$$

where k is the number of cells in the contingency table, f_i is an observed frequency, e_i is an expected frequency. The entries in the table are observed values. The test calculates expected values under the assumption that the null hypothesis is true. The number of degrees of freedom is needed to determine the rejection region. The number of degrees of freedom for a contingency table with r rows and c columns is *υ = (r - 1) (c - 1)*.

The objective of the test in this study is to compare populations of respondents. I am operating with nominal data i.e. the values are categories (man, woman etc). It seems therefore reasonable to benefit from the chi-squared test of a contingency table. MINITAB was used to run the tests.

This test is designed to determine whether two nominal variables are related. However, while using chi-squared test one should keep in mind that the reliability of the results depends on the number of observations. Higher number of observations in the cells of a contingency table makes the results of the test more reliable. Generally, the expected values should be five or more to make sure that the chi-squared distribution provides an adequate approximation of the sampling distribution (Keller, 2005). This requirement is also called "rule of five". In the next section I will describe testing of the hypotheses, paying a particular attention to the "rule of five".

3.4.3 Testing the hypotheses

In order to test the hypotheses listed in the section 3.4.1 I needed to tabulate the respective variables. The tables are presented in Table 13 (Appendix 3). It is easy to notice that cross tabulated data does not always satisfy the "rule of five". The number of observations in some cells is less than five. Truly, the expected values of these cells calculated by the test would also be less than five, undermining the reliability of test results. In such case it is reasonable

to combine rows or columns to increase the number of observations in the cells (Keller, 2005). For this purpose I made the following changes:

- Question 3: How often do you rent movies? There were five possible answer alternatives to this question: *more often than 3-4 times in a month/ 3-4 times in a month/ 1-2 times in a month/ seldom/ never*. Due to the low number of observations the first three answer alternatives were combined in one. It resulted in three categories: *often/ seldom/ never*.

- Question 4: How much do you spend on movie rental on average per month? There were five possible answer alternatives: *nothing/ <NOK100/ NOK100 to NOK300/ NOK301 to NOK500/ >NOK500*. Due to the low number of observations in the three last answer alternatives they were combined in one. It resulted in three categories: *nothing/ very little/ from average to much*.

- Question 13: What is your age? The age was grouped into four subgroups: *18-25, 26-35, 36-45, over 45*. Due to the low number of observations the in the first subgroup it was joined with the second. Thus, the number of subgroups was reduced as follows: *18-35, 36-45, over 45*.

- Question 18: What is the age of your children? The age of children was grouped into four subgroups: *under 6, 6-11, 12-15, over 15*. Due to the low number of observations the first two subgroups were joined into one. The same was done to the last two subgroups. It resulted in two age categories: *small children/ older children*.

- Hypothesis 3, 7 and 11 required data on individual valuations. The individual valuations (stated willingness to pay) are interval data, which are real numbers. To make it suitable for using in a chi-squared test of a contingency table, the data had to be turned into nominal data (the values of nominal data are categories). For this purpose the individual valuations were divided into five categories: *NOK 0/ NOK 1 - NOK 10/ NOK 11 - NOK 25/ NOK 26 - NOK 35/ over NOK 35*. The observations were replaced with the number of the corresponding category, and this (nominal) data was used in the test.

Both original and transformed data is presented in Table 13 (Appendix 3).

The results of the tests are presented in the table below.

Hypothesis	Pearson chi-square	df	P-value
1. The frequency of movie rental is independent of gender	0.118	2	0.943
2. The amount spent on movie rental is independent of gender	7.599	2	0.022*
3. The stated willingness to pay is independent of gender	4.308	4	0.366
4. The choice of movie category is independent of gender	41.042	4	0.000*
5. The frequency of movie rental is independent of age	18.652	4	0.001*
6. The amount spent on movie rental is independent of age	25.748	4	0.000*
7. The stated willingness to pay is independent of age	40.774	8	0.000*
8. The choice of movie category is independent of age	24.491	8	0.002*
9. The frequency of movie rental is independent of the age of children	6.380	2	0.041*
10. The amount spent on movie rental is independent of the age of children	5.538	2	0.063
11. The stated willingness to pay is independent of the age of children	17.936	4	0.001*

*statistically significant at 5% significance level

Some of the test results are quite expected and confirm intuitive assumptions. Others, however, seem rather surprising.

The results show that there is strong evidence to infer that the frequency of movie rental and age are related. The same goes for the amount spent on movie rental and age. These conclusions are expected and seem reasonable, as younger people are believed to be more interested in movie rental than the older ones.

The results also show that there is strong evidence to infer that the choice of movie category is related to age and gender. This result is perhaps not quite as intuitive as the previous one. On the other hand, it might seem normal that men tend to choose action and thriller while women are more inclined to choose drama and comedy. This relationship, however, could be studied closer. Another interesting result is that the amount spent on movie rental and gender is related. It other words the men seem to spend more money on movie rental then women. But on the other hand, the test does not provide enough evidence to reject the hypothesis 1

(the frequency of movie rental is independent of gender). In other words one cannot state that men also rent movies more often than women.

The thought behind hypotheses 9-11 was to test whether consumption pattern of the parents of small children differs from the rest of the respondents. The conclusions are rather indecisive. The test results show that there is statistically significant evidence to infer that the frequency of movie rental and the age of children are related. It is, however, not possible to say that the amount spent on movie rental and the age of children is related. There is namely not enough evidence to reject the hypothesis 10 (the amount spent on movie rental is independent of the age of children). However, parents of small children express clearly higher willingness to pay for movie rental via television. There is statistically significant evidence to infer that stated willingness to pay of respondents with small children is higher compared to the respondents with older children, aged between 12 and 15 (hypothesis 11).

3.5 Conclusive remarks

In this chapter I have described the research methodology of the current study and presented the results of data gathering. Firstly, the research design was described. Thereafter the information gathering technique was presented in detail, including target group and design of the questionnaire. After that the survey results were presented and discussed. The discussion of the results was supplemented with statistical tests of a number of hypotheses concerning consumption patterns of different groups of customers.

In the next chapter I will move to the analysis on the obtained observations of willingness to pay (individual movie valuations) for TV-based movie rental.

4. Analysis

In this part I will conduct an analysis on the individual movie valuations obtained in the survey. The analysis consists of two parts. Firstly, I will describe the distribution of the data and explain the advantages of replacing raw data with parametric estimates. I will then simulate a dataset based on the key parameters of the raw data (mean, standard deviation, correlation and covariance). In the second part of analysis I will apply different pricing techniques such as uniform pricing, component pricing, product bundling and two-part tariff to the simulated dataset to compare the effect these techniques have on the breakdown of the area under demand curve (produces surplus, consumer surplus, and dead weight loss).

4.1 Preparing data for analysis

The analysis to be conducted aims at defining the pricing alternative which performs best with respect to the capturing of the available surplus. I will then need to determine the revenue-maximizing solutions for each of the alternatives. This approach is based on the assumption that the underlying utility functions are smooth. It means that to obtain credible results a smooth distribution of the values is important. The character of the valuation distribution of raw data presents a challenge in this respect. I decided therefore to use parametric estimates in the analysis.

In the next section I will describe the distribution of the observed valuations. Thereafter the process of parametric estimation will be presented.

4.1.1 Distribution of individual valuations

Fig. 1 (Appendix 2) presents the distribution of the observed valuations. It's easy to see that the number of observations is especially high at the "round" numbers, such as 25, 30, 40, being extremely high at 50. Most probably, it results from the respondents' tendency to round the valuations to the nearest 5 or to the nearest 5 minus 1. This fact presents a challenge with respect to analysis of the data. The tendency to round valuations up or down leads to overstated quantity of movies valued at, say, NOK 50, while the quantity of movies valued at NOK 46, NOK 47, NOK 48 and NOK 51, NOK 52, NOK 53 is understated. Respondents tend to report a valuation of NOK 50 if they value a movie NOK 51. They are also most likely to report a valuation of NOK 49 if they value a movie NOK 48 or NOK 47.

Fig. 2 (Appendix 2) presents overall demand curve constructed by ordering individual valuation observations from highest to lowest. Fig. 3 (Appendix 1) shows the single-price revenue function derived from the observed data. For this function, the individual valuation observations were ordered from highest to lowest, defining $V(n)$[11]. Then, the maximum revenue available from selling any quantity n is $n*V(n)$. One can easily see that the "bunching" of the valuations results in plateaus on the demand function and spikes on the revenue function. The use of raw data in the analysis will, therefore, give misleading results. It will overstate the revenue available at multiples of 5 and the values slightly below these (such prices as NOK 39, NOK 49 etc.). At the same time it will understate the revenue available at the prices slightly higher than multiples of 5.

Shiller and Waldfogel (2009) underline that if spikes are sufficiently large, the estimated maximum revenue available will be exaggerated compared to the true maximum revenue. Further, they argue that use of the raw data for comparison of the impact different pricing techniques have on the breakdown of the area under demand curve would give misleading conclusions. This is due to the understatement of the benefit of pricing techniques that involve valuation of bundles. Indeed, summing up of valuations for different movies might average out the rounding error, thus removing the spikes. In such a case the maximum revenue available from a bundle would not be overstated.

In this study I will use uniform pricing model as a benchmark for other pricing schemes, including bundling. While applying uniform pricing one treats each observation separately, without considering other valuations by the same respondent. As mentioned before, if I use the observed (raw) data, the maximum revenue available under this pricing technique will most probably be overstated compared to the true value. Indeed, an analysis conducted on the raw data resulted in a revenue-maximizing uniform price of NOK 30 (see Table 11, Appendix 3). The analysis on the parametric data, however, gave a revenue-maximizing uniform price of NOK 25. As for bundling pricing, the maximum revenue available will most probably be close to the true revenue. Indeed, if we look at the share of producer surplus obtainable with pure bundling, the results of the analyses conducted on raw (0.445) and parametric (0.437) data are almost identical (see Table 9-10, Appendix 3). At the same time, the share of producer surplus obtainable with uniform pricing is considerably higher if

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[11] Here I adopt the symbols used by Shiller and Waldfogel (2009).

I conduct the analysis on the raw data (0.505) rather than parametric data (0.434). It seems therefore wrong to compare results of applying these models directly on the raw data. Shiller and Waldfogel have chosen to use parametric estimates in their study. Their approach seems to be reasonable also for the current study.

4.1.2   Parametric estimation

In order to get smoother demand curve and revenue function I've chosen to fit the valuation data to a parametric distribution. The next step is to choose the type of distribution and to determine the parameters.

Visual inspection of the distribution of raw data (individual valuations) does not give a clear answer about the distribution which would describe the values. Shiller and Waldfogel (2009) argue that lognormal distribution explains their data better than normal distribution. Lognormal distribution denotes a continuous probability distribution of a random variable whose logarithm is normally distributed. Also in the current study positive valuations have a pattern similar to lognormal distribution. However, an extremely high number of valuations at NOK 50 presents a remarkable irregularity. As mentioned above, it can be explained by the tendency to round valuations. To reduce the effect of this tendency I have grouped observed positive valuations into 10 groups thus reducing the number of bins and joining valuations which lie close to each other. Fig. 4 (Appendix 2) presents the fit of the grouped data to a lognormal distribution. The effects of "rounding" can still be observed, but one can see that a lognormal distribution is a reasonable choice to describe the observed data.

Because of the reasons discussed above I have chosen a lognormal distribution. However, there are two relationships independent form each other: the probability of getting a positive valuation and the absolute value of the positive valuation. Indeed, the probability of getting a positive valuation depends on the choice of movies and the personal preferences of the respondents. The absolute value of a valuation, however, depends on the reservation price of a respondent. For instance, two respondents with the same preferences for horror movies assign valuations to the same movies. They both hate the same three movies of the suggested selection. So, they state their valuation for those three movies at zero. These respondents, however, have different reservation prices. The first one would pay NOK 15 at most, because he could easily download an illegal copy for free. The other respondent, unlike the first one, values the movies at NOK 70, because he appreciates quality and the alternative for

him would be to see the movie in the cinema. This example was given to illustrate that the probability of getting a positive valuation appears to be driven by parameters other than those which generate positive valuations. Therefore I needed to estimate the parameters separately for (1) generating positive valuations and for (2) getting positive valuations (i.e. positive valuations as opposed to zero), so-called "zero-inflated multivariate lognormal"[12] distribution.

First, as explained before, I assume that the positive valuations have a lognormal distribution. I modelled the log positive valuations $v_{ij} = \mu_j + \varepsilon_{ij}$[13], where μ is mean and ε is normally distributed. Here i denotes individual and j denotes movie. I estimated μ and the standard deviation of ε, σ_j, using only positive valuations for movie j by respondent i. I then estimate the correlation of valuations between movie j and k (ρ_{jk}) using logs of valuations for individuals who report positive valuations for both movies j and k.

Thereafter I estimated the probabilities that respondent report positive valuations using the model $y_{ij} = \theta_j + \epsilon_{ij}$ where y is binary: it equals 1 if the valuation is positive and 0 if the observed valuation is 0. I estimated each θ_j by running movie-specific probit regression. To estimate the correlation of ϵ across the movies, I estimated a bivariate probit regression for each pair of songs.

I used the parameters obtained above to simulate valuations for 5 000 individuals. The quantity was determined by the following reasoning. To conduct the analysis, the number should be high enough to satisfy the requirements to the size of a random sample. Visual examination of the simulated data, its valuation distribution, demand function and revenue functions looked considerably smoother then the corresponding graphs based on the raw data (see Figures 7-9, Appendix 2). Further, visual examination of the respective graphs based on the simulated data containing 10 000 observation showed that the further increase of the number of observations does not influence the smoothness of the figures. That is, since the aim of fitting the data into a parametric distribution was to remove spikes from the curves and by so doing make the data smoother, 5000 observations seems to be a large enough sample. Shiller and Waldfogel (2009) also argue that 5000 is a large enough sample. The

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[12] This definition is adopted from the study by Shiller and Waldfogel (2009).

[13] Here I apply the symbols used by Shiller and Waldfogel (2009).

simulation was performed in STATA. Appendix 5 displays list of the commands used in the process of simulation.

4.1.3 Movie categories and parametric estimation

One thing should be mentioned before I move to the analysis on the simulated data. That is, the role of dividing the movie list into categories and how I dealt with it in the process of simulation.

As described in the section 3.3, the movie titles in the survey were divided into five categories. The challenge would be to use all this information in determining the parameters for fitting the data into a parametric distribution. This would present the following difficulties. Firstly, I would have to determine correlations between movie valuations within different categories. It would be technically difficult, provided that only few individual have chosen several categories. Secondly, using valuation information about all the categories would increase number of parameters and make the parameterization process very complex. So I went for a simpler approach. I used the information collected in the survey to choose the category to be used in parametric estimation. For a category to be chosen for further analysis I set the following requirements. Firstly, it must be the most representative category, that is the category that has the highest number of observations. Secondly, the data must have the highest validity indication of all five categories.

The category *action* got the highest number of observations (3990[14]). As an indication of validity I used the correlation between observed average valuation (stated willingness to pay) for each movie and rating of the respective move provided by Filmweb and IMDb (see section 3.3.3). So I had to compare the number of observations within each category and correlation between movie valuations and movie ratings. The highest positive correlation (0,86, p-value 0,000) was observed in the category *drama*. *Action* had the next best result (0,64, p-value 0,010) which is still better than the correlation over the whole set of movies (0,32, p-value 0,005). The category *action* was chosen for further analysis because of the highest number of observations and a high validity indication. Table 6 (Appendix 3) shows the number of observations by categories. Table 7 (Appendix 3) displays the results of correlation test between individual movie valuations and movie ratings by categories. It can

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[14] This number includes both positive and zero valuations.

be noticed that categories *family* and *thriller* both display negative correlation. Such a result does not seem reasonable and might be due to a relatively low number of observations in these categories. Even if summed up these two categories give a lower number of observations than *action* category alone. Thus, using *action* for parameterization and further analysis (i.e. limiting the dataset to *action* only) can also give an additional advantage: dropping off the categories which most probably reduce the validity of the dataset.

For the reasons explained above the observations used for parameterization were limited to the category *action*. The parameters were used to simulate valuations of 5 000 individuals. The resulting valuation distribution, demand and single-price revenue functions are displayed in the Fig. 7-9 (Appendix 2).

4.2 Application of pricing techniques

In this part I will present the results of applying different pricing techniques on the simulated observations. The following alternatives were used: uniform pricing, product bundling and two-part tariff. The main focus in the analysis is on the breakdown of the available surplus. I will calculate and present the share of producer surplus, consumer surplus and dead weight loss under these pricing alternatives. Uniform pricing will be using as a benchmark.

Producer surplus is normally defined as the amount of producer benefit by selling all units produced at market price that is higher than the marginal cost of production (Pindyck and Rubinfeld, 2009). Consumer surplus represents the benefit resulting from the difference between what the highest price a consumer is willing to pay and what the consumer actually pays. Deadweight loss is defined as net loss of total surplus, which occurs in the situations when, for example, people who have more marginal benefits than marginal cost are not buying the products. I assume that the marginal cost of the movies on demand is zero so that the surplus in this case is the entire area under the demand curve. The reasoning for this assumption is as follows. Firstly, the cost for selling an extra copy of a movie is indeed close to zero. Secondly, the focus of this study is to compare the breakdown of the surplus using different pricing techniques. The cost of selling an extra movie is the same for all the pricing alternatives and thus would have no impact on the change in the share of producer surplus, consumer surplus and dead weight loss.

4.2 Uniform pricing

To calculate the profit maximizing uniform price for a movie the following was done. Firstly, all the (*n*) movie valuations were ordered from highest to lowest: $V_1...V_n$[15]. Thereafter, I calculated the revenue as $n*V_n$ when V_n per movie is charged. For example, if $V_n=40$ and $V_{n+1}=39$, exactly *n* movies can be sold at the price *40*, since the reservation price for the next individual/movie will be lower than that. Fig. 9 (Appendix 2) displays the single-price (uniform price) revenue function relating revenue to the number of movies sold. The revenue maximizing price for uniform pricing is NOK 25. In this case the producer captures 43% of the surplus, while customer surplus and dead weight loss constitute 38% and 19% respectively (Table 9, Appendix 3).

Customer surplus was calculated as the difference between the individual valuation of the movie and the revenue maximizing single price (NOK 25) for each of the individual valuations higher than NOK 25. The individual surpluses were then summed up to find the total consumer surplus for this pricing technique. Dead weight loss was found by subtracting revenue (producer surplus) and customer surplus from the total available surplus. The total surplus, as noted before, is the total area under demand curve and was found simply by summing up all individual valuations.

It should, however, be pointed out that in this section all the movies were treated as a single good without differentiating the release time. In my case it would be impossible to take into consideration the release time since the observations were simulated. In reality, the use of uniform pricing would be a wrong approach for the following reasons. Firstly, the willingness to pay for the newer movies is typically higher. Using of uniform pricing is wrong in this case as it impedes producer from capturing consumer surplus while selling newer movies. At the same time one loses the customers whose reservation price for an older movie is lower than the single revenue maximizing price. Secondly, one should also take into consideration the genre of a movie. Movies are normally a matter of taste. It would be wrong to assume the same demand and willingness to pay for all movies. Thus, the use of uniform pricing would impede producer from capturing additional consumer surplus from the movies which hit the personal preferences.

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[15] Here I apply the symbols used by Shiller and Waldfogel (2009).

The results described above are obtained from the simulated dataset based on the valuations for *action* category. However, after performing the same calculations[16] for other categories I found that the breakdown of the surplus is quite similar. Table 10 (Appendix 3) displays the breakdown of the surplus (while applying uniform pricing) for all movie categories.

Like Shiller and Waldfogel (2009) I'm going to use the results obtained in this section as a benchmark for evaluating other pricing alternatives.

4.3 Component pricing

As mentioned in Chapter 2 component pricing implies setting a different price to each movie. Being rather difficult to implement in practice, this alternative is however interesting to explore.

To find the revenue maximizing prices for each song I used the same approach as in the previous section. The individual movie valuations were ordered from highest to lowest within each of the movies. Thereafter I found the revenue for each movie. The resulting revenue-maximizing prices for each of the 15 movies in the action category are presented in the Table 12 (Appendix 3).

The results of this pricing alternative are quite disappointing, taking into consideration that it is a more sophisticated alternative than uniform pricing. Producer and consumer surplus remain almost unchanged (producer surplus increases by 0.7% while consumer surplus increases by 0.1%). Dead weight loss goes down by 2%.

4.4 Pure bundling

Using pure bundling implies calculating the revenue-maximizing price for the whole set of suggested movies.

The total of 15 movies was considered a bundle. The calculations were performed in the following way. Firstly, I found an individual category valuation for every respondent. For

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[16] The dataset based on valuations by 5000 simulated respondents was created for all of the categories. The profit maximizing uniform price and the surplus breakdown was calculated for each of the categories.

this, I summed up individual movie valuations within a respondent. Thereafter the revenue maximizing bundle price was calculated in the same way as used in the previous sections. In other words, I ordered all the 15-movie bundle valuations from highest to lowest and calculated the corresponding revenues. The obtained revenue maximizing price for 15 movies is NOK 167. The impact on the breakdown of surplus is rather insignificant. Compared to the uniform pricing, revenue raises by 0.6%, consumer surplus raises by 1.5% while dead weight loss goes down by 4.5%.

Then, the different bundle sizes were considered, namely 3 movies and 5 movies. For this, I tested 10 random bundling combinations. The alternatives were tested under the assumption that the movies could be sold only within a bundle (i.e. it would be impossible to purchase a single movie). Also, a movie could be included into one bundle only. That is, if movie *1* was available as a part of the bundle together with the movies *2* and *3*, it could not be available as a part of another bundle or combined with other movies. Table 9 (Appendix 3) displays the results. It should be pointed out that even the best alternative out of 10 (both for bundling by 3 and 5 movies) performed significantly worse than uniform pricing.

Even though the bundles of 5 performed slightly better than the bundles of 3, both of these alternatives perform considerably worse than uniform pricing. Thus, the producer surplus goes down by 7.3% for bundles of 3. Bundles of 5 reduce the producer surplus by 5.8%. Under bundling by 3 the consumer surplus drops by 0.6%, while bundling by 5 movies raises consumer surplus by 2.1%. The dead weight loss is raised in the both cases. Under bundles of 3 the dead weight loss raises by 18%. The corresponding number for bundles of 5 is 9.2%.

4.5 Two-part tariff

Application of two-part tariff implies introduction of per-movie price p in combination with a hookup fee T which is independent of the number of movies purchased. Shiller and Waldfogel (2009) point out that uniform pricing and pure bundling are both the extreme versions of two-part tariff. In the first case the hookup fee T is equal to zero while in the second the movie price p is equal to zero. In this section the focus is on finding the revenue maximizing combination of T and p.

To solve this problem I used Excel Solver (evolutionary solving method for non-smooth problems). The following variables were defined:

T_i: hookup fee

p_i: per-movie price

V: individual movie valuation. V_{mr}: individual valuation by respondent r of the movie m; V_r sum of individual valuations by respondent r, i.e. the valuation of the entire set of movies by this respondent.

R: revenue. R_{mr}: revenue from movie m sold to respondent r. R_r: revenue from selling movies to the respondent r (all the movies this respondent is willing to buy without taking into consideration the hookup fee); R_i: the total revenue from a respondent including revenue from all the movies a respondent is willing to buy for the price p_i combined with the hookup fee T_i.

CS: customer surplus. CS_r: customer surplus for respondent r resulting from selling all the movies this respondent is willing to buy for the price p_i without taking into consideration the hookup fee. Consumer surplus was calculated as the difference between the sum of the individual movie valuations by respondent r and the sum total revenue from the movies sold to this respondent: $CS_r = V_r - R_r$

The problem was formulated as follows: to maximize the total revenue by trying different combinations of the hookup fee T_i and per-movie price p_i. The following conditions were formulated:

1) If per-movie price p_i exceeds the individual movie valuation of a respondent r, the resulting revenue from the movie m (R_{mr}) would be zero (no purchase).
2) If per-movie price p_i is less or equal to the individual movie valuation of a respondent r, but the entrance fee T_i exceeds the remaining consumer surplus CS_r of this respondent, the resulting revenue from this respondent would be zero (no purchase).
3) Non-negativity for all the values.

The Solver-model was built as follows. Firstly, the cells for changing values of T_i and p_i were chosen. To make sure that p_i was less or equal to the individual movie valuation I set a control column for each "respondent". For each individual movie valuation, the values in that column were set to p_i (if the respective movie valuation was higher or equal to p_i) or zero (if the respective movie valuation was lower than p_i). The sum of the values of the

control column showed the revenue obtainable from a "respondent" by selling movies given the price p_i (that is, R_r). There was, however, a hookup fee T_i to be taken into consideration. For this purpose, I calculated consumer surplus for each "respondent" by subtracting R_r from the sum of individual valuations by this respondent V_r ($CS_r = V_r - R_r$). If consumer surplus CS_r was higher or equal to the hookup fee T_i, it was assumed that a "respondent" would make a purchase. In the opposite case, the purchase wouldn't take place at all, since the movies would not be available without a hookup fee. So, if consumer surplus CS_r was higher or equal to the hookup fee T_i, the hookup fee was added to R_r resulting in the total revenue obtainable from the respondent R_t. In the opposite case, R_t was set to zero. Solver model was used to find the values of T_i and p_i maximizing $\sum R_t$. A macro was used to perform the repetitive task of setting formulas into the model.

The resulting combination of *(T; p)* is (NOK 73.3; NOK 25.5). The use of two-part tariff improves revenue considerably compared to uniform pricing – the revenue increases by almost 37%. It seems to happen partly on the expense of consumers: consumer surplus drops by 30%, while dead weight loss goes down by 23%. The results are displayed in Table 9 (Appendix 3).

5. Discussion

This section will sum up the findings of the previous chapter. The evaluation of the results is based on the theory presented in Chapter 2. Some of the findings will be compared to the corresponding results from the study by Shiller and Waldfogel (2009). Thereafter, the research method will be discussed; its weaknesses and possible pitfalls will be pointed out.

5.1 Summary of results

The economic theory indicates that various forms of price discrimination should provide significantly better results compared to uniform pricing with respect to the breakdown of the area under demand curve. The work by Shiller and Waldfogel (2009) is among the works which prove this statement right. The current study is not an exception. This empirical study with movies on demand in its focus has shown that price discrimination is able to increase producer surplus compared to the results obtained while using uniform pricing. There are, however, two peculiarities about the results of the current study. Firstly, the producer surplus available by using uniform pricing is already quite significant (43.5% compared to 27% in the case of digital music). Secondly, component pricing and bundling perform surprisingly poorly compared to uniform pricing. Thus, component pricing increases producer surplus by only 0.7% and pure bundling by 0.6%.

Two-part tariff performs decisively better than any of the pricing alternatives described above. It should also be mentioned that the share of the producer surplus reaches 59.4% under this pricing alternative. In general, the results of the current study differ from the results obtained by Shiller and Waldfogel (2009). Of course, the subjects of studies are rather different: Shiller and Waldfogel focused on digital music while I am interested in movies available for rental via TV. However, the difference in results is quite striking. Firstly, it is the absolute value of the revenue's share of surplus. Shiller and Waldfogel came to the conclusion that none of the pricing alternatives raises revenue's share of surplus above 37%. In general, the revenue's share of surplus in their study varies from 27% (uniform pricing) to 36.9% (two-part tariff). In the current study the producer surplus is significantly higher: from 43.5% (uniform pricing) to 59.4% (two-part tariff). Secondly, the pricing alternatives perform differently in case of movies on demand compared to digital music. Shiller and Waldfogel found that two-part tariff performs very similar to pure bundling. Based on the

results of my study, I cannot say the same. In my study two-part tariff is the decisive winner, while pure bundling achieves almost the same result as component pricing. It should be mentioned that the last two perform only slightly better than uniform pricing.

Surprisingly, bundling by 3 and 5 movies performs worse than uniform pricing. It does not seem consistent with economic theory. However, the characteristics of the data might provide an explanation to this result. As pointed out in the section 3.3.3, pairwise movie correlations are positive and quite high. The mean correlation for category *action* is 0.77. Economic theory shows that for bundling to perform better than alternative pricing techniques negative correlation of the products is a desirable condition. Then bundling can able capture more of the revenue compared, to uniform pricing. Positive correlation of 0.77 indicates that bundling most probably will not perform well on this data.

As discussed in section 3.3.3 the variance in the valuation data arise both across individuals and across movies. That is, movies differ with respect to the value they have for a respondent. Respondents are also quite different with respect to their preferences. One can, in other words, distinguish heterogeneity both across movies and across individuals. Hitt and Chen (2003) studied bundling in the situations with heterogeneous demand. They argue that limiting the size of a bundle leads to a substantial dead weight loss when the customers have heterogeneous preferences. Indeed, while bundling by 5 movies raises dead weight loss by 9%, reducing bundle size to 3 movies raises dead weight loss by 18%, that is, double as much (see Table 9, Appendix 3).

One should mention that the success of two-part tariff might also be explained by the heterogeneous demand. Thus, defining the hookup fee T alongside with per-movie price p enables the price discrimination of consumers in a more effective way. Hookup fee T and per-movie price p are both instruments used to differentiate the customers. That is, the hookup fee T helps to distinguish customers by the level of general expenditure on the respective goods. Per-movie price p helps to distinguish customers by their reservation prices for single movies while the possibility to pick a movie captures the individual movie preferences. Furthermore, as several studies indicate (Hitt and Chen 2003, Fishburn, Odlyzhko and Siders 2000), pricing techniques which allow self-selection often perform better compared to bundling with pre-defined set of goods. Two-part tariff has a self-selection element in the sense that consumers can choose freely from the vast library of titles instead of being offered a pre-defined set of movie titles.

So what is the optimal pricing technique for movies on demand? The results of this study indicate that perhaps not component pricing and not bundling. As for the bundling, one should specify that in this study I considered only small sizes of bundles, such as 15, 5 and 3 movies. One could think of the bundles consisting of 100 movies or more. But in the context of this study such a bundle should rather be considered a special version of two-part tariff with $p=0$. And two-part tariff is an alternative which has a potential to increase producer surplus considerably. But pricing decision should not be limited to calculations of expected revenue only. Very important elements of the pricing decision are analysis of the customer groups as well as analyses of market and product. Movie on demand as a product shares some of the features with information goods (that is, digital goods provided via Internet), as well as pricing challenges.

The question of pricing of information goods has been discussed in the literature and mentioned above in this study (see Chapter 2). There are opinions that in a fast-growing market the simple flat rate is the optimal choice (A. Odlyzko, 2001). Also Chu, Leslie, Sorensen (2009) claim that simple pricing strategies are often nearly optimal. Fishburn (2000), on the other hand, expresses a strong belief that while uniform pricing is used by newcomers to the market, bundling is the way to choose for the established firms. But an important aspect to consider would be the nature of the product. The opinions listed above consider information goods, provided mostly via Internet. The focus of the current study is, however, TV-based movies on demand. While this product shares some of the features with information goods (such as marginal cost), other features are quite different (such as demands to quality, ways of consumption). So the next question is whether movies on demand can be treated as information good. To my opinion the answer is yes, but with some restrictions. One should not forget that a movie is a particular good. First, the cost of providing movies via TV is considerably larger than the cost of offering information goods via internet. The production cost of a movie is borne by the production studios which then charge high fees for the rights to distribute a movie. Information goods distributed via Internet, however, are often distributed by the producers (software, music, photos, and research reports). Second, there is a limit of how many movies one can watch within a particular period of time. Consumption of movies is more time- and attention consuming than, for instance, digital music. Finally, it is to a large degree a matter of personal taste. That is why one should also take into account the customer characteristics. Here it would be reasonable to sum up the results of statistical tests conducted as a part of this study. The

results have shown that movie consumption patterns differ with gender, age and the age of children in the family (if any). It means that the optimal price discrimination should not only focus on quantity of movies consumed, but also distinguish target groups by gender, age, small children in the family and so on.

Thus, in my opinion, the optimal pricing technique for movies on demand would be a version of two-part tariff or, possibly, a set of two-part tariffs targeting specific groups of customers. A more complex pricing scheme, such as dynamic pricing or third-degree price discrimination would have at least two disadvantages. Firstly, it would be more costly to implement. Secondly, it would frustrate the customers who would have difficulties understanding it. Even though Odlyzko (2001) argued for uniform pricing, this technique would most probably perform worse than uniform pricing, even though this alternative would be the easiest to implement and the most understandable one for the customers. Finally, while arguing for the simple linear price (i.e. uniform pricing), Odlyzko (2001) had a rapidly growing market in mind. Video on demand doesn't seem to correspond to this definition. Even though the service has been in the market for at least ten years, it hasn't been spreading fast, as pointed out in Chapter 1.

In the next section I will discuss weakness and pitfalls of the research method used in the current study.

5.2 Evaluation of research method

This study is based on the data collected in an online survey. This method is known to be a quick, inexpensive and efficient way to assess information about the population (Saunders 2009, Zikmund 1997). However, one should keep in mind its pitfalls. I would like to draw particular attention to two aspects. First one is the weaknesses of the online survey as a method. Second one is the pitfalls of this method when used to elicit customers' willingness to pay.

One of the main weaknesses of survey as a research method is dependence on the survey questions. One does not communicate with the respondents directly and has a rather limited opportunity to get information other than outlined by the questions in the questionnaire. This, however, seems a minor problem in the current study. In this study I was interested in

movie consumption statistics and individual movie valuations. For these purposes standardized questions seem to be an acceptable method of information gathering.

Among other challenges of the survey method there are self-selection bias and response bias. Self-selection bias denotes the situation in which some of the respondents are most likely to respond to the questionnaire than the others. For instance, respondents who are interested in the product and/or like it are more likely to answer the survey questions than those who are not familiar with the product. This is a problem for the surveys where one needs to assess information across the whole population, for example to elicit the opinion about a service or a product. If only those who have a particular interest in the product choose to participate in the survey, the results might be skewed. However, it seems to be a minor problem for the current study. The main purpose of the survey was to elicit willingness to pay for movies on demand. Respondents with special interest for movies and their valuations were of a particular interest, as there is a higher probability that they are potential consumers of on demand services. Thus, self-selection in this case could be perceived more as an advantage then as a disadvantage.

The next challenge, response bias, occurs when respondents misrepresent the truth, either consciously or unconsciously. It happens when respondents, for instance, want to create a favourable impression. Alternatively it could happen if a respondent misunderstands the question. In either case the reliability of the results is undermined. In this study I tried to make the questions short, precise and clear. Besides, I included several questions for validation of the answers. Thus, the respondents were asked about their average monthly movie consumption, both frequency and amount of money they spend. The stated movie valuations for a respondent were compared with the answers to these validation questions in order to assess the reliability of the answers. In case of discrepancies between movie valuations and the answers to the questions about average movie consumption, the valuation data was deemed misleading and was removed from the dataset.

Further, there is criticism connected to using open ended survey as a research method for eliciting customers' willingness to pay. Nysveen and Pedersen (2004) point out that surveys tend to overestimate willingness to pay. This is related to the discrepancy between perceived attitude and the real intention to buy. That is, the respondent states the valuation of the product, but it does not always mean that at the moment of decision making he/she will really purchase the product. On the other hand, Nysveen and Pedersen mention the factors

that may lead to the underestimation of willingness to pay. One of them is sub-additivity. In the case of sub-additivity, respondents tend to add the cost of all items listed (movie titles in the case of the current study) which leads to conservative evaluations. Another possible pitfall is the possibility that a respondent feels "out of money" as he/she gets to the items (movie titles) further down on the list and gives more conservative estimates than in the beginning of the list (Nysveen, Pedersen 2004).

In this study I have tried to avoid the situation when movie valuations would be misleading. Firstly, I ensured that the customers understand the purchase situation. This was done by presenting a concise text explaining the situation (se Chapter 3). To make respondents familiar with the product, I included a poster picture and a short description of the movie. Thereafter, the stated individual movie valuations were examined carefully and compared to the stated movie consumption patterns. All the outliers and doubtful valuations (those which would not match the stated movie consumption pattern) were removed from the dataset.

6. Conclusions

6.1 Main findings

In this empirical study I've used the data on willingness to pay obtained from an online survey to calculate the impact of selected pricing techniques on the breakdown of the area under demand curve. Moreover, the data was used to statistically test hypotheses about consumer patterns for the movie rental.

The main findings of the study are as follows:

Firstly, the study has shown that a considerable share of the surplus (43%) can be appropriated by the producer by using uniform pricing technique (compare to 27% in the study of digital music by Shiller and Waldfogel). Secondly, more sophisticated alternatives have proved surprisingly little effective compared to uniform pricing. Component pricing and pure bundling improve the result of uniform pricing only by 0.7% and 0.6% respectively. Out of the tested pricing alternatives only two-part tariff has performed significantly better than uniform pricing. It raised revenue by 37% from 43% to 59% of the total surplus. But even though some of the surplus is still out of the reach of the producer, the results could indicate that sophisticated pricing has a potential to have a large impact on the revenue. The results of this study point towards two-part tariff as a possible way to go for the distributers of movies on demand.

Statistical tests performed on the survey data in section 3.4.3 revealed several tendencies in the consumption patterns. Thus, there is statistical evidence to infer that consumption habits differ between genders and age groups. In addition, families with young children also prove having different consumption habits compared to other respondent groups. This knowledge could be helpful for creating and offering several two-part tariffs, specifically designed for separate target groups.

6.2 Limitations

In this section I will point out a number of moments which should be taken into consideration while evaluating the results of this study.

Firstly, as most of the empirical studies, this one is dependent on the quality of data. The results are subject to sampling error. I am also aware of the fact that the analysis is based on rather limited number of respondents (479). Besides, the respondents were chosen from the customers of one particular company and might not be fully representative for the whole population.

Secondly, one should keep in mind the challenges of the movie selection process in this study. The number of movies chosen for the survey was limited to 75. Even though an attempt was made to capture diverse movie preferences by including titles from different categories as well as release time spread over 3 years, there is still a possibility that not all the respondents found a movie appealing to them.

Thirdly, this study covers a product which is relatively unknown to the customers. Of course, movie rental as such is a widely known phenomenon. However, the survey has shown that not many respondents have tried on demand services. It means that the experience of renting movies via TV provider is an unknown consumption experience for many of them. Furthermore, one should keep in mind that on demand services are not limited to movie library only. On-demand concept includes also TV-shows, news, sport and other content. The movie library is just a part of a compound product and it might be reasonable to talk about a pricing strategy which would cover all aspects of on demand product.

6.3 Suggestions for further research

Video on demand is a relatively new research area. It offers a wide area for both theoretical and empirical analysis. Here I will outline some of the directions for further studies.

An empirical research on customers' willingness to pay, applied to different/larger respondent samples could supplement this study and reveal more nuances in consumption patterns. Besides, a thorough mapping of customer preferences would open a door to opportunities for sophisticated pricing techniques and better customer targeting.

Furthermore, video on demand concept offers a wide range of topics for further research. It includes studies on different aspects of on demand services as well as composition of a product of which movies is only an integrated part.

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www.phrases.org.uk

Appendix

1. Survey questions

1 Hvor ofte går du på kino?

Oftere enn 3-4 ganger i måneden
3-4 ganger i måneden
1-2 ganger i måneden
Sjeldent
Aldri

2 Hvor ofte kjøper du filmer på DVD/Blue-ray?

Oftere enn 3-4 ganger i måneden
3-4 ganger i måneden
1-2 ganger i måneden
Sjeldent
Aldri

3 Hvor ofte leier du filmer (i en butikk og lignende)?

Oftere enn 3-4 ganger i måneden
3-4 ganger i måneden
1-2 ganger i måneden
Sjeldent
Aldri

4 Hvor ofte leier du filmer via din TV-leverandør?

Oftere enn 3-4 ganger i måneden
3-4 ganger i måneden
1-2 ganger i måneden
Sjeldent
Aldri

5 Hvor mye forbruker du på filmkjøp (DVD/Blue-ray) i gjennomsnitt per måned?

Ingenting
< NOK 100
NOK 100 til NOK 300
NOK 301 til NOK 500
> NOK 500

6 Hvor mye forbruker du på å leie filmer i gjennomsnitt per måned?

Ingenting
< NOK 100
NOK 100 til NOK 300
NOK 301 til NOK 500
> NOK 500

7 Hvilken måte å se film på foretrekker du?

Kino
Kjøp DVD/Blue-ray
Leie DVD/Blue-ray i butikk
Leie film via TV-leverandør
Nedlasting fra internett (gratis)
Streaming fra internet mot betaling
(SFAnytime, iTunes og lignende)
TV (free broadcasting, NOT paid channels)
Streaming fra internett gratis
Ikke interessert i film

8   Hvordan bestemmer du deg for å se en film?

Anbefalinger fra venner og lignende
Velger filmnyheter
Velger anerkjente toppfilmer
Valget er tilfeldig
Omtale
Det barna vil se på kino
Skuespiller/sjanger
Reklame
Ikke interessert i film

9   Velg filmkategori

Action
Drama
Familie
Komedie
Thriller

I neste del blir det presentert en rekke filmtitler. Filmtitlene er delt inn i 5 kategorier. Velg kategorien du er interessert i. Det er mulig å velge flere kategorier.

NB! En kategori inneholder 15 filmtitler og det tar ca. 10-13 min. å gå gjennom disse. Velger du flere kategorier, kan det ta lengre tid å besvare undersøkelsen.

Du er bedt om å angi det MAKSIMALE beløpet (i NOK) du er villig til å betale for å LEIE denne filmen direkte til din TV fra en LOVLIG kilde. Tenk deg at du ikke eier denne filmen og at den blir tilgjengelig med en gang du vil se den.

Skriv hvor mye filmen er verdt for DEG, ikke beløpet du tenker er rettferdig eller vanlig å betale.

Hvis du ikke er interessert i å se denne filmen skriv 0.

(The movie titles were presented here with a poster, a short description of the plot and information about starring actors, director, production studio, year of release. The respondent was asked to fill inn the amount he/she was willing to pay for the movie)

(The next set of questions was presented after the questions about movie valuations were answered):

10   Hvilke faktorer kunne øke beløpene du har oppgitt i øvrige spørsmålene?

Film har HD (high definition) - kvalitet
Film er tilgjengelig i 3D
Anledning til å lagre filmen til privat bruk
God filmutvalg
Tilgjengelig tidlig
Varighet på leie (filmen er tilgjengelig lenger)
Ingenting

11   Hvor ofte ser du ekstramateriale som finnes på DVD?

Aldri
Noen ganger
Alltid
Sjeldent

12   Hvor mange timer om dagen ser du på TV?

Mindre enn 1
1 til 3
3 til 5
Mere enn 5

13   Hva er din alder?

18-25
26-35
36-45
> 45

14 Kjønn

Kvinne
Mann

15 Hva er bruttoinntekten i husholdningen?

< 400 000
400 000 til 800 000
> 800 000

16 Hvor mange personer er det i husholdningen?

1
2
3 til 4
5 eller flere

17 Har du barn?

Ja
Nei

18 Hva er barnas/barnets alder?

Under 6
6 – 11
12 – 15
Over 15

19 Har du noen gang leid film via TV-leverandør?

Ja
Nei

20 Hvis ikke - hvorfor?

Er ikke vant til å bruke denne tjenesten
Kjenner ikke til tilbudet
Bruker billigere alternativer
Vanskelig å bruke denne tjenesten
Ikke interessert i film
Har ikke behov
Gidder ikke
Dårlig kvalitet
Dyrt
Foretrekker DVD og kino

21 Kunne du tenke deg å leie film via din TV-leverandør i framtiden?

Ja
Nei
Vet ikke

2. Figures

Figure 1: Distribution of movie valuations, raw data
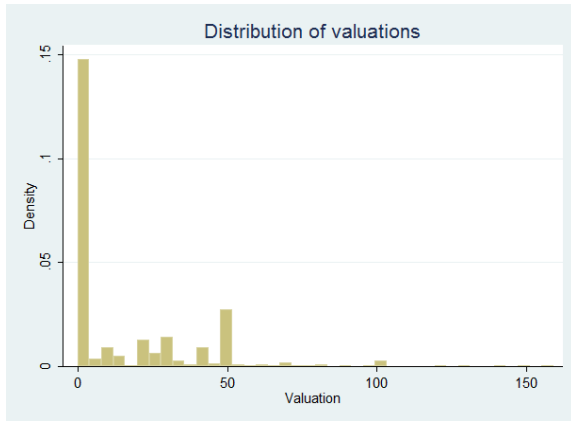
Figure 2: Overall demand curve, raw data
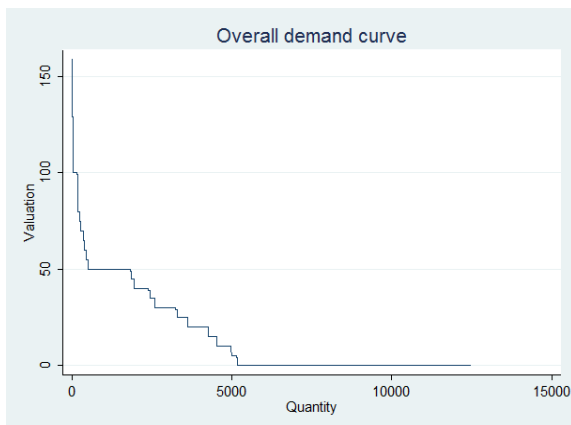
Figure 3: Single-price revenue function, raw data
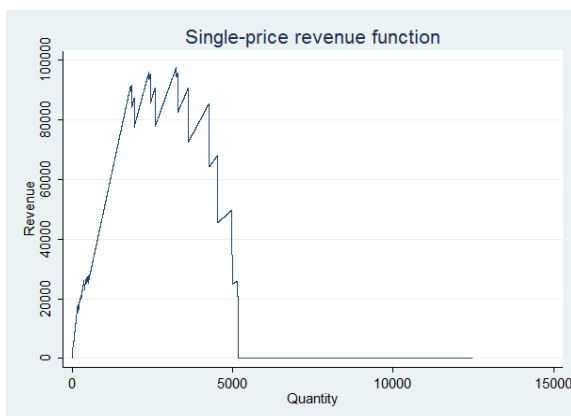
Figure 4: Fit of the observed data to lognormal distribution (program used: *Sigmaplot12*)
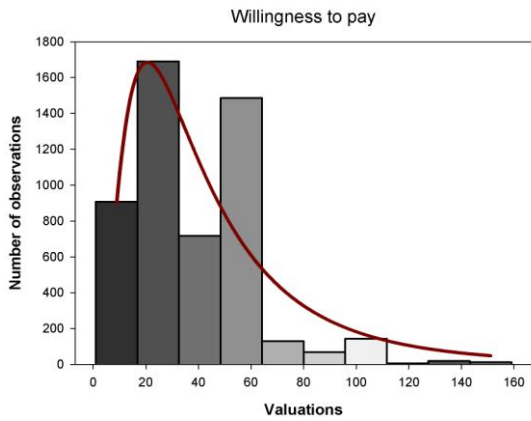
Figure 5: Pairwise correlations of song valuations, *action*
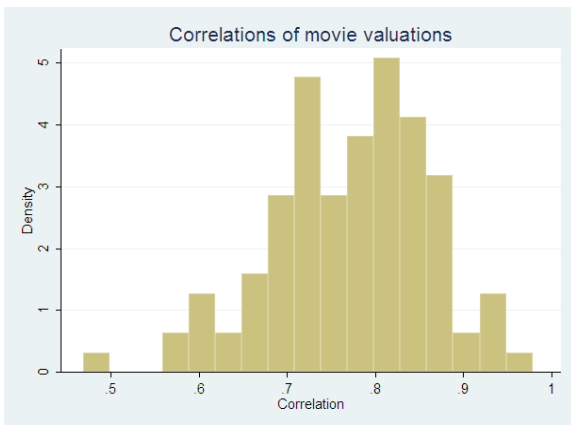
Fig 6: Valuations across individuals (for any number of movies n, the figures show the 25th, 50th, and 75th percentile of the distribution of the valuations of the n movies that the respondents value most)
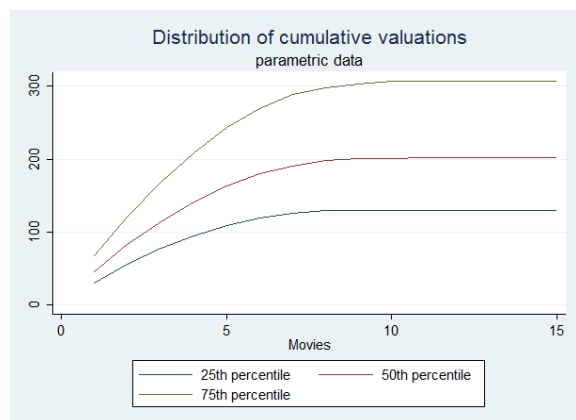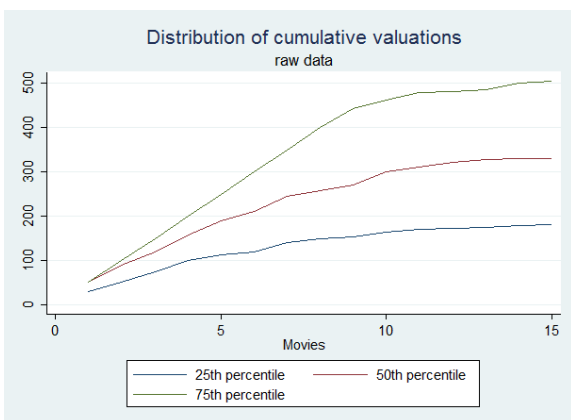
Figure 7: Distribution of movie valuations, category *action*
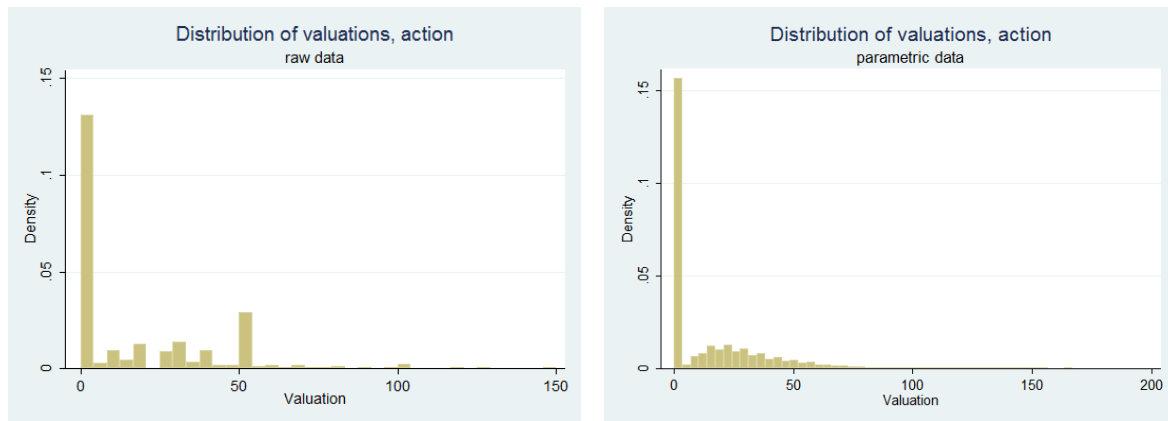
Figure 8: Overall demand curve, category *action*
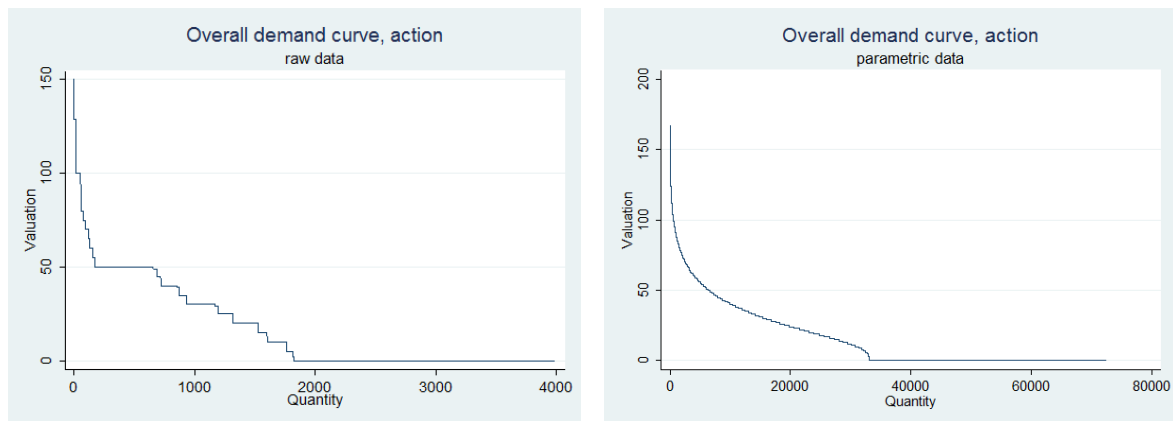
Figure 9: Single-price revenue function, category *action*
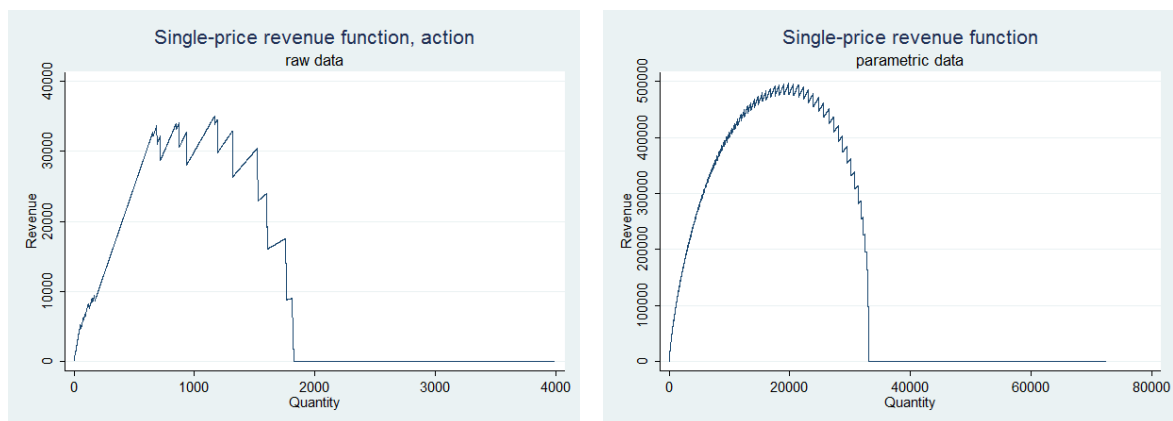
3. Tables

Table 1: Prices of movies on demand available in Norway (prices pr.25.03.12)

Provider	Movie charachteristic	Price per movie, NOK			
Altibox	New and popular	49			
http://www.altibox.no/	Older/less popular	39			
	New and popular/HD	79			
	Older/HD	59			
CDON.no	New and popular	39			
http://cdon.no/	Older/less popular	29	19	9	free
Film2home	New and popular	49	39		
http://www.film2home.no/no.aspx	Older/less popular	29	19		
Filmweb online	New and popular	39	35		
http://www.filmweb.no/online/	Older/less popular	29	19		
NextGenTel (broadpark)	New and popular	max 59			
http://www.nextgentel.no/privat/tv/interaktiv/filmkiosk/	Older/less popular	min 9			
SF Anytime	New and popular	39			
http://sfanytime.com/nb-NO/	Older/less popular	35	25		
	New and popular/HD	55			
	Older/HD	39			
Voddler	New and popular	37			
http://www.voddler.com/	Older/less popular	27	19		

Table 2: Movie list

Nr.	Title	Category	Year	Premiere in Norway (source: filmweb)	DVD available at the time of survey	Filmweb (max 6)	Date for information gathering	IMDB (max 10)	% liked Flixter
1	Jørgen+Anne=sant	Family	2011	25.02.2011	No	5,3	02.05.11	6,9	n/a
2	Megahjerne	Family	2010	25.12.2010	Yes	4,23	02.05.11	7,3	74 %
3	Gråtass får en ny venn	Family	2011	18.02.2011	No	4,42	02.05.11	n/a	n/a
4	Prinsessen og frosken	Family	2009	19.02.2010	Yes	4,87	02.05.11	7,3	72 %
5	Rango	Family	2011	04.03.2011	No	4,78	02.05.11	7,7	73 %
6	Til Huttetuenes land	Family	2009	22.01.2010	Yes	4,74	08.04.11	7,1	59 %
7	Grusomme meg	Family	2010	15.10.2010	Yes	4,98	02.05.11	7,5	81 %
8	Sammys eventyr	Family	2010	05.11.2010	Yes	4,31	02.05.11	6	31 %
9	Gnomeo and Julie	Family	2011	11.03.2011	No	4,88	02.05.11	5,7	58 %
10	Dragetreneren	Family	2009	26.03.2010	Yes	4,96	02.05.11	8,2	90 %
11	Se opp	Family	2009	25.09.2009	Yes	5,09	01.05.11	8,4	86 %
12	Legenden on Narnia - Reisen til det ytterste hav	Family	2010	25.12.2010	Yes	4,87	02.05.11	6,5	67 %
13	Den fantastiske Mikkel Rev	Family	2009	05.02.2010	Yes	4,7	01.05.11	7,9	79 %
14	Toy Story 3	Family	2010	27.08.2010	Yes	5,38	02.05.11	7,8	91 %
15	Rio	Family	2011	08.04.2011	No	5,1	02.05.11	7	82 %
16	Inception	Action	2010	21.07.2010	Yes	5,28	01.05.11	8,9	93 %
17	Thor	Action	2011	29.04.2011	No	4,92	01.05.11	7,8	n/a
18	Avatar	Action	2009	18.12.2009	Yes	5,49	01.05.11	8,2	92 %
19	World Invasion: Battle Los Angeles	Action	2011	08.04.2011	No	4,57	01.05.11	6,3	57 %
20	Red	Action	2010	05.11.2010	Yes	5,12	01.05.11	7,1	73 %
21	Unstoppable	Action	2010	12.11.2010	Yes	4,52	01.05.11	6,9	73 %
22	Trolljegeren	Action	2010	29.10.2010	Yes	5,23	01.05.11	7,3	n/a
23	Takers	Action	2010	05.11.2010	Yes	5,46	04.04.11	5,8	57 %
24	Salt	Action	2010	03.09.2010	Yes	4,83	01.05.11	6,5	62 %
25	The Adjustment Bureau	Action	2010	25.03.2011	No	4,35	01.05.11	7,2	69 %
26	Knight and Day	Action	2010	16.07.2010	Yes	4,97	01.05.11	6,4	52 %
27	Tomorrow, When the War Began	Action	2010	15.04.2011	No	5,02	02.05.11	6,3	n/a
28	Harry Potter og Dødstalismanene	Action	2010	19.11.2010	Yes	5,59	08.04.11	7,8	87 %
29	The Town	Action	2010	26.12.2010	Yes	4,95	01.05.11	7,7	84 %
30	The A-team	Action	2010	18.06.2010	Yes	5,28	06.04.11	7	n/a
31	Dinner for Schmucks	Comedy	2010	03.09.2010	Yes	4,56	01.05.11	6	48 %
32	Just Go with It	Comedy	2011	25.02.2011	No	5,06	01.05.11	6,2	73 %
33	No Strings Attached	Comedy	2011	18.03.2011	No	4,74	01.05.11	6,3	n/a
34	Did you hear about Morgans?	Comedy	2009	29.01.2010	Yes	4,4	01.05.11	4,4	31 %
35	Valentine's Day	Comedy	2010	12.02.2010	Yes	5,03	01.05.11	5,7	54 %
36	Grown ups	Comedy	2010	24.09.2010	Yes	5,17	01.05.11	5,8	59 %
37	Hangover	Comedy	2009	19.06.2009	Yes	5,47	02.05.11	7,9	87 %
38	It's Complicated	Comedy	2009	26.12.2009	Yes	4,6	01.05.11	6,6	63 %
39	Verre enn vers	Comedy	2010	22.12.2010	No	4,98	02.05.11	5,3	43 %
40	Due Date	Comedy	2010	03.12.2010	Yes	4,91	01.05.11	6,7	58 %
41	Klovn-The Movie	Comedy	2010	25.03.2011	No	4,92	01.05.11	7,9	n/a
42	Sykt lykkelig	Comedy	2010	05.11.2010	Yes	4,46	01.05.11	7,7	n/a
43	Zombieland	Comedy	2009	23.10.2009	Yes	5,4	02.05.11	7,8	87 %
44	UMEÅ4ever	Comedy	2010	01.04.2011	No	4,58	01.05.11	n/a	n/a
45	Love and Other Drugs	Comedy	2010	21.01.2011	No	4,78	01.05.11	6,6	56 %

46	Kongens Tale	Drama	2010	11.02.2011	No	5,12	01.05.11	8,4	94 %
47	Jeg reiser alene	Drama	2010	11.02.2011	No	4,9	01.05.11	7,2	n/a
48	A Single Man	Drama	2009	12.02.2010	Yes	4,3	02.05.11	7,6	78 %
49	Extraodinary measures	Drama	2010	16.04.2010	Yes	5,5	01.05.11	6,4	55 %
50	Spis elsk lev	Drama	2010	01.10.2010	Yes	4,33	01.05.11	5,2	47 %
51	Black Swan	Drama	2010	04.02.2011	No	5	01.05.11	8,5	86 %
52	Kongen av Bastøy	Drama	2010	17.12.2010	No	5,15	01.05.11	7,4	n/a
53	Country Strong	Drama	2010	15.04.2011	No	4,23	02.05.11	5,8	62 %
54	127 Hours	Drama	2010	11.02.2011	No	5,01	01.05.11	8	85 %
55	Cornelis	Drama	2010	12.11.2010	Yes	4,89	01.05.11	6,7	n/a
56	Dear John	Drama	2010	11.06.2010	Yes	5,35	01.05.11	5,9	66 %
57	True grit - et ekte mannfolk	Drama	2010	18.02.2011	No	4,84	01.05.11	8	87 %
58	Public Enemies	Drama	2009	24.07.2009	Yes	4,48	02.05.11	7,1	65 %
59	The Social Network	Drama	2010	22.10.2010	Yes	5	01.05.11	8,1	89 %
60	I en bedre verden	Drama	2010	24.09.2010	Yes	5,35	02.05.11	7,7	n/a
61	I Am Number Four	Thriller	2011	18.03.2011	No	5,05	01.05.11	6,3	65 %
62	Varg Veum -Svarte får	Thriller	2010	21.01.2011	Yes	3,91	01.05.11	6	n/a
63	Skyline	Thriller	2010	10.12.2010	Yes	4,04	17.04.11	4,5	20 %
64	Nokas	Thriller	2010	01.10.2010	Yes	4,99	01.05.11	5,9	n/a
65	Stone	Thriller	2010	01.10.2010	Yes	4	01.05.11	6,9	21 %
66	Green Zone	Thriller	2010	12.03.2010	Yes	5,04	01.05.11	7	60 %
67	The Rite	Thriller	2011	11.03.2011	No	4,43	01.05.11	6,1	51 %
68	22 bullets	Thriller	2010	15.12.2010 (Sweden, DVD)	Yes	5	02.05.11	6,7	53 %
69	Shutter Island	Thriller	2010	19.02.2010	Yes	4,84	01.05.11	8	73 %
70	Piranha	Thriller	2010	22.10.2010	Yes	4,91	01.05.11	6	45 %
71	The Next Three Days	Thriller		03.12.2010	Yes	4,88	02.05.11	7,4	66 %
72	Skyggen (The ghost writer)	Thriller	2009	26.03.2010	Yes	4,6	01.05.11	7,2	68 %
73	Tron: Legacy	Thriller	2010	17.12.2010	Yes	5,32	01.05.11	7,1	67 %
74	Varg Veum - dødens drabanter	Thriller	2011	08.04.2011	No	5	02.05.11	6,7	n/a
75	Let Me In	Thriller	2010	01.04.2011	No	6 (by 1 viewer)	01.05.11	7,3	74 %

Table 3: Summary of survey selection

1	Hvor ofte går du på kino?	N	%
	Oftere enn 3-4 ganger i måneden	2	0.4%
	3-4 ganger i måneden	6	1.3%
	1-2 ganger i måneden	42	8.8%
	Sjeldent	368	76.8%
	Aldri	61	12.7%
	Total	479	100%

2	Hvor ofte kjøper du filmer på DVD/Blue-ray?	N	%
	Oftere enn 3-4 ganger i måneden	8	1.7%
	3-4 ganger i måneden	12	2.5%
	1-2 ganger i måneden	96	20.0%
	Sjeldent	268	55.9%
	Aldri	95	19.8%
	Total	479	100%

3	Hvor ofte leier du filmer (i en butikk og lignende)?	N	%
	Oftere enn 3-4 ganger i måneden	4	0.8%
	3-4 ganger i måneden	15	3.1%
	1-2 ganger i måneden	28	5.9%
	Sjeldent	178	37.3%
	Aldri	252	52.8%
	Total	477	100%

4	Hvor ofte leier du filmer via din TV-leverandør?	N	%
	Oftere enn 3-4 ganger i måneden	1	0.2%
	3-4 ganger i måneden	5	1.1%
	1-2 ganger i måneden	13	2.7%
	Sjeldent	82	17.2%
	Aldri	375	78.8%
	Total	476	100%

5	Hvor mye forbruker du på filmkjøp (DVD/Blue-ray) i gjennomsnitt per måned?	N	%
	Ingenting	54	11.3%
	< NOK 100	303	63.3%
	NOK 100 til NOK 300	86	18.0%
	NOK 301 til NOK 500	31	6.5%
	> NOK 500	5	1.0%
	Total	479	100%

6	Hvor mye forbruker du på å leie filmer i gjennomsnitt per måned?	N	%
	Ingenting	98	20.5%
	< NOK 100	333	69.7%
	NOK 100 til NOK 300	39	8.2%
	NOK 301 til NOK 500	5	1.0%
	> NOK 500	3	0.6%
	Total	478	100%

7	Hvilken måte å se film på foretrekker du?	N	%
	Kino	272	56.8%
	Kjøp DVD/Blue-ray	187	39.0%
	Leie DVD/Blue-ray i butikk	61	12.7%
	Leie film via TV-leverandør	36	7.5%

	N	%
Nedlasting fra internett (gratis)	83	17.3%
Streaming fra internet mot betaling (SFAnytime, iTunes og lignende)	37	7.7%
TV (free broadcasting, NOT paid channels)	92	19.2%
Streaming fra internett gratis	2	0.4%
Ikke interessert i film	7	1.5%

8 Hvordan bestemmer du deg for å se en film?	N	%
Anbefalinger fra venner og lignende	150	31.3%
Velger filmnyheter	137	28.6%
Velger anerkjente toppfilmer	150	31.3%
Valget er tilfeldig	170	35.5%
Omtale	11	2.3%
Det barna vil se på kino	3	0.6%
Skuespiller/sjanger	4	0.8%
Reklame	1	0.2%
Ikke interessert i film	4	0.8%

9 Velg filmkategori	N	%
Action	264	55.1%
Drama	144	30.1%
Familie	73	15.2%
Komedie	199	41.5%
Thriller	155	32.4%

10 Hvilke faktorer kunne øke beløpene du har oppgitt i øvrige spørsmålene?	N	%
Film har HD (high definition) - kvalitet	186	38.8%
Film er tilgjengelig i 3D	58	12.1%
Anledning til å lagre filmen til privat bruk	198	41.3%
God filmutvalg	16	3.3%
Tilgjengelig tidlig	1	0.2%
Varighet på leie (filmen er tilgjengelig lenger)	1	0.2%
Ingenting	38	7.9%

11 Hvor ofte ser du ekstramateriale som finnes på DVD?	N	%
Aldri	192	40.5%
Noen ganger	250	52.7%
Alltid	27	5.7%
Sjeldent	5	1.1%
Total	474	100%

12 Hvor mange timer om dagen ser du på TV?	N	%
Mindre enn 1	81	16.9%
1 til 3	298	62.2%
3 til 5	83	17.3%
Mere enn 5	17	3.5%
Total	479	100%

13 Hva er din alder?	N	%
18-25	9	1.9%
26-35	60	12.6%
36-45	137	28.7%
> 45	271	56.8%
Total	477	100%

14 Kjønn	N	%
Kvinne	99	26.4%

Mann	375	79.1%
Total	474	100%

15 Hva er bruttoinntekten i husholdningen?

	N	%
< 400 000	87	19.1%
400 000 til 800 000	215	47.1%
> 800 000	154	33.8%
Total	456	100%

16 Hvor mange personer er det i husholdningen?

	N	%
1	58	12.3%
2	202	42.7%
3 til 4	159	33.6%
5 eller flere	54	11.4%
Total	473	100%

17 Har du barn?

	N	%
Ja	335	81.5%
Nei	76	18.5%
Total	411	100%

18 Hva er barnas/barnets alder?

	N	%
Under 6	72	21.5%
6 – 11	84	25.1%
12 – 15	77	23.0%
Over 15	212	63.3%

19 Har du noen gang leid film via TV-leverandør?*

	N	%
Ja	17	5.9%
Nei	270	94.1%
Total	287	100%

20 Hvis ikke - hvorfor?*

	N	%
Er ikke vant til å bruke denne tjenesten	104	38.5%
Kjenner ikke til tilbudet	47	17.4%
Bruker billigere alternativer	40	14.8%
Vanskelig å bruke denne tjenesten	11	4.1%
Ikke interessert i film	24	8.9%
Har ikke behov	37	13.7%
Gidder ikke	3	1.1%
Dårlig kvalitet	4	1.5%
Dyrt	3	1.1%
Foretrekker DVD og kino	3	1.1%

21 Kunne du tenke deg å leie film via din TV-leverandør i framtiden?*

	N	%
Ja	161	59.6%
Nei	102	37.8%
Vet ikke	7	2.6%
Total	270	100%

*   *The number of the respondents who answered these questions
     is lower than the previous ones. The reason is that the
     respondents were divided in two groups: active CD customers
     and passive CD customers. Passive customers are those who have
     stopped their subscription within the last 2 years. The questions
     19-21 were asked only to the active customers.*

Table 4: Valuations of the songs

Percentile	0.50 %	0.15 %	0.25 %	0.50 %	0.75 %	0.90 %	0.93 %	0.95 %	0.98 %	mean	median
Valuation, NOK	10	15	20	35	50	60	75	100	150	37,34	35,00

Table 5: Pairwise correlations of movie valuations by categories

Category	Average correlation of movie valuations
Action	0.77228
Comedy	0.80089
Drama	0.78099
Family	0.87454
Thriller	0.82637

Table 6: Number of observations by categories

Movie category	Nr. of observations (all)	Nr. of observations (positive)
Action	3990	1824
Comedy	2965	1055
Drama	2167	908
Family	1095	423
Thriller	2266	974

Table 7: Pearson correlation by categories (movie ratings vs movie valuations)

Movie category	Pearson correlation	p-value
Action	0.643	0.010
Comedy	0.271	0.328
Drama	0.862	0.000
Family	-0.164	0.560
Thriller	-0.194	0.489

Table 8: Alternative pricing techniques, raw data

Pricing technique	PS share	CS share	DWL share	%ΔPS	%ΔCS	%ΔDWL
Uniform pricing	0.50513	0.33128	0.16359			
Component pricing (movie)	0.52040	0.24631	0.23330	0.03	(0.26)	0.43
Pure bundling 15 movies	0.44497	0.29661	0.25841	(0.12)	(0.10)	0.58
Two-part tariff	0.64422	0.26278	0.09300	0.28	(0.21)	(0.43)

Table 9: Alternative pricing techniques, parametric data

Pricing technique	PS share	CS share	DWL share	%ΔPS	%ΔCS	%ΔDWL
Uniform pricing	0.43470	0.37932	0.18598			
Component pricing	0.43793	0.37985	0.18223	0.01	0.00	(0.02)
Pure bundling	0.43726	0.38513	0.17762	0.01	0.02	(0.04)
Bundling 3 movies	0.40305	0.37703	0.21992	(0.07)	(0.01)	0.18
Bundling 5 movies	0.40944	0.38747	0.20309	(0.06)	0.02	0.09
Two-part tariff	0.59380	0.26363	0.14257	0.37	(0.30)	(0.23)

Table 10: Breakdown of surplus, parametric data by categories (uniform pricing)

Movie category	PS share	CS share	DWL share
Action	0.43470	0.37932	0.18598
Drama	0.44931	0.36122	0.18946
Comedy	0.41925	0.36793	0.21282
Family	0.42633	0.36549	0.20817
Thriller	0.42943	0.36489	0.20568

Table 11: Category-specific revenue maximizing prices, raw data

Movie category	Family	Action	Comedy	Drama	Thriller
Price, NOK	40	30	30	30	30

Table 12: Component pricing: movie-specific revenue maximizing prices, parametric data

Movie number	Revenue max. price, NOK
1	27
2	26
3	26
4	20
5	26
6	24
7	25
8	28
9	24
10	25
11	28
12	18
13	26
14	23
15	25

Comment: Movie numbers in the table do not correspond to the movie numbers in Table 2. Since the data is simulated, the movie title

here is of little interest. The spread of revenue maximizing prices across movies presents the main interest in this table.

Table 13: Chi - squared test for contingency table: the input data

Comment: The tables used in chi-square test are grouped by the hypothesis. The first table presents the raw data. In most of the cases some transformations have been made to make the data satisfy "the rule of five". The adjusted table (with combined rows, columns or both) is presented below the table with raw data. The table used in the test is marked with grid. The tables are in Norwegian as it is the language of the survey.

Hypothesis 1: The frequency of movie rental is independent of gender

	Kvinne	Mann
Oftere enn 3-4 ganger i måneden	0	3
3-4 ganger i måneden	6	9
1-2 ganger i måneden	3	25
Sjeldent	35	133
Aldri	52	188

(table with combined rows)

	Kvinne	Mann
Ofte	9	37
Sjeldent	35	133
Aldri	52	188

Hypothesis 2: The amount spent on movie rental is independent of gender

	Kvinne	Mann
< NOK 100	58	260
NOK 100 til NOK 300	7	31
NOK 301 til NOK 500	1	3
> NOK 500	1	2
Ingenting	29	63

(table with combined rows)

	Kvinne	Mann
Ingenting	29	63
Litt	58	260
Noe	9	36

Hypothesis 3: The stated wtp is independent of gender

Wtp	Kvinne	Mann
0	31	145
NOK 1 - NOK 10	14	42
NOK 11 - NOK 25	18	79
NOK 26 - NOK35	12	39
>NOK 35	21	55

(table with combined rows)

0	31	145
NOK 1 - NOK 10	14	42
NOK 11 - NOK 25	18	79
NOK 26 - NOK35	12	39
>NOK 35	21	55

Hypothesis 4: The choice of movie category is independent of gender

	Kvinne	Mann
Action	31	223
Comedy	40	148
Drama	50	85
Familie	25	46
Thriller	26	119

Hypothesis 5: The frequency of movie rental is independent of age

	18-25	26-35	36-45	> 45
Oftere enn 3-4 ganger i måneden	1	0	2	0

	3-4 ganger i måneden	1	6	5	3
	1-2 ganger i måneden	0	1	6	12
	Sjeldent	4	19	61	85
	Aldri	3	24	53	161

(table with combined rows)

	18-35	36-45	>45
Ofte	**9**	**13**	**15**
Sjeldent	**23**	**61**	**85**
Aldri	**27**	**53**	**161**

Hypothesis 6: The amount spent on the movie rental is independent of age

	18-25	26-35	36-45	> 45
< NOK 100	6	40	97	176
NOK 100 til NOK 300	2	8	14	14
NOK 301 til NOK 500	0	1	2	1
> NOK 500	0	2	1	0
Ingenting	1	9	13	70

(table with combined rows)

	18-35	36-45	>45
Ingenting	**10**	**13**	**70**
Litt	**46**	**97**	**176**
Noe	**13**	**17**	**15**

Hypothesis 7: The stated wtp is independent of age

	18-25	26-35	36-45	> 45
Wtp				
0	1	9	38	130
NOK 1 - NOK 10	1	7	16	32
NOK 11 - NOK 25	4	20	27	46
NOK 26 - NOK35	1	10	21	20
>NOK 35	2	14	25	34

(table with combined rows)

	18-35	36-45	> 45
0	**10**	**38**	**130**
NOK 1 - NOK 10	**8**	**16**	**32**
NOK 11 - NOK 25	**24**	**27**	**46**
NOK 26 - NOK35	**11**	**21**	**20**
>NOK 35	**16**	**25**	**34**

Hypothesis 8: The choice of movie category is independent of age

	18-25	26-35	36-45	> 45
Action	5	45	98	107
Comedy	4	35	59	92
Drama	2	13	31	90
Familie		10	20	41
Thriller	1	28	48	69

(table with combined rows)

	18-35	36-45	> 45
Action	**50**	**98**	**107**
Comedy	**39**	**59**	**92**
Drama	**15**	**31**	**90**
Familie	**10**	**20**	**41**
Thriller	**29**	**48**	**69**

Hypothesis 9: The frequency of movie rental is independent of age of children

	Under 6	6 - 11	12 - 15	Over 15
Oftere enn 3-4 ganger i måneden	0	1	1	0
3-4 ganger i måneden	5	1	0	4
1-2 ganger i måneden	4	3	2	12
Sjeldent	10	20	19	69
Aldri	13	23	14	117

(table with combined rows)

	Småbarn	Eldre barn

Ofte	**14**	**19**
Sjeldent	**30**	**88**
Aldri	**36**	**131**

Hypothesis 10: The amount spent on the movie rental is independent of the age of children

	Under 6	6 - 11	12 - 15	Over 15
< NOK 100	20	34	30	139
NOK 100 til NOK 300	6	6	3	13
NOK 301 til NOK 500	0	0	0	2
> NOK 500	0	1	0	0
Ingenting	6	7	3	48

(table with combined rows)

	Småbarn	Eldre barn
Ingenting	**13**	**51**
Litt	**54**	**169**
Noe	**13**	**18**

Hypothesis 11: The stated wtp is independent of the age of children

	Under 6	6 - 11	12 - 15	Over 15
Wtp				
0	5	13	11	98
NOK 1 - NOK 10	2	5	6	23
NOK 11 - NOK 25	14	12	12	33
NOK 26 - NOK35	5	6	4	20
>NOK 35	6	12	3	28

(table with combined rows)

	Småbarn	Eldre barn
0	**18**	**109**
NOK 1 - NOK 10	**7**	**29**
NOK 11 - NOK 25	**26**	**45**
NOK 26 - NOK35	**11**	**24**
>NOK 35	**18**	**31**

4. MINITAB output

4.1 Pearson correlation: movie ratings vs movie valuations

Correlation: Ratings; Valuations, all movies

```
Pearson correlation of Ratings and Valuations = 0,321
P-Value = 0,005
```

Correlation: Ratings; Valuations, family

```
Pearson correlation of Ratings and Valuations = -0,164
P-Value = 0,560
```

Correlation: Ratings; Valuations, action

```
Pearson correlation of Ratings and Valuations = 0,643
P-Value = 0,010
```

Correlation: Ratings; Valuations, comedy

```
Pearson correlation of Ratings and Valuations = 0,271
P-Value = 0,328
```

Correlation: Ratings; Valuations, drama

```
Pearson correlation of Ratings and Valuations = 0,862
P-Value = 0,000
```

Correlation: Ratings; Valuations, thriller

```
Pearson correlation of Ratings and Valuations = -0,194
P-Value = 0,489
```

4.2 Regression on movie and individual effects

Regression Analysis: logval versus respid; movie

```
The regression equation is
logval = 3,55 + 0,000404 respid - 0,00301 movie


Predictor        Coef    SE Coef       T       P
Constant       3,5522     0,1007   35,28   0,000
respid      0,0004038  0,0001175    3,44   0,001
movie       -0,003010   0,001243   -2,42   0,016
```

```
S = 0,682883   R-Sq = 1,0%   R-Sq(adj) = 0,8%


Analysis of Variance

Source            DF        SS       MS      F      P
Regression         2    8,1968   4,0984   8,79  0,000
Residual Error  1821  849,1853   0,4663
Total           1823  857,3821
```

Regression Analysis: logval versus movie

```
The regression equation is
logval = 3,65 - 0,00299 movie


Predictor       Coef    SE Coef       T      P
Constant     3,64616    0,09717   37,52  0,000
movie       -0,002987  0,001247   -2,40  0,017


S = 0,684905   R-Sq = 0,3%   R-Sq(adj) = 0,3%


Analysis of Variance

Source            DF        SS       MS      F      P
Regression         1    2,6918   2,6918   5,74  0,017
Residual Error  1822  854,6903   0,4691
Total           1823  857,3821
```

Regression Analysis: logval versus respid

```
The regression equation is
logval = 3,32 + 0,000402 respid


Predictor        Coef    SE Coef        T      P
Constant      3,32120    0,03217   103,25  0,000
respid      0,0004023  0,0001177     3,42  0,001


S = 0,683793   R-Sq = 0,6%   R-Sq(adj) = 0,6%


Analysis of Variance

Source            DF        SS       MS       F      P
Regression         1    5,4642   5,4642   11,69  0,001
Residual Error  1822  851,9179   0,4676
Total           1823  857,3821
```

4.3 Chi-squared test of a contingency table

H1: The frequency of movie rental is independent of gender.

Chi-Square Test: Female; Male

```
Expected counts are printed below observed counts
Chi-Square contributions are printed below expected counts

      Female    Male   Total
   1      9      37      46
        9,73   36,27
        0,054   0,015

   2     35     133     168
       35,52  132,48
        0,008   0,002

   3     52     188     240
       50,75  189,25
        0,031   0,008

Total    96     358     454

Chi-Sq = 0,118; DF = 2; P-Value = 0,943
```

H2: The amount spent on movie rental is independent of gender.

Chi-Square Test: Female; Male

```
Expected counts are printed below observed counts
Chi-Square contributions are printed below expected counts

      Female    Male   Total
   1     29      63      92
       19,41   72,59
        4,737   1,267

   2     58     260     318
       67,09  250,91
        1,233   0,330

   3      9      36      45
        9,49   35,51
        0,026   0,007

Total    96     359     455

Chi-Sq = 7,599; DF = 2; P-Value = 0,022
```

H3: The stated willingness to pay is independent of gender

Chi-Square Test: Female; Male

```
Expected counts are printed below observed counts
Chi-Square contributions are printed below expected counts

      Female    Male   Total
   1     31     145     176
       37,05  138,95
        0,989   0,264

   2     14      42      56
       11,79   44,21
        0,414   0,111
```

```
   3      18        79       97
       20,42     76,58
       0,287     0,077


   4      12        39       51
       10,74     40,26
       0,149     0,040


   5      21        55       76
       16,00     60,00
       1,563     0,417

Total      96       360      456

Chi-Sq = 4,308; DF = 4; P-Value = 0,366
```

H4: The choice of movie category is independent of gender.

Chi-Square Test: Female; Male

```
Expected counts are printed below observed counts
Chi-Square contributions are printed below expected counts

        Female    Male   Total
   1       31      223     254
        55,09   198,91
        10,536    2,918


   2       40      148     188
        40,78   147,22
        0,015    0,004


   3       50       85     135
        29,28   105,72
        14,660    4,060


   4       25       46      71
        15,40    55,60
        5,985    1,658


   5       26      119     145
        31,45   113,55
        0,944    0,262

Total      172      621     793

Chi-Sq = 41,042; DF = 4; P-Value = 0,000
```

H5: The frequency of movie rental is independent of age.

Chi-Square Test: Young; Mid; Older

```
Expected counts are printed below observed counts
Chi-Square contributions are printed below expected counts

        Young    Mid    Older   Total
   1       9      13       15      37
        4,88   10,51    21,60
        3,470   0,589    2,019


   2       23      61       85     169
        22,31   48,02    98,68
```

```
      0,022  3,511   1,896

  3     27     53     161    241
      31,81  68,47  140,72
      0,727  3,496   2,923

Total    59    127    261    447

Chi-Sq = 18,652; DF = 4; P-Value = 0,001
1 cells with expected counts less than 5.
```

H6: The amount spent on movie rental is independent of age

Chi-Square Test: Young; Mid; Older

```
Expected counts are printed below observed counts
Chi-Square contributions are printed below expected counts

       Young    Mid   Older   Total
  1      10     13      70      93
      14,04  25,84   53,11
      1,163  6,384   5,369

  2      46     97     176     319
      48,16  88,65  182,19
      0,097  0,787   0,210

  3      13     17      15      45
       6,79  12,51   25,70
      5,668  1,615   4,455

Total    69    127    261     457

Chi-Sq = 25,748; DF = 4; P-Value = 0,000
```

H7: The stated willingness to pay is independent of age

Chi-Square Test: Young; Mid; Older

```
Expected counts are printed below observed counts
Chi-Square contributions are printed below expected counts

        Young    Mid   Older   Total
  1       10     38     130     178
       26,82  49,36  101,83
      10,546  2,614   7,796

  2        8     16      32      56
        8,44  15,53   32,03
       0,023  0,014   0,000

  3       24     27      46      97
       14,61  26,90   55,49
       6,029  0,000   1,623

  4       11     21      20      52
        7,83  14,42   29,75
       1,279  3,003   3,194

  5       16     25      34      75
       11,30  20,80   42,90
       1,956  0,849   1,848
```

```
Total      69    127    262    458
```

Chi-Sq = 40,774; DF = 8; P-Value = 0,000

H8: The choice of movie category is independent of age.

Chi-Square Test: Young; Mid; Older

```
Expected counts are printed below observed counts
Chi-Square contributions are printed below expected counts

      Young    Mid   Older   Total
   1     50     98     107     255
      45,70  81,80  127,50
      0,405  3,206   3,296

   2     39     59      92     190
      34,05  60,95   95,00
      0,720  0,063   0,095

   3     15     31      90     136
      24,37  43,63   68,00
      3,603  3,656   7,118

   4     10     20      41      71
      12,72  22,78   35,50
      0,583  0,339   0,852

   5     29     48      69     146
      26,16  46,84   73,00
      0,308  0,029   0,219

Total    143    256    399    798
```

Chi-Sq = 24,491; DF = 8; P-Value = 0,002

H9: The frequency of movie rental is independent of the age of children

Chi-Square Test: Small; Older

```
Expected counts are printed below observed counts
Chi-Square contributions are printed below expected counts

      Small  Older  Total
   1     14     19     33
       8,30  24,70
      3,911  1,315

   2     30     88    118
      29,69  88,31
      0,003  0,001

   3     36    131    167
      42,01 124,99
      0,860  0,289

Total     80    238    318
```

Chi-Sq = 6,380; DF = 2; P-Value = 0,041

H10: The amount spent on movie rental is independent of the age of children

Chi-Square Test: Small; Older

```
Expected counts are printed below observed counts
Chi-Square contributions are printed below expected counts

      Small   Older   Total
  1      13      51      64
       16,10   47,90
       0,597   0,201

  2      54     169     223
       56,10  166,90
       0,079   0,026

  3      13      18      31
        7,80   23,20
       3,469   1,166

Total    80     238     318

Chi-Sq = 5,538; DF = 2; P-Value = 0,063
```

H11: The stated willingness to pay is independent of the age of children

Chi-Square Test: Small; Older

```
Expected counts are printed below observed counts
Chi-Square contributions are printed below expected counts

      Small   Older   Total
  1      18     109     127
       31,95   95,05
       6,091   2,047

  2       7      29      36
        9,06   26,94
       0,467   0,157

  3      26      45      71
       17,86   53,14
       3,708   1,246

  4      11      24      35
        8,81   26,19
       0,547   0,184

  5      18      31      49
       12,33   36,67
       2,611   0,878

Total    80     238     318

Chi-Sq = 17,936; DF = 4; P-Value = 0,001
```

5. STATA commands

Commands which were used to simulate the dataset with observations from 5000 respondents are presented in this section.

```
* Respid denotes the number of respondent

insheet using "C:\Master\data.csv", delimit(;)
drop if respid==.
destring, replace
drop status
rename category cat

* The next series of commands is run on the category action which has nr.2

keep if cat==2
save "C:\Master\cat2.dta", replace
keep movie
sort movie
duplicates drop
gen movie1=_n
distinct movie
distinct movie1
merge m:m movie using "C:\Master\cat2.dta"
drop _merge movie
rename movie1 movie
order respid movie valuation cat
reshape wide valuation, i(respid cat) j(movie)
save "C:\Master\cat2_all.dta", replace

local varnum=15

forvalues i=1(1)15 {
recast double valuation`i'
}

forvalues i=1(1)15 {
replace valuation`i'=. if valuation`i'==0 | valuation`i'==1
gen lvaluation`i'=ln(valuation`i')
}

* Create a matrix with correlation coefficients and covariance

matrix C = I(`varnum')
matrix V = I(`varnum')

* Correlation matrix C

forvalues i=1(1)15 {
      forvalues j=1(1)`i'{
      capture  corr lvaluation`i' lvaluation`j'

* Get the correlation and results, if there has not been error
      if _rc==0{

* Rho is the correlation
```

```
matrix C[`i',`j']=r(rho)
      matrix C[`j',`i']=r(rho)
        }

else{
* If correlation had an error, set results to missing values

      matrix C[`i',`j']=.
      matrix C[`j',`i']=.
        }
* Set appropriate values on the diagonal

      matrix C[`i',`i']=1
        }
}

* Covariance matrix V

forvalues i=1(1)15 {
      forvalues j=1(1)`i'{
      capture  corr lvaluation`i' lvaluation`j', cov

* Get the covariance and results, if there has not been an error

      if _rc==0{

* Cov_12 is the covariance

      matrix V[`i',`j']=r(cov_12)
      matrix V[`j',`i']=r(cov_12)
        }
      else{

* If correlation had an error sets results to missing values

      matrix V[`i',`j']=.
      matrix V[`j',`i']=.
        }
        }
}


* Vector with all the expected values

matrix accum M=lvaluation*, means(M) noconstant
mat list M

drop respid cat

* Simulate data with observations from 5000 "respondents"

clear
drawnorm lny1-lny15, n(5000) cov(V) means(M) forcepsd

forvalues i=1(1)15 {
gen y`i'=exp(lny`i')
}

forvalues i=1(1)15 {
replace y`i'=int(y`i')
```

```
}

gen n=_n
sort n
save "C:\Master\sim_data.dta", replace

* Simulate the probability of positive/zero valuation

clear
clear matrix
use "C:\Master\cat2_all.dta", replace
local varnum=15

forvalues i=1(1)`varnum' {
replace valuation`i'=0 if valuation`i'==0
replace valuation`i'=1 if valuation`i'>0
}

* Create matrix with correlation coefficients

matrix V = I(`varnum')

forvalues i=1(1)15 {
      probit valuation`i'

* Vector of means

      gen b`i'=_b[_cons]
}

matrix accum M=b*, means(M) noconstant
mat list M


foreach i of numlist 1(1)`varnum' {
      foreach j of numlist 1(1)`i'{
      while `i'<`j' {
      biprobit valuation`i' valuation`j'

* Get correlation and results - rho is the correlation

      matrix V[`i',`j']=e(rho)
      matrix V[`j',`i']=e(rho)

* Put appropriate values on the diagonal

      matrix V[`i',`i']=1
      }
      }
}


matrix accum M=b*, means(M) noconstant
mat list M

clear
drawnorm z1-z15, n(5000) cov(V) means(M) forcepsd

* Create 0/1 outcome if z_i is less/more then zero

foreach i of numlist 1(1)15 {
```

```
replace z`i'=0 if z`i'<=0
replace z`i'=1 if z`i'>0
}

foreach i of numlist 1(1)15 {
su z`i'
}

gen n=_n
sort n
merge n using "C:\Master\sim_data.dta"
assert _merge==3
drop _merge

* Drop the outliers – observations with values over 6*SD (standard
deviation)

foreach i of numlist 1(1)15 {
replace lny`i'=lny`i'*z`i'
replace y`i'=y`i'*z`i'
drop z`i'
su y`i'
drop if y`i'>6*r(sd)
}

foreach i of numlist 1(1)15 {
su y`i'
}


save "C:\Master\sim_data_cat2.dta", replace

set dp comma
outsheet using "C:\Master\simulert_data_cat2_excel.csv" , comma nolabel
replace
```