The Economics of New Products and Productivity

Three Essays on Applied Industrial Organization

Inaugural-Dissertation
zur Erlangung des Grades
Doctor oeconomiae publicae (Dr. oec. publ.)
an der Ludwig-Maximilians-Universität München

2011

vorgelegt von

Michal Mašika

Referentin:	Prof. Dr. Monika Schnitzer
Koreferent:	Prof. Dr. Tobias Kretschmer
Promotionsabschlussberatung:	16. Mai 2012

Datum der mündlichen Prüfung: 07. Mai 2012

Namen der Berichterstatter: Monika Schnitzer, Tobias Kretschmer, Gregor Zöttl

Věnováno mojí rodině za její podporu v celém mém dosavadním životě.

Acknowledgements

I wrote this thesis during my doctoral study at the University of Munich. The support of many - supervisors, colleagues, friends, and family - helped me to successfully complete this thesis.

First and foremost, I would like to thank my supervisor Monika Schnitzer. During the last four and half years she continuously supported my research and gave me invaluable comments. Without her patience, her sharing of experience and knowledge as well as rigorous academic thinking, writing this dissertation would have been impossible. I am indebted to Tobias Kretschmer who gave me precious feedback and kindly agreed to become my second supervisor. I am also grateful to Gregor Zöttl for agreeing to be my third examiner.

Special thanks go to my colleague Martin Watzinger who gave me valuable suggestions to improve all three chapters of this thesis. Without his help, the successful completion of this dissertation would not be possible. I am also deeply indebted to my co-authors Dominik Ruderer, Evžen Kočenda and Jan Hanousek. I learned some of the most valuable lessons, intellectually as well as personally, from working together with them.

Many thanks go to my current and former colleagues at the Seminar for Comparative Economics Basak Akbel, Katharina Eck, Martina Engemann, Karin Fritsch, Anna Gumpert, Christa Hainz, Iris Kesternich, Maria Lehner and Christian Mugele. They all helped the progress of my thesis in innumerable ways. It was always a great pleasure to work with all of you! I also want to thank our student helpers for their excellent research assistance.

This work also profited enormously from fruitful discussions with many other colleagues and friends during our lunches in the Mensa. In particular I want to thank to Sebastian Doedens, Moritz Hahn, Lukas Buchheim, Darko Jus and René Cyranek.

Part of this dissertation was written during my research stay at Boston University. I would like to thank the local faculty, especially Marc Rysman, and PhD students for welcoming and hosting me. I enjoyed the inspiring research environment and benefited from the insightful suggestions I received on my work.

I am also very grateful to my friends for their continuous support and friendship. Finally, my greatest gratitude goes to my family - your love and care have been invaluable during the whole process!

Michal Mašika, June 2012

Contents

Introduction

Between 1960 and 2000 real GDP per capita increased by more than the factor of two in the US.[1] The standard economic growth model of Robert Solow traces growth to either more capital, more labor input or to an increase in productivity. According to empirical growth accounting exercises the latter factor is the most important: For example, Aghion and Howitt (2007) argue that in the same time period between 30% and 70% of growth in the OECD countries came from productivity increases and the remaining share is due to physical capital accumulation.

The determinants of productivity are of the greatest interest to the public and an active area of economic research. Two frequently named sources of productivity growth are the introduction of new goods and corporate governance (Bartelsman and Doms, 2000 and Syverson, 2011). New products are important for consumers as they often embed new technologies with superior performance. New products increase the offered varieties which is generally assumed to increase consumers' utility (Krugman, 1979). In addition, product entry intensifies competition, reducing the market power of incumbents and therefore the average price for consumers. Thus, the gains from the introduction of new products may be immense. For example, Petrin (2002) estimated the total welfare gains from the minivan introduction to be US$ 2.9 billion during the first five years (1984 - 1988). Hausman et al. (1997) estimated that the introduction of the cellular phone results in a yearly consumer welfare gain of around US$ 50 billion.

New products not only benefit the consumer, but also the innovators as the examples of early investors and founder of companies like Facebook, Google or Apple show. Despite the large gains through the new products, we can observe a large failure rates of pioneer

[1] Google Data Explorer: `http://www.google.com/publicdata/explore?ds=z66q6n8n9alqcc_&ctype=l&met_y=gnp_pc_ch`, online, accessed: 14.12.2011.

companies. This is likely caused by the high level of risk involved in the development and marketing of such products. After the product has been developed, one of the most important tasks for the innovator is to explain the new and often complex product to the consumers since they are only willing to pay a high price for it if they understand its features and potential.

As this marketing effort requires a high initial investment, not only start-ups (but also established firms) are often unable or unwilling to finance it alone. Manufacturers of innovative products often sell their product exclusively to one retailer. The most prominent example is the distribution of Apple Inc.'s 'iPhone´.[2] The first chapter of this dissertation examines such exclusive arrangements. In particular, we study firms' incentives to voluntarily restrict their distribution channel to a single retailer as well as the impacts of such behavior on the welfare.

After the introduction of a new product, both the innovator and established firms are often unsure if the new product substitutes or complements to existing products. This is an important question for every innovator and for welfare considerations, because substitutes increase product market competition and drive down prices while complements increase the demand and the utility of existing goods. The second chapter of this dissertation takes a closer look at the market entry of a highly successful new product, the free commuter newspaper in Switzerland. In the years 1999-2008 the circulation of free newspaper increased by almost 200%. We examine empirically if free daily newspapers are substitutes or complements to the traditional daily press.

After a new product is successfully introduced, other firms often follow suit and establish - in the best of all cases - a competitive market. Although this is the theoretical hope, Syverson (2011) found that even in the most narrow markets, a firm on the 90th percentile of the productivity distribution produces up to two times more output with the same inputs than a firm on the 10th quantile. However, it is still an open question what causes such a large dispersion. One obvious candidate is corporate governance, the second source of productivity growth mentioned earlier. Gompers et al. (2003) show that better governed firms achieve a higher market return. Bloom and Van Reenen (2010)

[2] A similar strategy is adopted, for example, by Oracle: Oracle's Exadata storage server is available exclusively on HP's hardware. Another example is the exclusive distribution of the first touchscreen Blackberry via Verizon or the distribution of the first Blackberry Pearl via T-Mobile.

argue that better management practices lead to higher productivity. Some firms are just better managed than others and practices differ significantly across countries.
But why do not all firms implement good governance and superior management techniques? This might be due to the ownership structure of the companies. Large blockholder might have more influence on the manager to induce them to act in their interest. Foreign owners might be able to transfer production and process technology to improve the performance of companies. In the third chapter of this dissertation, we therefore change our focus to consider the effect of different ownership types on the efficiency of Czech firms from 1998 to 2007.

In the remainder of this introduction, we briefly summarize the main contributions of the three chapters in this thesis. All chapters are self-contained and can be read separately.

As we noted above, many manufacturers of innovative products sell their product exclusively to one retailer, at least for a limited time span. Both the rationale of manufacturers to adopt this behavior and to abandon it as well as such a behavior's impact on welfare are still not completely understood. Moreover, a crucial factor of such a retailing strategy's impact in vertically related markets is the presence/absence of competition at the different market segments. However, most models of vertically related markets abstract from the presence of multiple buyers and multiple sellers, that is, either the downstream segment or the upstream segment is represented by a single firm, and hence, derive simplified conclusions. According to Whinston (2008), developing models that consider competition on both segments is a high priority.
The first chapter of this dissertation directly addresses both issues mentioned above.[3] We provide a rationale for an exclusive retailing (ER) arrangement and advance the literature by considering competition among companies at both, the upstream as well as the downstream market.

We develop a four-stage game where two upstream manufacturers produce differentiated brands and sell them to two non-differentiated downstream retailers. At the first stage the manufacturers choose to sell their products to all retailers or to limit themselves to a single 'exclusive' retailer. At the second stage upstream firms simultaneously choose

[3]This chapter is based on the article "Exclusive Retailing" which is joint work with Dominik Ruderer from the University of Munich.

their wholesale prices. At stage 3 retail companies can undertake brand specific demand enhancing marketing investments and at stage 4 retail competition in prices takes place.

On the one hand, the adoption of ER is costly for the manufacturer as it results in a unilateral retail price increase (*double markup effect*). On the other hand, it comes with two profit enhancing effects. First, the positive retail margin enhances incentives to invest in brand specific marketing (*investment effect*). Second, due to strategic complementarity the competing manufacturer reacts to the price increase of the retailer also with a price increase. This weakens interbrand competition (*competition softening effect*). While the investment effect is procompetitive, the two other effects are clearly anti-competitive.

According to our model, a higher degree of exclusivity leads to higher prices (at the wholesale as well as the retail stage) and to higher retail profits. Moreover, marketing investment also increases. We show that three types of equilibria exist and that the equilibrium selection depends on the cost of investment and the degree of substitutability of brands: (i) If marketing is not efficient or brands are rather distinct from each other, both manufacturers sell to all retailers. (ii) If efficiency of marketing has an intermediate value and brands are not too similar, only one manufacturer adopts ER. (iii) Both manufacturers adopt ER if marketing is highly efficient or brands are similar. Finally, we find that a manufacturer's interest in adopting ER is not aligned with a social welfare maximization. In particular, ER should only be allowed by competition authorities if retail investment is sufficiently efficient or interbrand competition is tough.

In the second chapter we consider the impact of entry of a new product on the demand for existing products in media markets using an example of free commuter newspapers in Switzerland.[4] We are interested in whether free commuter newspapers are substitutes or complements to the paid-for daily press. As we noted above, to examine this question is important due to welfare assessment of the innovative products. Moreover, in a context of the media markets, there is an ongoing discussion whether media competition is beneficial or not: On the one hand, consumers might value socially valuable "hard" political news less than a social planner would. As a result, a higher level of competition might cause crowding out of high quality news. On the other hand, increasing competition might

[4]This chapter is based on the article "Free commuter newspapers and the market for pad-for daily newspapers".

limit the bias stemming from the supply side of the media market, e.g. weakening the politicians' influence on media (Gentzkow and Shapiro, 2008).

The first effect rests on the assumption that "hard" and "soft" news outlets are substitutes. In order to shed more light on this rarely tested assumption, this chapter quantifies the impact of the successive expansion of free commuter newspapers on the readership and circulation of the traditional daily press in the Swiss newspaper market, controlling for market and year fixed effects. Moreover, we employ a novel identification strategy using the distribution via the transport system, a special characteristic of free daily newspapers. Throughout our analysis we allow for multihoming, i.e. that each consumer can buy more than one newspaper. This is an important but up to now neglected feature of the media market. We proceed in two steps: We first estimate the relationship between the circulation of free commuter newspapers and the circulation of traditional daily newspapers. Then, we analyze whether free newspaper penetration changes the structure of the audience of traditional newspapers.

We find that the expansion of free daily newspaper has a small negative impact on the circulation and readership of the traditional daily press. However, commuter newspapers only withdraw readership from low quality newspapers, such as local and national tabloids. Our results indicate that the behavior of multihomers constitutes an important driving force in this substitution pattern. Furthermore, we show that free commuter newspapers especially draw younger and less educated individuals away from daily newspapers. Finally, we find that free newspaper penetration expands the size of the market, meaning that a larger fraction of the population is informed. This effect is more pronounced among young and less educated readers. All this suggests that "hard" and "soft" news media outlets are distinct markets.

This chapter contributes to the literature in several ways. First, as far as we know, this is the first work investigating the competitive effects of the introduction of free commuter newspapers which have become an important player in the media markets in many countries worldwide. Second, we collect a novel data set by merging data about newspaper circulation with data about readership characteristics and Census data. This data set could be used in future research to answer other economic question, such as the impact

of media competition on electoral participation and outcomes. Third, while the previous studies abstract from multihoming among readers, we explicitly consider it in our analysis.[5] We show that assuming that all readers only read one newspaper may lead to a bias in the estimation.

The third chapter of this dissertation empirically analyzes the evolution of firm efficiency in the Czech Republic from 1998 to 2007.[6] Using a large panel of more than 190,000 firm-years we study which firms fully utilize their resources, how firm efficiency evolves over time, and how efficiency is related to the ownership structure of firms.

One key idea shaping policies during the privatization wave in Central and Eastern Europe in the 1990s was that ownership structure is an important determinant of firm performance (Estrin et al. 2009). Policy makers and economists expected that privately held companies would be more efficient than the formerly state-owned companies, because they had an incentive to maximize profits and therefore utilize input more efficiently. In addition, if the new owner is from another country, he would possibly transfer technology and management practices improving the efficiency of the acquired firm. However, there is still a lack of reliable empirical evidence how the type of ownership influenced the medium- and long-term efficiency of firms in Central and Eastern Europe after the privatization was completed.

This chapter fills this gap in the literature by estimating the firm efficiency in the Czech Republic with a stochastic frontier model and then relating this efficiency to different ownership types. The ownership categories are defined by the concentration of the ownership shares and the domicile of the owner. We therefore consider separately the effect of majority and minority ownership as well as the effect of foreign and domestic owners. Our results suggest that the possibility that owners can control a firm is consistently beneficial for its efficiency. In addition, foreign ownership is positively related to firm efficiency. If we split our sample according to the technology intensity of the firm's sector, we find that firms using high and low technology are influenced more by the type of ownership

[5] To the best of our knowledge, the only study that specifically controls for multihoming is Gentzkow (2007).

[6] This chapter is based on the article "Efficiency and the Ownership of Czech Firms" which is joint work with Jan Hanousek and Evžen Kočenda from the Center for Economic Research & Graduate Education - Economics Institute in Prague.

than firms with an intermediate technology level. In the final part of our study we trace the effect of ownership over time and find that ownership effects mattered most at the beginning of our sample period, but converge towards the end.

For our analysis we construct a unique firm-level panel data combining detailed ownership data and financial performance from three different data sources. Our data set contains a representative sample of privatized and newly established firms from the Amadeus database, representing the bulk of the economic activity in the Czech Republic. From the Aspekt and Čekia databases we collect detailed ownership data, which allows us to construct more fine-grained ownership categories than typically used in the literature. Thus, we are able to develop a more systematic analytical framework for evaluating the efficiency effect of domestic versus foreign ownership, as well as the effect of various degrees of ownership concentration. Another advantage of our study compared to the prior literature is that we cover a time period when accounting rules conforming to the international standard (IAP) were already in place. This is important since we - just as the majority of studies examining productivity - make use of balance sheet data, which is sensitive to a change in the accounting rules.

Chapter 1

Exclusive Retailing

1.1 Introduction

The introduction of the 'iPhone´ by Apple Inc. in 2007 came with an announcement that marketing efforts for this mobile handset would be undertaken exclusively via one mobile carrier per country. In Germany this exclusive carrier became T-Mobile, while in the US the 'iPhone´ was marketed via AT&T. Though at that time Apple Inc. was well known for its personal computers, music players (the 'iPod') and online music store ('iTunes'), it was unknown for mobile handsets. In 2010 the exclusivity arrangement was abandoned in most national markets. Both the rationale of Apple Inc. to adopt this behavior and to drop it as well as the effect on competition and welfare are still not completely understood.

In this chapter, we provide a rationale for such an exclusive retailing (ER) arrangement. ER eliminates the disciplining effect of intrabrand competition between retailers, giving the exclusive retailer market power and hence, a higher retail margin. While creating such a *double markup effect* is costly for the manufacturer, it also comes with two profit-enhancing effects. First, it can serve as a mechanism to enhance brand-specific marketing investments by retailers (*investment effect*). This can be profitable for the manufacturer if the retailer owns a relatively more efficient marketing investment technology.[1] Second,

[1] In the 'iPhone´ context, this would mean that the ER arrangement enhances marketing investments by T-Mobile resp. AT&T into Apple's iPhone. Apple was not well known for mobile handsets at that time and the mobile carriers had a much better distribution network as well as access to their customer data. Hence, mobile carriers had a relatively better technology in marketing the iPhone. A similar argument can be made for a lot of other products, in particular when the manufacturer does not have

ER might serve as a commitment device for reduced interbrand competition among manufacturers. In other words, the elimination of intrabrand competition by one manufacturer leads to a unilateral price increase, incentivizing the competing manufacturer to increase prices (*competition softening effect*). While the *investment effect* can be interpreted as *procompetitive*, the two other effects are clearly *anticompetitive*.

Our model analyzes a vertically related industry where two upstream manufacturers produce differentiated brands and sell them to two downstream retailers at linear wholesale prices. The downstream retailers resell the upstream goods to consumers. Producing as well as reselling the brand is associated with constant production/resale costs which are set to zero for simplicity. While consumers have different preferences regarding the brands, they are indifferent between retailers. The manufacturers can choose to sell their brands via both retailers or exclusively via one of the retailers.[2] Thus, three different settings can arise: (*i*) Both manufacturers sell to both retailers. (*ii*) One manufacturer sells to both retailers, while the other manufacturer sells to only one retailer. (*iii*) Each manufacturer sells to only one retailer.[3]

Besides reselling brands, retailers can also conduct brand specific marketing. Investment into marketing raises the perceived relative quality of a brand and enhances demand for the brand regardless of which retailer resells the good. We assume that the different parties cannot contract on a specific level of marketing effort.

When manufacturers sell their brand non-exclusively, intrabrand competition at the retail stage drives down prices to the retailers' marginal cost, which consists of the wholesale price being paid for the brand. Retailers could invest into brand specific marketing. But as intrabrand competition eliminates any retail margin, retailers would never gain from such an investment and hence, will not invest.

If a manufacturer adopts ER, intrabrand competition at the retail stage does not exist anymore. Hence, the retailer can gain a positive margin on the sale of the brand. More-

direct contact to its final customers. For example, the microchip producer Intel partly relies on marketing by its downstream retailers.

[2]In other words, they can choose if they want to have intrabrand competition or not at the retail stage for their brand.

[3]Here, we rule out the case where both manufacturers exclusively sell to the same retailer and hence, foreclose the second retailer from the market. Though it turns out that this setting would maximize industry profits, we believe that such foreclosure would never be allowed by competition authorities.

over, the brand specific investment becomes now retailer specific, investment becomes lucrative for the retailer and positive investment levels can be observed. In addition, the possibility of the retailer to gain a positive margin results in a double markup problem. This leads to a unilateral retail price increase of the exclusively sold brand and thus, weakens interbrand competition.

Using this model, we can derive the following results. First, we find that prices (at the wholesale as well as at the retail level), investment and retail profits are higher when one or both manufacturers adopt exclusivity relative to a situation where none of the manufacturers chooses exclusivity. However, more exclusivity in the market does not necessarily mean higher equilibrium values.[4]

Second, with competition among upstream brands, we show that three types of equilibria exist, depending on the cost of investment as well as the degree of substitutability among brands: (*i*) Both manufacturers adopt non-exclusive retailing (NER). (*ii*) One manufacturer adopts NER, while the other manufacturer adopts ER. (*iii*) Both manufacturers adopt ER. When adopting ER, manufacturers trade off the cost (*double markup effect*) and the benefits (*investment effect* and *competition softening effect*) of such behavior. Equilibrium (*i*) occurs when the investment cost is large and brands are rather distinct from each other. Equilibrium (*ii*) occurs when both, investment cost as well as the similarity among brands, attain intermediate values. Equilibrium (*iii*) occurs for either very similar brands, very low investment costs or both.

Third, when upstream brands are asymmetric with respect to the investment cost in marketing their brand, the occurrence of equilibrium (*i*) is not affected. Moreover, the asymmetric equilibrium (*ii*) will occur for a larger parameter space, while equilibrium (*iii*) will occur for a smaller parameter space. In particular, for rather asymmetric brands the symmetric ER (*iii*) equilibrium will only occur for highly competitive markets.

Finally, we find that the incentive for a manufacturer to adopt ER contradicts with a welfare maximizing regulator's view of ER. This gives scope for regulatory intervention. In particular, ER should only be allowed if retail investment is sufficiently efficient or interbrand competition is rather tough.

[4]E.g., wholesale prices might be lower when both brands are distributed exclusively compared to a situation when only one brand is distributed exclusively.

This chapter contributes to two streams of literature, *vertical restraints* and *exclusive contracting*. Both analyze restrictions which are put on one trading party by another trading party. While in most of these articles the selling party restricts the buying party in establishing alternative trading relationships, in our work the selling party commits itself to trade only with one of the buyers.

The literature on *vertical restraints* considers different kinds of restrictions such as exclusive dealing, resale price maintenance, exclusive territories, franchise fees and quantity forcing. Similar to our work, this literature models the vertical structure of an industry explicitly.

Besanko and Perry (1993, 1994) model the equilibrium incentives to adopt exclusivity when interbrand competition exists. Though we also consider interbrand competition, they look at exclusive arrangements where a retailer is allowed to deal with only one manufacturer, while we look at situations where a manufacturer only deals with one retailer. While the former is most often described as exclusive dealing, we characterize the latter as exclusive retailing. Moreover, Besanko and Perry (1993) investigate the situation when a manufacturer can conduct retailer-specific investment. We, in contrast, investigate the case when the retailer can conduct manufacturer-specific investment. Besanko and Perry (1994) do not consider investments at all, but foreclosure of retailers. We explicitly rule out any foreclosure.

Similar to our work, Mathewson and Winter (1984) analyze the role of vertical restraints for inducing retail advertising efforts. They investigate the effect of different kinds of vertical restraints, but do not consider ER. Moreover, they do not consider interbrand competition, as we do. In Winter (1993) similar policies are considered, but in a different framework with spatial competition. Among others, Rey and Stiglitz (1995) discuss vertical restraints as a measure to weaken upstream competition.[5] They consider a similar setting to ours, but restrict their analysis to symmetric outcomes only where either none or both manufacturers choose exclusivity, while we also analyze potential asymmetric outcomes. Moreover, they do not consider retail investment.

Armstrong (1999) and Harbord and Ottaviani (2001) analyze the link between the type of payment within a contract (lump-sum vs. linear payment) and the manufacturer's

[5]Similar contributions, but with a different objective, Telser (1960) and Jullien and Rey (2007).

decision to adopt exclusivity. They find that downstream competition as well as the possibility of resale among retailers plays an important role on the optimality of exclusivity. However, they neither consider investments nor upstream competition.

The literature on *exclusive contracting* considers only exclusive dealing arrangements and no other forms of restraints. In contrast to our work, this literature uses an incomplete contracting framework. Two different views of exclusivity arrangements can be found. The anticompetitive view (Bolton and Aghion (1987), Rasmusen, Ramseyer and Wiley (1991), Bernheim and Whinston (1998), Segal and Whinston (2000)) argues that exclusivity serves to foreclose potential rivals from the market and hence hinders competition. The procompetitive view (Klein (1988), Frasco (1991), Marvel (1982), Masten and Snyder (1993), Areeda and Kaplow (1988)) argues that exclusivity is needed in order to protect the return on non-contractible asset-specific investments. Without exclusivity, investment incentives would be reduced. Such contracting arrangements can therefore be welfare enhancing, even when these lead to the foreclosure of potential rivals (Fumagalli et al. (2009)). Although we use a different methodology, we incorporate both the pro- as well as the anticompetitive view of exclusivity. Finally, de Fontenay et al. (2010) analyze the equilibrium incentives to adopt exclusivity in a modified Nash bargaining framework and apply the results to our main example, the 'iPhone-case'. However, they do not consider any anticompetitive elements of exclusivity.

In the next Section we present our model. In Section 1.3 we derive the outcomes for all different regimes of ER and in Section 1.4 the equilibrium incentives of firms to adopt exclusivity. In Section 1.5 we analyze the incentives of manufacturers to adopt ER in case of asymmetric manufacturers. In Section 1.6 we derive welfare results and in Section 1.7 we conclude.

1.2 The Model

Our model consists of three types of agents: Manufacturers, retailers and consumers.

Manufacturers. Consider two manufacturers, denoted by $i = 1, 2$, who produce differentiated brands at a constant marginal cost equal to zero. The manufacturers need retailers in order to sell their goods to consumers. Manufacturers simultaneously choose whether to adopt exclusive retailing (ER) or non-exclusive retailing (NER). We define ER as selling exclusively to one retailer, while NER means that the manufacturer sells to all retailers. After choosing the specific distribution system, the manufacturers are assumed to set a linear wholesale price w_i.[6, 7]

Four different distribution systems can potentially arise:[8] (*i*) Both manufacturers choose NER, (N/N). (*ii*) One of the manufacturers chooses NER, while the other manufacturer chooses ER, (E/N). (*iii*) Both manufacturers choose ER (E/E) and both manufacturers choose different retailers. Hence, both retailers are active on the market, each reselling one brand. (*iv*) Both manufacturers choose ER and both manufacturers sell their brand via the same retailer. As a result, the other retailer is foreclosed from the market, while the first retailer has monopoly power over the whole market. The fourth case is excluded from our subsequent analysis, as we believe that such a monopolization of the market (which in fact yields the highest industry profits) would always be banned by competition authorities.[9]

[6] The use of linear wholesale prices can be justified by our focus on 'innovative' industries. Such industries are usually associated with high degrees of uncertainty. Linear prices can serve as a tool to share the risk among trading parties. Moreover, linear wholesale prices are widely used in the literature, e.g. Arya et al. (2008), Buehler and Schmutzler (2008) as well as Inderst and Valletti (2009).

[7] Note that though our analysis focuses on linear wholesale prices, our results are robust to the introduction of two-part tariffs, if the two parts of the tariffs are not chosen at the same point in time. The manufacturer could auction off the ER-right ex ante to one of the retailers. If the retail price is set after the auction our results still hold. However, if the retail price is set within the auction, any double markup and competition softening effect would vanish.

[8] Figures, illustrating all of the distribution systems, can be found in appendix A.1.

[9] In principle, we can achieve the same results in a $n \times m$ model, where n is the number of manufacturers and m is the number of retailers. However, in an equilibrium where all manufacturers adopt exclusivity, $m > n$ implies that some of the retailers are foreclosed from the market. Moreover, in the same equilibrium, $n > m$ implies that at least one retailer has to sell two brands exclusively. This eliminates any competition between the two respective brands, which is equivalent to distribution system (*iv*). For this reason, we excluded this scenario.

Retailers. There are two retailers, denoted by $j = A, B$, who are active on the retail market with a constant marginal cost of reselling equal to zero. Hence, their marginal cost consists only of the wholesale price w_i. The retailers are assumed to be undifferentiated. I.e. consumers are indifferent between retailers, but they differentiate among brands. We assume retailers to compete in prices. Retailers can undertake brand-specific demand-enhancing investments. The investment raises the consumers valuation for a specific brand regardless of which retailer conducts the investment. θ_{ij} denotes investment by retailer j in brand i and θ_i is the sum of investments in brand i by both retailers. The investment is not contractible. Following our example from above, the investment can be thought of as marketing effort undertaken by mobile service providers (MSP) into a specific handset/brand. Marketing for specific handsets by a MSP can be more efficient than by the handset manufacturer herself, depending on the brand value in the mobile service sector as well as the available marketing technologies. Marketing effort is hard to contract on as the actual value of a marketing campaign depends on many factors. The investment cost is assumed to be retailer- as well as brand-specific and given by $C(\theta_{ij}) = {}^{K_i}\!/_2 \cdot \theta_{ij}^2$. K_i expresses the slope of the marginal cost of investment and might differ among brands, but not among retailers. For example, manufacturers having a high brand value in the mobile service sector are associated with a relatively high K_i, while manufacturers with a low brand value within the sector are associated with a relatively small K_i. In other words, retail investment is more efficient for manufacturers with just a weak brand value. For most of the analysis we analyze the case with ($K_1 = K_2 \equiv K$), i.e., symmetric brands. In Section 1.5 we consider a case with asymmetric brands ($K_1 \neq K_2$).[10]

Consumers. We assume the following linear demand system that can be derived from a quadratic utility function as it is used in Singh and Vives (1984). Demand for brand 1 is given by $q_1(p_1, p_2)$ and demand for brand 2 by $q_2(p_2, p_1)$, with

$$q_1(p_1, p_2) = \alpha - \beta p_1 + \gamma p_2 + \theta_1 \quad and \quad q_2(p_2, p_1) = \alpha - \beta p_2 + \gamma p_1 + \theta_2,$$

where $\alpha = {}^{1-d}\!/_{1-d^2}$, $\beta = {}^{1}\!/_{1-d^2}$, $\gamma = {}^{d}\!/_{1-d^2}$ and $\theta_i = \theta_{iA} + \theta_{iB}$. The parameter $d\,\epsilon(0,\,1)$ represents the degree of product homogeneity. As d approaches 0, the brands of the two

[10] We assume K not to be too small in order to ensure that the model is well defined ($K > {}^{(4-4d^2)}\!/_{(8-4d-2d^2+d^3)}$).

manufacturers become independent. As d approaches 1, the brands become completely homogeneous. When both retailers sell the same brand and set the same price, demand is divided equally between both retailers. The investment θ_1 can be thought of as increasing the relative valuation for brand 1 relative to brand 2. This means that raising θ_1 has no direct effect on the demand for brand 2.

Timing. At stage 1 both manufacturers choose simultaneously their distribution channel(s). At stage 2 manufacturers set wholesale prices to one or both of the retailers, depending on the choice at stage 1. At stage 3 retail companies undertake the demand enhancing marketing investments. At stage 4 retail companies compete.

1.3 Characterization of distribution systems

As we will show below, all the distribution systems mentioned above can occur as an equilibrium outcome in our model: N/N, E/N and E/E. In this section, we will characterize these equilibria with respect to prices, quantities, retail investment as well as profits.

Before we do so, we introduce a framework in order to disentangle the different effects stemming from the exclusivity decision. Superscripts E/E and N/N describe the equilibrium values in the E/E resp. N/N equilibrium. E/N describes the equilibrium values of a brand which has adopted ER, while the competing manufacturer sells her brands non-exclusively. In contrast, N/E describes the equilibrium values of the brand not having adopted ER, while the competing has done so. All equilibrium values and results can be found in the Appendix.

Framework. We identify three subeffects stemming from the introduction of ER: The *double markup effect* captures the unilateral price responses to the exclusivity decision. The *competition softening effect* takes into account the competitive responses to the double markup effect due to the strategic complementarity of prices. Finally, the *investment effect* captures the impact from retail investment which is linked to the introduction of ER. We characterize the three effects using the case where only one manufacturer adopts

ER relative to the situation without exclusivity ($N/N \rightarrow E/N$). However, the effects from the introduction of ER by the second brand ($N/N \rightarrow E/E$) are derived in the same way. Note, that the effects are always derived relative to the N/N regime which serves as our benchmark case.

1. Double Markup Effect

   Exclusivity grants the downstream retailer a monopoly in retailing the brand. This allows the retailer to increase the retail price above the wholesale price and earn an additional markup. The double markup effect captures the unilateral effect stemming from this retail market power. Conceptionally, we define the double markup effect as the unilateral effect stemming from the introduction of exclusivity, neglecting the investment possibility and holding all the competitor's choice variables constant. This allows us to abstract from any effect resulting from the competition among manufacturers and to focus solely on the price increase of the exclusive brand. Technically, we take the difference of the variable of interest in equilibrium with and without exclusivity, fixing all the choice variables of the competing brand at the level without exclusivity and setting the investment level to zero, $f_i(E/N \mid w_{-i} = w_{-i}^{N/N}, p_{-i} = p_{-i}^{N/N}, \theta_i = 0) - f_i(N/N)$, where $f_i(\cdot)$ denotes the variable of interest.

2. Competition Softening Effect

   The competition softening effect captures the effect from exclusivity which stems from the existence of interbrand competition, neglecting any investment opportunities. In other words, while the double markup effect is capturing the unilateral effect from exclusivity, the competition softening effect captures the additional bilateral effect (or the competitive responses) to the double markup effect (neglecting the investment possibility). Technically, the competition softening effect is given by $f_i(E/N \mid \theta_i = 0) - f_i(E/N \mid w_{-i} = w_{-i}^{N/N}, p_{-i} = p_{-i}^{N/N}, \theta_i = 0)$.
   As the firms' choice variables are strategic complements, the unilateral price increase due to the double markup effect is followed by a price increase by the competing firm. Hence, the competition softening effect captures the anticompetitive element of ER.

3. Investment Effect

   The investment effect captures the effect from investment (induced by the exclusivity choice) on all the variables, taking into account the unilateral as well as the bilateral effect from retail market power. Technically, we derive the investment effect as the residual effect (total effect net of the double markup as well as the competition softening effect), which is given by $f_i(E/N) - f_i(E/N \mid \theta_i = 0)$.
   This effect captures the procompetitive element of ER.

We can now characterize the different equilibrium distribution systems.

Both manufacturers choose *NER - (N/N).* Under N/N, the outcome of the market game coincides with a standard differentiated Bertrand game: When both manufacturers distribute their brand non-exclusively, intrabrand competition exists for both brands. Retail firms are undifferentiated and compete in prices. Hence, competition drives down retail prices to the retailers' marginal cost, which consists of the wholesale price ($p_1 = w_1$, $p_2 = w_2$). I.e. retail companies do not make any profit ($\pi_A = \pi_B = 0$). Retail investment is brand-specific, i.e. regardless of which retailer undertakes the investment, the demand enhancing effect from investment affects all retailers to the same extent. As retail companies do not earn a positive retail margin, they do not have any incentive to invest and, hence no investment will take place ($\theta_1 = \theta_2 = 0$). Consequently, manufacturers set their wholesale prices just as retail firms would not exist and the outcome of the market game coincides with a standard differentiated Bertrand game.

One manufacturer chooses *ER* and the other manufacturer chooses *NER - (E/N).* When one of the manufacturers chooses exclusivity, intrabrand competition for this brand is broken and a retail monopoly is created. While this changes the analysis of the exclusive brand completely, the analysis of the retail and investment stage of the non-exclusive brand remains identical to the N/N-case. We denote the exclusive brand by 1 and the non-exclusive brand by 2.

The adoption of ER by one retailer induces an increase of wholesale and retail prices of both brands relative to the N/N-equilibrium as well as a positive retail investment level

and retail profit for the exclusive brand. The effects in detail are:

The monopoly right on the sale of brand 1 allows the exclusive retailer to raise the retail price above the wholesale price and to gain a positive retail margin, while the wholesale price stays constant (*double markup effect*). As for brand 2 intrabrand competition still exists, so no extra retail margin can be gained here.

Retail prices are strategic complements. Hence, the non-exclusive brand can raise its retail as well as its wholesale price.[11] The price increase of the non-exclusive brand softens interbrand competition in the market and gives the exclusive retailer as well as the manufacturer scope to set higher prices (*competition softening effect*).

As investments became retailer-specific, the exclusive retailer can recoup some of the benefit from investment and faces an increased incentive to invest. A positive investment level in brand 1 can be observed, while no investment is undertaken in brand 2 ($\theta_1^* > 0$, $\theta_2^* = 0$). Investment increases the consumers' valuation of the brand, which in turn makes a higher retail and wholesale price of the exclusive brand optimal. Due to the strategic complementarity of retail prices, the non-exclusive brand's prices will increase, too (*investment effect*).

As all three effects have a positive impact on prices and no intrabrand competition exists for brand 1 anymore, the profit of the exclusive retailer increases. As for brand 2 intrabrand competition still exists, no retail profits can be made on the sale of this brand. Moreover, the profit of manufacturer 2 increases due to the higher price level and hence, weaker interbrand competition. However, the effect on the profit of manufacturer 1 is ambiguous as the double markup effect decreases profits, while the other two effects increase manufacturers' profit.

Both manufacturers choose *ER - (E/E).* When both manufacturers choose exclusivity in selling their brands, they break intrabrand competition for both brands and create monopolies on the downstream market for selling the particular brand. According to the same reasoning from above this means higher prices, investments and retail profits for both brands relative to the N/N regime. However, this is not necessarily true

[11] As intrabrand competition for brand 2 still exists, $p_2^{E/N} = p_2^{N/E} = w_2^{E/N}$. Hence, when manufacturer 2 raises the wholesale price, the retail price increases by the same amount, $\partial p_2^{N/E} / \partial w_2^{N/E} = 1$.

relative to the E/N regime as the three effects of exclusivity partly change when both manufacturers adopt ER.

Both retailers have a monopoly right on the sale of the two brands. Consequently, both retailers can raise the retail price above the wholesale price and gain a positive retail margin, while both wholesale prices stay constant. As this double markup effect is constructed as a unilateral effect, the impact is exactly the same as under the E/N regime. But this time, both retail prices increase and not only one of them (*double markup effect*). The competition softening effect is stronger on all prices (wholesale and retail) compared to the E/N-equilibrium. Due to the reciprocal adoption of ER both retail prices are higher and hence, the competitive price adjustment is stronger (*competition softening effect*).
Investment has become retailer-specific for both retailers. I.e. both retailers invest in 'their' respective brand. Individual investment levels will be higher relative to when only one retailer undertakes the investment: The demand enhancing investment increases the quantity which consumers are willing to purchase at a given price. In the E/E regime the price level is already higher relative to the E/N regime (both without investment). So is the retail margin and investment is more lucrative. Moreover, higher investment levels also lead to a price increase, which again increases the retail margin and hence, investment incentives. The higher investment level has a positive impact on all prices relative to the N/N regime.
However, the impact relative to the E/N regime is ambiguous: For a very efficient investment technology (very low values of K), it becomes lucrative for the manufacturer to decrease the wholesale price in order to increase the retail margin and hence, incentivize investment. In other words, the effect of an additional investment on a manufacturer's sales are so high that it overcompensates the wholesale price decrease. If this downward pressure on the wholesale price is large enough, also the retail prices might be affected. Nevertheless, this effect is not strong enough to overcompensate the positive impact on prices through the double markup and competition softening effect (*investment effect*) as shown in Proposition 1.3.1.

In sum, all equilibrium values under the E/E regime are higher than in the N/N regime. Moreover, the retail prices, investments and profits under the E/E regime are also higher compared to the E/N regime. However, this is not necessarily true for the wholesale

prices as will be shown in the next section. In addition, we can say that the adoption of exclusivity by the manufacturer of a non-exclusive brand has a positive impact on the profit of a manufacturer who has already had adopted ER.

Equilibrium comparison. The following Proposition compares the equilibrium values of retail as well as wholesale prices, investment levels and retail profits for the three different equilibria and summarizes the results we have described above. The comparison of wholesale profits can be found in Section 1.4.

Proposition 1.3.1 *Retail as well as wholesale prices, retail profits and investment levels are highest when both manufacturers adopt exclusive retailing and lowest when both firms do not adopt exclusive retailing. In the asymmetric distribution regime, the retail price, the investment level and the retail profit of the exclusive brand are higher relative to the non-exclusive brand. In contrast, the wholesale price of the exclusive brand is lower relative to the non-exclusive brand. That is*

$$\begin{aligned}
p_i: &\quad p_i^{E/E} > p_i^{E/N} > p_i^{N/E} > p_i^{N/N} \\
w_i: &\quad w_i^{E/E} >^{(*)} w_i^{N/E} > w_i^{E/N} > w_i^{N/N} \\
\theta_i: &\quad \theta_i^{E/E} > \theta_i^{E/N} > \theta_i^{N/E} = \theta_i^{N/N} \\
\pi_i^{Retail}: &\quad \pi_{Retail}^{E/E} > \pi_{Retail}^{E/N} > \pi_{Retail}^{N/E} = \pi_{Retail}^{N/N}.
\end{aligned}$$

$^{(*)}$ *If and only if* $K > \bar{K} = {}^{(d^4+2d^3-5d^2-2d+4)}/_{(4-d^2)}$.

Proof See Appendix.

Generally, we can say that a higher degree of exclusivity leads to higher prices at the wholesale and at the retail stage as well as to higher retail profits. In addition, also the investment level increases.

All three effects stemming from ER affect the retail price positively. Hence, it is not surprising that the retail price is increasing with exclusivity. But it should be noted that

the retail price of the exclusive brand in the asymmetric equilibrium will be higher than the retail price of the non-exclusive brand. This is because the double markup and the investment effect affect the retail price of the exclusive brand directly while the retail price of the non-exclusive brand is affected only indirectly via the competition softening as well as the investment effect due to the strategic complementarity of retail prices.

The opposite result can be observed for the wholesale prices. As described above, the double markup effect does not affect any of the wholesale prices, but both wholesale prices are affected by the competition softening and the investment effect. However, the sum of these effects is stronger on the wholesale price of the non-exclusive brand than on the wholesale price of the exclusive brand. As for the former no retail margin exists, the price responses by the manufacturer are always more extreme and hence, the effects are stronger.[12] However, the wholesale price under the E/E regime is only higher relative to the N/E regime, whenever K is not extremely small ($K > \bar{K}$). If this was the case, retail investment is so efficient that it is optimal for the manufacturer to give the retail company additional incentives to invest by lowering the wholesale price and hence, leave the retail company a larger share of the joint profit. This effect is stronger under the E/E regime as investment incentives are higher relative to the E/N regime.[13]

Investment in a brand is zero whenever the manufacturer has not adopted exclusivity, while the investment level is positive when exclusivity has been adopted. Moreover, the investment level in a brand increases when also the competing brand adopts exclusivity as investment levels are strategic complements. The adoption of exclusivity by the competing manufacturer increases the price level and retail margin in the market and hence, softens competition. A higher retail margin makes investment more lucrative, as investment increases sales (for a given price) which are associated with a higher retail margin now. Hence, investment incentives and eventually, investment levels will be higher.

Finally, the retail profit is zero whenever the retailer does not have an exclusive distribution right, and positive when he has one. Moreover, the retail profit is higher when

[12]The exclusive manufacturer faces a trade-off when he increases $w^{E/N}$. On the one hand, it allows the manufacturer to extract more of the joint profit. On the other hand, it exaggerates the double markup problem ($\partial p^{E/N}/\partial w^{E/N} > 0$) and decreases the investment activity of the retailer.

[13]Note that this additional constraint ($\bar{K}$) is just slightly stronger than the SOCs. So, this case only appears for extremely efficient retail investment technologies. Moreover, it should be noted that for these values the E/E-regime would arise endogenously.

both manufacturers have adopted ER relative to when only one manufacturer has done so ($\pi_i^{E/E} > \pi_i^{E/N}$): Interbrand competition is weakest when both manufacturers have adopted ER due to the double markup as well as competition softening effect. Weaker competition allows retail firms to increase their retail price and hence, they can earn a higher margin and profit.

1.4 Endogenous choice of distribution system

The preceding analysis has taken the distribution system as given. In this section, we show that all the contractual solutions we described in the last section can arise as the equilibrium outcome of this game. As mentioned above, the manufacturers choose noncooperatively whether they sell their brand exclusively or non-exclusively at the beginning of this game. The Nash equilibrium in this stage depends on the relative size of the manufacturers' equilibrium profits, $\pi_i^{E/E}$, $\pi_i^{N/N}$, $\pi_i^{E/N}$ and $\pi_i^{N/E}$. Figure 1.1 illustrates the normal form of the game.
The following proposition states our main result regarding the existence of the different first stage equilibria.

Proposition 1.4.1 *There exist three different equilibria in pure strategies in this game, given different combinations of d and K: (i) Both manufacturers do not adopt exclusive retailing in equilibrium. (ii) One manufacturer adopts exclusive retailing and the other manufacturer does not adopt exclusive retailing in equilibrium. (iii) Both manufacturers adopt exclusive retailing in equilibrium.*
In addition, multiple equilibria of type (i) and (iii) exist for some parameter combinations.

Proof See Appendix.

In Figure 1.2, we can observe that all three equilibria emerge for a rather substantial parameter space. Their occurrence can be explained quite intuitively using the manufacturers rationale for ER and how it is affected by the intensity of competition d and the investment cost K.

Figure 1.1: Choice of distribution system

2 / 1	NER	ER
NER	$\pi^{N/N}$, $\pi^{N/N}$	$\pi^{N/E}$, $\pi^{E/N}$
ER	$\pi^{E/N}$, $\pi^{N/E}$	$\pi^{E/E}$, $\pi^{E/E}$

If the retail investment technology is very efficient (low K), the benefit for the manufacturer from ER through the investment effect is larger than the cost from ER through the double markup effect. But if the investment becomes more expensive (K increases), retail investment becomes less important and hence, ER becomes less profitable or unprofitable. Hence, for a low K ER is more profitable than for a high K and hence, more firms adopt ER.[14]

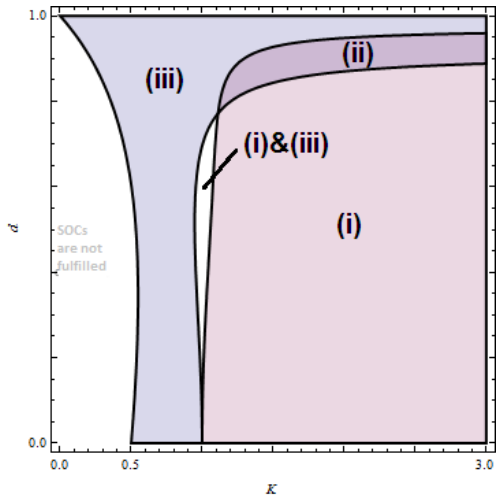
Moreover, if interbrand competition is rather weak (low d), the retail markup under ER is quite large as the competitive pressure on the exclusive retailer from the competing brand is rather weak. Hence, the double markup effect is quite large and ER costly for the manufacturer. However, if d is large, the competitive pressure on the retailer under ER from the competing brand will be quite high, so that the retail markup is rather small and ER becomes more lucrative. When d is very high, ER will be optimal for both manufacturers even when retail investment is not feasible at all (e.g. $K \to \infty$). With a very high d the double markup effect vanishes, but the competition softening effect prevails. Hence, manufacturers adopt ER even without the possibility of retail investment.

It remains to explain, when and why only one and not the other manufacturer adopts exclusivity for some parameter combinations and not for others.[15] As can be seen in Figure 1.2, for intermediate values of d and K one manufacturer has the incentive to adopt exclusivity, given the competing manufacturer does not do so. When the

[14]Note that the double markup as well as the competition softening effect are not dependent on K by construction.

[15]In more formal terms, we can say that for the parameter constellations leading to one of the symmetric equilibria, the manufacturers' incentive to (not) adopt exclusivity is a dominant strategy regardless of what the competing manufacturer is doing. In contrast, for the parameter constellations leading to the asymmetric equilibrium, the manufacturer's decision to (not) adopt exclusivity is dependent on the belief what the other manufacturer is doing. Hence, the competing manufacturer's choice alters the own optimality condition in such a way that a different decision becomes optimal. We are interested in how the respective optimality conditions are altered.

Figure 1.2: Equilibrium distribution systems



first manufacturer chooses ER, the retail prices will increase and interbrand competition in the market becomes softer. This raises the non-exclusive manufacturer's profit ($\pi^{N/E}_{Manufacturer} > \pi^{N/N}_{Manufacturer}$). Hence, the effect from ER on the second manufacturer's profit has to be stronger than for the first manufacturer, so that she actually adopts ER. The adoption of ER is more profitable, when d is relatively higher or/and K is relatively lower as then the cost/benefit of ER would be lower/higher (see above). Consequently, combinations of d and K exist, so that one manufacturer adopts ER and the other one does not do so.

1.5 Asymmetric Brands

In this section, we explore the case of asymmetric manufacturers, i.e., the efficiency of retail investment is different among brands ($K_2 = K_1 + \Delta$, $\Delta > 0$).

The parameter K_i can be interpreted as the relative efficiency of retail marketing (to manufacturer marketing) in a certain brand. Efficiency of retail marketing usually depends on a manufacturer's brand reputation as well as the marketing skills/technology of the retailer. If a firm's brand reputation is well established in the market, retail investment might be inefficiently costly (relative to marketing by the manufacturer herself) and hence the respective cost parameter K_i should be rather high. In contrast, if a manufacturer has recently entered a new market and retail companies are well-established in the market,

K_i should be rather low. Moreover, manufacturers not having any direct contact to their final customers and selling their products via retailers should be associated with a low K_i.[16, 17] Different retail marketing efficiencies can appear, if an established brand exists in the market (high K_i), while another brand is a new entrant which is dependent on marketing investment by established retail companies (low K_i). This reflects our iPhone example quite well. While a number of well established mobile phone producers (e.g. Nokia, Samsung, SonyEricsson) already existed, Apple was a newcomer in this market. This also means that the 'old' producers already had established marketing channels, while Apple had to arrange new channels. For Apple it was relatively more efficient to rely on marketing by a third party already active in the mobile phone market.

Our main result for asymmetric brands is summarized in the following Proposition.

Proposition 1.5.1 *Suppose upstream manufacturers are asymmetric with respect to the brand specific investment technology parameter, $K_1 \neq K_2$, then:*
(i) The parameter space of the N/N-equilibrium and the parameter space where either the E/N- or the E/E-equilibrium occur does not change.

(ii) The parameter space where the E/N-eq. occurs increases to the expense of the parameter space of the E/E-eq.

Proof See Appendix.

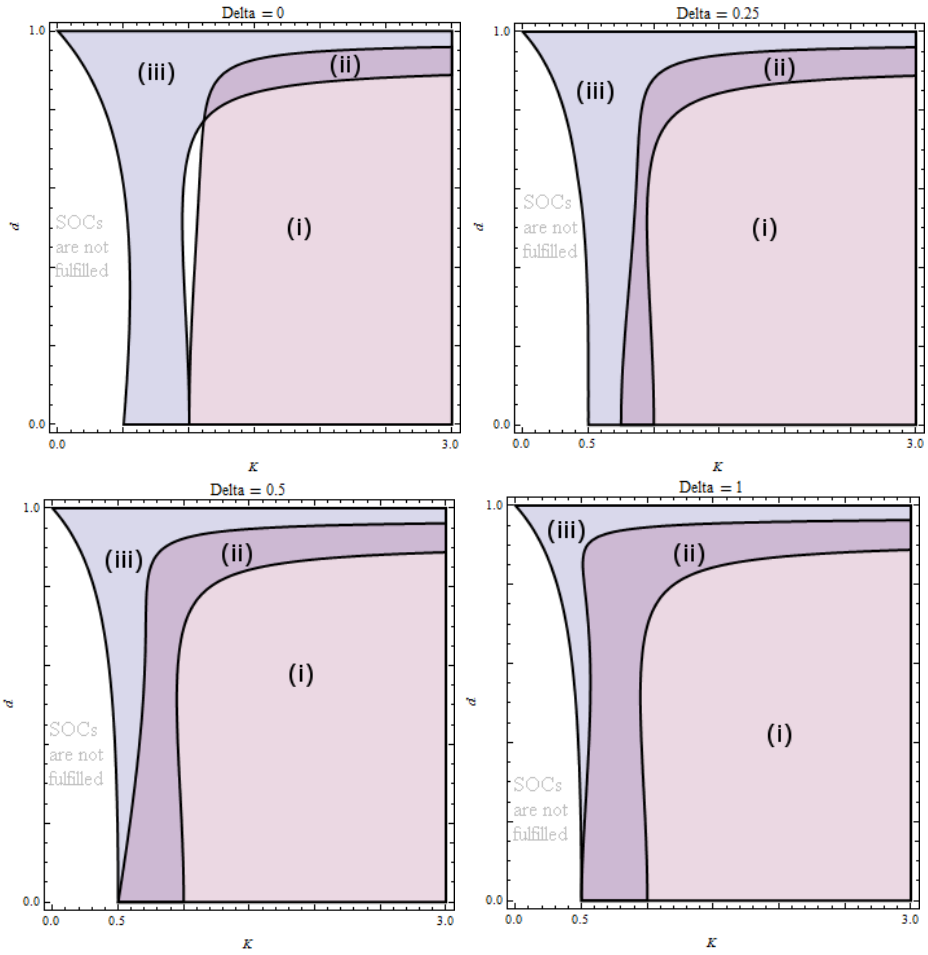
Introducing asymmetric brands does not alter the parameter space of the N/N-equilibrium. The value of K_i only matters for a firm actually adopting ER, as otherwise no investment is undertaken. Hence, there is no change in the occurrence of the N/N-equilibrium.
The introduction of asymmetric brands keeps the parameter space where either the E/N- or the E/E-equilibrium occurs constant. This result follows immediately from the first result. But the introduction of asymmetric brands increases the space where the E/N-equilibrium occurs and decreases the space of the E/E-equilibrium. In other words, the

[16] As already mentioned above, the microchip producer Intel largely relies on marketing by its downstream retailers.
[17] Note, that we abstract from marketing skills differing among retailers and assume both retailers as equally efficient.

asymmetric equilibrium occurs more often and the E/E-equilibrium less often, the larger the asymmetry among brands. The intuition for this is quite straightforward: Suppose, we observe the E/E-equilibrium and increase the difference $K_2 - K_1$ by increasing K_2: For manufacturer $1's$ decision, whether or not to adopt ER, nothing changes. But if the increase of K_2 is sufficiently large, exclusivity might not be worthwhile for manufacturer 2 anymore and she will choose not to adopt ER. Hence, the larger the difference $K_2 - K_1$, the larger will be the 'E/N space' to the expense of the 'E/E space'. Moreover, introducing only a very small asymmetry, the multiplicity of equilibria disappears.

Figure 1.3 illustrates the changes in the different parameter spaces for different values of $\Delta = K_2 - K_1$. This equation is for illustrational purposes redefined in the following way: $\Delta = K_2 - K$.

Figure 1.3: Asymmetric Brands



In the context of our 'iPhone' example, this could be interpreted as follows. Apple Inc. was a new market entrant in 2007, while the other manufacturers of mobile handsets

were already established in the market. Hence, the relative efficiency of retail marketing was higher for Apple than for its competitors ($K_{Apple} < K_{Competitor}$). While Apple Inc. adopted ER arrangements, most of its competitors refrained from such arrangements. As can be seen in Figure 1.3, the larger the difference in the retail marketing efficiency, the larger is the parameter space where the asymmetric equilibrium occurs. In other words, the observed asymmetric equilibrium in the Apple case, could be a result for quite a large set of parameters. However, the iPhone's success on the market for mobile handsets led to a decrease of Apple's retail marketing efficiency. In other words, as Apple itself has become better known for its mobile handsets, it no longer had to rely on marketing investments by its retailer anymore. This means, while ER was a profitable strategy just after market entry, it is not profitable anymore. In our model, this would mean that the difference in retail market efficiencies became smaller ($K_{Competitor} - K_{Apple}) \downarrow$ and so has the parameter space in which the asymmetric equilibrium occurs. In 2010, Apple Inc. abandoned its ER arrangements in most countries.

1.6 Welfare Implications

As has been shown in the preceding analysis, a manufacturer trades off the cost (*double markup effect*) against the benefits from ER (*investment effect* and the *strategic effect*) when adopting ER. In contrast to this rationale, a welfare maximizing regulator trades off the procompetitive effect of ER (*investment effect*) against the anticompetitive effect of ER (*double markup effect* and the *strategic effect*).

Figure 1.4: Manufacturer vs. Regulator

	$double\,markup\ effect$	$competition\,softening\ effect$	$investment\ effect$
$Manufacturer$	$-$	$+$	$+$
$Regulator$	$-$	$-$	$+$

This simple comparison already suggests that a manufacturer's interest in adopting ER is not aligned with a regulator's interest, rationalizing government intervention. In this section, we will analyze this issue in more depth using the case of symmetric manufacturers.

The first part of our welfare result is summarized in the following Proposition:

Proposition 1.6.1 *Suppose manufacturers are symmetric and the retail investment technology is sufficiently efficient: Consumer surplus is increasing with exclusive retailing if and only if both manufacturers adopt ER. Moreover, consumer surplus is decreasing with exclusive retailing when only one manufacturer adopts ER and the other manufacturer does not adopt ER.*

Proof See Appendix.

The Proposition states that ER benefits consumers if and only if the retail investment technology is sufficiently efficient and both manufacturers adopt ER.
First, a more efficient retail investment technology results in a higher investment effect, which unambiguously increases consumer surplus. This effect has to be strong enough to counter the price increase from the double markup as well as the competition softening effect, which unambiguously decrease consumer surplus.
Second, as was shown in Proposition 1.3.1, (individual and total) retail investment is higher under the E/E regime compared to the E/N regime and so the investment effect is. This smaller investment effect under E/N turns out to be insufficient to counter the two other effects which decrease CS. Hence, as shown in Proposition 1.3.1, the adoption of ER by one manufacturer is always harming consumers, while it might benefit consumers when it is adopted by both. The left hand side of Figure 1.5 illustrates when ER is positive for consumers and when not. In the meshed area consumers lose from ER, while in the remaining area consumers benefit from ER (given the manufacturer(s) adopt ER). The second part of our welfare result is summarized in the following Proposition:

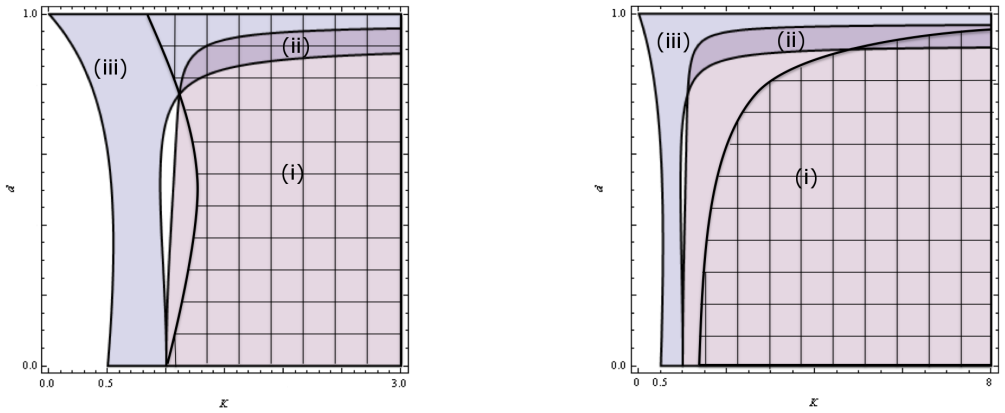
Proposition 1.6.2 *Suppose manufacturers are symmetric and the retail investment technology is sufficiently efficient: In contrast to Proposition 1.3.1, welfare is also increasing with exclusive retailing, if only one manufacturer adopts ER. Moreover, for exclusive retailing to be welfare enhancing, retail investment must be more cost efficient the weaker the competition is.*

Proof See Appendix.

In line with the preceding result, welfare increases with ER, whenever the retail investment technology is sufficiently efficient. In order to fully understand this result, it is helpful to disentangle the separate effects on consumer and producer surplus: The investment effect unambiguously increases consumer and producer surplus. The impact of the double markup and the competition softening effect on consumers' welfare is clearly negative, while it is sometimes positive on producers. The overall harm by these two effects is decreasing with the intensity of competition. Therefore, in addition to the result above, welfare is also increasing in exclusivity for rather high investment costs given the competition is sufficiently tough.

In other words, ER increases welfare even for a relatively smaller investment effect and a higher cost of investment compared to consumer surplus. This can be easily seen by comparing the meshed areas in Figure 1.5.

Figure 1.5: Consumer surplus (left) and welfare (right)



Note: The meshed areas illustrate situations when exclusive retailing decreases consumer surplus (left) and welfare (right), respectively. Moreover, the figure depicts all three equilibria described above: (i) N/N equilibrium, (ii) E/N equilibrium and (iii) N/N equilibrium.

Using this analysis, we can make two observations, which are in contrast to Proposition 1.3.1: First, ER can also have a positive effect on welfare under E/N, as the benefit from investment for producers outweighs the harm caused by the double markup as well as the competition softening effect, if competition is not too weak.

Second, a negative relationship between the cost of investment and the intensity of competition exists for ER to be welfare enhancing. While the (positive) investment effect decreases with the investment cost, the adverse impact from the double markup and the competition softening effect decrease with tougher competition. Hence, ER even turns

out to be welfare enhancing for a rather inefficient investment technology as long as competition is tough enough. The right hand side of Figure 1.5 illustrates when ER is welfare enhancing and when not. In the meshed area, ER decreases welfare. In the remaining area, ER enhances welfare (given the manufacturer(s) adopt ER).

1.7 Conclusion

This chapter has identified a rationale for exclusive retailing agreements, combining a pro- and an anticompetitive view of ER. ER comes at a cost for the manufacturer as it distorts downstream competition, gives retail firms a margin and creates a double markup problem. However, it is this retail margin which incentivizes downstream retailers to invest in (procompetitive) brand-specific marketing which benefits the manufacturer of the brand. Moreover, the additional margin for the retail firm is a (anticompetitive) commitment device for higher prices in the market and softer interbrand competition.

We analyze the equilibrium incentives for a manufacturer to adopt ER when inter- as well as intrabrand competition exist. Therefore, we derive conditions under which no manufacturer, one manufacturer and both manufacturers adopt ER. We find the more efficient the retail investment technology and the tougher interbrand competition, the more often ER arrangements can be observed. In addition, we analyze the market conduct for each of these equilibria.

We find that manufacturers adopt ER too often from a welfare point of view. ER is usually welfare enhancing, whenever retail investment is rather efficient and/or brands are rather similar. But if brands are sufficiently differentiated and manufacturers do not depend on retail marketing, such arrangements should be forbidden by competition authorities.

In our model, firms compete in prices. However, ER would also occur in a setup where firms compete in quantities, but any competition softening effect would vanish. Moreover, our model turns out to be robust to changes in the timing. So, the basic mechanism goes through when the manufacturer cannot commit to a wholesale price before the retail investment is undertaken. In addition, we have only considered demand enhancing investments, increasing consumers' perceived quality of a brand. This kind of investment

has always a positive effect on the competing firm's profit. An interesting case would be to consider cost decreasing investments as this would always have a negative effect on the competitor's profit. Another interesting project for future research would be to explicitly include upstream market entry in our framework. New market entrants should be particularly dependent on third party marketing investment. As we have shown, ER serves as an instrument to incentivize such investment and hence, might have an entry promoting effect.

Chapter 2

Free commuter newspapers and the market for paid-for daily newspapers

2.1 Introduction

Ideally, the free daily tabloids that are popping up in the Bay Area and elsewhere like mushrooms after a rain would complement rather than substitute for relatively high-quality paid newspapers[...] Commuters and shoppers would pick up the free daily tabs to learn what the city council was up to, and still subscribe to a broadsheet for regional and world news. Young people would enjoy the brevity of the free papers, then "graduate" to more substantive broadsheets. People who won't pay to read would still be informed.
Michael Stoll, Grade the News[1]

The welfare assessment of new goods depends on whether they are substitutes, complements or independent of existing products. They are clearly welfare enhancing if the new good complements existing goods or is independent of them, i.e. creates a new market. If new goods are substitutes, they may replace existing products with positive externalities and therefore potentially reduce welfare. For example, there is an ongoing discussion in media markets about whether new media outlets provide less socially valuable "hard" political news than the social planner would. Instead of informing the public about matters of public interest, they rely

[1] http://www.gradethenews.org/2005/freepapers3.htm, online, accessed: 03.12.2011.

on "soft news" about car chases and celebrity scandals to satisfy consumers' demands. Due to increased competition, traditional media outlets which provide quality information about political issues are deprived of readers and revenues. Eventually, they might even be forced to exit the market. Then, without political information, citizens are unable to cast informed votes and large social gains from participatory democracy might not be internalized (Downs (1957); Coase (1974) and Posner (1986)). This argument provides a rationale for why policymakers limit competition in media markets all over the world (Djankov et al. (2003)).

Although compelling, this reasoning rests on the implicit and untested assumption that "hard" and "soft" news outlets are substitutes. Many consumers might not be at the margin between consuming hard news or soft news but between consuming any news or no news at all (Gentzkow and Shapiro (2008)). Consequently, new boulevard style media outlets might even increase the share of politically informed citizens.

To help assess the impact of entry in the media market on consumer surplus, this chapter investigates the substitution pattern between the free commuter newspapers and traditional daily newspapers.[2] To this end, we quantify the impact of penetration of free commuter newspapers on the readership and circulation of the paid-for daily press in the Swiss newspaper market, controlling for market and time fixed effects. In addition, we apply an instrumental variable approach to properly identify the effect to be examined. We use a special characteristic of free newspapers (their distribution via the transport system) to create a valid instrument. We find that free newspapers are weak substitutes to traditional daily press. However, they do not take away readers from high quality broadsheet newspapers. They only capture market share from the incumbent yellow press. This suggests that "hard" and "soft" news media outlets are active in different markets. Moreover, we find that this substitution effect is largely driven by multihomers' substitution behavior. This simply means that people who read more than one daily newspaper replace their second/third paper with the new product. We also find no significant effect on readership among highly educated people and among older readers. Finally, we find that free newspapers create new readers in the market for daily print newspapers, meaning that a larger fraction of the population is informed.

[2]Moreover, determining the degree of substitutability is important for many competition policy debates (e.g. merger control). This measure is pivotal in defining relevant market as well as in merger simulation (Motta (2004); FCC (2001)).

The penetration of free commuter newspapers in Switzerland is especially well suited to test the substitution pattern between "hard" and "soft" news. First, the entry of free newspapers in Switzerland was massive. Since 1999, the circulation of free daily newspapers has increased from 346,000 to almost 1,000,000. During the same period, paid-for newspaper sales dropped by almost 15%. This provides us ample variation to test our hypothesis. Second, free commuter newspapers entered sequentially in different markets. They first entered in Zurich and then gradually spread to more than 130 out of 155 counties (regional markets). This allows us to control for market and time fixed effects. Third, the commuter papers were distributed free of charge in the transportation system. This gives us the possibility of creating a valid instrument.

The empirical analysis relies on three different data sets. The first data set contains a municipal-level panel of free newspaper readership in more than 150 regional markets from 1999 to 2008. Moreover, this data also includes population characteristics for each of these single markets, as well as information about the newspaper readership structure. This data set is based on an annual survey conducted by the Swiss Research Media Institute (WEMF). The second data set contains information about newspaper circulation on the municipal level and is provided by Publicitas. Both these data sets are matched with Census data from the year 2000 that provides information about population characteristics at the municipal level. To the best of our knowledge, this is the first work using this data set to conduct an economic study as detailed as ours.

Our empirical strategy is based on George (2008) and George and Waldfogel (2006) and consists of two different steps: In the first step, we explore whether free dailies take readers away from the traditional daily press.[3] In order to mitigate potential endogeneity concerns, we exploit the panel structure of the data and a special feature of free newspapers (i.e. distribution via the transport system). To construct valid instruments we employ commuter data. In addition, we examine in this step whether free newspapers create a new market.

In the second step, we analyze whether free newspaper penetration changes the structure of the audience of traditional newspapers. Unlike in George (2008), the richness of our data makes it possible to estimate the change in readership

[3]There are two different theories considering the free paper as a direct competitor (substitute) as well as a promoter for traditional press (a complement). See, for example, Mahoney and Collins (2005).

separately for each "reader group". Examining this question is important because in differentiated product markets the distribution of individuals' preferences affects the product options available to consumers.[4] In other words, if free newspapers reduce or change the composition of the readership for paid-for newspapers, the incumbent may reduce the size of its product or cease to operate. Alternatively, the incumbent may change its product in order to gain new readers who are not attracted by commuter newspapers.

To the best of our knowledge, only little work has been done on the substitution patterns of boulevard style and broadsheet media. Prat and Strömberg (2005) provide evidence that the introduction of private television in Sweden increased political information and political participation relative to a public television monopoly. So far, the effects of commuter newspapers have only been examined by communication scientists. Bakker (2007) and Mahoney and Collins (2005) descriptively show that there is only a weak substitution.

In the economic literature, studies examining product substitutability on the market for news have so far focused on the relationship between online and print media. Kaiser (2006) analyzed the effect of website provision on the demand for German women's magazines. The results from a logit and a nested logit model on market level data suggest that website provision significantly cannibalized magazines. Significant and negative effect of online presence on the demand for print media is also found by Filistrucchi (2005). He examines the demand for Italian national daily newspapers by using a logit-type demand model.

However, as pointed out in Gentzkow (2007), the use of discrete choice models in studies examining newspaper markets is more than doubtful. The reason is that the starting point of these demand models is that the consumers choose exactly one product from the available set. Since multihoming plays an important role in the relationship between free and paid-for newspapers, we do not use discrete choice demand models.[5]

Despite the evidence that new media draw readers from print media, only little work has examined how new products alter the consumer structure of old products.

[4]The fact that consumers affect each other through product markets has been documented especially in media markets. See George and Waldfogel (2003) for evidence on daily newspapers, Waldfogel (2003) and Waldfogel (2004) for evidence on radio and television markets, respectively.

[5]Gentzkow (2007) developed a model dealing with this problem. Unfortunately, we cannot use it as we have no data on readers at micro level.

While George and Waldfogel (2006) examine the effect of the New York Times expansion on the audience for local newspapers, the Internet's impact on traditional newspaper readership is a subject of George (2008). She finds that the readership of daily newspapers changes because younger, highly educated urban whites are more attracted by the Internet.

The remainder of this chapter is organized as follows. Section 2.2 documents aggregate trends in free and paid-for newspaper coverage. Section 2.3 summarizes the data. Section 2.4 describes the empirical strategy and presents the results. Section 2.5 concludes.

2.2 Trends in Traditional and Free Paper Circulation

2.2.1 Free daily penetration

We are interested in identifying the effect of free daily newspapers' penetration on the circulation and readership of traditional daily newspapers.[6] Since 1995, free newspapers have been a new player in the market for the daily press. There are three important differences from the traditional newspapers. First, the small format makes it very convenient to read these newspapers on any means of public transport. This suggests that free commuter newspapers may not be in direct competition with traditional dailies and so their introduction may lead to a market expansion. Second, in contrast to the traditional daily press, they are distributed via a transport system. This feature plays an important role for the identification of the effect examined. Third, the pricing strategy of free newspapers reflects the two-sided character of the newspaper market. Free newspapers generate their revenues only from the advertiser side of the market.[7]

Besides these characteristics, there are further features connected with free newspapers' expansion, making a study examining their effect on the daily press in-

[6]While a newspaper's circulation is the number of newspapers distributed on an average day, a newspaper's readership corresponds with the number of newspapers read on an average day. Unlike the previous studies, we are interested in both variables as these may be different from each other and may provide us with interesting insights with respect to multihomers' behavior in the newspaper market.

[7]In order to properly examine welfare consequences one should consider both sides of the market (Evans (2003)). Since we are primarily interested in the impact on readers, we do not consider the competition in the advertising markets. Moreover, the available data do not allow us to make such a comprehensive study.

teresting and suitable. Free commuter daily newspapers constitute a new product in the market for news, which has experienced a considerable increase in circulation and readership during the last decade. Table B.1 shows the increase in free daily circulation by continent, along with a measure of the supply expansion (i.e. the number of countries where free newspapers entered the market) between 1995 and 2009. This table generally reflects the increasing importance of free commuter newspapers worldwide. Free commuter dailies were first introduced in 1995 in Sweden. Ever since, publishers around the whole world have launched free dailies and today we can find them in almost 60 countries.

This pattern is reflected in our data set, even though our data refers to one country only. As noted above, to investigate the relationship between free and paid-for newspapers, we utilize the successive expansion of free dailies in Switzerland. The first free commuter paper in Switzerland was "20 Minuten". It was launched in Zurich on 13 December 1999 by the Norwegian publisher Schibsted, UK investor Apax and Ernst Müller-Möhl. After entering the Zurich market, it moved to Berne and Basel in October 2000. The Swiss publisher Tamedia took "20 Minuten" over after threatening to launch the competing free daily "Express" in 2003. In 2004, "20 Minuten" started an edition in Luzern and in 2005 in St. Gallen. Until 2005, there was no free paper in the French part of Switzerland. A year later, in March 2006, the first free French written newspapers (i.e. "20 Minutes") were launched in Geneva and Lausanne. In January 2007, these newspapers also entered the Neuenburg and Jura cantons. Coverage increased to 2.2 million readers from more than 130 Swiss counties in 2008. Thus, it can be seen that the Swiss market for free daily newspapers is really large and fits the worldwide development of free newspapers very well. In addition, there was a lot of entry into and exit out of this market. Only the owners of "20 Minuten" have already reported to have reached their break even. Metro, called "Metropol" in Switzerland, started soon after "20 Minuten" in January 2000, but closed down in 2002. Free daily ".ch" started in 2007 and was available for less than two years, Tamedia's own "NEWS" was dropped in December 2009. In the French part of Switzerland, "Le Matin Bleu" vanished after the merger with the French edition of "20 Minuten".[8]

Table B.2 illustrates this successive expansion. It shows increases in free newspaper

[8]The closing down of many free papers in 2008 and 2009 was caused by the bad situation on the advertising side of the media market connected with the financial crisis.

readership by region, along with the number of counties which the free papers entered between 1999 and 2004 and between 2005 and 2008. This table provides us with the following useful insights. Regions in which the free newspapers were more active experienced a greater growth of the total readership. Moreover, even though free newspapers were physically distributed only in seven markets, they have affected market structure in more than 130 markets until 2008. This point indicates the important role of commuters for the expansion of free newspapers and helps us to identify their impact on paid-for newspapers. Third, there are still markets without free newspapers (e.g. in the Italian part of Switzerland). The development of free newspaper readership in Switzerland can also be seen in Figure B.1. The fraction of individuals reading or paging through at least one of the free commuter papers rose from 9% in 2000 to 43% in 2008.

The last feature that makes our study suitable is that free commuter newspapers address a distinct audience. Targeting can help us identify the effect of free dailies on paid-for newspaper consumption. This effect may be identified from the differences between the target and non-target group. Free newspapers target readers with preferences for boulevard, short and simple written articles - a set of preferences for which age (i.e. younger readers) or education (i.e. low education) seems to be a reasonable proxy. The support for this targeting can be found in many communication science studies and press releases of free newspaper publishers. Table 2.1 shows free daily papers coverage for different user types in 1999, 2002, 2005 and 2008. The left columns describe the fraction of each sociodemographic group in the population older than 14, while the right columns show the fraction of each group among all free newspaper readers. All figures are taken from WEMF's survey MACH Basic.

The biggest difference between both fractions can be seen for young people (ages 14-29). Young people comprised about 28% of the respondents in 2002, but 44% of those who read free newspapers. Even with the rapid expansion of free dailies, young people made up a larger fraction of the free paper audience than the general population in 2008. The corresponding numbers are 23% and 33%, respectively. Commuters are also more likely than others to read or page through free newspapers, making 43-45% of the population and 55% of free paper readers. The reason may be that they have direct access to this new product. In addition,

highly educated people are slightly under-represented among free paper readers.[9] Finally, income does not seem to play an important role for the decision to read free commuter newspapers or not.

Table 2.1: Free Newspaper Coverage by Group, 1999, 2002, 2005 & 2008

	All individuals				Free paper readers			
	1999	2002	2005	2008	1999	2002	2005	2008
All individuals	100%	100%	100%	100%	0%	13%	19%	40%
High Education	24%	26%	30%	34%	0%	22%	24%	31%
Age 14-29	28%	28%	23%	23%	0%	44%	36%	33%
Age 60+	21%	21%	23%	23%	0%	8%	9%	12%
Commuter	43%	44%	44%	45%	0%	56%	57%	55%
HH Income > 8000 SFR	28%	34%	34%	38%	0%	40%	38%	39%
HH Income < 6000 SFR	49%	43%	43%	39%	0%	34%	37%	35%

Source: WEMF MACH Basic 00-09/2 - Own computation

2.2.2 Paid-for daily newspapers

The circulation of daily paid-for newspapers has been declining in Switzerland since the mid-1980s. Figure B.2 illustrates traditional paper circulation from 1990 to 2008. A small decline during the 1990s was followed by a steeper decline since 2000 (entry of commuter newspapers in the market). This trend may suggest a potential role for the commuter papers in circulation declines.

With clear differences in free newspaper readership across demographic groups, it is therefore reasonable to expect differential trends in the readership of traditional newspapers across different types of individuals. Figure B.3 shows daily newspaper readership for two age categories. Readership among younger individuals (aged 14-29) declines throughout the whole period, though the trend constantly steepens after 2002. Readership in the oldest group (60+) is more or less stable over the examined period. Hence, the gap in readership between older and younger readers becomes larger: while in 1999 this gap constituted only 10 percentage points, the 2008-data indicated more than 20 percentage points difference. Figure B.4 plots differential trends for individuals with high and low education. Readership among highly educated individuals is higher throughout the whole period. However, it

[9]The division into highly and less educated people is made according to the Swiss Statistical Office. People with higher schooling than A-level (i.e. Maturitätsschule, Lehrkräfte-Seminar, Höhere Fach/Berufsausbildung, Höhere Fachschule & Universität) belong to the highly educated group.

declines in a very similar way to the readership among less educated individuals. Figure B.5 plots readership trends by commuter status. We can observe successive declines in both groups since 2002-2003. However, the decline in the fraction of commuters is a little steeper. Readership by income is depicted in Figure B.6, in which we can observe very similar patterns to those in Figure B.4.

To sum up, the simultaneous increase in readership of free newspapers and decrease in readership of traditional dailies indicates a potential substitutability of those two types of dailies. Moreover, differences in free paper reading across demographic groups combined with changing traditional newspaper readership patterns suggest that the free dailies might have contributed to changes in the audience for paid-for daily newspapers. Sections 2.3 and 2.4 develop formal tests for these effects.

2.3 Data

The empirical work relies on three panel datasets constructed from longitudinal information on: (i) daily newspaper circulation, (ii) daily newspaper readership and (iii) sociodemographic factors. The data spans the period from 1999 to 2008. Both circulation and readership data have been collected by an impartial non-profit public utility institution - the Swiss research media institute (AG für Medienforschung WEMF) which is the Swiss equivalent to the US Audit Bureau of Circulation. WEMF ascertains, monitors and publishes circulation, newspaper and magazine dissemination and coverage information with the aim of facilitating open competition between the suppliers of advertising space. The data on sociodemographic factors are taken from the 2000 Census as well as from the MACH Basic 2000 to 2009/2 surveys provided by WEMF.

Newspaper circulation is measured as the residual between the number of newspaper copies produced and the number of newspapers returned to the publisher. This data is a municipal-level panel of per-capita newspaper circulation. Unfortunately, the data for the year 2005 is not available due to a measurement change of the circulation in Switzerland.

The readership variable is based on the answers of respondents from the MACH Basic survey. Each respondent is asked if she read or scanned through a particular newspaper in its last occurrence interval. If the answer is positive, the respondent is

counted as a reader of this particular newspaper. Summing up all readers provides the readership data for a particular newspaper. The newspaper readership data is a county-level panel of per-capita readership. This survey allows us to construct two different readership variables. The first one is defined as the share of people who read at least one daily paper (hereafter extensive readership). The second one is defined as the average number of newspapers read by one person (hereafter intensive readership). The only difference between these two readership measures is that the latter one directly controls for multihoming.

The sociodemographic factors are collected at two different geographical levels. The county demographics are provided by the MACH Basic survey. MACH Basic supplements record newspaper coverage along with demographic characteristics for approximately 23,000 individuals a year. The municipal demographics are drawn from the 2000 Census. Demographic characteristics follow Census definitions, with "highly educated" corresponding to the fraction of individuals in a municipality with at least an A level. The category for youth covers ages 14-29 and older ages 60 and higher. "Commuter" corresponds to the fraction of commuters in the municipality.

We analyze the impact of free commuter newspaper penetration on per capita circulation and per capita readership of about 60 paid-for daily newspapers in more than 2,300 municipalities covering more than 90 counties.[10] The number of newspapers corresponds with almost 80% of the Swiss daily newspaper population. We aggregate newspaper circulation data as well as readership data to create municipality and county totals each year, respectively. We link the paid-for newspaper circulation and readership data to county-level data on free newspaper readership data in these years, as well as demographics on municipal or county level drawn either from the 2000 Census or MACH Basic, respectively.

Tables 2.2 and B.3 report summary statistics for circulation, extensive and intensive readership as well as sociodemographic data. There is a considerable variation in free paper penetration across markets, with per capita readership ranging from 0 at the fifth percentile to 0.825 at the ninety-fifth percentile. Moreover, there is also a considerable variation across counties. Both the extensive and intensive readership of paid-for dailies also vary across markets and over time, although the

[10]We restrict our sample to markets with at least 99 respondents in the MACH Basic survey in order to ensure the representativeness of the sample.

later variation is small.

Large variation across municipalities as well as over time can also be seen by per capita paid-for paper sales. This ranges from 3% at the fifth percentile to 52 % at the ninety-fifth percentile. The bottom of Table 2.2 reports descriptive statistics of sociodemographic factors at municipal level. Table B.3 summarizes sociodemographic data at county level stemming from the MACH Basic survey. We can observe similar trends to those in the Census data.

Table 2.2: Descriptive Statistics

Intensive paid readership	year	n	mean	sd	p5	p25	median	p75	p95
Aggregate county	2002	94	1.000	0.232	0.429	0.897	1.034	1.141	1.280
Aggregate county	2005	94	0.956	0.210	0.400	0.869	0.971	1.083	1.243
Aggregate county	2008	94	0.858	0.182	0.413	0.781	0.851	0.948	1.133
Source: WEMF MACH Basic 00-09/2									
Extensive paid readership	year	n	mean	sd	p5	p25	median	p75	p95
Aggregate county	2002	94	0.715	0.120	0.393	0.695	0.740	0.772	0.852
Aggregate county	2005	94	0.673	0.133	0.311	0.647	0.706	0.756	0.833
Aggregate county	2008	94	0.649	0.109	0.360	0.600	0.667	0.714	0.793
Source: WEMF MACH Basic 00-09/2									
Intensive free readership	year	n	mean	sd	p5	p25	median	p75	p95
Aggregate county	2002	94	0.102	0.117	0.000	0.000	0.041	0.182	0.321
Aggregate county	2005	94	0.171	0.139	0.000	0.000	0.200	0.274	0.387
Aggregate county	2008	94	0.467	0.223	0.000	0.368	0.494	0.618	0.825
Source: WEMF MACH Basic 00-09/2									
Per capita paid sales	year	n	mean	sd	p5	p25	median	p75	p95
Aggregate municipal	2002	2368	0.305	0.122	0.083	0.242	0.303	0.368	0.493
Aggregate municipal	2006	2368	0.303	0.141	0.041	0.243	0.301	0.360	0.505
Aggregate municipal	2008	2368	0.296	0.140	0.034	0.235	0.298	0.355	0.516
Source: WEMF MA Performance 00-09 (Publicitas)									
Municipal demographics	year	n	mean	sd	p5	p25	median	p75	p95
Fraction age 14-29	all	21312	0.221	0.037	0.160	0.199	0.223	0.244	0.274
Fraction age 60+	all	21312	0.237	0.055	0.159	0.200	0.233	0.267	0.336
Fraction at least A-level	all	21312	0.207	0.081	0.104	0.151	0.191	0.249	0.365
Fraction commuter	all	21312	0.558	0.100	0.399	0.496	0.562	0.621	0.718

Source: 2000 Census
Notes: Intensive readership is defined as the average number of newspapers read by one person. Extensive paid readership is defined as the share of people reading at least one paid-for newspaper. All variables used in this table are described in Table B.4.

2.4 Empirical Strategy and Results

We employ two approaches to examine the effect of free commuter newspaper penetration on paid-for newspaper readership and sales. First, we estimate the overall relationship between commuter newspaper penetration and traditional newspaper readership at both the extensive and the intensive margin in a county. Moreover, we examine whether free commuter newspapers bring new readers to the print media.

As we have stated before, different sociodemographic groups might be attracted in different ways by free commuter newspapers. Our second empirical approach therefore asks whether penetration of free dailies reduces paid-for newspaper circulation among its target audience (e.g. young people), while possibly increasing traditional newspaper circulation among non-targeted consumers (e.g. old people). To do this, we estimate the relationship between free newspaper readership and paid-for newspaper readership for each sociodemographic group separately and then compare the coefficients of interest.

2.4.1 Relationship between free and paid-for newspapers

In a first step, we estimate the overall effect of free papers on traditional newspaper sales and readership, respectively. To this end, we estimate the following cross-sectional relationship:

$$\frac{PP_m}{Pop_m} = \beta_0 + \beta_1 \frac{FP_m}{Pop_m} + \beta_2 X_m + \epsilon_m \tag{2.1}$$

where PP_m/Pop_m stands for per capita readership of paid-for papers and FP_m/Pop_m is the per capita free paper readership in the market m. X_m are market characteristics (e.g. fraction of highly educated people). We use two different dependent variables: the average number of newspapers read by one person and the share of people who read at least one newspaper. While the intensive readership (i.e. the average number of newspapers read by one person) specifically controls for multihoming, the extensive readership (i.e. the share of people who read at least one newspaper) does not. To construct the first one we simply aggregate all readers of paid-for newspapers in a market m and divide it by the population in that

market. The only difference from the construction of the latter is that we count the multihomers only once by the aggregation over all paid-for newspapers.[11] In this simple model, β_1 shows the relationship between free newspaper penetration and traditional newspaper circulation and readership, respectively.

Table 2.3 presents the results. The only difference between the first two columns and the last two columns is the dependent variable. The first two columns show the cross-sectional relationship between free and paid-for newspaper readership in a county for 2002 and 2006 if we do not allow for multihoming. The main coefficient of interest is not significant, indicating that free commuter newspapers have no significant impact on traditional daily newspapers. However, these purely cross-sectional estimates are vulnerable to an omitted variable bias: free newspaper penetration might be correlated with some unobservable determinants of traditional newspaper readership, as for example, the impact of other media outlets, the demand for information and many more.

Further, the results indicate that the only control variable which affects the readership in the market is the fraction of highly educated people. The other controls are not significantly different from zero on conventional levels. However, this result should not be overinterpreted, as there is not enough variation in sociodemographic group fractions across counties. To better examine the effect of the sociodemographic group readership, we estimate the alternative equation 2.1 on the municipal level. The results are provided in the Table B.5. In addition to the previous findings, these results show a negative correlation between the readership of paid-for newspapers and the fraction of young people.

In the next regression, we are able to control for market and time fixed effects by using longitudinal data. We estimate

$$\frac{PP_{mt}}{Pop_{mt}} = \beta_0 + \beta_1 \frac{FP_{mt}}{Pop_{mt}} + \phi_t + \mu_m + \epsilon_{mt} \tag{2.2}$$

where μ_m is a market fixed effect and ϕ_t are time dummies. The time dummies control for common factors in all markets, which vary over time. They capture, for example, the effects of subscription prices, prices paid at the newsstand, the

[11] To make this clearer, let us assume that we have only two paid-for newspapers A and B in the market with two people. While newspaper A is read only by the first person, both individuals read newspaper B. In this case, our intensive (extensive) readership would be equal to 3 (2).

Table 2.3: The Effect of Free Newspaper Penetration on Aggregate Paid-for Newspaper Readership by Year

	Extensive paid-for readership		Intensive paid-for readership	
	2002	2006	2002	2006
Intensive free paper	0.033	-0.045	0.158	-0.123
readership	(0.126)	(0.099)	(0.259)	(0.198)
Fraction age	-0.152	0.035	-0.137	0.107
14-29	(0.344)	(0.315)	(0.624)	(0.558)
Fraction age	-0.190	0.262	-0.523	0.567
60+	(0.277)	(0.344)	(0.591)	(0.570)
Fraction high	0.223	0.374*	0.650*	0.775**
education	(0.198)	(0.206)	(0.369)	(0.343)
Fraction HH	-0.204	-0.007	-0.298	-0.219
Income<4000 SFR	(0.213)	(0.179)	(0.406)	(0.434)
Constant	0.831***	0.520***	1.109***	0.677**
	(0.198)	(0.152)	(0.374)	(0.302)
Counties	94	94	94	94

Notes: Standard errors in parentheses. To assure the representativeness only counties with more than 99 respondents are used. All variables used in this table are described in Table B.4.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

business cycle and the effect of outside media on the demand for traditional daily newspapers. Market fixed effects control for time invariant factors in every market. As the examined period is quite short, sociodemographic factors are included in market fixed effects. As a robustness check, we also included sociodemographic variables and a number of other controls in equation 2.2. The results of this regression are reported in Table B.6. [12]

The coefficient β_1 is consistently estimated as long as the entry and penetration of free papers is exogenous. This assumption is hard to justify as there are potentially unobservable market characteristics that influence both paid-for newspaper readership and free newspaper entry. In order to mitigate these endogeneity concerns, we use a special feature of commuter newspapers. As noted before, the transportation system plays an important role for the distribution of free commuter newspapers. This may influence both entry and penetration.

Suppose there are two markets A and B, one with and the other one without free newspapers. We argue that free newspapers may actually affect market structure in both markets, although they are physically distributed in only one of them.

[12]Moreover, as a robustness check we also use a random effects model. We do not report the results of the random effects model here as a robust Hausman test indicates that the random effects model is not appropriate.

This argument is correct as long as there are at least some people who commute from B to A reading free newspapers.[13] In that sense, market entry at least in market B can be seen as exogenous. This holds true as long as the publisher which distributes its free papers in the transportation system of market A does not care where the people are coming from.

As this is a rather strong assumption, we investigate the impact of the free commuter papers using various different empirical strategies which are robust to a variety of endogeneity concerns. In one robustness check, we exclude the counties in which free commuter papers were physically distributed from the estimation. The results of this estimation can be seen in Table B.7 and are similar to those of our main specification.

Nevertheless, there are still endogeneity concerns because demand for both free and traditional newspapers might be influenced by an unobservable demand for information. In this case, our estimates are biased towards zero and it is not possible to consistently estimate the examined effect without valid instruments. Therefore, we need some factors that affect the readership of free dailies without influencing the readership of traditional dailies. The ideal instrument would be the length of all public transport lines and / or the number of public transport stops in cities with free commuter newspapers, since this is definitely orthogonal to demand for paid-for dailies, but influences both the supply and the demand of free commuter newspapers. Unfortunately, we do not have such data. Instead, we construct the following instrument on the market level:

We aggregate all people commuting on public transport to counties with free dailies and divide them by the total number of commuters using public transport. These commuters have easier access to free newspapers than the rest of the population of public transport commuters and are therefore more likely to read this new product. However, the question remains whether this characteristic has an impact on being a reader of paid-for newspapers or not. In other words, is there any difference between public transport commuters commuting to counties with free dailies and those who commute somewhere else with respect to their attitudes to paid-for newspapers? We argue that there is no significant difference between these two groups as long

[13] This example exactly resembles the situation in Switzerland where free commuter newspapers have physically entered only the seven largest markets (counties) but have changed the newspaper consumption of people in more than 130 markets.

Table 2.4: The Effect of Free Newspaper Penetration on Aggregate Paid-for Newspaper Readership

	Intensive paid-for readership		Extensive paid-for readership	
	FE	IV	FE	IV
Intensive free paper readership	-0.089***	-0.164**	0.011	-0.055**
	(0.032)	(0.069)	(0.025)	(0.027)
2000 year dummy	-0.008	-0.003	-0.004	0.000
	(0.011)	(0.012)	(0.006)	(0.006)
2001 year dummy	-0.021*	-0.016	-0.013**	-0.008
	(0.011)	(0.012)	(0.006)	(0.007)
2002 year dummy	0.006	0.012	0.000	0.007
	(0.013)	(0.014)	(0.007)	(0.007)
2003 year dummy	0.021	0.029**	0.009	0.017**
	(0.013)	(0.014)	(0.007)	(0.007)
2004 year dummy	-0.008	0.004	-0.007	0.003
	(0.014)	(0.016)	(0.008)	(0.008)
2005 year dummy	-0.032**	-0.017	-0.042***	-0.030**
	(0.015)	(0.018)	(0.014)	(0.013)
2006 year dummy	-0.064***	-0.042*	-0.043***	-0.024**
	(0.017)	(0.023)	(0.010)	(0.010)
2007 year dummy	-0.090***	-0.061**	-0.064***	-0.039***
	(0.019)	(0.027)	(0.012)	(0.012)
2008 year dummy	-0.103***	-0.066**	-0.069***	-0.038**
	(0.020)	(0.033)	(0.014)	(0.015)
Constant	1.003***		0.713***	
	(0.010)		(0.006)	
Fixed effects	County	County	County	County
Counties	940	930	940	930

Notes: Standard errors in parentheses. Standard errors are clustered on the county level. To assure the representativeness only counties with more than 99 respondents are used. All variables used in this table are described in Table B.4.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

as we condition on market and time fixed effects in our main specification (see Table 2.4) and/or on market and time fixed effects along with sociodemographic characteristics and interest variables in the robustness section (see Table B.6).

Table 2.4 reports the estimates of equation 2.2. The dependent variable in the first two columns is the average number of paid-for newspapers read by one person and the dependent variable in the next two columns is the share of people reading at least one paid-for newspaper. As noted above, the first variable contains information about multihomers. The results suggest that a weak substitution is going on. However, by comparing the first two with the second two columns we can see that not considering multihomers leads to an underestimation of the substitution effect.

So, it seems that people do substitute their second newspaper rather than their first one.

How large is the effect of free newspapers on the consumption of traditional daily newspapers? In 2008, the intensive free paper readership was 0 in the fifth percentile market and 0.8 in the ninety-fifth percentile market. Using our estimates, the difference of 0.8 free paper penetration across counties translates into a difference of 0.131 fewer paid-for newspapers read. The average of paid-for newspaper readership amounts to 0.957. Thus, the difference in free newspaper penetration among the fifth and ninety-fifth percentile markets implies that paid-for newspaper readership is about 13% lower.

Our coefficient can be interpreted in a more direct way. The coefficient of -0.164 means that on average six additional readers of free commuter newspapers would decrease the readership of paid-for newspapers by one. Moreover, by using some computation we can reinterpret these findings in terms of the number of copies. To do this, we construct data about the number of readers per copy by taking readership data and dividing them by circulation data. While a copy of free newspapers is read by 2.44 readers, 3 people share a copy of paid-for newspapers. By incorporating the later number into the substitution ratio computed above we get that 18 additional readers of free newspapers would decrease the number of copies of paid-for dailies by one. If we use now the information about number of readers per copy on free newspaper side, we get the following substitution ratio: 15 additional copies of free newspapers would lead to a reduction of paid-for newspaper copies by two. To check this result, we re-estimate this relationship by using circulation data of paid-for newspapers on the municipal level. The results are provided in Table B.8 and indicate a similar substitution pattern.

So far we have argued that people substitute their second or third newspaper rather than their first newspaper. To test this statement we re-estimate equation 2.2 with the share of singlehomers and share of heavy readers as dependent variable.[14] Heavy readers are defined as readers of six consecutive issues of a particular daily paid-for newspaper. Thus, this variable may serve as a good proxy for subscriptions. The results are reported in Table 2.5. We find in the second column no effect of free newspapers on the number of singlehomers: however, the fourth

[14]Moreover, we directly compare the coefficients of Table 2.4 using stacking of both datasets and testing whether the interaction term is statistically different from zero. The results are provided in Table B.9

column suggests a negative but not statistically significant impact on subscription readers. If we combine these findings with the results of Table 2.4 and our descriptive statistics we arrive at the following conclusion: Free newspaper penetration leads to a small reduction of consumption of the traditional daily press, at least for some people. This effect can be decomposed into the effect on singlehomers and multihomers, where the impact on multihoming usage seems to be more pronounced. Furthermore, there is weak evidence for that number of subscription readers going down.

Table 2.5: The Effect of Free Newspaper Penetration on Singlehomers, Heavy readers and New readers

	Singlehomers		Heavy readers		New readers	
	(1)	(2)	(3)	(4)	(5)	(6)
	FE	IV	FE	IV	FE	FE
Intensive free paper	0.081***	0.033	-0.059*	-0.095	0.234***	
readership	(0.029)	(0.032)	(0.033)	(0.064)	(0.018)	
Free paper entry						0.047***
dummy						(0.009)
2000 year dummy	0.003	0.005	0.062***	0.066***	-0.005	-0.014**
	(0.007)	(0.007)	(0.012)	(0.013)	(0.005)	(0.007)
2001 year dummy	-0.002	0.001	0.061***	0.063***	-0.011*	-0.018**
	(0.007)	(0.007)	(0.012)	(0.012)	(0.006)	(0.007)
2002 year dummy	-0.003	0.004	0.061***	0.065***	0.006	0.005
	(0.007)	(0.007)	(0.014)	(0.014)	(0.006)	(0.007)
2003 year dummy	0.001	0.006	0.063***	0.069***	0.013**	0.011
	(0.009)	(0.009)	(0.014)	(0.015)	(0.006)	(0.007)
2004 year dummy	-0.002	0.005	0.045***	0.053***	0.003	0.007
	(0.008)	(0.009)	(0.015)	(0.015)	(0.007)	(0.007)
2005 year dummy	-0.028*	-0.021	0.038**	0.047***	-0.029**	-0.021
	(0.015)	(0.015)	(0.015)	(0.016)	(0.013)	(0.014)
2006 year dummy	-0.013	0.001	-0.001	0.013	-0.023***	0.001
	(0.010)	(0.012)	(0.017)	(0.021)	(0.008)	(0.008)
2007 year dummy	-0.028**	-0.010	-0.030	-0.015	-0.039***	0.005**
	(0.012)	(0.014)	(0.019)	(0.024)	(0.009)	(0.008)
2008 year dummy	-0.022	-0.000	-0.044**	-0.023	-0.045***	0.021
	(0.015)	(0.017)	(0.021)	(0.030)	(0.011)	(0.009)
Constant	0.424***		0.848***		0.713***	0.713***
	(0.005)		(0.011)		(0.005)	(0.005)
Fixed effects	County	County	County	County	County	County
Counties	940	930	940	930	940	940

Notes: Standard errors in parentheses. Standard errors are clustered on the county level. To assure the representativeness only counties with more than 99 respondents are used. All variables used in this table are described in Table B.4.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Can we therefore conclude that the free commuter press does not constitute any threat to the traditional print press? To answer this question, we have to consider the two-sidedness of the newspaper market. Our results imply that there is no

large effect on the extensive margin. However, we do not have a good idea for what happens on the intensive margin, in terms of how much time people spend reading the traditional press. It may be the case that people have just a fixed time period for media consumption and therefore reading a free newspaper might reduce the time spent with the paid-for press. This in turn may weaken the bargaining position of the publisher in the negotiating process with advertisers. Consequently, the competition on this side of the market may be very hard. Examining the advertiser's side of the market can help us fully understand the competition between the paid-for and free daily press. Unfortunately, we do not have the necessary data and therefore have to leave this question for future research.

Do free newspapers create new readers for the print media? In other words, does this new product lead to an expansion of the market? The answer to this question is positive and can be found in the fifth column of Table 2.5. In this column we regress the union of paid-for and free newspaper readers on the free newspaper readers. Econometrically, this regression has the problem that the dependent variable is a function of the independent variable. Therefore, there may be a mechanical relationship between our dependent and independent variables. However, if the free newspaper penetration does not lead to market expansion, we should not see any positive coefficient. Moreover, to support this argument, we reestimate this relationship with a dummy variable for the occurrence of free newspapers in the market. The coefficient remains positive and highly significant (see the sixth column of Table 2.5). Finally, simple descriptive statistics (see Figure B.7) also support this statement.

2.4.2 Impact on high and low quality paid-for newspapers

Moreover, as noted above, there are some concerns that free papers crowd out high-quality papers and thereby the aggregate quality of articles will decrease (Ahrens (1999); Haas (2005); Price (2003)). To examine this, we first divide the traditional newspapers into two groups: high-quality papers and low-quality papers. We define a high-quality paper as a newspaper which is supra-regional (i.e. distributed in many cantons) and is supposed to have more in-depth content.[15] Such a division

[15]Newspapers NZZ, Tages Anzeiger, Le Temps and LaRegione Ticino belong to the high-quality papers. From the low-quality newspapers, we exclude Blick and 24Heures as these are supra-regional boulevard newspapers. We specifically look at this group in the robustness section (see Table B.10.

was created by communication scientists around Heinz Bonfadelli at the University of Zurich. We are aware that such a classification is always subjective and never precise. Therefore, we use regular prices as well as subscription prices as an additional measure for quality. We compute the means of subscription as well as regular prices over the examined period and rank the publications in descending order according to these measures. If a newspaper is then among the top ten newspapers according to both measures we consider it as high-quality newspaper.

Table 2.6: The Effect of Free Newspaper Penetration on High and Low Quality Newspaper

	Quality: region based				Quality: price based			
	high		low		high		low	
	FE	IV	FE	IV	FE	IV	FE	IV
Intensive free	0.011	-0.010	-0.056**	-0.090*	0.003	-0.022	-0.092***	-0.153**
paper readership	(0.011)	(0.019)	(0.024)	(0.054)	(0.009)	(0.023)	(0.029)	(0.064)
2000 year	-0.010**	-0.009**	0.001	0.003	0.003	0.005	-0.013	-0.009
dummy	(0.004)	(0.004)	(0.010)	(0.011)	(0.007)	(0.007)	(0.010)	(0.011)
2001 year	-0.016***	-0.015***	-0.011	-0.008	-0.013*	-0.012	-0.009	-0.005
dummy	(0.004)	(0.004)	(0.010)	(0.011)	(0.007)	(0.008)	(0.010)	(0.011)
2002 year	-0.011***	-0.010**	0.009	0.012	0.008	0.010	-0.002	0.002
dummy	(0.004)	(0.004)	(0.011)	(0.012)	(0.007)	(0.008)	(0.011)	(0.012)
2003 year	-0.008**	-0.007	0.014	0.019	0.011	0.014*	0.009	0.016
dummy	(0.004)	(0.004)	(0.011)	(0.012)	(0.007)	(0.008)	(0.011)	(0.013)
2004 year	-0.011**	-0.008*	-0.010	-0.004	0.005	0.009	-0.013	-0.003
dummy	(0.005)	(0.005)	(0.011)	(0.013)	(0.007)	(0.008)	(0.013)	(0.015)
2005 year	-0.022***	-0.018***	-0.027**	-0.019	-0.003	0.001	-0.032**	-0.020
dummy	(0.005)	(0.006)	(0.013)	(0.015)	(0.008)	(0.009)	(0.013)	(0.016)
2006 year	-0.025***	-0.020***	-0.048***	-0.037*	-0.002	0.004	-0.065***	-0.046**
dummy	(0.006)	(0.007)	(0.015)	(0.020)	(0.007)	(0.010)	(0.017)	(0.022)
2007 year	-0.038***	-0.030***	-0.055***	-0.041*	-0.011	-0.002	-0.081***	-0.058**
dummy	(0.007)	(0.009)	(0.015)	(0.022)	(0.007)	(0.011)	(0.018)	(0.026)
2008 year	-0.038***	-0.028***	-0.062***	-0.044	-0.013*	-0.001	-0.092***	-0.063**
dummy	(0.008)	(0.010)	(0.016)	(0.028)	(0.008)	(0.013)	(0.020)	(0.031)
Constant	0.175***		0.644***		0.246***		0.766***	
	(0.003)		(0.009)		(0.006)		(0.009)	
Fixed effects	County	County	County	County	County	County	County	County
Counties	940	930	940	930	940	930	940	930

Notes: Standard errors in parentheses. Standard errors are clustered on the county level. To assure the representativeness only counties with more than 99 respondents are used. All variables used in this table are described in Table B.4.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

We re-estimate equation 2.2 for these two groups and Table 2.6 reports the results of this estimation. Free newspaper penetration has no significant effect on high-quality papers and a strong negative effect on local tabloids. These findings are in line with predictions of theoretical models on vertical differentiation (e.g. Gabszewicz and Thisse (1980)). We can observe this effect whether or not we use a region-based or price-based quality measure. The difference in point estimates between these two measures is caused by the fact that the low-quality group based on price includes two national boulevard newspapers, Blick and 24Heures, while the region-based group not. Thus, the overall effect is largely driven by the reduction of readership of local low-quality tabloids. The results suggest that while the number of readers of high-quality newspapers does not change, many readers

of local tabloids switch to the new product. Moreover, results in Table B.10 indicate that the national yellow press also loses its readers due to free newspaper penetration.

2.4.3 The change in audience of paid-for daily newspapers

The previous results indicate that the free newspapers take some readers away from paid-for dailies. However, it is possible that free penetration reduces paid-for readership among its target audience (e.g. young readers, ...), while increasing paid-for readership among non-targeted consumers. As noted in George and Waldfogel (2006) and George (2008), we can identify the effect of free paper expansion from the changing gap between the tendency for targeted and non-targeted readers to purchase traditional daily press. This strategy is valid under the condition that the endogenous change in paid press correlated with free papers growth is the same for both groups. Unlike George and Waldfogel (2006) and George (2008), we are able to estimate the impact on the gap in readership between different groups in a direct way due to the available information about group-specific readership. Thus, we estimate the following two equations:

$$\frac{PP^1_{mt}}{Pop^1_{mt}} = \beta^1_0 + \beta^1_1 \frac{FP_{mt}}{Pop_{mt}} + \phi^1_t + \mu^1_m + \epsilon^1_{mt} \tag{2.3}$$

$$\frac{PP^2_{mt}}{Pop^2_{mt}} = \beta^2_0 + \beta^2_1 \frac{FP_{mt}}{Pop_{mt}} + \phi^2_t + \mu^2_m + \epsilon^2_{mt} \tag{2.4}$$

where the dependent variables are per-capita paid-for newspaper readership in the market m among target (i.e. group 1) and non-target (i.e. group 2) readers at time t, respectively. The constants show baseline traditional newspaper coverage for each group and the coefficients β^1_1 and β^2_1 reflect the effect of free paper penetration on traditional paper readership by group. Direct comparison of these coefficients reveals differences in the examined effect.

Table 2.7 presents estimates of equations for the eight categories of readers. The top row of the table identifies the examined group. The coefficients of our interest are in line with what we expected. The paid-for newspaper readership is decreasing more slowly in groups with lower free paper penetration relative to groups with

higher free newspaper penetration.

Table 2.7: The Effect of Free Paper Penetration on Audience of Paid-for Newspaper

	young	old	highly educ	less educ	high inc	less inc	commuters	no commuters
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	FE	FE	FE	FE	FE	FE	FE	FE
Intensive free	-0.137**	0.057	0.031	-0.095*	-0.015	-0.039	-0.106**	-0.050
paper readership	(0.062)	(0.075)	(0.053)	(0.053)	(0.048)	(0.039)	(0.043)	(0.059)
2000 year	-0.036*	-0.024	0.023	-0.022	0.007	-0.025*	-0.000	0.006
dummy	(0.021)	(0.032)	(0.033)	(0.020)	(0.025)	(0.014)	(0.018)	(0.020)
2001 year	-0.048**	0.016	-0.074**	-0.013	-0.044*	-0.013	-0.040**	-0.018
dummy	(0.020)	(0.036)	(0.036)	(0.022)	(0.025)	(0.015)	(0.019)	(0.022)
2002 year	0.014	0.041	0.024	-0.003	0.005	-0.015	0.014	0.029
dummy	(0.024)	(0.035)	(0.030)	(0.023)	(0.026)	(0.018)	(0.019)	(0.025)
2003 year	-0.011	0.030	0.037	0.008	0.022	0.023	0.012	0.037
dummy	(0.027)	(0.036)	(0.034)	(0.022)	(0.025)	(0.016)	(0.019)	(0.025)
2004 year	-0.042	0.040	0.002	-0.034	0.017	-0.026	-0.023	-0.011
dummy	(0.026)	(0.036)	(0.036)	(0.024)	(0.025)	(0.017)	(0.020)	(0.020)
2005 year	-0.057**	0.029	-0.021	-0.038	-0.045**	-0.031*	-0.049**	-0.021
dummy	(0.026)	(0.035)	(0.034)	(0.026)	(0.021)	(0.018)	(0.019)	(0.024)
2006 year	-0.137***	0.001	-0.083**	-0.052*	-0.094***	-0.072***	-0.095***	-0.054**
dummy	(0.031)	(0.036)	(0.038)	(0.030)	(0.026)	(0.021)	(0.024)	(0.026)
2007 year	-0.168***	-0.034	-0.087**	-0.087**	-0.110***	-0.102***	-0.117***	-0.108***
dummy	(0.032)	(0.044)	(0.038)	(0.035)	(0.029)	(0.023)	(0.025)	(0.029)
2008 year	-0.168***	-0.016	-0.104**	-0.080**	-0.132***	-0.111***	-0.135***	-0.122***
dummy	(0.035)	(0.053)	(0.039)	(0.038)	(0.030)	(0.024)	(0.029)	(0.030)
Constant	0.890***	0.793***	0.854***	0.826***	1.094***	0.898***	1.035***	0.957***
	(0.018)	(0.025)	(0.025)	(0.017)	(0.018)	(0.012)	(0.014)	(0.016)
Fixed effects	County	County	County	County	County	County	County	County
Counties	940	940	940	940	940	940	940	940

Notes: Standard errors in parentheses. Standard errors are clustered on the county level. Note that commuters in this table are defined as people living and working in different counties. This may be a reason why we don't see any significant difference between commuters and no commuters. To assure the representativeness only counties with more than 99 respondents are used. All variables used in this table are described in Table B.4.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

To examine whether these point estimates are significantly different from each other, we follow two different approaches. First, we use seemingly unrelated estimation. This allows us to use the Chow test to directly compare coefficients. The appropriate test statistics can be found in Table 2.8. Second, we can stack the specific group datasets and construct interaction terms (group x free paper penetration). The coefficient of this interaction term is the coefficient of interest. We report these results in the appendix section in Table B.11.

Table 2.8: Comparison of Group-specific Effects

	young vs. old	highly vs. less educated	higher vs. lower HH income	commuters vs. no commuters
χ^2	3.83	4.45	0.27	0.66
p-Value	0.0502	0.0348	0.6053	0.4149

Notes: H_0: Group-specific coefficients are statistically not different.

We can see that the coefficient estimates for groups more likely to read free commuter newspapers (young, less educated and commuters) are virtually all negative, suggesting that increases in free paper penetration in a market reduce newspaper

readership among these groups relative to the general population. Similarly, the coefficient estimates for the groups less likely to substitute to free newspapers (highly educated or old) tend to be slightly positive but not significant, suggesting that increase in the penetration of commuter papers in a market has no impact on newspaper coverage among these groups. Moreover, as Table 2.8 suggests, there is a significant difference between the young and old and the highly educated and less educated group, respectively. This finding implies that the quality of the traditional papers is likely not to decline. If the quality decreased, we would probably observe a reduction of the highly educated readership and old readership.[16] Furthermore, there is no impact on the readership gap between the high income and low income group, indicating other reasons for substitution besides prices. To sum up, the substitution pattern observed in the first part of this section is largely driven by young and less educated people. In the last step we examine whether

Table 2.9: The Effect of Free Newspaper Penetration on New Readership by Group

	young	old	highly educ	less educ	high inc	less inc	commuters	no commuters
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	FE	FE	FE	FE	FE	FE	FE	FE
intensive free	0.408***	0.181***	0.158***	0.281***	0.231***	0.252***	0.248***	0.207***
paper readership	(0.028)	(0.051)	(0.035)	(0.026)	(0.024)	(0.018)	(0.020)	(0.022)
2000 year	-0.007	-0.005	0.018	-0.001	-0.010	-0.020***	0.004	-0.007
dummy	(0.010)	(0.020)	(0.019)	(0.011)	(0.012)	(0.007)	(0.009)	(0.012)
2001 year	-0.023**	0.005	-0.032	-0.008	-0.026**	-0.019**	-0.019**	-0.012
dummy	(0.010)	(0.020)	(0.020)	(0.012)	(0.010)	(0.008)	(0.009)	(0.013)
2002 year	0.013	0.001	0.018	-0.004	-0.005	-0.009	0.007	-0.010
dummy	(0.011)	(0.023)	(0.021)	(0.013)	(0.012)	(0.009)	(0.009)	(0.011)
2003 year	-0.003	0.028	0.014	0.001	-0.004	0.006	0.009	0.005
dummy	(0.013)	(0.021)	(0.020)	(0.012)	(0.011)	(0.009)	(0.010)	(0.011)
2004 year	-0.003	0.026	-0.011	-0.012	-0.007	-0.017*	-0.004	-0.006
dummy	(0.012)	(0.024)	(0.018)	(0.013)	(0.011)	(0.009)	(0.010)	(0.010)
2005 year	-0.026*	-0.031	-0.037*	-0.023	-0.044***	-0.043***	-0.029**	-0.011
dummy	(0.015)	(0.030)	(0.022)	(0.018)	(0.014)	(0.014)	(0.013)	(0.015)
2006 year	-0.041***	-0.010	-0.030	-0.027*	-0.044***	-0.038***	-0.024*	-0.035**
dummy	(0.013)	(0.026)	(0.022)	(0.015)	(0.012)	(0.010)	(0.012)	(0.014)
2007 year	-0.065***	-0.008	-0.046**	-0.037**	-0.065***	-0.048***	-0.041***	-0.046***
dummy	(0.015)	(0.032)	(0.023)	(0.017)	(0.015)	(0.011)	(0.013)	(0.013)
2008 year	-0.081***	-0.030	-0.031	-0.038**	-0.069***	-0.064***	-0.043***	-0.042***
dummy	(0.018)	(0.037)	(0.022)	(0.017)	(0.017)	(0.013)	(0.015)	(0.016)
Constant	0.660***	0.734***	0.752***	0.643***	0.776***	0.682***	0.731***	0.714***
	(0.008)	(0.015)	(0.013)	(0.008)	(0.008)	(0.006)	(0.007)	(0.008)
Fixed effects	County	County	County	County	County	County	County	County
Counties	940	940	940	940	940	940	940	940

Notes: Standard errors in parentheses. Standard errors are clustered on the county level. Note that commuters in this table are defined as people living and working in different counties. To assure the representativeness only counties with more than 99 respondents are used. All variables used in this table are described in Table B.4.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

the market expansion effect found in Section 2.4.1 differs across sociodemographic groups. To this end, we regress the union of paid-for and free readership on the

[16]This speculation is in line with communication science literature (Haas (2005)) that goes even further, arguing that traditional newspapers differentiate more from the commuter newspapers by increasing their quality.

intensive free paper readership. The results are provided in Table 2.9. The results indicate that free commuter newspapers are successful in bringing new readers to the daily print press across all groups. If we compare coefficients (see Table 2.10) we find that free commuter newspapers are able to create new readers along the whole population, although the impact on the young, less educated and commuter groups is more pronounced. We find again no significant difference between both income groups.

Table 2.10: Comparison of Group-specific Effects on New Readership

	young vs. old	highly vs. less educated	higher vs. lower HH income	commuters vs. no commuters
χ^2	16.14	10.56	0.70	3.02
p-Value	0.0001	0.0012	0.4021	0.0822

Notes: H_0: Group-specific coefficients are statistically not different.

2.5 Conclusion

This chapter investigates the impact of penetration of free commuter newspapers on the readership and circulation of the paid-for daily press using panel data techniques and instrumental variable. We find that free daily newspapers are weak substitutes for the traditional daily press, although one has to differentiate among the quality of paid-for newspapers. In particular, commuter newspapers take readership away from low quality newspapers, such as local and national tabloids. The demand for high quality newspapers does not seem to be affected. Moreover, our results suggest that this pattern is amplified through the behavior of multihomers. Further, it is shown that free commuter newspapers differentially draw younger and less educated individuals away from daily newspapers. As a result, the audience for traditional newspapers has changed. Older individuals and individuals with higher education form an even a larger fraction of the traditional newspaper market. Finally, we find that free newspaper penetration creates new readers of daily print press. This effect is more pronounced among young and less educated readers.

We cannot conclusively tell if total welfare increased due to the introduction of free papers as we are unable to quantify the external benefits and costs. Privately - by revealed preferences - readers who are switching to the free newspapers

increase their surplus. The effect on consumers who do not switch depends on the competitive reaction of the traditional paid-for newspapers: For example, a repositioning of the paid-for newspaper's content might benefit or harm existing readers. The results here suggest that not much repositioning was done in terms of quality, however we cannot provide accurate evidence due to a lack of data. To properly examine the repositioning issue, data about newspapers' contents would be needed. One could then use simple regression models to look at content changes as a response to free paper penetration.

This chapter does not examine the external effect on the advertising markets, which should be considered to fully examine the welfare implications of free newspaper penetration. Free papers might intensify the competition in the advertising market and thus drive down prices paid-for newspaper can demand for their advertising space. In addition, it is possible that the time spent by reading traditional daily newspapers decreases with the entry of free newspapers. As this variable is important for the willingness-to-pay considerations of advertisers this might further weaken the demand for the advertisements in paid-for papers. Further research is necessary to consider this external effect of the introduction of free newspapers.

Another interesting aspect of this chapter is that a larger fraction of the population is informed. This is particularly important from a political point of view as more information might increase the participation in the elections and therefore lead to a more representative political landscape and a more participatory democracy. However, to quantify the effect of free newspaper on election participation and its outcome is beyond the scope of this chapter, so we leave this questions for further research.

Chapter 3

Efficiency and the Ownership of Czech Firms

3.1 Introduction

The economic reforms of the 1990s in Central and Eastern Europe (CEE) were aimed at creating competitive market economies and more efficient enterprises by firm restructuring, privatization, and supporting institutional reforms (Aussenegg and Jelic, 2007). The privatization of state-owned enterprises (SOEs) in the former command economies in the CEE region has been at the center of a debate among economists and policy makers since the late 1980s. The SOEs were originally established to ensure a better provision of public goods as well as political control of production in centrally planned economies. However, they were unable to keep up with technical and innovative progress. For this reason both economists and policy makers expected SOEs' efficiency to increase after privatization under new owners and management, but institutional, legal, and accounting deficiencies hampered performance in many privatized firms (Jandik and Rennie (2008)). Moreover, an efficiency increase was expected as a result of hardening of budget constraints (Frydman et al., 2000). Finally, newly established firms were expected to exhibit high performance as they were established by new owners with a focus on core competence and profits. In this respect, it became evident that the ownership type is a key determinant of corporate performance and, therefore, received particular attention in the design of the reform process (Estrin et al., 2009).

However to date, there has been a lack of reliable empirical evidence on medium-term firm efficiency and the determinants of efficiency in post-transition economies in the CEE region (Hanousek et al., 2007a). We fill this gap in the literature by analyzing the efficiency of Czech firms (privatized former SOEs and newly established firms) and how this efficiency is determined by ownership structures. We employ a stochastic production frontier model and use unique firm-level panel data of more than 190,000 firm/years for the period 1998-2007.

Our results are in line with theoretical predictions that companies with a majority or controlling owner are more efficient than firms with dispersed ownership (Hill and Snell, 1989; Blomström et al., 2001). In addition, foreign ownership is positively related to firm efficiency in our data. The effects appear to be larger in the high technology sector and in the low-technology sector than in the medium-technology sector. Furthermore, using our method, we are able to trace the effect over time. We find that the effect of ownership increases over time and the performance of all owners converges at the end of our sample.

This chapter is related to two strands of literature. First, we contribute to the literature examining the effects of ownership structure on firm performance in transition countries (see Boycko et al., 1996 for a theoretical treatment and Djankov and Murell, 2002; Morck et al., 2005; and Estrin et al., 2009 for empirical surveys). The current literature almost uniformly suggests that privatization to foreign owners greatly increases efficiency. The effect of domestic ownership is largely also positive but not as much as the effect of foreign ownership. This is the case only for Central European economies. In CIS (Commonwealth of Independent States) countries the effect of domestic ownership is insignificant or slightly negative (Brown et al., 2006; Estrin et al., 2009). In addition, these efficiency differences between domestic- and foreign-owned firms do not seem to diminish over time (see e.g., Blomström, 1988; Haddad and Harrison, 1993; Aitken and Harrison, 1999; and Arnold and Javorcik, 2009).[1]

Furthermore, several studies examine the concentration of ownership and find that it plays an important role, with majority private ownership having mostly positive effects on productivity (Pivovarsky, 2003). The overall positive effect is again

[1]Some of these studies do not control for possible selection effects when foreign owners purchase only the most productive firms. However, even after controlling for such effects, the difference between domestic- and foreign-owned firms remains large and persistent (Estrin et al., 2009).

driven primarily by foreign-owned firms. Finally, some studies suggest that de novo firms are more productive than or at least as productive as SOEs privatized to domestic owners (Sabrianova et al., 2005). In contrast to the above review, the literature on firm efficiency in CEE countries is rather limited. Little is known about the technical efficiency of firms that underwent restructuring during the transformation process toward a market economy.

Second, this chapter is related to the literature estimating technical efficiency. We employ the stochastic production possibility frontier approach introduced by Aigner et al. (1977) and Meeusen and van den Broeck (1977), and further adapted for panel data and time-varying technical efficiency by Khumbhakar (1990) and Battese and Coelli (1995). Although this methodology is well established in the empirical literature, there is still a lack of reliable empirical evidence on firm technical efficiency in post-transition economies.

A few authors analyze this agenda for the pre-transition years, finding that there is substantial variation between highly efficient firms and firms that can still achieve considerable efficiency gains. For instance, Brada and King (1994) analyze the efficiency of firms in Poland. Brada et al. (1997) estimate the efficiency of Czechoslovak and Hungarian firms in the early 1990s using frontier production functions. They compute the average efficiency level for different sectors and find that this level varies between 40-80%.[2] Furthermore, the authors test whether firm characteristics affect technical efficiency. As a result firm size and profitability is found to be positively related to efficiency, whereas ownership has no significant effect. Methodologically, Brada et al. (1997) stress that technical efficiency can be measured independently of firms' profit (or output) maximization objectives and measures of technical efficiency facilitate comparison across economic systems. Therefore, measuring allocative efficiency, which is based on selecting the mix of inputs that generates the least-cost production, remains problematic given the periods of macroeconomic instability prevalent in most of the post-transformation economies.[3]

Funke and Rahn (2002) examine the efficiency gap between East and West German

[2]Indeed, most of the authors using the stochastic production possibility frontier approach compute average efficiencies across sectors. This approach was mainly used in agricultural economics (see Coelli, 1995 for a survey).

[3]Cullmann and Von Hirschhausen (2008) estimate both technical and allocative efficiency for 32 Polish electricity distribution companies between 1997 and 2002. They find that technical efficiency increased while allocative efficiency decreased during the transition period.

firms using firm-level data over the period 1994-1998. Their estimates indicate that this gap decreased over the examined period. Nevertheless, East German firms were still significantly less efficient than their counterparts in West Germany. Further, Konings and Repkin (1998) estimated the efficiency of firms in Bulgaria (1993-1995) and Romania (1994-1995) using firm-level data. They used firm size (market share) and profitability (profit margin) to explain firm efficiency in the two countries. The technical efficiency of firms was found to vary significantly both within and across industrial sectors in each country. The findings also suggest that in the course of transition, firm behavior becomes more diverse, which results in an increase in the variation of firms' efficiency levels within industrial branches. The results also support the hypothesis of Ickes and Ryterman (1993) that in a Soviet-type economy dominated by large heavy-industrial enterprises, efficiency levels would be high due to increased control and the assignment of better managers.

Studies targeting the early stage of the transformation frequently use small and often unrepresentative samples of firms, often combine data from different accounting systems, and only have access to limited data on firm ownership. As a result, they often treat ownership as a relatively simple categorical concept (e.g., private versus state or state versus foreign, domestic private outsider versus domestic private insider), and they are often unable to distinguish the exact extent of ownership by individual owners or even relatively homogeneous groups of owners. These shortcomings prevent many studies from providing accurate evidence on the effects of various ownership categories on technical efficiency.

In this chapter we advance the literature by systematically addressing issues related to the efficiency effects of ownership and by eliminating the earlier shortcomings. First, we use panel data on a large sample of medium-sized and large firms in the Czech Republic that were privatized as well as those established as new firms; they constitute the bulk of the country's economy.[4] Second, we have access to a more

[4]A massive privatization program was administered in the Czech Republic in the first half of the 1990s under three different schemes: restitution, small-scale privatization, and large-scale privatization. The first two schemes began in 1990 and were important during the early years of the transition. Large-scale privatization, by far the most important scheme, began in 1991, was completed in early 1995, and allowed for various privatization techniques (auctions, tenders, direct sales). Most large-size and many medium-size firms were transformed into joint-stock companies and their shares were distributed through voucher privatization (almost one-half of the total number of all of the shares of all joint stock companies were privatized in the voucher scheme), sold in public auctions or to strategic partners, or transferred to municipalities. The voucher scheme was part of the large-scale privatization process. Two waves of voucher privatization took place, in 1992-93 and 1993-94. Both waves were administered in the same manner and there were no differences in their set-up.

detailed measure of ownership than any prior study and so we are able to develop a more systematic analytical framework for evaluating the efficiency effect of domestic versus foreign ownership, as well as the effect of various degrees of ownership concentration. Third, we cover a period when accounting rules conforming to the international standard (IAP) were already in place. This prevents measurement errors since we - just as the majority of studies examining productivity - make use of balance sheet data which is sensitive to a change in the accounting rules.

The chapter is structured as follows. In Section 3.2 we present our methodological approach. The data is described in Section 3.3. Section 3.4 presents our empirical results and section 3.5 concludes.

3.2 Modeling Strategy

3.2.1 Theoretical background

In our analysis we employ the stochastic production possibility frontier approach introduced by Aigner et al. (1977) and Meeusen and van den Broeck (1977) and further adapted for panel data by Khumbhakar (1990) and Battese and Coelli (1995). The method measures technical efficiency under single-output production. More importantly, the methodology helps us to explain firm-level differences in efficiency as a function of the number of explanatory variables. As pointed out in Sinani et al. (2007) , efficiency is a very useful concept to utilize, especially in the context of a transition economy.

The estimation strategy consists of two parts. First, we define a production function of firm i in time t, which gives us the technological link between inputs (x) and the resulting output (y) under the assumption that production is conducted in an efficient manner:

$$y_{it} = f(x_{it}; \beta)$$

Due to some degree of inefficiency, a particular firm potentially produces less than this theoretical maximum. Moreover, the firm's output is also subject to various random shocks that encompass anything from bad weather to unexpected good

luck. Thus, the production function is further expanded to

$$y_{it} = f(x_{it}; \beta) \cdot TE_{it} \cdot exp(v_{it}), \tag{3.1}$$

where v_{it} denotes a random shock, which is i.i.d. and drawn from a $N(0, \sigma_v^2)$ distribution. The firm's technical efficiency TE_{it} represents the ratio of observed output to maximum feasible output and lies within the interval of zero and one (i.e. zero and one hundred percent). If $TE_{it} = 1$ then the firm employs all inputs efficiently and achieves an optimal output. If TE_{it} is smaller than one then the firm experiences some degree of inefficiency in its production. As the inefficiency of a particular firm is not ex-ante observable, we treat efficiency as a stochastic variable with a distribution common to all firms. So, the technical efficiency can be written as $TE_{it} = exp(-u_{it})$, where u_{it} is non-negative. Moreover, u_{it} is i.i.d.-distributed according to a truncated-normal distribution that is truncated at zero with mean μ_{it} and variance $\sigma_u^2 (u_{it} \sim N^+(\mu_{it}, \sigma_u^2))$. After inserting this expression into equation 3.1 and after taking the natural log of both sides we obtain

$$\ln y_{it} = \ln f(x_{it}; \beta) + v_{it} - u_{it} \tag{3.2}$$

However, technical efficiency scores obtained from the estimation of the equation above are of little use for policy implications if we do not examine the sources of inefficiency. Therefore, the second part of our strategy considers potential determinants of efficiency on firm level. The relationship between firm inefficiency and its determinants is given by:

$$u_{it} = z_{it}\delta + w_{it}, \tag{3.3}$$

where z_{it} is a vector of variables expected to affect firm level efficiency, δ is a vector of unknown parameters to be estimated, and w_{it} is an unobservable random shock, drawn from a truncated normal distribution with mean zero and unknown variance σ_u^2.

There exist at least two approaches to estimate equation (3.2) and equation (3.3). The first approach is a two-stage procedure which is based on a successive estimation of both equations. However, as noted by Battese and Coelli (1995), there is a

serious problem with this approach. In the first stage the inefficiencies are assumed to be i.i.d., while in the second stage they are assumed to be a function of different factors. Thus, the assumption in the second stage contradicts the assumption in the first stage. The second approach directly deals with this problem estimating the equations 3.2 and 3.3 simultaneously using maximum likelihood. We apply this approach in this chapter.

3.2.2 Empirical approach - Efficiency estimation

In order to parameterize the first part of our model, we employ a Cobb-Douglas production technology. The Cobb-Douglas production function is a convenient and frequently used tool in the literature (e.g. Brada et al., 1997; Brown et al., 2006 and Hájková and Hurník, 2007; Brown et al., 2006).

Moreover, the Cobb-Douglas technology assumes that the returns to scale are fixed, and that the elasticity of substitution is equal to one. These assumptions may be too restrictive if we examine the production functions of firms from different sectors. Indeed, there is evidence that industries within a one-digit NACE division differ with respect to capital intensity, labor intensity, or technology intensity (Laafia, 2002; Bjørnskov et al., 2009). Therefore, we interact the parameters of the Cobb-Douglas production function with indicators for the two-digit NACE industries. As a result, in the specification below we consider different parameters of the Cobb-Douglas function for each two-digit NACE sector and so account for unobserved industry heterogeneity.

Estimating a separate set of coefficients for every industry in equation 3.4 has an additional advantage since it accounts for industry specific ownership structures (see e.g., Demsetz, 1983 and Demsetz and Lehn, 1985 for theoretical evidence and Thomsen and Pedersen, 1998 for empirical evidence). Therefore, the specific effects of various sectors do not interfere with the ownership effects determined by equation 3.5. Formally, our model of the efficiency frontier of I firms ($i = 1, \ldots, I$) in J two-digit NACE sectors ($j = 1, \ldots, J$) over T time periods ($t = 1, \ldots, t$) is specified as follows:

$$\ln y_{it} = \beta_{0j} + \beta_{1j} \ln c_{it} + \beta_{2j} \ln l_{it} + \epsilon_i + \phi_t + v_{it} - u_{it} \tag{3.4}$$

In equation 3.4, $\ln y_{it}$ is the natural log of the value of the production of firm i at time t, measured as firm sales. $\ln c_{it}$ is the natural log of the capital of each firm measured as working capital, and $\ln l_{it}$ is the natural log of the firm's labor measured by the number of employees.[5] We also include firm (ϵ_i) and year (ϕ_t) fixed-effects to account for firm specific heterogeneity as well as for time-specific effects (country-wide economic development and business cycle). Finally, v_{it} and u_{it} are defined as in the previous subsection.

Some scholars have noted that the estimation of equation 3.4 is not robust towards endogeneity concerns since the transmitted firm-specific productivity shock might be correlated with the input factors (Marschak and Andrews, 1944). Levinsohn and Petrin (2003) (hereafter LP) and Olley and Pakes (1996) (hereafter OP) propose a solution for this problem by using materials and investment as proxies for unobserved productivity to separate the effect of observed technology on input allocation. The main insight of these models is that the labor demand or investment is an invertible function of unobserved productivity and thus can be used to substitute productivity.

However, the proposed solutions have also weaknesses, e.g., the nonparametric approximations. Van Biesebroeck (2008) argue that a major problem of these approaches is "that the inverted functions are complicated mappings from states to actions, which must hold for all firms regardless of their size or competitive position." (see Van Biesebroeck (2008), p. 316). Moreover, Van Biesebroeck (2008) compares five different productivity measures and comes to the conclusion that the choice of method is of less importance if the main interest is in the residual. Finally, the LP and OP approaches are more data intensive as they require data on the material cost and investment, respectively. Thus, the use of these semi-parametric approaches would extremely reduce our dataset and lessen the advantage we have through the information on firm's ownership structure.

The stochastic frontier approach allows efficiency to be influenced by factors outside

[5]In order to show that our results are robust to the use of different input proxies we estimate the Cobb-Douglas function with fixed assets, and total capital as proxies for capital and staff costs as a proxy for labor. Note that staff costs and number of employees are close measures of labor intensity since within a given industrial sector we can expect a relatively stable wage distribution as shown by Krueger and Summers (1988) as well as Crinò (2005) specifically for Poland, Hungary, and the Czech Republic. Additional definitions and relationships between financial variables used can be found at: `http://amadeus.bvdep.com/amadeus/help/HelpAmadeus/AFAccRat.htm`. Our results were not substantially different. All alternative results are readily available upon request.

the firm's control. We can distinguish random shocks that affect the production frontier (machinery breakdown, new policies affecting access to or utilization of inputs, etc.) from factors over which the firm has some control (workforce size, skill and effort, capital utilization, etc). The specification itself is estimated as a panel with fixed effects to alleviate the potential problem of unobserved (fixed) firm heterogeneity, including the endogeneity of firm ownership with respect to efficiency.

3.2.3 Empirical approach - Determinants of efficiency

The ownership structure of companies has been identified in numerous studies as a key determinant of firm performance (see Estrin et al., 2009 for a general overview and Hanousek et al., 2007a, 2009 for specific results related to Czech firms). Therefore, we are particularly interested in how firm efficiency u_{it} is determined by its ownership structure. Specifically, we aim to answer the questions, formulated as hypotheses, that appear below.

The literature examining the agency problem arising from the separation of ownership and control often argues that managers might pursue other goals than the owners would like. Because of this, a concentrated ownership structure might lead to higher firm efficiency since it results in the superior monitoring of managers (Hill and Snell, 1989; Shleifer and Vishny, 1997). Therefore, we expect that there will be a positive relationship between ownership concentration and efficiency. We are able to identify all owners with ownership stakes of at least 10 percent; sometimes, but definitely not as a rule, we are able to identify dispersed ownership of less than 10%. Therefore, we are able to test whether the baseline relationship between ownership concentration and efficiency holds and formulate the following baseline hypothesis:

Hypothesis 1 *A majority owner reduces a firm's inefficiency.*

The findings of the agency theory indicate that control is a very good mechanism to make sure that managers work in the interest of the owners. So, the only issue that matters is not majority ownership per-se but the possibility to control the firm's management. In other words, dispersed and/or minority ownership should not improve a firm's efficiency as control is very likely to be missing in such an

ownership structure. However, in the presence of dispersed ownership, even a minority owner with a sufficiently high stake is able to control a firm. For example, La Porta et al. (1999) employ 20% as a threshold for control of a company. Control can then be exerted even by minority owners to ensure that managers fulfil their duties. Our data allows us to test the link between control and efficiency as we are able to identify controlling minority ownership. Based on this reasoning we formulate the next hypothesis.

Hypothesis 2 *Minority controlling ownership reduces a firm's inefficiency.*

Furthermore, in the trade literature it has been argued that foreign owners have better access to superior technology, meaning that owned by foreigners should be more efficient (Blomström et al., 2001; Temouri et al., 2008). Hence, the existence of the technological gap between foreign and domestic owners has become a stylized fact in the applied trade literature. Especially in the context of a transition economy, it is likely that foreign owners have more experience with market-oriented environment and international markets. This can also result in increased efficiency. Based on this we formulate the next hypothesis.

Hypothesis 3 *A foreign owner reduces a firm's inefficiency.*

Another explanation of the productivity gap between foreign- and domestic-owned firms could be the differential access to external credit (Gorodnichenko and Schnitzer, 2010). This is especially important in a transition economy context where many firms have to carry out high investment rates to substitute the old obsolete capital for new advanced technology. This reason is largely absent in the case of the Czech Republic, though. Access to external financing was relatively easy before banks were fully privatized and banking privatization was achieved by 2001 (Hanousek et al., 2007b). After EU accession in 2004 the frictions on the lending market were largely absent as the country complied with *acquis communautaire*.

We aim to test the above hypotheses by employing a model that links firm efficiency with its ownership structure plus some other key firm characteristics. The model for each year (period t) is specified as follows:

$$u_{it} = \delta_0 + \delta_1 Size_{it} + \delta 2 Debt_{it} + \delta_3 Age_{it} + \sum_{j=4}^{J} \delta_j OWN_{it}^{j} + w_{it} \quad \forall i = 1, \ldots, N, t = 1, \ldots, T \tag{3.5}$$

In specification 3.5 u_{it} is the inefficiency level of firm i in time t. u_{it} can also be interpreted as the distance from the efficiency frontier. Therefore, larger u_{it}'s are assigned to less efficient companies. Ownership structure (OWN_{it}^{j}) is defined in year t for each firm i to account for a specific ownership category j. We distinguish the domestic or foreign ownership of firms based on the exact knowledge of the owner's origin. If information on the owner's domicile is missing, we introduce a special category of an "unknown" domicile. Therefore, we consider the categories of domestic, foreign, and unknown domicile owners. From our data we can also distinguish the extent of the ownership concentration along with the extent of control over a firm. Following the country- and legal-specific approach of Hanousek et al. (2007b), we construct ownership categories to distinguish majority, monitored majority, controlling minority, and combined controlling minority ownership. We elaborate on the exact rules for the assignment of the different ownership categories in the next section.

Additionally, we include several controls that represent major firm characteristics. The variable *Size* is measured as ln (Total Assets) and captures the effect of firm size on its inefficiency. The variable *Debt*, defined as Total liabilities/Total Assets (in percent), accounts for the effect of the firm capital structure on its efficiency. Finally, the variable *Age* is defined as number of years from a firm's incorporation and measures the effect of firm's age on its efficiency.

As noted above, specifications 3.4 and 3.5 are estimated within the "one-stage procedure" designed by Battese and Coelli (1995) by using maximum likelihood approach. Based on the estimates obtained from 3.5, we are able to test our hypotheses that link firm (in)efficiency with firm ownership.

3.3 Data

We employ firm-level unbalanced panel data for the Czech Republic for the period 1998-2007 from the Amadeus database. Our data set is constructed from several editions of the Amadeus database and, for this reason, we can also include in our data firms that exited the market and consequently might have disappeared from more recent editions. In this way we minimize selection and survival biases. Depending on the specific year, we have firm-level balance-sheet data (sales, working

capital, and number of employees) for 4,240 to 34,642 firms. We further combine the balance-sheet data with ownership data obtained from the Amadeus, Aspekt, and Čekia databases. Combining these three data sources provides us with comprehensive information about the firms' ownership structure. Altogether we work with a unique firm-level panel data of more than 190,000 firm/year observations for the period 1998-2007.

As most firms in our sample are multiproduct companies, we are unable to obtain exact information about the input- and output-quantities connected with the production process of each product of a firm. To circumvent this problem, we follow the standard approach in the literature and use the variables recorded in the firms' balance sheets to approximate a firm's output, labor, and capital input (see Coelli et al., 2005 for an overview). We use sales to measure the production of each firm and as inputs we employ working capital (which is a major part of current assets, represented by stocks+debts-credits) and number of employees. The variables are in natural logs as shown in specification 3.4 to minimize the effect of different firm size.

The descriptive statistics for all variables are shown in Table 3.1. The number of firms increases dramatically from 1998 on, confirming our argument in Section 3.1 that early studies relying on unrepresentative samples could not deliver accurate results. The mean values of our economic variables are in absolute values to provide a perspective on the scope of operation. In our sample the mean of working capital as well as the number of employees decreases as more and more of the smaller firms enter our dataset as time progresses. This is in accord with the values for sales, which becomes smaller with time as well.

As firm efficiency might be industry-specific, we estimate a different set of coefficients for every two-digit NACE category (Pavitt, 1984). In order to capture different effects across subsectors, we follow the approach of Laafía (2002), who divides industries according to their technology and knowledge intensity. This approach is based on the Eurostat official industrial-sector aggregations. In manufacturing industries we have four groups: high technology, medium-high technology, medium-low technology, and low technology. In service industries we distinguish five groups: knowledge-intensive services (KIS), high-tech KIS, market KIS (excluding financial intermediation and high-tech services), less-knowledge-intensive

Table 3.1: Simple descriptive statistics

Year	Sales	Working capital	Number of employees	Number of firms
1998	13 505 503	59 467	242.2	4 240
1999	10 446 056	47 631	213.0	5 036
2000	10 549 254	51 124	195.5	6 015
2001	10 709 491	49 929	174.1	6 926
2002	7 044 422	29 000	96.3	13 350
2003	6 506 458	22 325	75.1	19 700
2004	6 080 603	18 470	61.0	29 523
2005	5 616 113	16 950	52.1	33 470
2006	5 590 190	16 331	42.3	38 255
2007	7 821 798	20 173	44.8	34 642

services (LKIS), and market LKIS.[6]

The ownership variables are defined according to country-specific legal rules as argued in Gugler (2003) and are described in Table C.1. As shown in Hanousek et al. (2007b) owners have under Czech law different opportunities to influence corporate governance. In particular, majority ownership (more than 50% of shares) grants the owner the right to staff management and supervisory boards, alter and transfer a firms' assets and make crucial strategic decisions at general shareholder meetings. Through management and supervisory boards, majority ownership also facilitates more direct executive control of the company. Moreover, minority owners with a block ownership of at least 10% of shares are potentially important because the law entitles the holder of this stake to call general shareholder meetings and obstruct decisions by delaying implementation through lengthy court proceedings. These minority shareholders (including the state) may thus use their ownership position to delay or completely block the implementation of decisions by stronger shareholder(s).

Majority ownership represents a high degree of concentrated ownership, while minority ownership can be viewed as a form of moderately dispersed ownership.[7] Based on the above distinction of ownership concentration, we define several specific ownership categories. Rather than using exact percentage stakes, we opt for dummy variables that differentiate various ownership categories and allow us to

[6] An overview of examined industries is provided in tables C.2 and C.3.

[7] Highly dispersed ownership arises when the stake of the largest holder does not reach the legal (10 percent) minority.

provide more comprehensive results than previous studies. All ownership categories are exclusively defined and are further subdivided for domestic and foreign owners, as well as those with an unknown domicile.

Majority ownership is a dummy variable that is coded 1 when an owner holds more than a 50% stake in a firm and otherwise there is only dispersed ownership; it is coded 0 otherwise. Thus, this category provides the majority owner with effective control over the company.

Monitored majority ownership is a dummy variable that is coded 1 when there is majority ownership in a firm, but at the same time there exists at least one minority owner with a stake higher than 10%; it is coded 0 otherwise. This ownership category reflects the situation in firms where the majority owner is confronted with at least one non-marginal owner pursuing its own interest.

There are two minority-category variables. First, *controlling minority ownership* is a dummy variable that is coded 1 when an owner holds a stake in a firm that is greater than 10%, and this stake is greater than the sum of all the remaining stakes that can be identified, e.g. the remaining stakes of all the listed companies. It is coded 0 otherwise. This is an extreme case of control provided through a minority stake in a company with highly dispersed ownership. It is a realistic category, as in numerous companies dispersed ownership prevents the emergence of larger stakes.

This category has two implications relevant to our analysis. First, at general shareholder meetings dispersed owners would have to act in concert to override the decision of the single controlling minority owner. Second, according to the law, shareholders have to disclose their identities in order to execute commonly shareholder rights by agreement. In this case, their identities would be revealed and listed in the commercial registry, and the database would contain the ownership identities of highly dispersed owners.

Combined controlling minority ownership is the second minority category. It is coded as 1 if there are two owners whose combined stake exceeds 50% and is coded as 0 otherwise. These two owners cannot individually control the firm or act against each other as individually they do not have enough voting power. However, they may or may not coordinate their steps and control the company via combined voting rights that give them a majority.

As noted earlier, we are able to distinguish domestic and foreign owners for many

of the firms in our data set. However, for all the categories defined above there are firms in the sample for which we are not able to determine domicile of their owners. Either an owner is listed in the database without a country code identifying its domicile, or a firm has a legal structure that prevents distinguishing between domestic and foreign owners; e.g., a firm with unregistered stocks. Therefore, for the first two categories (i.e. majority and monitored majority ownership) we introduce an additional dummy variable for unknown ownership. Finally, a constant contains all the categories not captured by our dummies (i.e. mainly minority unknown ownership). In this case the firm either exhibits highly dispersed ownership or does not report on its ownership.

3.4 Empirical Results

First, we estimate equation 3.4 to determine how capital and labor influence production across different sectors. We employ a likelihood ratio test to test formally for the efficiency frontier model. The results are presented in Table 3.2.[8] The contribution of capital and labor to firm production differs as the coefficient associated with labor is uniformly larger than that of capital. This finding indicates that firms are on average more labor-intensive. Furthermore, we also formally test whether the sum of the coefficients associated with both inputs is statistically different from unity; this would indicate constant-returns-to-scale production. The results of these tests show that the sum of the coefficients is smaller than one (about 0.8 on average), a level indicating decreasing returns-to-scale (DRS). These results, although at first glance surprising, are typical for transition economies that are characterized by outdated, labor intensive technology as well as by the excessive use of inputs in the production process.

With the help of these estimates we can back out for every firm a level of inefficiency which we decompose in the next step.

[8]The results for each industry are provided in tables C.4 and C.5.

Table 3.2: First step - Efficiency frontiers

NACE Grouping	Constant term	Log Working Capital	Log Number of Employees
Manufacturing industries:			
High-technology	11.424	0.294	0.550
Medium-high-technology	11.697	0.297	0.491
Medium-low-technology	11.856	0.277	0.494
Low-technology	11.818	0.274	0.493
Service industries:			
Knowledge-intensive services (KIS)	12.107	0.215	0.563
High-tech KIS	12.035	0.222	0.571
Market KIS*	12.091	0.221	0.559
Less Knowledge-intensive services (LKIS)	11.978	0.292	0.510
Market services less KIS	11.971	0.294	0.510

Notes: We use industry classification according to OECD-Eurostat (Laafia 2002). It is also available at: `http://epp.eurostat.ec.europa.eu/cache/ITY_SDDS/Annexes/htec_esms_an2.pdf`. In the table we present the weighted averages of the estimated coefficients; weights correspond to the number of observations.
* Market KIS excludes financial intermediation and high-tech services.

3.4.1 Ownership effects

In Table 3.3 we report the results from of specification 3.5 where we quantify the effect of the different ownership types on inefficiency level for every year in our sample. The dependent variable in all regressions is the inefficiency of a particular firm and the explanatory variables are dummies for the various ownership types, firm age, the debt ratio, and the logarithm of total assets for each firm. The ownership variables are divided according to the ownership concentration as described in Section 3.3.

The reported coefficients should be interpreted in the following manner. A fully efficient firm would have a distance from the efficiency frontier equal to zero. Hence, the positive value of a statistically significant coefficient associated with an ownership category indicates that this ownership type moves a firm away from the efficiency frontier. This means that the specific ownership category is associated with a lower contribution to firm efficiency. Conversely, a negative and statistically significant coefficient associated with a specific category indicates that the category helps to move a firm closer to the efficiency frontier and the firm becomes more efficient.

The results in the first and the third row of Table 3.3 confirm our hypotheses that a majority owner as well as a controlling minority owner reduces a firm's inefficiency, although the coefficients of majority ownership are not significant for some years (at the beginning of the examined period). Moreover, the coefficient of controlling

Table 3.3: Effects of ownership structure on inefficiency

Ownership category	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Majority	0.010	-0.004	-0.001	-0.002	-0.007	-0.013***	-0.020***	-0.021***	-0.026***	-0.031***
	(0.008)	(0.007)	(0.006)	(0.006)	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Monitored majority	0.025	0.014	0.025**	0.026**	-0.001	-0.012	-0.011	-0.012	-0.013*	-0.013
	(0.015)	(0.014)	(0.012)	(0.012)	(0.010)	(0.008)	(0.007)	(0.008)	(0.008)	(0.008)
Controlling minority	-0.006	-0.001	-0.018**	-0.025**	-0.032***	-0.044***	-0.044***	-0.037***	-0.032***	-0.037***
	(0.010)	(0.010)	(0.009)	(0.010)	(0.009)	(0.008)	(0.008)	(0.009)	(0.009)	(0.009)
Combined controlling minority	0.000	0.001	0.001	0.003	0.014*	-0.001	-0.018***	-0.023***	-0.029***	-0.033***
	(0.010)	(0.010)	(0.009)	(0.009)	(0.008)	(0.007)	(0.007)	(0.007)	(0.007)	(0.008)
log (Total assets)	0.048***	0.051***	0.057***	0.057***	0.060***	0.060***	0.061***	0.062***	0.064***	0.065***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Debt ratio (percent)	0.071***	0.037***	0.045***	0.000	0.031***	0.021***	0.019***	0.012***	0.022***	0.034***
	(0.003)	(0.002)	(0.002)	(0.000)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Age of the firm	-0.003***	-0.004***	-0.003***	-0.005***	-0.004***	-0.005***	-0.007***	-0.007***	-0.006***	-0.006***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	-0.545***	-0.519***	-0.616***	-0.521***	-0.586***	-0.541***	-0.507***	-0.508***	-0.538***	-0.545***
	(0.033)	(0.030)	(0.026)	(0.025)	(0.019)	(0.016)	(0.014)	(0.013)	(0.013)	(0.014)
R-squared	0.188	0.164	0.216	0.180	0.228	0.235	0.215	0.220	0.225	0.232
N	4240	5036	6015	6926	13346	19696	29514	33458	38238	34635

Note: The dependent variable is the firm-level inefficiency obtained from the estimation of equation 3.4. The explanatory variables are dummy variables for the various ownership types, firm age, the debt ratio, and the logarithm of total assets for each firm. The definition of each explanatory variable can be found in Table C.1. The constant is supposed to cover those ownership categories connected with the smallest possibility to have a control over firm.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

minority ownership seem to be even smaller than the coefficient of pure majority, indicating that not the concentrated ownership per se but the possibility to control a firm is consistently beneficial to firm efficiency. Note, however, that the impact of controlling minority ownership is not significantly different from the impact of majority ownership. This can be seen in Figure C.1.

Several empirical works show that majority owners can change their attitude when a strong minority owner is present in the firm, for example, in the case of dividend payments (Gugler, 2003). Therefore, we also investigate the effect of this specific ownership type (i.e. monitored majority) on the efficiency. The results in the second row of Table 3.3 indicate no impact on firm's efficiency compared to the base category as the coefficients are, most of the time, not significantly different from zero. This suggests that a positive disciplining effect on firm efficiency when a majority owner must account for the presence of an influential minority shareholder does not materialize.

Minority owners whose combined shares provide them with a majority of the voting rights -*combined controlling minority ownership*- are a special ownership category but deliver rather similar result as the controlling minority ownership, at least for the second part of the examined time period. In this category two minority owners face a situation where neither of them can fully control the company and only coordinated steps would enable them to control jointly the company. The inability to control fully a firm by one of the two minority owners resembles a "Mexican standoff". This slang term defines a stalemate or a confrontation that neither of the parties can win. To come out of the deadlock the parties must resolve the situation by negotiation, surrender, or attack. The estimated coefficients are almost zero in the beginning of our data and turn negative from 2003 onwards, hinting at a peaceful use of power between the two minority shareholders. In other words, this category is positively related with firm's efficiency from 2003 onwards.

Finally, using our method, we are able to trace the ownership effect over time. We find that this effect increases over time, meaning that the effect of all four ownership categories on efficiency is improving. In addition, the performance of all owners converges at the end of our sample. This is certainly a positive feature, hinting at improved management and corporate governance in Czech firms.

In order to shed more light on the results from Table 3.3, we additionally divide each

Table 3.4: Effects of detailed ownership structure on inefficiency

Ownership category	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Majority foreign	-0.020**	-0.030***	-0.030***	-0.035***	-0.048***	-0.060***	-0.060***	-0.059***	-0.064***	-0.069***
	(0.010)	(0.009)	(0.008)	(0.008)	(0.006)	(0.006)	(0.006)	(0.005)	(0.005)	(0.006)
Majority domestic	0.104***	0.072***	0.069***	0.054***	0.025***	0.022***	0.025***	0.025***	0.019***	0.003
	(0.014)	(0.012)	(0.010)	(0.009)	(0.007)	(0.006)	(0.007)	(0.006)	(0.006)	(0.006)
Majority unknown	0.112	-0.099**	0.013	-0.013	-0.060**	-0.006	-0.010**	-0.019***	-0.019***	-0.021***
	(0.079)	(0.050)	(0.036)	(0.057)	(0.029)	(0.006)	(0.004)	(0.006)	(0.006)	(0.007)
Monitored majority foreign	0.038***	0.024***	0.040***	0.029**	0.010	-0.017*	-0.030***	-0.016*	-0.016*	-0.021*
	(0.016)	(0.014)	(0.013)	(0.013)	(0.011)	(0.010)	(0.009)	(0.009)	(0.009)	(0.010)
Monitored majority domestic	-0.020	-0.048	0.058	0.038	-0.047**	-0.014	-0.034	-0.011	-0.023	-0.026
	(0.087)	(0.063)	(0.043)	(0.034)	(0.023)	(0.025)	(0.035)	(0.026)	(0.028)	(0.031)
Monitored majority unknown	0.068	0.151	0.023	-0.055	0.059	0.008	0.014*	-0.001	0.009	-0.005
	(0.137)	(0.114)	(0.057)	(0.113)	(0.066)	(0.011)	(0.008)	(0.011)	(0.011)	(0.012)
Controlling minority foreign	0.059*	0.041*	0.056**	0.019	-0.008	-0.015	-0.001	0.001	-0.009	-0.020*
	(0.034)	(0.021)	(0.024)	(0.019)	(0.012)	(0.013)	(0.014)	(0.013)	(0.014)	(0.011)
Controlling minority domestic	-0.018*	-0.024**	-0.039***	-0.045***	-0.063***	-0.072***	-0.071***	-0.061***	-0.059***	-0.067***
	(0.010)	(0.010)	(0.009)	(0.010)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Combined controlling minority foreign	0.055	0.151**	0.077*	0.148***	0.050**	0.031**	0.023	0.021	0.019	0.012
	(0.061)	(0.070)	(0.046)	(0.039)	(0.025)	(0.014)	(0.028)	(0.028)	(0.028)	(0.031)
Combined controlling minority domestic	-0.002	-0.002	0.007	-0.003	0.004	-0.013*	-0.021***	-0.019***	-0.023***	-0.034***
	(0.011)	(0.010)	(0.010)	(0.010)	(0.008)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
log(Total assets)	0.039***	0.040***	0.043***	0.046***	0.051***	0.54***	0.057***	0.059***	0.059***	0.061***
	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Debt ratio (percent)	0.073***	0.041***	0.017***	0.000	0.010***	0.005***	0.004***	0.002***	0.001***	0.005***
	(0.003)	(0.002)	(0.001)	0.000	0.001	0.001	0.000	0.000	0.000	0.001
Age of the firm	-0.004***	-0.005***	-0.006***	-0.007***	-0.008***	-0.008***	-0.008***	-0.008***	-0.007***	-0.007***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	-0.389***	-0.338***	-0.328***	-0.320***	-0.374***	-0.381***	-0.404***	-0.414***	-0.421***	-0.439***
	(0.033)	(0.030)	(0.025)	(0.020)	(0.013)	(0.010)	(0.008)	(0.007)	(0.007)	(0.008)
R-squared	0.166	0.137	0.144	0.160	0.206	0.228	0.237	0.249	0.248	0.256
N	4240	5036	6015	6926	13346	19696	29514	33458	38238	34635

Note: The dependent variable is the firm-level inefficiency obtained from the estimation of equation 3.4. The explanatory variables are dummy variables for the various ownership types, firm age, the debt ratio, and the logarithm of total assets for each firm. The definition of each explanatory variable can be found in Table C.1.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

ownership category according to the owner's origin. The results of this estimation are reported in Table 3.4. In order to improve the accessibility of our results, we also present our findings in a graphical form in Figure C.2, where we plot coefficient values along with 95% confidence intervals.

The coefficient of *Majority foreign ownership*, our first category, is negative and significantly different from zero at least on the 5% level for all years. Furthermore, the estimated coefficients associated with foreign majority owners decrease over time (coefficient range -0.020 to -0.069). These results may be interpreted in the following way. At the start of the period we might still see some selection effect: for example, companies which were bought by foreign firms after the transition to capitalism might be a positive selection of Czech firms. However, if foreign owned firms become more efficient over time this might indicate a positive effect of foreign owners. Thus, foreign-majority-owned firms are connected with improving efficiency. In the case of domestic-majority-controlled firms, coefficients are positive and their values decrease over time (coefficient range from 0.104 to 0.019). This finding indicates that domestic majority owners are less conducive to firms' efficiency but their impact improves over time. Hence, foreign owners contribute to a firm's efficiency considerably more than domestic owners. Figure C.2 suggests that domestic majority owners improve the efficiency of their firms faster than foreign majority owners, which might point to a future convergence in efficiency levels. This convergence may be explained by technology spillovers from the foreign owners to the domestic owners.

In firms where a foreign majority owner is confronted with the presence of a minority owner (or owners) the ownership structure is conducive to the firm's efficiency in general. The estimated coefficients are positive in the beginning of our data and turn negative from 2003 onwards. In terms of the domestic owners, the lack of statistically significant coefficients indicates no impact on firm's efficiency, albeit the majority of the coefficients is negative. Furthermore, the monitored majority category does not correlate with firm efficiency at a better level than a simple majority. This confirms our previous finding from Table 3.3 that there is no positive disciplining effect on firm efficiency when a majority owner is confronted with at least one non-marginal shareholder.

Minority owners whose stakes are still larger than the combined stakes of the rest of the known owners also contribute to firm efficiency, but the effect of *control-*

ling minority ownership is less conclusive for foreign owners due to statistically insignificant coefficients. In addition, domestic minority owners' impact increases firm efficiency (coefficient range -0.018 to -0.071). These coefficients do not statistically differ from those of majority ownership. This interesting result implies that domestic minority owners are not only effective in controlling firms but also in improving their corporate governance. In other words, not ownership concentration per se but the possibility to control is important to improve firm efficiency.

The last category to be examined is *combined controlling minority ownership*. As we noted above, in this category two minority owners face a situation where neither of them can fully control the company and only coordinated steps would enable them to control jointly the company.

How does this arrangement work for firm efficiency? Foreign owners record positive and statistically significant coefficients for about the first half of the researched period while domestic owners record negative significant coefficients for the second half. Hence, foreign owners seem to struggle and are unable to cooperate to improve firm efficiency. The consistently negative coefficients in the case of domestic owners indicate that this ownership category is conducive to firm efficiency. Moreover, the negative coefficients associated with domestic owners hint at a peaceful use of power between the two minority shareholders and a contributing effect of this ownership arrangement with respect to firm efficiency. Alternatively, firms can be established from the beginning as having cooperating co-owners, so a deadlock is averted.[9]

3.4.2 Effects of economic sectors

As a next step, we estimate how firm efficiency is affected when we distinguish between different economic sectors in which firms operate (manufacturing and services) and the different technology intensity the firms exhibit. Our additional analysis serves also as a robustness check. In Tables 3.5 and 3.6 we report results that distinguish between the manufacturing (Table 3.5) and the service sectors (Table 3.6).[10] Within these broad sectors we further distinguish firms on different

[9]Indeed, we can see in our data that many domestic firms in this category are owned by relatives.

[10]We estimate specification 3.5 for the manufacturing and the service sectors without considering the origin of the owner. The results can be found in Tables C.6 and C.7 for the manufacturing and the service sectors, respectively. The results suggest that all defined categories significantly increase firm's efficiency compared to the dispersed ownership. The only exception constitutes the monitored majority ownership

technology levels. As mentioned in Section 3.3, this division strictly adheres to the methodology of Eurostat.

According to Table 3.5, ownership matters most for firms belonging to high-

Table 3.5: Detailed ownership effects in manufacturing industries; all years

Ownership category	Technology			
	High	Medium-high	Medium-low	Low
Majority foreign	-0.093***	-0.064***	-0.029***	-0.088***
	(0.006)	(0.007)	(0.007)	(0.005)
Majority domestic	0.049***	0.034***	0.025***	0.013**
	(0.006)	(0.008)	(0.009)	(0.005)
Majority unknown	-0.013*	-0.018*	-0.009	0.005
	(0.007)	(0.010)	(0.011)	(0.007)
Monitored majority foreign	-0.049***	-0.027**	-0.016	-0.073***
	(0.010)	(0.012)	(0.011)	(0.009)
Monitored majority domestic	-0.063***	0.053**	0.032	-0.027
	(0.023)	(0.026)	(0.037)	(0.026)
Monitored majority unknown	-0.010	-0.021	-0.019	-0.001
	(0.012)	(0.023)	(0.029)	(0.015)
Controlling minority foreign	-0.020	0.028	-0.043**	0.038***
	(0.013)	(0.018)	(0.018)	(0.013)
Controlling minority domestic	-0.107***	-0.041***	-0.104***	-0.106***
	(0.009)	(0.010)	(0.009)	(0.008)
Combined controlling minority foreign	0.036	-0.005	0.161***	0.131***
	(0.023)	(0.035)	(0.037)	(0.028)
Combined controlling minority domestic	-0.080***	0.023**	-0.061***	-0.063***
	(0.007)	(0.010)	(0.008)	(0.007)
log(Total assets)	0.055***	0.041***	0.049***	0.037***
	(0.001)	(0.001)	(0.001)	(0.001)
Debt ratio (percent)	0.006***	-0.002	0.001***	0.003***
	(0.001)	(0.002)	(0.000)	(0.001)
Age of the firm	-0.006***	-0.008***	-0.004***	-0.004***
	(0.000)	(0.000)	(0.000)	(0.000)
Constant	-0.404 ***	-0.214***	-0.365***	-0.189***
	(0.011)	(0.017)	(0.017)	(0.011)
R-squared	0.259	0.208	0.205	0.168
N	1352	7415	8122	14968

Note: The dependent variable is the firm-level inefficiency obtained from the estimation of equation 3.4. The explanatory variables are dummy variables for the various ownership types, firm age, the debt ratio, and the logarithm of total assets for each firm. The definition of each explanatory variable can be found in Table C.1.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

and low-technology sectors, and less for firms in the medium-high and medium-low technology sectors. In these sectors, especially foreign owners tend to be associated with the highest efficiency. This result can be explained by the following reasoning. First, foreigners have a better access to the technology. Therefore, their impact on a firm's performance is more pronounced in high-tech sectors where technology

in the services, which is negative but not significant.

plays an important role. Second, foreigners have more experience with competition markets and therefore may push firms towards the efficiency frontier. As a consequence, the impact of foreign owners is also large in low-tech industries that are characterized by larger innovation pressure.[11] Very similar result can be found in Haddad and Harrison (1993).

Table 3.6: Detailed ownership effects in service sectors; all years

Ownership category	Knowledge-intensive services (KIS)	High-tech KIS	Market KIS	Less Knowledge-intensive services (LKIS)	Market LKIS
Majority foreign	-0.081***	-0.089***	-0.071***	-0.045***	-0.039***
	(0.005)	(0.011)	(0.006)	(0.004)	(0.004)
Majority domestic	0.024***	0.007	0.020**	0.026***	0.026***
	(0.006)	(0.013)	(0.008)	(0.004)	(0.004)
Majority unknown	-0.009	-0.047***	-0.006	-0.011***	-0.011***
	(0.006)	(0.014)	(0.007)	(0.004)	(0.004)
Monitored majority foreign	-0.069**	-0.054	-0.086**	-0.047**	-0.024
	(0.027)	(0.038)	(0.038)	(0.020)	(0.019)
Monitored majority domestic	-0.041***	-0.083***	-0.034***	0.026***	0.029***
	(0.008)	(0.018)	(0.010)	(0.006)	(0.006)
Monitored majority unknown	0.051***	0.017	0.055***	-0.004	-0.007
	(0.011)	(0.026)	(0.013)	(0.007)	(0.007)
Controlling minority foreign	-0.008	0.006	-0.048***	-0.012	0.002
	(0.013)	(0.028)	(0.017)	(0.009)	(0.009)
Controlling minority domestic	-0.101***	-0.134***	-0.095***	-0.087***	-0.084***
	(0.008)	(0.019)	(0.009)	(0.006)	(0.006)
Combined controlling minority foreign	-0.137***	-0.070	-0.158***	0.087***	0.074***
	(0.025)	(0.060)	(0.029)	(0.018)	(0.017)
Combined controlling minority domestic	-0.032***	-0.047***	-0.035***	-0.004	-0.002
	(0.006)	(0.012)	(0.008)	(0.004)	(0.004)
log (Total assets)	0.059***	0.056***	0.060***	0.062***	0.062***
	(0.001)	(0.002)	(0.001)	(0.000)	(0.000)
Debt ratio (percent)	0.003***	0.017***	0.003***	0.002***	0.001***
	(0.000)	(0.002)	(0.000)	(0.000)	(0.000)
Age of the firm	-0.007***	-0.001*	-0.008***	-0.005***	-0.005***
	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)
Constant	-0.420***	-0.420***	-0.434***	-0.483***	-0.480***
	(0.007)	(0.020)	(0.008)	(0.005)	(0.005)
R squared	0.237	0.231	0.239	0.244	0.247
N	39670	5327	30085	81496	81067

Note: The dependent variable is the firm-level inefficiency obtained from the estimation of equation 3.4. The explanatory variables are dummy variables for the various ownership types, firm age, the debt ratio, and the logarithm of total assets for each firm. The definition of each explanatory variable can be found in Table C.1.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

It is also interesting to note that minority domestic owners who are able to exert control over firms because the rest of the ownership is dysfunctionally dispersed,

[11] Indeed, the innovation process in new EU economies is dominated by foreign multinationals. Uzagalieva et al. (2011) show that local firms in the new EU markets experience efficiency gains if they supply industries with a higher share of foreign firms or if foreign firms sell to them.

exhibit a comparably high degree of efficiency, confirming our previous result that not concentration per se but the possibility to control matters.

The results for firms operating in services are presented in Table 3.5. On average, ownership matters more for firms belonging to the sectors of knowledge-intensive services (KIS) than for firms from less knowledge-intensive sectors. They do quite well with foreign majority and monitored majority owners, driving the best efficiency results.

Yet another pattern emerges when we compare specific foreign and domestic ownership. The efficiency differences between these two groups appear to be smaller for firms operating in the service than in the manufacturing sector. This can be explained by a more important role of technology in manufacturing sectors. A similar pattern can be detected for firms controlled by combined-controlling minority owners. On the other hand, differences in contribution to efficiency between foreign and domestic owners are smaller in firms controlled by monitored majority and controlling minority owners operating in manufacturing sectors. Hence, when we put the above results into perspective with those reported in Table 3.4, controlling minority domestic owners operating firms in manufacturing sectors represent the group of owners that is most conducive to improving efficiency in Czech firms.

3.5 Conclusion

We analyze the evolution of efficiency in Czech firms from 1998 to 2007 and how efficiency is affected by firm ownership structure. We provide evidence that the ownership structure matters.

Our key result is that not the concentrated ownership per se but the possibility to control a firm is consistently beneficial to firm efficiency. This finding is in favor of the agency theory and in line with the general key results summarized by Estrin et al. (2009). Moreover, we show that minority domestic owners are conducive to firm efficiency at a slightly higher level than a pure majority. Finally, minority owners who share the control in a firm may end up rivaling each other, which is not conducive to efficiency. However, our evidence highlights that domestic minority owners do cooperate and improve the efficiency of their firms, while we do not see this evidence for the foreign owned firms.

In the second part of our analysis, we estimate how the efficiency effects change with the sector the firm operates in and with the technology intensity. We show that firms belonging into the high- and low-technology sectors are most sensitive to the ownership effect. Moreover, we show that differences in impact on firm efficiency between foreign and domestic owners are less pronounced for owners operating in services than in manufacturing. As services are more aimed at the local market, the domestic controlled firms may benefit from better knowledge of the latter. This knowledge and less export-orientation might contribute to eliminate differences among domestic and foreign owners in firms operating in services.

Overall, we find evidence of improving efficiency among the firms in our sample. This is certainly a positive feature hinting at improved management and corporate governance in Czech firms.

Appendices

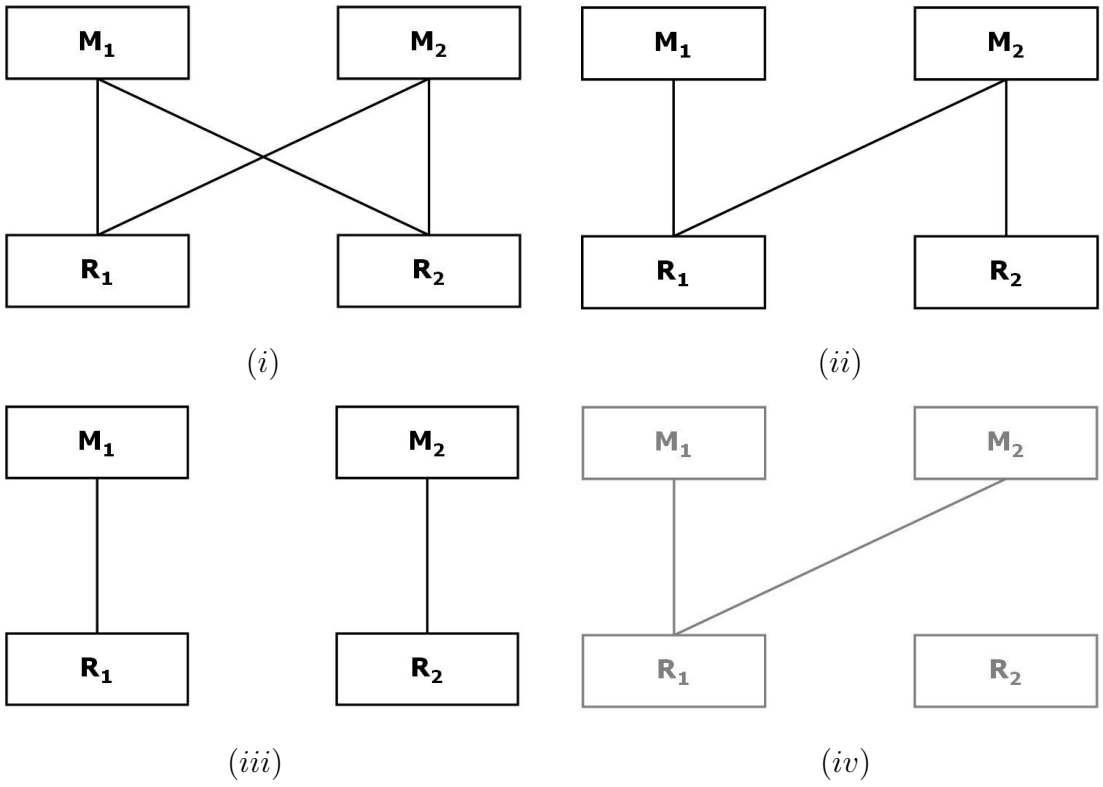
Appendix A

Appendix to Chapter 1

A.1 Distribution Systems

The following graphs represent the four different possible distribution systems.

Figure A.1: Distribution Systems



A.2 Equilibrium Values

To avoid very long expressions, we redefine some polynomials in the following way:

$A(K,d) \equiv 2K + d^2 - 1,$

$B(K,d) \equiv Kd^2 - 2K - d^2 + 1,$

$C(K,d) \equiv -d^2K + 2dK + 4K + d^3 + 2d^2 - d - 2,$

$D(K,d) \equiv -5d^2K + 8K - d^4 + 5d^2 - 4,$

$E(K,d) \equiv 3dK + 4K + d^3 + 2d^2 - d - 2,$

$F(K,d) \equiv 8 - 8d^2 - 16K + 8d^2K - d^4K,$

$G(K,d) \equiv d^4K - 6d^2K + 8K + 4d^2 - 4,$

$H(K,d) \equiv d^3K - 2d^2K - 4dK + 8K + 4d^2 - 4,$

$I(K,d) \equiv d^3K + 2d^2K - 4dK - 8K - 4d^2 + 4,$

$J(K,d) \equiv 2d^3K + 5d^2K - 2dK - 8K - 4d^2 + 4,$

$L(K,d) = d^6K^2 - 11d^4K^2 + 40d^2K^2 - 48K^2 + 10d^4K - 50d^2K + 40K - 8d^4 + 16d^2 - 8$

Table A.1: Equilibrium values

	(N/N)	(E/N)	(E/E)
w_1	$\frac{1-d}{2-d}$	$\frac{(1-d)C(.)}{D(.)}$	$\frac{(1-d)I(.)}{(2-d)J(.)}$
w_2	$\frac{1-d}{2-d}$	$\frac{(1-d)E(.)}{D(.)}$	$\frac{(1-d)I(.)}{(2-d)J(.)}$
p_1	$\frac{1-d}{2-d}$	$\frac{(1-d)(A(.)+K)C(.)}{A(.)D(.)}$	$\frac{2(d-1)L(.)}{(d-2)H(.)J(.)}$
p_2	$\frac{1-d}{2-d}$	$\frac{(1-d)E(.)}{D(.)}$	$\frac{2(d-1)L(.)}{(d-2)H(.)J(.)}$
q_1	$\frac{1}{(2-d)(1+d)}$	$\frac{KC(.)}{(1+d)A(.)D(.)}$	$-\frac{(d+2)KG(.)}{(d+1)H(.)J(.)}$
q_2	$\frac{1}{(2-d)(1+d)}$	$-\frac{E(.)B(.)}{(d+1)A(.)D(.)}$	$-\frac{(d+2)KG(.)}{(d+1)H(.)J(.)}$
θ_1	0	$\frac{(1-d)C(.)}{A(.)D(.)}$	$\frac{4(d-1)G(.)}{(2-d)H(.)J(.)}$
θ_2	0	0	$\frac{4(d-1)G(.)}{(2-d)H(.)J(.)}$
π_{R1}	0	$\frac{(1-d)K[C(.)]^2}{2(1+d)A(.)[D(.)]^2}$	$\frac{(d-1)KF(.)[G(.)]^2}{(d-2)^2(d+1)[H(.)]^2[J(.)]^2}$
π_{R2}	0	0	$\frac{(d-1)KF(.)[G(.)]^2}{(d-2)^2(d+1)[H(.)]^2[J(.)]^2}$
π_{M1}	$\frac{1-d}{(2-d)^2(1+d)}$	$\frac{(1-d)K[C(.)]^2}{(1+d)A(.)[D(.)]^2}$	$\frac{(1-d)(d+2)KI(.)G(.)}{(d-2)(d+1)H(.)[J(.)]^2}$
π_{M2}	$\frac{1-d}{(2-d)^2(1+d)}$	$\frac{(d-1)B(.)[E(.)]^2}{(1+d)A(.)[D(.)]^2}$	$\frac{(1-d)(d+2)KI(.)G(.)}{(d-2)(d+1)H(.)[J(.)]^2}$

Moreover, from the second order conditions and non-negativity constraints we know

that $B(.) < 0$. This implies $A(.) > 0, C(.) > 0, D(.) > 0, E(.) > 0, F(.) < 0, I(.) < 0$, and $J(.) < 0$. Using all SOCs and non-negativity conditions, we restrict the parameter space to $K > {}^{(4-4d^2)}/_{8-4d-2d^2+d^3}$, so that the model is well defined. This implies $G(.)$, $H(.) > 0$.

A.3 Framework

The effects for the case when only one manufacturer adopts ER are defined as described in Section 1.3. The definition of the effects for the case when both manufacturers adopt ER are given by:

1. Double Markup Effect

   The exact formal definition of the double markup effect for the case when both firms adopt ER ($N/N \rightarrow E/E$) is slightly different from the case when only one firm adopts ER ($N/N \rightarrow E/N$). The reason herefore is that the respective outcome is not only influenced by one manufacturer's exclusivity decision, but by both manufacturers' exclusivity decisions.
   Hence, the definition of the double markup effect now includes one additional element capturing the second brand's double markup and is given by $f_i(E/E \mid w_{-i} = w_{-i}^{N/N}, p_{-i} = p_{-i}^{N/N}, \theta_i = \theta_{-i} = 0) + f_i(E/E \mid w_i = w_i^{N/N}, p_i = p_i^{N/N}, \theta_i = \theta_{-i} = 0) - f_i(N/N) \equiv f_i(E/E \mid w_i = w_{-i} = w^{DM}, p_i = p_{-i} = p^{DM}, \theta_i = \theta_{-i} = 0)$. w^{DM} and p^{DM} represent wholesale resp. retail prices resulting from the double markup effect. Moreover, note that for some values (e.g. all prices), the second element of this expression equals zero. Hence, for these values the double markup effect is given by the same definition as for ($N/N \rightarrow E/N$).

2. Competition Softening Effect

   The effect is given by:

   $f_i(E/E \mid \theta_i = \theta_j = 0) - f_i(E/E \mid w_i = w_j = w^{DM}, p_i = p_j = p^{DM}, \theta_i = \theta_j = 0)$.

3. Investment Effect

   The effect is given by $f_i(E/E) - f_i(E/E \mid \theta_i = \theta_j = 0)$.

The following two tables show the signs of the three different effects on the equilibrium values.

Table A.2: Composition of the Total Effect: N/N==>E/N

N/N==>E/N	Double Markup	Competition Softening	Investment	Total
w_1	0	+	+	+
w_2	0	+	+	+
p_1	+	+	+	+
p_2	0	+	+	+
θ_1	0	0	+	+
θ_2	0	0	0	0
π_{R1}	+	+	+	+
π_{R2}	0	0	0	0
π_{M1}	-	+	+	+ / -
π_{M2}	+	+	+	+
CS	-	-	+	+/-
PS	+/-	+	+	+/-
$Welfare$	-	-	+	+/-

Table A.3: Composition of the Total Effect: N/N==>E/E

N/N==>E/E	Double Markup	Competition Softening	Investment	Total
w_1	0	+	+	+
w_2	0	+	+	+
p_1	+	+	+	+
p_2	+	+	+	+
θ_1	0	0	+	+
θ_2	0	0	+	+
π_{R1}	+	+/-	+	+
π_{R2}	+	+/-	+	+
π_{M1}	-	+/-	+	+/-
π_{M2}	-	+/-	+	+/-
CS	-	-	+	+/-
PS	+/-	+/-	+	+/-
$Welfare$	-	-	+	+/-

A.4 Proofs

We start by referring to Sturm's theorem which provides the basis of most of the following proofs:[1] Given equation

$$f(x) = a_0x^n + a_1x^{n-1} + \cdots + a_{n-1}x + a_n, \tag{A.1}$$

where the coefficients a_i are real numbers and $a_0 \neq 0$, let $N(x)$ be the number of sign changes (disregarding vanishing terms) in the sequence of functions:
$f_0 = f(x) = g_0(x)f_1(x) - f_2(x) \quad f_1 = f'(x) = g_1(x)f_2(x) - f_3(x) \quad f_2 = g_2(x)f_3(x) - f_4(x) \ldots,$
where for $i > 1$ each $f_i(x)$ is (-1) times the remainder obtained on dividing $f_{i-2}(x)$ by $f_{i-1}(x)$ and $f_n(x) \neq 0$ is a constant. Then the number of real roots of eq. A.1 located between two real numbers a and b $(b > a)$ excluding the own roots of eq. A.1 is equal to $N(a) - N(b)$.

Sturm's theorem provides a simple algorithm to determine for each real polynomial the number of real roots in any given interval (a, b). Thus, if a real polynomial has no real roots in interval (a, b), it will be sufficient to evaluate this polynomial at an arbitrary number from this interval, in order to determine its sign.[2]
We can use a simple example to explain how Sturm's theorem works: Assume, we are looking for the sign of $8-6d-2d^3+d^4$ for $d\epsilon\,(0,1)$. Thus, the chain of Sturm's functions is: $f_0 = 8 - 6d - 2d^3 + d^4$, $f_1 = -6 - 6d^2 + 4d^3$, $f_2 = -29 + 18d + 3d^2$, $f_3 = 111 - 82d$ and $f_4 = -1$. Now, we can examine the changes of the signs:

d	f_0	f_1	f_2	f_3	f_4	$N(d)$
0	+	-	-	+	-	3
1	+	-	-	+	-	3

The examined expression has zero roots. Hence, the expression is positive.

Proof of Proposition 1.3.1.

In order to prove proposition 1 we make use of some information stated above:

$K > \underline{K} = \frac{4-4d^2}{8-4d-2d^2+d^3}, \quad d \in (0,1), \quad A(.) > 0, \quad B(.) < 0, \quad C(.) > 0 \quad D(.) > 0, \quad H(.) > 0, \quad J(.) < 0$

[1] In the description of Sturm's theorem we follow Korn and Korn (1968).
[2] Sturm's theorem was firstly announced in 1829 (Sturm, 1829). The proof can be found in Khovanskii and Burda (2008).

- *Retail prices:*

  - $p_i^{N/E} - p_i^{N/N} = \frac{2(1-d)d(d+1)K}{(2-d)D(.)} > 0$
  - $p_i^{N/E} - p_i^{E/N} = \frac{(1-d)K(3d^2K-4K+d^4-3d^2+2)}{A(.)D(.)} \Rightarrow sgn(p_i^{N/E} - p_i^{E/N}) = sgn(3d^2K - 4K + d^4 - 3d^2 + 2).$

    This polynomial is decreasing in K:

    $3d^2K - 4K + d^4 - 3d^2 + 2|_{K=\underline{K}} = \frac{(-1+d)d(1+d)\left(8-6d^2-2d^3+d^4\right)}{(-2+d)^2(2+d)} < 0 \Rightarrow 3d^2K - 4K + d^4 - 3d^2 + 2 < 0 \Rightarrow p_i^{N/E} - p_i^{E/N} < 0$
  - $p_i^{E/E} - p_i^{E/N} = \frac{(1-d)(2L(.)A(.)\cdot D(.)-(2-d)(A(.)+K)C(.)H(.)J(.))}{(2-d)A(.)D(.)H(.)J(.)} = \frac{(d-1)dK\Lambda(.)}{A(.)D(.)H(.)J(.)}$

    The difference is larger than zero if and only if $\Lambda(.) > 0$.

    $\frac{\partial^3\Lambda(.)}{\partial K^3} = \left(1-d^2\right)\left(768\left(1-d^2\right)+1536+432d^4+6d^5\right)+(1-d)\left(288d\left(1-d^2\right)+96d\right)+36d^8+66d^5+384d^4 > 0$

    $\frac{\partial^2\Lambda(.)}{\partial K^2}|_{K=\underline{K}} = 2(d-1)\left[(32+96d)\left(d^2-1\right)+(d-1)\left(12d\left(1-d^2\right)+20d+2d^6\right)-32d^4-21d^5-d^6\right](d+1)(d+2) > 0 \Rightarrow \frac{\partial^2\Lambda(.)}{\partial K^2} > 0$

    $\frac{\partial\Lambda(.)}{\partial K}|_{K=\underline{K}} = -\frac{(d-1)^2d(d+1)^2\left[\left(d^2-1\right)\left(192-48d^2+10d^4+d^5\right)+(d-1)\left(24d\left(1-d^2\right)+40d\right)-22d^4-23d^5\right]}{(d-2)^2} > 0 \Rightarrow \frac{\partial\Lambda(.)}{\partial K} > 0$

    $\Lambda(.)|_{K=\underline{K}} = -\frac{4(d-4)(d-1)^4d^2(d+1)^3(d^2-2d-4)(d^3+2d^2-4)}{(d-2)^4(d+2)} > 0 \Rightarrow \Lambda(.) > 0 \Rightarrow p_i^{E/E} - p_i^{E/N} > 0$

  Q.E.D.

- *Wholesale prices:*

  - $w_i^{E/N} - w_i^{N/N} = \frac{(1-d)d^2(d+1)K}{(2-d)D(.)} > 0$
  - $w_i^{N/E} - w_i^{E/N} = \frac{(1-d)d(d+1)K}{D(.)} > 0$
  - $w_i^{E/E} - w_i^{N/E} = \frac{(1-d)d^2(1+d)K\left(4-2d-5d^2+2d^3+d^4-4K+d^2K\right)}{(2-d)D(.)J(.)}$

    $\Rightarrow w_i^{E/E} - w_i^{N/E} > 0 \Leftrightarrow d^2K - 4K + d^4 + 2d^3 - 5d^2 - 2d + 4 < 0 \Leftrightarrow K > \frac{d^4+2d^3-5d^2-2d+4}{4-d^2}.$

  Q.E.D.

- *Investment:*

  - $\theta_i^{N/E} - \theta_i^{N/N} = 0$
  - $\theta_i^{E/N} - \theta_i^{N/N} = \theta_i^{E/N} = \frac{(1-d)C(.)}{A(.)D(.)} > 0$
  - $\theta_i^{E/E} - \theta_i^{E/N} = \frac{(1-d)(-4G(.)A(.)D(.)-(2-d)C(.)H(.)J(.))}{(2-d)A(.)D(.)H(.)J(.)} = \frac{(1-d)dK\Theta(.)}{(d-2)A(.)D(.)H(.)J(.)}$

    $\Rightarrow \theta_i^{E/E} - \theta_i^{E/N} > 0 \Leftrightarrow \Theta(.) > 0$

    $\frac{\partial^2\Theta(.)}{\partial K^2} = \left(1-d^2\right)\left(64\left(1-d^3\right)+128d\left(1-d\right)+192+48d^4+14d^5\right)+4d^8+18d^5+32d^4 > 0$

    $\frac{\partial\Theta(.)}{\partial K}|_{K=\underline{K}} = \frac{(d-1)d(d+1)(d^2-2d-4)\left[8\left(1-d^2\right)+(1-d)\left(40-20d^2\right)+d^4+2d^5\right]}{(2-d)} > 0 \Rightarrow \frac{\partial\Theta(.)}{\partial K} > 0$

    $\Theta|_{K=\underline{K}} = \frac{4(4-d)(d-1)^3d^2(d+1)^2(d^2-2d-4)(d^3+2d^2-4)}{(d-2)^3(d+2)} > 0 \Rightarrow \Theta(.) > 0 \theta_i^{E/E} - \theta_i^{E/N} > 0.$

  Q.E.D.

- *Retail profits:*
  - $\pi_R^{N/E} - \pi_R^{N/N} = 0$
  - $\pi_R^{E/N} - \pi_R^{N/N} = \frac{(1-d)K[C(.)]^2}{2(1+d)A(.)[D(.)]^2} > 0$
  - $\pi_R^{E/E} - \pi_R^{E/N} = \frac{(1-d)K\left(-2A(.)[D(.)]^2F(.)[G(.)]^2-(2-d)^2[C(.)]^2[H(.)]^2[J(.)]^2\right)}{2(2-d)^2(1+d)A(.)[D(.)]^2[H(.)]^2[J(.)]^2} = \frac{(d-1)dK^2\Sigma(.)}{2(2-d)^2(1+d)A(.)[D(.)]^2[H(.)]^2[J(.)]^2}$
    $\Rightarrow \pi_R^{E/E} - \pi_R^{E/N} > 0 \Leftrightarrow \Sigma(.) < 0$

$$
\begin{aligned}
\frac{\partial^5\Sigma(.)}{\partial K^5} &= 480d^{17} - 3360d^{16} - 17640d^{15} + 82560d^{14} + 249600d^{13} - 873600d^{12} - 1856640d^{11} + 5191680d^{10} \\
&\quad +8087040d^9 - 18923520d^8 - 21288960d^7 + 43253760 + 33177600d^5 - 60456960d^4 - 28016640d^3 \\
&\quad +47185920d^2 + 9830400d - 15728640 \overset{Sturm's\,Theorem}{<} 0 \\
\frac{\partial^4\Sigma(.)}{\partial K^4}|_{K=\underline{K}} &= -48(d-2)^2(d-1)d(d+1)(d+2)^2[(d-1)[(1-d^2)(3456-2336d^2) + 422d^4(1-d) + 248d^4] \\
&\quad +(d^2-1)[(1-d^2)(2432-1696d^2+626d^4) + 606d^4 + 33d^8 + 4d^9] - 41d^8 - 43d^9] < 0 \\
&\quad \Rightarrow \frac{\partial^4\Sigma(.)}{\partial K^4} < 0 \\
\frac{\partial^3\Sigma(.)}{\partial K^3}|_{K=\underline{K}} &= -6(d-1)^2d^2(d+1)^2(d+2)\{(1-d)[(1-d)(1148d^6(1-d)(1-d^2)(41435+46476d+549d^6) \\
&\quad +(1-d^3)(5460+4d^6) + 419d + 2587d^4 + 16950d^5 + 2620d^6 + 20d^{10}) + 4044] + 261\} < 0 \\
&\quad \Rightarrow \frac{\partial^3\Sigma(.)}{\partial K^3} < 0 \\
\frac{\partial^2\Sigma(.)}{\partial K^2}|_{K=\underline{K}} &= \frac{4(1-d)^3d^3(d+1)^3}{(2-d)^2}\{(d-1)\{(1-d)[(1-d^2)(50295+28382d-15410d^3+2028d^5+541d^6) \\
&\quad +(1-d)(3948d+d^{11}) + 12611d^4 + 728d^5 + 1511d^6 + 72d^9 + 29d^{10} + d^{11}] + 1844\} - 45\} < 0 \\
&\quad \Rightarrow \frac{\partial^2\Sigma(.)}{\partial K^2} < 0 \\
\frac{\partial\Sigma(.)}{\partial K}|_{K=\underline{K}} &= \frac{16(d-4)(d-1)^5d^4(d+1)^4(-4+2d^2+d^3)\{(1-d)(160-76d^2)}{(d-2)^4(d+2)} \\
&\quad +\frac{(1-d^2)(224-140d^2+15d^4) + 3d^4(1-d^3) + 14d^4 + d^8\}}{(d-2)^4(d+2)} < 0 \Rightarrow \frac{\partial\Sigma(.)}{\partial K} < 0. \\
\Sigma(.)|_{K=\underline{K}} &= -\frac{32(d-4)^2(d-1)^7d^5(d+1)^5(d^2-2d-4)(d^3+2d^2-4)^2}{(d-2)^6(d+2)^2} < 0 \Rightarrow \Sigma(.) < 0. \\
&\quad \Rightarrow \pi_R^{E/E} - \pi_R^{E/N} > 0.
\end{aligned}
$$

Q.E.D.

Proof of Proposition 1.4.1.

In order to prove this proposition it is sufficient to show that there exist parameters d and K satisfying equilibrium conditions.

(i) Both manufacturers do **not** adopt exclusive retailing.

$\pi_{Mi}^{N/N}/\pi_{Mi}^{E/N} > 1$ & $\pi_{Mi}^{N/E}/\pi_{Mi}^{E/E} > 1$

The later condition assures that the type (i) equilibrium is unique. Suppose $d = 0.85$ and $K = 1.8$. As can be easily shown, these values satisfy the conditions above. Hence, the N/N distribution system constitutes an unique equilibrium.

M1\M2	Exclusivity	Non-exclusivity
Exclusivity	0.110, 0.110	0.060, 0.122
Non-exclusivity	0.122, 0.060	0.061, 0.061

(*ii*) One manufacturer adopts exclusive retailing and the other manufacturer does not adopt exclusive retailing.

$\pi_{Mi}^{E/N}/\pi_{Mi}^{N/N} > 1$ & $\pi_{Mi}^{N/E}/\pi_{Mi}^{E/E} > 1$

The later condition assures that the second manufacturer is not willing to adopt exclusivity if the first one has done so. Suppose that $d = 0.85$ and $K = 1.2$. As can be easily shown, these values satisfy the conditions above. Hence, there are two identical asymmetric equilibria of type E/N given the values for d and K.

M1\M2	Exclusivity	Non-exclusivity
Exclusivity	0.125, 0.125	0.065, 0.126
Non-exclusivity	0.126, 0.065	0.061, 0.061

(*iii*) Both manufacturers adopt exclusive retailing.

$\pi_{Mi}^{E/E}/\pi_{Mi}^{N/E} > 1$ & $\pi_{Mi}^{E/N}/\pi_{Mi}^{N/N} > 1$

The later condition assures that the type (*iii*) equilibrium is unique. Suppose that $d = 0.85$ and $K = 0.6$. As can be easily shown, these values satisfy the conditions above. Hence, the E/E distribution system constitutes an unique equilibrium.

M1\M2	Exclusivity	Non-exclusivity
Exclusivity	0.202, 0.202	0.086, 0.143
Non-exclusivity	0.143, 0.086	0.061, 0.061

It remains to be shown that for some parameter combinations there exist multiple equilibria of type (*i*) and (*iii*).

Thus,$\pi_{Mi}^{N/N}/\pi_{Mi}^{E/N} > 1$ & $\pi_{Mi}^{E/E}/\pi_{Mi}^{N/E} > 1$

Suppose $d = 0.5$ and $K = 1$. As can be easily shown, these values satisfy the conditions above:

M1\M2	Exclusivity	Non-exclusivity
Exclusivity	0.237, 0.237	0.142, 0.226
Non-exclusivity	0.226, 0.142	0.148, 0.148

Q.E.D.

Proof of Proposition 1.5.1.

The proof consists of two steps:

(i) The N/N-equilibrium occurs if and only if both firms have no incentive to adopt exclusivity if their competitor has not done so. The profits in the N/N regime remain the same as in the symmetric case as no investment occurs and so, investment costs are irrelevant for the manufacturers' profits. Moreover, the profits in the E/N regime (i.e. the more efficient firm adopts exclusivity) do not change either as only the more efficient firm invests and its investment costs remain equal to the symmetric case. Thus, the incentive of the more efficient firm not to adopt exclusivity if its competitor has not done so, remain unchanged. In addition, the profits in the N/E regime (i.e. less efficient firm adopts exclusivity) are due to a smaller investment effect (i.e. higher investment cost) lower than in the E/N regime. Therefore, if it is not profitable for the more efficient firm to adopt exclusivity, neither it is efficient for the less efficient manufacturer. Hence, the situation is equal to the symmetric case. Q.E.D.

(ii) The E/N- equilibrium occurs when the following two conditions are satisfied:

1. Manufacturer 1 has an incentive to adopt exclusivity when its competitor has not adopted it yet.

2. Manufacturer 2 has incentives not to adopt exclusivity when its competitor has adopted it.

We have seen in (i) that the first incentive is the same in both the symmetric and the asymmetric case. Thus, we have to show that the incentive in 2. is larger in the asymmetric than in symmetric case. Hence, it is sufficient to show that $\pi_{M2}^{E/E}$ is lower in the asymmetric than in the symmetric case. Note that the double markup effect as well as the competition softening effect are equal in both cases. The investment effect is smaller, the larger the investment costs are. As manufacturer 2 has larger investment cost in the asymmetric case, its profit is smaller in this case than in the symmetric case.

The argument follows in algebraic form:

Let the investment costs of retailer 1 and retailer 2 be $K(\frac{\theta_{11}^2}{2}+\frac{\theta_{12}^2}{2})$and $(K+\Delta)(\frac{\theta_{11}^2}{2}+$

$\frac{\theta_{12}^2}{2}$), respectively. We want to show that $\pi_{M2}^{E/E}$ is a decreasing in Δ:

$$\pi_{M2}^{E/E} = \frac{(2+d)G(K,d)M(K,\Delta,d)[P(K,\Delta,d)]^2}{(2-d)(1+d)Q(K,\Delta,d)[R(K,\Delta,d)]^2}$$

We already know that $G(K,d) > 0 \,\forall d \in (0,1) \wedge K > \frac{4-4d^2}{8-4d-2d^2+d^3}$

$$\Rightarrow sgn(\frac{\partial \pi_{M2}^{E/E}(K,\Delta,d)}{\partial \Delta}) = sgn(\frac{\partial (M(K,\Delta,d)[P(K,\Delta,d)]^2/Q(K,\Delta,d)[R(K,\Delta,d)]^2)}{\partial \Delta})$$

Therefore, we have to determine the sign of

$$\frac{\partial \left[M(K,\Delta,d)[P(K,\Delta,d)]^2\right]}{\partial \Delta} Q(K,\Delta,d)[R(K,\Delta,d)]^2 - \frac{\partial \left[Q(K,\Delta,d)[R(K,\Delta,d)]^2\right]}{\partial \Delta} M(K,\Delta,d)[P(K,\Delta,d)]^2.$$

If this term is negative, the profit of the second manufacturer decreases when Δ increases. We can rewrite this term as: $8(-1+d)^2(1+d)P(.)R(.)Z(K,\Delta,d)$

First, we examine the sign of $P(d,K,\Delta)$:

$\frac{\partial P(.)}{\partial \Delta} = 32 - 48d^2 + 4d^3 + 16d^4 - 4d^5 + K[(-4+d^2)^2(-4-d+2d^2)] \Rightarrow \frac{\partial P(.)}{\partial \Delta \partial K} = (-4+d^2)^2(-4-d+2d^2) < 0$

$\frac{\partial P(.)}{\partial \Delta}|_{K=\underline{K}} = -4(-1+d)d(1+d)(-6-d+3d^2) < 0 \Rightarrow \frac{\partial P(.)}{\partial \Delta} < 0 \,\forall \Delta$

$P(.)|_{\Delta=0} = -16 + 32d^2 - 16d^4 + 64K + 8dK - 92d^2K - 4d^3K + 28d^4K - 4d^5K - 64K^2 - 16dK^2 + 64d^2K^2 + 8d^3K^2 - 20d^4K^2 - d^5K^2 + 2d^6K^2$

$\frac{\partial P^2(.)|_{\Delta=0}}{\partial K^2} = 2(-2+d)^2(2+d)^2(-4-d+2d^2) < 0$

$\frac{\partial P(.)|_{\Delta=0}}{\partial K}\ |_{K=\underline{K}} = -4(-1+d)d(1+d)(-10-d+5d^2) < 0 \Rightarrow \frac{\partial P(.)|_{\Delta=0}}{\partial K} < 0$

$[P(.)|_{\Delta=0}]|_{K=\underline{K}} = \frac{32(-1+d)^3d^2(1+d)^2}{(-2+d)^2(2+d)} < 0 \Rightarrow P(.)|_{\Delta=0} < 0 \Rightarrow P(.) < 0$ for any d, K, Δ from our domain of definition.

Second, we examine the sign of $R(d,K,\Delta)$.

$\frac{\partial R(.)}{\partial \Delta} = 32 - 52d^2 + 20d^4 + K[(-2+d)(2+d)(-4-d+2d^2)(-4+d+2d^2)]$

$\Rightarrow \frac{\partial R(.)}{\partial \Delta \partial K} = (-2+d)(2+d)(-4-d+2d^2)(-4+d+2d^2) < 0$

$\frac{\partial R(.)}{\partial \Delta}|_{K=\underline{K}} = -\frac{4(-1+d)^2d(1+d)(-8-d+4d^2)}{-2+d} < 0 \Rightarrow \frac{\partial R(.)}{\partial \Delta} < 0 \,\forall \Delta$

$R(.)|_{\Delta=0} = (-4+4d^2+8K-2dK-5d^2K+2d^3K)J(.)$

$\Rightarrow sgn[R(d,K,\Delta)|_{\Delta=K}] = -sgn[-4+4d^2+8K-2dK-5d^2K+2d^3K]$

$\frac{\partial(-4+4d^2+8K-2dK-5d^2K+2d^3K)}{\partial K} = 8-2d-5d^2+2d^3 > 0 \wedge (-4+4d^2+8K-2dK-5d^2K+2d^3K)|_{K=\underline{K}} = -\frac{4(-1+d)^2d(1+d)}{(-2+d)(2+d)} > 0$

$\Rightarrow -4+4d^2+8K-2dK-5d^2K+2d^3K>0 \Rightarrow R(.)<0$ for any d, K, Δ from our domain of definition.

In order to complete the proof, we have to show that $Z(d,K,\Delta)$ is always negative:

$\frac{\partial^2 Z(.)}{\partial \Delta} = 2(d-2)X(d,k)$

$\frac{\partial^3 X(.)}{\partial K^3} = 6(-2+d)^3(2+d)^4(-4-d+2d^2)(16-15d^2+d^3+3d^4) > 0$

$\frac{\partial^2 X(.)}{\partial K^2}|_{K=\underline{K}} = -4(-2+d)(-1+d)[-21d^4-3(1-d)d^4+(1-d^2)(-224+72d+80d^2-37d^3-4d^4)]d(1+d)(2+d)^3 > 0 \Rightarrow \frac{\partial^2 X(.)}{\partial K^2} > 0$

$\frac{\partial X(.)}{\partial K}|_{K=\underline{K}} = \frac{16(-1+d)^2d^2(1+d)^2(2+d)(-128+42d+181d^2-52d^3-72d^4+16d^5+7d^6)}{-2+d} > 0 \Rightarrow \frac{\partial X(.)}{\partial K} > 0$

$X(.)|_{K=\underline{K}} = -\frac{32(-1+d)^4d^3(1+d)^3(48+10d-45d^2-3d^3+10d^4)}{(-2+d)^3} > 0 \Rightarrow X(.) > 0 \Rightarrow \frac{\partial^2 Z(.)}{\partial \Delta} < 0$ for any Δ

$\frac{\partial Z(.)}{\partial \Delta}|_{\Delta=0} = 2(-4+4d^2+8K-2dK-5d^2K+2d^3K)\Xi(K,d)$

We have already shown that $(-4+4d^2+8K-2dK-5d^2K+2d^3K)>0$.

Thus, $sgn[\frac{\partial Z(d,K,\Delta)}{\partial \Delta}|_{\Delta=K}] = sgn[\Xi(K,d)]$

$\frac{\partial^3 \Xi(.)}{\partial K^3} = 6(-2+d)^3(2+d)^4(16-15d^2+d^3+3d^4) < 0$

$\frac{\partial^2 \Xi(.)}{\partial K^2}|_{K=\underline{K}} = -4(-2+d)(-1+d)d(1+d)(2+d)^2(128-2d-127d^2+2d^3+28d^4+2d^5) < 0 \Rightarrow \frac{\partial^2 \Xi(.)}{\partial K^2} < 0$

$\frac{\partial \Xi(.)}{\partial K}|_{K=\underline{K}} = \frac{4(-1+d)^2d^2(1+d)^2(2+d)(156-80d-129d^2+51d^3+16d^4)}{-2+d} < 0 \Rightarrow \frac{\partial \Xi(.)}{\partial K} < 0$

$\Xi(.)|_{K=\underline{K}} = -\frac{48(-1+d)^4d^3(1+d)^3(-10-d+5d^2)}{(-2+d)^3} < 0 \Rightarrow \Xi(.) < 0 \Rightarrow \frac{\partial Z(.)}{\partial \Delta}|_{\Delta=0} < 0 \Rightarrow \frac{\partial Z(.)}{\partial \Delta} < 0$

$Z(.)|_{\Delta=0} = \Omega(d,K)I(d,K)(-4+4d^2+8K-2dK-5d^2K+2d^3K)$

We have already shown that $I(.)<0$ and $-4+4d^2+8K-2dK-5d^2K+2d^3K>0$.

Therefore, $sgn[Z(d,K,\Delta)|_{\Delta=0}] = -sgn[\Omega(d,K)]$

$\frac{\partial^3 \Omega(.)}{\partial K^3} = 6(-2+d)^2(2+d)^2(16-15d^2+d^3+3d^4) > 0$

$\frac{\partial^2 \Omega(.)}{\partial K^2}|_{K=\underline{K}} = -4(-1+d)d(1+d)(2+d)(48-28d-33d^2+18d^3+2d^4) > 0 \Rightarrow \frac{\partial^2 \Omega(.)}{\partial K^2} > 0$

$\frac{\partial \Omega(.)}{\partial K}|_{K=\underline{K}} = \frac{48(-1+d)^3d^2(1+d)^2(-3+d+d^2)}{(-2+d)^2} > 0 \Rightarrow \frac{\partial \Omega(.)}{\partial K} > 0$

$\Omega(.)|_{K=\underline{K}} = -\frac{96(-1+d)^5d^3(1+d)^3}{(-2+d)^4(2+d)} > 0 \Rightarrow \Omega(.) > 0 \Rightarrow Z(.)|_{\Delta=0} < 0 \Rightarrow Z(.) < 0$

$\Rightarrow \frac{\partial \pi_{M2}^{E/E}}{\partial \Delta} < 0$ for any d, K, Δ from our domain of definition.

Q.E.D

Proof of Proposition 1.6.1.

This proof consists of three parts:

1. We show that under $K < \tilde{K} = \frac{4(3+d)-2d^2(5+d)+2(1+d)\sqrt{4(3+d)-2d^2(5+d)+2(1+d)}}{(4-d^2)^2}$ consumer surplus in E/E is larger than in N/N.
2. We show that under this condition consumer surplus in E/E is always larger than in E/N.
3. We show that under this condition there exists no asymmetric equilibrium.

ad 1. Note that both E/E and E/N are symmetric. Thus, the consumer surplus in the E/E regime is larger than in the N/N regime if the quantity under E/E is larger than under N/N. This is the case if the following condition holds:

$$\frac{(-1+d)(16+16d-16d^2-16d^3-48K-40dK+32d^2K+28d^3K+4d^4K+32K^2+16dK^2-16d^2K^2-8d^3K^2+2d^4K^2+d^5K^2)}{(-2+d)(1+d)H(.)J(.)} > 0$$

$$\Leftrightarrow K^2(32+16d-16d^2-8d^3+2d^4+d^5)+K(-48-40d+32d^2+28d^3+4d^4)+16+16d-16d^2-16d^3<0$$

under consideration of SOC ($K > \underline{K}$) by solving this inequality we get: $K < \tilde{K}$. Q.E.D.

ad 2. Note that the investment effect on consumer surplus is stronger in E/E than in E/N. This can be explained by reciprocal investment in marketing of both brands. Moreover, the effect of K on consumer surplus is stronger in E/E case than in E/N case since in E/N case only exclusive retailer invests and therefore K directly affects the quantity of the exclusive brand but indirectly the quantity of the non-exclusive brand (via product differentiation). In the E/E regime both quantities are affected directly. In other words, the difference between consumer surplus in these two regimes is increasing in K. We can show this statement using some simple algebra:

$$\frac{\partial(CS^{E/E}(d,K)-CS^{E/N}(d,K))}{\partial K} = -\frac{(1-d)\chi(d,K)}{[A(d,K)]^3[D(d,K)]^3[H(d,K)]^3[J(d,K)]^3}$$

$$\Rightarrow \frac{\partial(CS^{E/E}(d,K)-CS^{E/N}(d,K))}{\partial K} < 0 \Leftrightarrow \chi(.) < 0$$

$$\begin{aligned}
\frac{\partial\chi^{10}(.)}{\partial K^{10}} &= -9747+8559d+\left(1-d^2\right)(-5130+(1-d)(-62703+(1-d)(-145710d^7-57577d^{10}-20831d^{11}+8494d^{12} \\
&\quad +1260d^{13}-520d^{14}-166202\left(1-d^5\right)+\left(1-d^2\right)\left(-145797d^2-194182d^3+88872d^5-114319d^6-142582d^7\right) \\
&\quad +(1-d)\left(-18362-382381d^3+360000d^5-103273d^7\right)))) < 0 \\
\frac{\partial^9\chi(.)}{\partial K^9}|_{K=\underline{K}} &= 362880\,(-1+d)\,(2+d)^4\,(1048576+7864320d-10158080d^2-11206656d^3+18980864d^4-20746240d^5 \\
&\quad -3653632d^6+64204800d^7-24083200d^8-67990528d^9+31040832d^{10}+38386848d^{11}-18019808d^{12}
\end{aligned}$$

$$-12651200d^{13}+5740476d^{14}+2509294d^{15}-1033931d^{16}-320648d^{17}+105389d^{18}+31118d^{19}-6804d^{20}$$
$$-1944d^{21}+384d^{22}) \overset{\text{Sturm's Theorem}}{<} 0 \Rightarrow \frac{\partial^9\chi(.)}{\partial K^9}<0$$

$$\frac{\partial^8\chi(.)}{\partial K^8}|_{K=\underline{K}} = \frac{1}{(-2+d)^2}120960(-1+d)^2d(1+d)(2+d)^3(-7340032-30146560d+57016320d^2+42270720d^3$$
$$-76464128d^4+35938304d^5-32413696d^6-112777216d^7+148110336d^8+98087168d^9$$
$$-137400192d^{10}-44632320d^{11}+63497024d^{12}+12731248d^{13}-16717568d^{14}-2679720d^{15}$$
$$+2717456d^{16}+442294d^{17}-302807d^{18}-48374d^{19}+21419d^{20}+2998d^{21}-564d^{22}-216d^{23}$$
$$+32d^{24}) \overset{\text{Sturm's Theorem}}{<} 0 \Rightarrow \frac{\partial^8\chi(.)}{\partial K^8}<0$$

$$\frac{\partial^7\chi(.)}{\partial K^7}|_{K=\underline{K}} = \frac{1}{(-2+d)^4}5040(-1+d)^3d^2(1+d)^2(2+d)^2(208666624+523239424d-1431044096d^2$$
$$-649723904d^3+1702133760d^4-2441216d^5+567300096d^6+97677312d^7-2405477376d^8$$
$$+223821312d^9+1969144832d^{10}-206317312d^{11}-826604608d^{12}+54924128d^{13}+211237872d^{14}$$
$$-3415200d^{15}-35656848d^{16}-421884d^{17}+3995722d^{18}+152135d^{19}-291579d^{20}-26497d^{21}$$
$$+16876d^{22}+345d^{23}-154d^{24}-68d^{25}+8d^{26}) \overset{\text{Sturm's Theorem}}{<} 0 \Rightarrow \frac{\partial^7\chi(.)}{\partial K^7}<0$$

$$\tfrac{\partial^6\chi(.)}{\partial K^6}|_{K=\underline{K}} = -\frac{1}{(-2+d)^6}720(-1+d)^4d^3(1+d)^3(2+d)(1148190720+1623719936d-6943670272d^2-1522401280d^3$$
$$+8220934144d^4+2014773248d^5-774782976d^6-5065863168d^7-4622747648d^8+5247410176d^9$$
$$+4049376256d^{10}-2562309888d^{11}-1816873216d^{12}+678837248d^{13}+503555264d^{14}-110289440d^{15}$$
$$-86226880d^{16}+11722352d^{17}+9880928d^{18}-858008d^{19}-795262d^{20}+56696d^{21}+32777d^{22}$$
$$+1211d^{23}-1726d^{24}+100d^{25}+8d^{26}) \overset{Sturm's\,Theorem}{<} 0 \Rightarrow \frac{\partial^6\chi(.)}{\partial K^6}<0$$

$$\frac{\partial^5\chi(.)}{\partial K^5}|_{K=\underline{K}} = \frac{1}{(-2+d)^8}1440(-1+d)^5d^4(1+d)^4(332922880+199491584d-1760821248d^2-36962304d^3$$
$$+2259894272d^4+627998720d^5-1291350016d^6-1559681024d^7+308211712d^8+1385933824d^9$$
$$+129782016d^{10}-645355392d^{11}-145858112d^{12}+179201344d^{13}+52903040d^{14}-30329632d^{15}$$
$$-10084800d^{16}+3458848d^{17}+1137880d^{18}-285658d^{19}-81390d^{20}+16299d^{21}+4552d^{22}$$
$$-1041d^{23}-26d^{24}+12d^{25}) \overset{Sturm's\,Theorem}{<} 0 \Rightarrow \frac{\partial^5\chi(.)}{\partial K^5}<0$$

$$\frac{\partial^4\chi(.)}{\partial K^4}|_{K=\underline{K}} = -\frac{1}{(-2+d)^{10}(2+d)}192(-1+d)^6d^5(1+d)^5(1132986368-16515072d-5268635648d^2$$
$$+867237888d^3+7730397184d^4+1038114816d^5-6994022400d^6-3360485376d^7$$
$$+4043362304d^8+3117941248d^9-1270275584d^{10}-1575115008d^{11}+145991296d^{12}$$
$$+462831872d^{13}+29444576d^{14}-81874432d^{15}-11125552d^{16}+9191840d^{17}+1427988d^{18}$$
$$-720396d^{19}-73314d^{20}+35772d^{21}+578d^{22}-869d^{23}+78d^{24}-8d^{25}+d^{26}) \overset{Sturm's\,Theorem}{<} 0$$
$$\Rightarrow \frac{\partial^4\chi(.)}{\partial K^4}<0$$

$$\frac{\partial^3\chi(.)}{\partial K^3}|_{K=\underline{K}} = \frac{1}{(-2+d)^{12}(2+d)^2}192(-1+d)^7d^6(1+d)^6(418643968-196476928d-1758494720d^2$$
$$+647462912d^3+2949898240d^4-332296192d^5-3090866176d^6-306096128d^7$$
$$+1992954368d^8+565802240d^9-791036288d^{10}-362372608d^{11}+180364800d^{12}$$
$$+123434784d^{13}-20026032d^{14}-23989320d^{15}+364488d^{16}+2810316d^{17}+119628d^{18}$$
$$-186354d^{19}-17010d^{20}+8591d^{21}+172d^{22}+56d^{23}-63d^{24}+6d^{25}) \overset{Sturm's\,Theorem}{<} 0$$
$$\Rightarrow \frac{\partial^3\chi(.)}{\partial K^3}<0$$

$$\frac{\partial^2\chi(.)}{\partial K^2}|_{K=\underline{K}} = -\frac{1}{(-2+d)^{14}(2+d)^3}768(-4+d)(-1+d)^9d^7(1+d)^8(-4-2d+d^2)(-4+2d^2+d^3)$$
$$(507904-532480d-933888d^2+761344d^3+909312d^4-431360d^5-495936d^6$$

$$
\begin{aligned}
& +82240d^7 + 150576d^8 + 5712d^9 - 21104d^{10} - 4340d^{11} + 2044d^{12} + 242d^{13} \\
& -13d^{14} - 32d^{15} + 4d^{16}) \overset{Sturm's\,Theorem}{<} 0 \Rightarrow \frac{\partial^2 \chi(.)}{\partial K^2} < 0 \\
\frac{\partial \chi(.)}{\partial K}|_{K=\underline{K}} &= \frac{512(-4+d)^2(-1+d)^{11}d^8(1+d)^9(-4-2d+d^2)^2(-4+2d^2+d^3)^2}{(-2+d)^{16}(2+d)^4} \\
& [53d^4 + 12d^5 + 10d^8 + (1-d)(1728 - 584d^2) + 41d^4(1-d^3) \\
& +(1-d^2)(1472 - 1224d^2 + 90d^4)] < 0 \Rightarrow \frac{\partial \chi(.)}{\partial K} < 0 \\
\chi(.)|_{K=\underline{K}} &= -\frac{6144(-4+d)^3(-1+d)^{13}d^9(1+d)^{10}(-4-2d+d^2)^3(-4+2d^2+d^3)^3}{(-2+d)^{18}(2+d)^5} < 0 \\
& \Rightarrow \chi(.) < 0
\end{aligned}
$$

$\Rightarrow \frac{\partial(CS^{E/E}(d,K) - CS^{E/N}(d,K))}{\partial K} < 0$ for any d, K from our domain of definition.

Using these results, we can prove the original statement: If consumer surplus under E/E is larger than under N/N, the same logic also applies to size of the consumer surplus under E/N. We know that the consumer surplus is larger under E/E than under N/N if K is sufficiently small (see the condition above). In addition, we divide our parameter space into two subspaces:

i. $0 < d < 0.5$

ii. $0.5 \leq d < 1$

ad i. Suppose that $K = 1 + d/2$. Moreover, note that:

$\tilde{K} < 1 + \frac{d}{2} \Leftrightarrow 0 < 32d^2 + 48d^3 + 24d^4 - 20d^5 - 8d^6 - 2d^7 - d^8 + d^9 + \frac{d^{10}}{4}$ for $d \in (0, 0.5)$

$$
\begin{aligned}
(CS^{E/E} - CS^{E/N})|_{K=1+d/2} &= -\frac{(-1+d)d^2}{8(1+d)(1+d+d^2)^2(-4-2d+d^2+2d^3)^2(8+d^4)^2(-8-12d+9d^3+2d^4)^2} \\
& (32768 + 262144d + 843776d^2 + 1236992d^3 + 65536d^4 - 2930688d^5 - 5085184d^6 \\
& -3376128d^7 + 1018880d^8 + 3631872d^9 + 2476224d^{10} - 12800d^{11} - 1026432d^{12} \\
& -530624d^{13} + 75048d^{14} + 176824d^{15} + 50584d^{16} - 18520d^{17} - 16249d^{18} \\
& -3812d^{19} + 32d^{20} + 144d^{21} + 16d^{22})) \overset{Sturm's\,Theorem}{>} 0
\end{aligned}
$$

Remember that this difference is decreasing in K. Thus, $CS^{E/E} > CS^{E/N}$ for d between 0 and 1/2 and $K < 1 + d/2$.

ad ii. Suppose now that $K = 3/2 - d/2$. Moreover, note:

$$\tilde{K} < \tfrac{3}{2} - \tfrac{d}{2} \Leftrightarrow 0 \overset{\text{Sturm's Theorem}}{<} 128 - 320d + 96d^2 + 240d^3 - 76d^4 - 96d^5 + 22d^6 + 20d^7 - \tfrac{15d^8}{4} - \tfrac{3d^9}{2} + \tfrac{d^{10}}{4}$$

$$\begin{aligned}(CS^{E/E} - CS^{E/N})|_{K=3/2-d/2} \quad = \quad & \frac{(1-d)}{8}(-2+d)^{-2}(1+d)^{-1}(2-d+d^2)^{-2}(-8-3d+3d^2+2d^3)^{-2} \\ & (-16+20d-6d^2-5d^3+d^4)^{-2}(-16+8d+5d^2-5d^3+2d^4)^{-2} \\ & (-29360128+103809024d-50135040d^2-166428672d^3 \\ & +177827840d^4+95567872d^5-206496768d^6+7089664d^7+143738048d^8-62955392d^9 \\ & -56805760d^{10}+56995824d^{11}+2648800d^{12}-25435624d^{13}+9554739d^{14}+4915108d^{15} \\ & -4818244d^{16}+417792d^{17}+992954d^{18}-407896d^{19}-41316d^{20}+68536d^{21}-14853d^{22} \\ & -2044d^{23}+1552d^{24}-272d^{25}+16d^{26}) \overset{Sturm's Theorem}{>} 0\end{aligned}$$

Remember that this difference is decreasing in K. Thus, $CS^{E/E} > CS^{E/N}$ for d between 1/2 and 1 and $K < 3/2 - d/2$. Q.E.D

ad 3. We have already shown that if the above mentioned condition is binding, the consumer surplus under N/N is larger than under E/N. Now, we show that there exists no asymmetric equilibrium under this condition.

First, consider the incentives of a manufacturer to adopt exclusivity if the competing manufacturer one has not adopted exclusivity. These incentives are the stronger the smaller K is. In order to see that, note that K does not affect the profit in the N/N regime. However, it negatively influences the profit in the E/N regime. Thus, the difference between profits in both regimes is decreasing in K. Second, consider the incentives of a manufacturer to adopt exclusivity if the competing manufacturer has adopted exclusivity. These incentives are stronger the smaller K is as the impact of K on profits under E/E is direct as well as indirect while in E/N regime only indirect. Thus, the difference between the manufacturer profit of the non-exclusive brand in E/N and the manufacturer profit under E/E is increasing in K. The algebraic proof is given here:

$$\frac{\partial(\pi_1^{E/N} - \pi_1^{N/N})}{\partial K} = \frac{(-1+d)^2 C(.)}{[A(.)]^2 [D(.)]^3}(-8-4d+18d^2+9d^3-12d^4-6d^5+2d^6+d^7+32K+16dK-46d^2K-17d^3K+17d^4K+d^5K-3d^6K-32K^2-16dK^2+20d^2K^2-2d^3K^2-9d^4K^2)$$

Consider now the second derivative of the last term in the product above with respect to K:

$$-64 - 32d + 40d^2 - 4d^3 - 18d^4 < 0$$

By evaluating of first derivative at K's lower bound we get:

$$-\frac{(-1+d)d(1+d)(-128-80d+32d^2-24d^4-7d^5+3d^6)}{(-2+d)^2(2+d)} < 0$$

Thus, the first derivative is negative for all K's. In other words, the expression is decreasing in K. We evaluate this expression at the lower bound of K:

$$\frac{(-1+d)^2d^2(1+d)^2(-128-96d-48d^2+4d^4-4d^5-2d^6+d^7)}{(-2+d)^4(2+d)^2} < 0$$

Thus, the incentives to adopt exclusivity, if the competitor has not adopted exclusivity, is decreasing in K.

The impact of K on the incentives not to adopt exclusivity when the other one has adopted it is given by:

$$\frac{\partial(\pi_2^{E/N}-\pi_2^{E/E})}{\partial K} = \frac{(1-d)^2\varpi(d,K)}{(2-d)[A(d,K)]^2[D(d,K)]^3[H(d,K)]^3J(d,K)]^3} \Rightarrow \frac{\partial(\pi_2^{E/N}-\pi_2^{E/E})}{\partial K} > 0 \Leftrightarrow \varpi(.) < 0$$

$$\begin{aligned}
\frac{\partial^8\varpi(.)}{\partial K^8} &= 40320(-2+d)^2(2+d)^4(-131072+98304d+311296d^2-307200d^3-227328d^4+403456d^5 \\
&\quad -23552d^6-292288d^7+125632d^8+128384d^9-75968d^{10}-34584d^{11}+21200d^{12}+5165d^{13} \\
&\quad -2914d^{14}-292d^{15}+168d^{16}) \overset{Sturm's\,Theorem}{<} 0 \\
\frac{\partial^7\varpi(.)}{\partial K^7}|_{K=\underline{K}} &= 5040(-1+d)d(1+d)(2+d)^3(2490368-2228224d-4980736d^2+5406720d^3+2267136d^4 \\
&\quad -5056512d^5+2019328d^6+2285568d^7-2754176d^8-545088d^9+1315264d^{10}+101360d^{11} \\
&\quad -315416d^{12}-26708d^{13}+40218d^{14}+5127d^{15}-3190d^{16}-428d^{17}+152d^{18}) \overset{Sturm's\,Theorem}{<} 0 \\
&\quad \Rightarrow \frac{\partial^7\varpi(.)}{\partial K^7} < 0 \\
\frac{\partial^6\varpi(.)}{\partial K^6}|_{K=\underline{K}} &= \frac{1}{(-2+d)^2}720(-1+d)^2d^2(1+d)^2(2+d)^2(-20185088+20643840d+34832384d^2-38346752d^3 \\
&\quad -12771328d^4+21049344d^5-12476416d^6+1000960d^7+14889216d^8-4535936d^9-7092288d^{10} \\
&\quad +1371344d^{11}+1910096d^{12}-113332d^{13}-300544d^{14}-4376d^{15}+27280d^{16}+1855d^{17}-1334d^{18} \\
&\quad -204d^{19}+56d^{20}) \overset{Sturm's\,Theorem}{>} 0 \Rightarrow \frac{\partial^6\varpi(.)}{\partial K^6} > 0 \\
\frac{\partial^5\varpi(.)}{\partial K^5}|_{K=\underline{K}} &= \frac{1}{(-2+d)^4}120(-1+d)^3d^3(1+d)^3(2+d)(92274688-104857600d-145457152d^2+154927104d^3 \\
&\quad +76447744d^4-42135552d^5-5560320d^6-44448768d^7-18159616d^8+36814848d^9+14847104d^{10} \\
&\quad -11526656d^{11}-5530688d^{12}+1817520d^{13}+1038472d^{14}-148612d^{15}-116292d^{16}+5176d^{17}+7974d^{18} \\
&\quad -51d^{19}-210d^{20}-36d^{21}+8d^{22}) \overset{Sturm's\,Theorem}{<} 0 \Rightarrow \frac{\partial^5\varpi(.)}{\partial K^5} < 0 \\
\frac{\partial^4\varpi(.)}{\partial K^4}|_{K=\underline{K}} &= -\frac{1}{(-2+d)^6}96(-1+d)^4d^4(1+d)^4(65536000-81166336d-102531072d^2+108441600d^3 \\
&\quad +86843392d^4-30713856d^5-55618560d^6-25549824d^7+19732992d^8+24935744d^9 \\
&\quad -1266560d^{10}-9296064d^{11}-1178128d^{12}+1773000d^{13}+370332d^{14}-208484d^{15}-49628d^{16} \\
&\quad +15309d^{17}+3837d^{18}-641d^{19}-216d^{20}+36d^{21}) \overset{Sturm's\,Theorem}{<} 0 \Rightarrow \frac{\partial^4\varpi(.)}{\partial K^4} < 0 \\
\frac{\partial^3\varpi(.)}{\partial K^3}|_{K=\underline{K}} &= \frac{1}{(-2+d)^8(2+d)}24(-1+d)^5d^5(1+d)^5(119013376-158990336d-198967296d^2 \\
&\quad +229949440d^3+221495296d^4-126754816d^5-170844160d^6+9434112d^7+79060992d^8 \\
&\quad +25422080d^9-20823424d^{10}-13156992d^{11}+2726944d^{12}+3030064d^{13}-199664d^{14} \\
&\quad -388688d^{15}+6936d^{16}+33292d^{17}-1294d^{18}-1649d^{19}+200d^{20}+2d^{21}) \overset{Sturm's\,Theorem}{<} 0 \\
&\quad \Rightarrow \frac{\partial^3\varpi(.)}{\partial K^3} < 0
\end{aligned}$$

$$\begin{aligned}
\frac{\partial^2\varpi(.)}{\partial K^2}|_{K=\underline{K}} &= -\frac{1}{(-2+d)^{10}(2+d)^2}32(-1+d)^6d^6(1+d)^6(33816576-48726016d-62046208d^2+85196800d^3\\
&+73228288d^4-68294656d^5-56822784d^6+25639680d^7+29120256d^8-2739648d^9-9091136d^{10}\\
&-1166048d^{11}+1740272d^{12}+395040d^{13}-217696d^{14}-52732d^{15}+21940d^{16}+1758d^{17}-1031d^{18}\\
&+37d^{19}+8d^{20}) \overset{Sturm's\,Theorem}{<} 0 \Rightarrow \frac{\partial^2\varpi(.)}{\partial K^2}<0\\
\frac{\partial\varpi(.)}{\partial K}|_{K=\underline{K}} &= \frac{384(-4+d)^2(-1+d)^8d^7(1+d)^7(-4-2d+d^2)(-4+2d^2+d^3)^2}{(-2+d)^{12}(2+d)^3}(896-512d\\
&-960d^2+256d^3+392d^4-28d^5-24d^6-7d^7+2d^8)<0 \Rightarrow \frac{\partial\varpi(.)}{\partial K}<0\\
\varpi(.)|_{K=\underline{K}} &= -\frac{1536(-4+d)^3(-1+d)^{10}d^8(1+d)^8(-4-2d+d^2)^2(-4+2d^2+d^3)^3}{(-2+d)^{14}(2+d)^4)}<0\\
&\Rightarrow \varpi(.)<0 \text{for any } d,\ K \text{ from our domain of definition.}
\end{aligned}$$

Therefore, the difference between the profit of the non-exclusive manufacturer in the E/N regime and the profit of the manufacturer in the E/E regime is increasing in K.

In order to complete the non-existence proof we divide our parameter space into three subspaces:

- Consider the case where d is smaller than 0.5. In addition, suppose that $K = 1$.

$$1 < \tilde{K} \Leftrightarrow 0 < -(-2+d)^2d(2+d)(-8+4d^2+6d^3+d^4)$$

The incentive of manufacturer 1 to adopt exclusivity if its competitor has not done so is given by:

$$\frac{(-1+d)d^2(8-8d-d^2-2d^3-7d^4+2d^5+d^8)}{(-2+d)^2(1+d)(-2+d^2)^2(1+d^2)(2+d^2)^2}<0$$

From the previous analysis we know that this difference is decreasing in K. Therefore, for $d < 0.5$ and $K > 1$ there exists no asymmetric equilibrium.

Consider now the incentives not to adopt exclusivity if competitor has done so:

$$\frac{(-1+d)d^2}{(-2+d)(1+d)(-2+d^2)^2(1+d^2)(2+d^2)^2(4-4d+2d^2+d^3)(-4-2d+d^2+2d^3)^2}(-128-320d-32d^2+464d^3+592d^4+64d^5-436d^6-536d^7-228d^8+160d^9+232d^{10}+92d^{11}-15d^{12}-32d^{13}-13d^{14}+d^{16}) \overset{Sturm's\,Theorem}{<} 0$$

Thus, no positive incentive to adopt ER exists. From the previous analysis we know that this difference is increasing in K. Therefore, for $d < 0.5$ and $K < 1$ there exists no asymmetric equilibrium. In other words, if d is smaller

than 0.5, there is no asymmetric equilibrium.

- Consider now the second subsection, where $0.5 \leq d < 0.75$. In addition, suppose that $K = 1 + d/10$

$$1+\frac{d}{10} < \tilde{K} \Leftrightarrow 0 \overset{Sturm's\ Theorem}{<} -\frac{1}{100}(-2+d)^2 d(2+d)(-640-48d+416d^2+704d^3+172d^4+22d^5+d^6) \forall d \in [0.5, 0.75)$$

The incentive of manufacturer 1 to adopt exclusivity if its competitor has not done so is given by:

$$\frac{(-1+d)d(1600+8640d-4736d^2-4360d^3-6596d^4-7406d^5+674d^6+748d^7+1119d^8+1000d^9)}{2(-2+d)^2(1+d)(5+d+5d^2)(-40-8d+5d^3+10d^4)^2} \overset{Sturm's\ Theorem}{<} 0$$

From the previous analysis we know that this difference is decreasing in K. Therefore, for $0.5 \leq d < 0.75$ and $K > 1 + d/10$ there exists no asymmetric equilibrium.

Consider now the incentives not to adopt exclusivity if competitor has adopted ER:

$$\frac{(-1+d)d}{2(-2+d)(1+d)(5+d+5d^2)(40-32d+16d^2+8d^3+d^4)(-40-28d+8d^2+25d^3+2d^4)^2(-40-8d+5d^3+10d^4)^2}$$

$$(51200000-304640000d^2-334080000d^3+274764800d^4+899090944d^5+540852224d^6-453013376d^7-1044911360d^8$$

$$-673223392d^9+121484528d^{10}+486807040d^{11}+306455472d^{12}+21145876d^{13}-81353138d^{14}-48840906d^{15}-$$

$$6462016d^{16}$$

$$+3835231d^{17}+1490522d^{18}+221176d^{19}+15240d^{20}+400d^{21}) \overset{Sturm's\ Theorem}{<} 0$$

From the previous analysis we know that this difference is increasing in K. Therefore, for d between 0.5 and 0.75 and $K < 1 + d/10$ there exists no asymmetric equilibrium.

In sum there exists no asymmetric equilibrium if d is smaller than 0.75.

- Finally, consider the last subsection, where $0.75 \leq d < 1$. In addition, suppose that $K = 1408/1000 - 408d/1000$.

$$\frac{176}{125}-\frac{51d}{125} > \tilde{K} \Rightarrow \frac{1}{15625}(-2+d)^2(2+d)(185232-402848d+9384d^2+243040d^3+73452d^4-51236d^5-12750d^6+$$

$$2601d^7) \overset{Sturm's\ Theorem}{>} 0$$

Consider now the incentives to not adopt exclusivity if competitor has adopted it:

$$-\frac{-1+d}{(-2+d)(1+d)(227-102d+125d^2)(-908+1112d-352d^2-278d^3+51d^4)(908-56d-482d^2-97d^3+102d^4)^2(-908+408d+255d^2-255d^3+125d^4)^2}$$

$$(15738720504451584-31026772800625920d-16508458186889600d^2+57675869217678016d^3+823226689552768d^4-$$

$$48456960603325984d^5+16259005070184112d^6+14133753170213392d^7-16350914893485352d^8+$$

$6309091534897108d^9+5541810617834892d^{10}-5959840533879032d^{11}+409043007808180d^{12}+1641500886532907d^{13}-911172926276052d^{14}-41892114047363d^{15}+352649497192055d^{16}-105007538527782d^{17}-75443462220731d^{18}+35466154432341d^{19}+4900095065961d^{20}-3980342487375d^{21}+422825062500d^{22}) \overset{Sturm\ T.}{<} 0$

From the previous analysis we know that this difference is increasing in K. Therefore, for d between 0.75 and 1 and $K < 1408/1000 - 408d/1000$ there exists no asymmetric equilibrium.

Thus, there exists no asymmetric equilibrium for $K < \tilde{K}$. Q.E.D

Proof of Proposition 1.6.2.

This proof consists of four parts:

1. We show that social welfare in E/N as well as in E/E is a decreasing function of K
2. We determine a condition under which welfare increases with exclusivity
3. We show that there exist both E/E and E/N equilibria under this condition.
4. We show that for exclusive retailing to be welfare enhancing, retail investment must be more cost efficient the weaker the competition is.

ad 1. The intuition behind this proof is simple. Consider that only the investment effect depends on the cost of investment. Moreover, the investment effect has always a positive impact on welfare. Since this effect is stronger the smaller K is, welfare under both regimes is decreasing in K. This can also be shown algebraicly:

First, consider welfare in the E/N regime: We have already shown that consumer surplus as well as profits of the exclusive manufacturer are decreasing in K. Note, that the profit of the exclusive retailer is also decreasing in K. Thus, we only have to show that the profit of the non-exclusive manufacturer is decreasing in K:

$\frac{\partial \pi_{M2}^{E/N}}{\partial K} = \frac{(1-d)^2 d E(.) \upsilon(.)}{[A(.)]^2 [D(.)]^3}$ with

$\frac{\partial^2 \upsilon(.)}{\partial K^2} = 64 + 32d - 48d^2 - 8d^3 + 14d^4 > 0$

$\frac{\partial \upsilon(.)}{\partial K}|_{K=\underline{K}} = \frac{2(-1+d)d(1+d)\left(-4-2d+d^2\right)\left(16-4d-6d^2+d^3+2d^4\right)}{(-2+d)^2(2+d)} > 0 \Rightarrow \frac{\partial \upsilon(.)}{\partial K} > 0$

$\upsilon(.)|_{K=\underline{K}} = \frac{(-1+d)^2 d^2 (1+d)^2 G(.)\left(128-112d^2-16d^3+64d^4+12d^5-12d^6-2d^7+d^8\right)}{(-2+d)^4(2+d)^2} > 0 \Rightarrow \upsilon(.) > 0$ for any d, K from our domain of definition.

Thus, the profit of the non-exclusive manufacturer is decreasing in K and so the welfare is decreasing in K under E/N.

Now consider welfare in the E/E regime. We have already shown that consumer surplus as well as manufacturer profits are decreasing in K.

Therefore, it remains to be shown that the retailer profit also decreases in K:

$\frac{\partial \pi_R^{E/E}}{\partial K} = -\frac{8(1-d)^2(1+d)G(.)\tau(.)}{[G(.)]^3[J(.)]^3}$ with

$\frac{\partial^3 \tau(.)}{\partial K^3} = -3072 + 2304d + 3840d^2 - 2496d^3 - 2112d^4 + 1008d^5 + 624d^6 - 180d^7 - 96d^8 + 12d^9 + 6d^{10} < 0$

$\frac{\partial^2 \tau(.)}{\partial K^2}|_{K=\underline{K}} = -8(-2+d)(-1+d)d(2+d)^2(14 - 5d - 17d^2 + 4d^3 + 5d^4) < 0 \Rightarrow \frac{\partial^2 \tau(.)}{\partial K^2} < 0$

$\frac{\partial \tau(.)}{\partial K}|_{K=\underline{K}} = \frac{16(-1+d)^3 d^2(1+d)(2+d)\left(-11+2d+7d^2\right)}{-2+d} < 0 \Rightarrow \frac{\partial \tau(.)}{\partial K} < 0$

$\tau(.)|_{K=\underline{K}} = -\frac{192(-1+d)^5 d^3(1+d)^2}{(-2+d)^3} < 0 \Rightarrow \tau(.) < 0$ for any d, K from our domain of definition.

Thus, the profit of the retailer is decreasing in K and so the welfare in E/E is decreasing in K.

ad 2. Consider the difference between welfare in E/N and N/N:

$TS^{E/N} - TS^{N/N} = \frac{(d-1)S(d,K)}{2(2-d)^2(1+d)[A(.)]^2[D(.)]^2} > 0 \Leftrightarrow S(d,K) < 0$ with

$S(.) = 48+32d-200d^2-112d^3+331d^4+146d^5-275d^6-86d^7+119d^8+22d^9-25d^{10}-2d^{11}+2d^{12}-336K-176dK+1104d^2K+468d^3K-1371d^4K-426d^5K+787d^6K+152d^7K-195d^8K-18d^9K+9d^{10}K+2d^{12}K+848K^2+288dK^2-2068d^2K^2-492d^3K^2+1736d^4K^2+234d^5K^2-534d^6K^2-26d^7K^2+d^8K^2-4d^9K^2+17d^{10}K^2-896K^3-64dK^3+1472d^2K^3-56d^3K^3-644d^4K^3+82d^5K^3-39d^6K^3-22d^7K^3+47d^8K^3+320K^4-128dK^4-304d^2K^4+128d^3K^4-20d^4K^4-40d^5K^4+45d^6K^4$

The implicit function S(d,K) is the threshold between the meshed and the non-meshed region in Figure 1.5. We have to show that under this condition welfare is increasing with exclusivity when both manufacturers adopt exclusivity. Consider therefore the difference between welfare in E/E and N/N:

$TS^{E/E} - TS^{N/N} = \frac{(d-1)T(d,K)}{(2-d)^2(1+d)[H(.)]^2[J(.)]^2} > 0 \Leftrightarrow T(d,K) < 0$ with

$T(.) = 768+256d-2816d^2-768d^3+3840d^4+768d^5-2304d^6-256d^7+512d^8-5376K-1280dK+16896d^2K+3328d^3K-19200d^4K-3072d^5K+9216d^6K+1280d^7K-1536d^8K-256d^9K+13568K^2+1280dK^2-36288d^2K^2-3072d^3K^2+34816d^4K^2+3456d^5K^2-14384d^6K^2-2096d^7K^2+2352d^8K^2+432d^9K^2-64d^10K^2-14336K^3+2048dK^3+32256d^2K^3-3200d^3K^3-27008d^4K^3+448d^5K^3+10784d^6K^3+760d^7K^3-2064d^8K^3-304d^9K^3+152d^10K^3+32d^11K^3+5120K^4-3072dK^4-9472d^2K^4+4352d^3K^4+7296d^4K^4-2432d^5K^4-2976d^6K^4+672d^7K^4+676d^8K^4-92d^9K^4-81d^10K^4+5d^11K^4+4d^12K^4$

In order to show that the first condition is stronger than the second, it is sufficient to find such K for which the following condition is satisfied:

$\forall d \in (0,1): \; S(.) > 0 \; \wedge \; T(.) < 0$

Hence, we divide our parameter space into the following 7 subspaces, in each of which we find a K satisfying the above-mentioned conditions. The subspaces with the corresponding K's can be found below.

1. $d \in (0, 0.5) \;\; K = \frac{9}{10} + \frac{\sqrt{21}}{10} + \frac{117d}{20} - \sqrt{21}d$
2. $d \in (0.5, 0.8) \;\; K = \frac{1}{3} + \frac{10d}{3}$
3. $d \in (0.8, 0.9) \;\; K = -\frac{57}{5} + 18d$
4. $d \in (0.9, 0.95) \;\; K = -40 + 50d$
5. $d \in (0.95, 0.98) \;\; K = -\frac{785}{3} + \frac{850d}{3}$
6. $d \in (098, 0.99) \;\; K = -1158 + 1200d$
7. $d \in (0.99, 1) \;\; K = 981125 - 1981000d + 1000000d^2$

By inserting the values for K into $T(.)$ and $S(.)$ and by means of Sturm's theorem, we can show that $T(.) < 0$ and $S(.) > 0$.[3] This implies that welfare is increasing with exclusivity if investment is sufficiently efficient, i.e. $S(d, K) < 0$

ad 3. Welfare is increasing with exclusivity if and only if one or both manufacturers are willing to adopt exclusivity. In order to prove this statement, it is sufficient to find parameters d and K satisfying the equilibrium conditions.

(i) One manufacturer adopts exclusive retailing and the other manufacturer does not adopt exclusive retailing. $\pi_{Mi}^{E/N} / \pi_{Mi}^{N/N} > 1$ & $\pi_{Mi}^{N/E} / \pi_{Mi}^{E/E} > 1$

Suppose that $d = 0.85$ and $K = 1.2$. As can be easily shown these values satisfy the conditions above:

$\pi_{Mi}^{E/N} / \pi_{Mi}^{N/N}$	$\doteq 1.06$
$\pi_{Mi}^{N/E} / \pi_{Mi}^{E/E}$	$\doteq 1.01$
$S(d, K)$	-149.11

[3]Note that these conditions are also satisfied for the endpoints of the intervals. The step-by-step proof can be provided upon request.

(*ii*) Both manufacturers adopt exclusive retailing. $\pi_{Mi}^{E/E}/\pi_{Mi}^{N/E} > 1$ & $\pi_{Mi}^{E/N}/\pi_{Mi}^{N/N} > 1$

Suppose that $d = 0.85$ and $K = 0.6$. As can be easily shown these values satisfy the conditions above:

$\pi_{Mi}^{E/E}/\pi_{Mi}^{N/E}$	$\doteq 1.42$
$\pi_{Mi}^{E/N}/\pi_{Mi}^{N/N}$	$\doteq 1.40$
$S(d,K)$	$\doteq -14.44$

ad 4. We have already shown that welfare under E/N is equal to welfare under E/E if and only if $S(.) = 0$. By using the implicit function theorem we can determine $K'(d)$:

$K'(d) = -\frac{\frac{\partial S(.)}{\partial d}}{\frac{\partial S(.)}{\partial K}} = \frac{U(d,K)}{V(d,K)}$

First, note that there is no K smaller than 1.1 satisfying $S(.) = 0$. Thus:

$\frac{\partial^4 U(.)}{\partial K^4} = 3072 + 14592d - 9216d^2 + 1920d^3 + 4800d^4 - 6480d^5 > 0$

$\frac{\partial^3 U(.)}{\partial K^3}|_{K=1.1} = -\frac{12}{5}\left(-1568 + 672d + 3804d^2 - 7320d^3 - 1175d^4 + 2385d^5 - 385d^6 + 940d^7\right) \overset{Sturm's\ T.}{>} 0 \Rightarrow \frac{\partial^3 U(.)}{\partial K^3} > 0\ \forall K \geq 1.1$

$\frac{\partial^2 U(.)}{\partial K^2}|_{K=1.1} = -\frac{2}{25}\left(-21312 + 29128d + 18936d^2 - 53440d^3 + 26775d^4 - 50400d^5 - 17255d^6 + 31220d^7 - 900d^8 + 4250d^9\right) \overset{Sturm's\ T.}{>} 0$

$\Rightarrow \frac{\partial^2 U(.)}{\partial K^2} > 0\ \forall K \geq 1.1$

$\frac{\partial U(.)}{\partial K}|_{K=1.1} = \frac{1}{250}(114048 - 139632d + 102156d^2 - 4000d^3 - 216875d^4 + 434685d^5 - 26145d^6 + 44380d^7 + 60300d^8 - 116000d^9 - 6000d^{11})$

$\Rightarrow \frac{\partial U(.)}{\partial K}|_{K=1.1} > 0 \Rightarrow \frac{\partial U(.)}{\partial K} > 0\ \forall K \geq 1.1$

$U(.)|_{K=1.1} = \frac{428544 - 262656d + 1194768d^2 - 740280d^3 - 277950d^4 + 1243935d^5 - 716030d^6 + 1269320d^7 + 118800d^8 - 273500d^9 + 110000d^{10} - 252000d^{11}}{5000}$

$\Rightarrow U(.)|_{K=1.1} > 0 \Rightarrow U(.) > 0\ \forall K \geq 1.1$

Second, examine the sign of $V(d,K)$ at the place where $S(d,K) = 0$:

$V(.)|_{S(.)=0} > 0 \Leftrightarrow S(.) - \frac{V(.)K}{4} \equiv W(.) < 0$

$\frac{\partial^3 W(.)}{\partial K^3} = -1344 - 96d + 2208d^2 - 84d^3 - 966d^4 + 123d^5 - \frac{117d^6}{2} - 33d^7 + \frac{141d^8}{2} < 0$

$\frac{\partial^2 W(.)}{\partial K^2}|_{K=1.1} = \frac{1}{20}(1+d)\left(-12608 + 16256d - 9040d^2 - 2648d^3 + 16116d^4 - 8730d^5 - 3237d^6 + 1991d^7 - 420d^8 + 340d^9\right) < 0$

$\Rightarrow \frac{\partial^2 W(.)}{\partial K^2} < 0\ \forall K \geq 1.1$

$\frac{\partial W(.)}{\partial K}|_{K=1.1} = \frac{1+d}{400}(-52928 + 103616d - 148000d^2 + 51592d^3 + 67176d^4 - 62250d^5 + 49233d^6 - 23059d^7 - 17940d^8 + 10780d^9 - 600d^{10} + 600d^{11}) \Rightarrow \frac{\partial W(.)}{\partial K} < 0 \Rightarrow \frac{\partial W(.)}{\partial K} < 0 \; \forall K \geq 1.1$

$W(.)|_{K=1.1} = \frac{(1+d)(-57216+216192d-418320d^2+249544d^3-105888d^4-40490d^5+193401d^6-128003d^7+25480d^8-6560d^9-22600d^{10}+14600d^{11})}{4000}$

$\Rightarrow W(.)|_{K=1.1} \overset{Sturm's\ T.}{<} 0 \Rightarrow W(.) < 0 \; \forall K \geq 1.1$

$\Rightarrow V(.) > 0 \; \forall K \geq 1.1 \Rightarrow K'(d) > 0$

Q.E.D.

Appendix B

Appendix to Chapter 2

B.1 Free commuter newspaper expansion

The following two tables illustrate the successive expansion of free commuter newspapers worldwide and in Switzerland, respectively.

Table B.1: Free Paper Circulation, 1995 - 2008

	World free daily circulation (x1000)				World free dailies, countries			
Year	Europe	Americas	Rest	**Total**	Europe	Americas	Rest	**Total**
1995	231			231	2			2
1996	249			249	2			2
1997	558			558	4			4
1998	918			918	6			6
1999	2711	180		2891	10	3		13
2000	5292	1779	495	7566	14	6	4	24
2001	7371	1907	765	10043	17	7	5	29
2002	8345	2212	2008	12565	16	8	8	32
2003	8778	3097	2922	14797	16	8	8	32
2004	11010	3384	3770	18164	19	8	10	43
2005	15375	5028	4407	24810	24	9	10	43
2006	24267	6204	5853	36324	29	10	12	51
2007	26890	6832	8097	41819	31	10	15	56
2008	25272	7128	9270	41670	33	10	17	60
2009	21354	6712	8915	36981	33	10	17	60

*Source:*Newspaper Innovation 2009 - Own Construction

Table B.2: Expansion and Free Paper Readership Growth, 1999-2008

Regions	Readership growth (x1000) 99-04	Readership growth (x1000) 05-08	Counties added entry 99-04	Counties added entry 05-08
Ostmittelland	453	493	36	0
Westmittelland	368	377	34	7
Alpen und Voralpen	126	309	15	13
Suisse romande	3	1071	3	25
Liechtenstein	0	2	0	1
Svizzera italiana	0	0	0	0

Source: WEMF MACH Basic 00-09/2 - Own Computation

B.2 Additional descriptive statistics

The following table depicts the descriptive statistics of sociodemographic variables on the county level.

Table B.3: Descriptive Statistics - Sociodemographics: county level

County demographics	year	n	mean	sd	p5	p25	median	p75	p95
fraction at least A-level	2002	94	0.235	0.067	0.120	0.192	0.241	0.273	0.357
	2005	94	0.274	0.073	0.161	0.222	0.270	0.322	0.414
	2008	94	0.304	0.076	0.188	0.256	0.295	0.345	0.438
	all	940	0.259	0.079	0.133	0.205	0.256	0.312	0.394
fraction HH-Income over 8000 SFR	2002	94	0.330	0.085	0.176	0.280	0.333	0.393	0.480
	2005	94	0.324	0.075	0.180	0.274	0.323	0.367	0.444
	2008	94	0.367	0.071	0.243	0.333	0.369	0.414	0.500
	all	940	0.324	0.080	0.185	0.269	0.326	0.379	0.455
fraction HH-Income under 6000 SFR	2002	94	0.438	0.079	0.311	0.377	0.435	0.488	0.583
	2005	94	0.443	0.068	0.330	0.400	0.439	0.481	0.558
	2008	94	0.393	0.073	0.286	0.347	0.386	0.429	0.545
	all	940	0.440	0.080	0.311	0.385	0.438	0.491	0.577
fraction age 14-29	2002	94	0.286	0.050	0.209	0.252	0.280	0.311	0.379
	2005	94	0.234	0.034	0.183	0.208	0.231	0.259	0.294
	2008	94	0.237	0.039	0.172	0.214	0.236	0.259	0.308
	all	940	0.256	0.048	0.181	0.225	0.256	0.286	0.333
fraction age 60+	2002	94	0.207	0.049	0.120	0.178	0.207	0.237	0.286
	2005	94	0.218	0.044	0.139	0.185	0.224	0.255	0.280
	2008	94	0.214	0.046	0.133	0.185	0.218	0.245	0.283
	all	940	0.213	0.049	0.129	0.180	0.213	0.246	0.291
fraction commuter	2002	94	0.454	0.094	0.300	0.400	0.462	0.509	0.607
	2005	94	0.458	0.090	0.276	0.400	0.462	0.531	0.583
	2008	94	0.473	0.083	0.348	0.423	0.477	0.533	0.593
	all	940	0.455	0.090	0.286	0.405	0.465	0.519	0.583

*Source:*WEMF MACH Basic 00-09/2

Table B.4: Variables Description

Variable	Description
Readership data	
Extensive paid-for readership	The share of people reading at least one paid-for newspaper
Intensive paid-for readership	The average number of paid-for newspapers read by one person
Intensive free readership	The average number of free newspapers read by one person
Singlehomers	2 * extensive paid-for readership - intensive paid-for readership
Heavy readers	The share of people reading six consecutive issues of a particular daily paid-for newspaper
New readers	The union of set of paid-for newspaper readers with the set of free newspaper readers
Circulation	The number of newspapers distributed on an average day
Sociodemographic data	
Fraction young	The share of people aged between 14 and 29
Fraction old	The share of people 60 and older
Fraction highly educated	The share of people with at least A-level
Fraction less educated	The share of people with education less than A-level
Fraction high income	The share of people with the household income larger than 8000 SFR
Fraction low income	The share of people with the household income smaller than 4000 SFR
Fraction commuters	The share of people living and working in the different counties
Fraction no commuters	The share of people living and working in the same county
Instrumental variable	People using the public transport system commuting to counties with free newspapers divided by the sum of all commuters using the public transport system

B.3 Additional results (Robustness Section)

Table B.5 provides the results of the following estimated equation:

$$\frac{PP_m}{Pop_m} = \beta_0 + \beta_1 \frac{FP_c}{Pop_c} + \beta_2 X_m + \epsilon_m,$$

where $\frac{PP_m}{Pop_m}$ is per capita paid-for newspaper circulation in a municipality, $\frac{FP_c}{Pop_c}$ is free paper readership in a county and X_m are the sociodemographic fractions in a municipal. The coefficient β_2 may be interpreted as a sociodemographic group-readership gradient across municipalities.

Table B.5: The Effect of Free Newspaper Penetration on Aggregate Paid-for Newspaper Circulation by year

	(1)	(2)	(3)	(4)
	2002	2002	2006	2006
Fraction age	-0.228*	-0.247	-0.268**	-0.223
14-29	(0.135)	(0.169)	(0.108)	(0.154)
Fraction age	-0.006	-0.113	-0.071	-0.247*
60+	(0.085)	(0.133)	(0.115)	(0.145)
Fraction high	0.367***	0.257***	0.237***	0.244**
education	(0.052)	(0.087)	(0.061)	(0.097)
Intensive free paper		0.070		0.054
readership		(0.073)		(0.081)
Constant	0.319***	0.370***	0.390***	0.396***
	(0.078)	(0.098)	(0.068)	(0.101)
Fixed effects	Counties		Counties	
Counties	94	94	94	94
Municipals	2559	2559	2277	2277

Notes: Dependent variable is aggregate per capita paid-for newspaper circulation in each municipal. Standard errors in parentheses. Constants in fixed-effects regression represent the average value of the fixed effects. Standard errors are clustered by County.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B.6 provides the results of estimation of equation 2.2 after including additional controls for different sociodemographic groups and different interests on the county level. The coefficient of main interest barely changes. The results additionally indicate that paid-for readership is negatively correlated with the fraction of young people as well as the fraction of people with smaller income on the one hand and positively correlated with the share of people with interest in local news on the other.[1]

[1]Please, note that there is not enough variation across markets as well as over time to properly estimate the relationship between our controls and paid-for newspaper readership.

Table B.6: The Effect of Free Newspaper Penetration on Aggregate Paid-for Newspaper Readership (with controls)

	Intensive paid-for readership		Extensive paid-for readership	
	FE	IV	FE	IV
Intensive free paper	-0.109***	-0.174***	0.003	-0.065**
readership	(0.031)	(0.066)	(0.024)	(0.026)
Fraction young	-0.063	-0.050	-0.083**	-0.077*
	(0.095)	(0.097)	(0.041)	(0.042)
Fraction old	0.129*	0.147**	0.050	0.054
	(0.075)	(0.074)	(0.047)	(0.047)
Fraction highly	0.094	0.102	0.023	0.035
educated	(0.074)	(0.075)	(0.053)	(0.054)
Fraction HH	-0.305***	-0.317***	-0.148***	-0.152***
income < 6000 SFR	(0.074)	(0.075)	(0.041)	(0.042)
Fraction of people with interests in:				
local news	0.188**	0.205**	0.143***	0.155***
	(0.079)	(0.080)	(0.045)	(0.045)
national news	0.130	0.148	-0.030	-0.022
	(0.105)	(0.105)	(0.062)	(0.062)
business	0.074	0.060	0.096	0.094
	(0.120)	(0.121)	(0.069)	(0.071)
real estate	0.038	0.084	-0.003	0.016
	(0.160)	(0.156)	(0.094)	(0.095)
computer	0.151	0.155	-0.098	-0.096
	(0.129)	(0.129)	(0.060)	(0.059)
art	0.006	0.012	0.045	0.046
	(0.130)	(0.129)	(0.072)	(0.072)
literature	0.033	0.065	0.048	0.069
	(0.138)	(0.137)	(0.072)	(0.074)
sport	0.092	0.122*	0.048	0.068*
	(0.076)	(0.072)	(0.041)	(0.040)
job announcements	-0.017	0.013	0.010	0.026
	(0.095)	(0.098)	(0.056)	(0.058)
Constant	0.987***		0.732***	
	(0.061)		(0.035)	
Time dummies	yes	yes	yes	yes
Fixed effects	county	county	county	county
Counties	940	930	940	930

Notes: Standard errors in parentheses: Standard errors are clustered on the county level

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

In Table B.7 we examine the relationship between free newspapers and paid-for newspapers in counties where there are no boxes with free newspapers. The results indicate an even larger substitution pattern than our main specification. This may be caused by the fact that people from other counties spend more time commuting and therefore they are more likely to use a free commuter newspaper. Moreover, this finding is in line with stronger competition between local newspapers and free newspapers found in Table 2.6.

Table B.7: The Effect of Free Newspaper Penetration on Aggregate Paid-for Newspaper Readership in counties without free newspapers

	Intensive paid-for readership		Extensive paid-for readership	
	FE	IV	FE	IV
Intensive free paper	-0.096***	-0.268***	0.020	-0.066
readership	(0.035)	(0.100)	(0.028)	(0.046)
2000 year dummy	-0.007	0.003	-0.003	0.001
	(0.011)	(0.013)	(0.006)	(0.006)
2001 year dummy	-0.020*	-0.009	-0.013*	-0.007
	(0.011)	(0.013)	(0.007)	(0.007)
2002 year dummy	0.011	0.025*	0.001	0.009
	(0.013)	(0.015)	(0.007)	(0.007)
2003 year dummy	0.020	0.039***	0.008	0.018**
	(0.013)	(0.014)	(0.007)	(0.007)
2004 year dummy	-0.008	0.016	-0.008	0.004
	(0.015)	(0.016)	(0.008)	(0.008)
2005 year dummy	-0.031**	-0.001	-0.044***	-0.030**
	(0.015)	(0.019)	(0.015)	(0.015)
2006 year dummy	-0.058***	-0.012	-0.042***	-0.019
	(0.017)	(0.027)	(0.010)	(0.013)
2007 year dummy	-0.082***	-0.020	-0.065***	-0.034**
	(0.019)	(0.033)	(0.013)	(0.016)
2008 year dummy	-0.096***	-0.017	-0.070***	-0.031
	(0.021)	(0.043)	(0.015)	(0.021)
Constant	0.997***		0.711***	
	(0.011)		(0.006)	
Fixed effects	County	County	County	County
Counties	940	930	940	930

Notes: Standard errors in parentheses: Standard errors are clustered on the county level
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B.8 specifically looks at the impact of free commuter newspapers on paid-for newspapers sales in order to check the robustness and plausibility of our results in the main specification. The results indicate the same substitution ratio as Table 2.4.

Table B.8: The Effect of Free Newspaper Penetration on Aggregate Paid-for Newspaper Circulation

	(1) FE	(2) IV
Intensive free paper	-0.007	-0.054***
readership	(0.008)	(0.014)
year dummy 2000	0.010*	0.012**
	(0.005)	(0.005)
year dummy 2001	0.003	0.006
	(0.005)	(0.005)
year dummy 2002	0.006	0.010
	(0.007)	(0.007)
year dummy 2003	0.002	0.006
	(0.004)	(0.005)
year dummy 2004	0.010	0.015**
	(0.006)	(0.006)
year dummy 2006	0.006	0.021**
	(0.006)	(0.009)
year dummy 2007	0.004	0.023**
	(0.006)	(0.009)
year dummy 2008	0.001	0.024**
	(0.006)	(0.010)
Constant	0.299***	
	(0.004)	
Fixed effects	Municipality	Municipality
Municipalities	19863	19557

Notes: Standard errors in parentheses: Standard errors are clustered by county-year.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B.9 provides an additional test for a statistical difference of coefficients in regressions with and without considering multihoming. We are interested in the coefficient of the interaction term. As we can see, this is always positive, meaning that multihoming behavior plays an important role in the substitution activities between paid-for and free daily newspapers.

Table B.9: The Effect of Free Newspaper Penetration on Singlehomers and Multihomers

	(1) FE	(2) FE	(3) IV	(4) IV
singlehomers	-0.242***	-0.242***	-0.242***	-0.242***
	(0.006)	(0.012)	(0.006)	(0.012)
intensive free paper	-0.089***	-0.089***	-0.164**	-0.164**
readership	(0.033)	(0.033)	(0.073)	(0.073)
free paper	0.100***	0.100**	0.109**	0.109
x singlehomers	(0.028)	(0.042)	(0.053)	(0.076)
Constant	0.974***	0.974***	0.973***	0.973***
	(0.011)	(0.011)	(0.011)	(0.011)
fixed effects	(1)-(4): market, market x group, time, time x group			
N	1880	1880	1880	1880

Standard errors in parentheses. Standard errors are clustered on the county level and on county-group level in odd columns and even columns, respectively.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

In Table 2.6 we have seen that free commuter newspapers compete with local tabloids rather than with national high-quality press. In the next step we look at the relationship between the national yellow press and free commuter newspapers. Table B.10 indicates that the Swiss national yellow press (i.e. Blick and 24Heures) can be seen as a weak substitute for free newspapers. This competition pressure was seen as one of the reasons why Ringier AG launched its own free commuter newspaper "Blick am Abend" in 2008.

Tables B.11 and B.12 provide results for the estimations with stacked group specific data. The results indicate the same substitution pattern as our main specification. Young and less educated people are attracted more by free newspapers. Moreover, table B.12 confirms our result that the expansion of free commuter newspaper the informativness of people in the market since it brings new readers to the print daily media.

Table B.10: The Effect of Free Newspaper Penetration on National Yellow Press

	(1) FE	(2) IV
Intensive free paper	-0.044***	-0.074***
readership	(0.014)	(0.017)
2000 year dummy	-0.000	0.002
	(0.004)	(0.004)
2001 year dummy	0.005	0.006
	(0.004)	(0.004)
2002 year dummy	0.008**	0.011***
	(0.004)	(0.004)
2003 year dummy	0.014***	0.018***
	(0.004)	(0.005)
2004 year dummy	0.013**	0.018***
	(0.006)	(0.006)
2005 year dummy	0.013**	0.018***
	(0.006)	(0.007)
2006 year dummy	0.006	0.015*
	(0.006)	(0.008)
2007 year dummy	-0.000	0.011
	(0.008)	(0.010)
2008 year dummy	-0.005	0.009
	(0.008)	(0.011)
Constant	0.192***	
	(0.003)	
Fixed effects	County	County
Counties	940	930

Notes: Standard errors in parentheses: Standard errors are clustered by county.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B.11: The Effect of Free Newspaper Penetration on Aggregate Paid-for Newspaper Readership by group

	young vs. old		highly vs. less educ		high vs. low inc		commuters vs. no comm.	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	FE	FE	FE	FE	FE	FE	FE	FE
intensive free	0.057	0.057	0.031	0.031	-0.015	-0.015	-0.106**	-0.106**
paper readership	(0.079)	(0.079)	(0.055)	(0.055)	(0.050)	(0.050)	(0.046)	(0.046)
young	-0.131***	-0.131***						
	(0.028)	(0.033)						
free paper	-0.194*	-0.194*						
x young	(0.105)	(0.105)						
less educated			-0.243***	-0.243***				
			(0.029)	(0.031)				
free paper			-0.126**	-0.126				
x less educated			(0.063)	(0.080)				
low HH					-0.214***	-0.214***		
income					(0.020)	(0.023)		
free paper					-0.024	-0.024		
x low income					(0.050)	(0.065)		
no commuters							-0.169***	-0.169***
							(0.024)	(0.019)
free paper							0.056	0.056
x no commuters							(0.076)	(0.072)
Constant	0.914***	0.914***	0.987***	0.987***	1.083***	1.083***	1.027***	1.027***
	(0.026)	(0.026)	(0.026)	(0.026)	(0.019)	(0.019)	(0.015)	(0.015)
fixed effects	(1)-(8): market, market x group, time, time x group							
N	1880	1880	1880	1880	1880	1880	1880	1880

Standard errors in parentheses. Standard errors are clustered on the county level and on county-group level in odd columns and even columns, respectively.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B.12: The Effect of Free Newspaper Penetration on new readers by group

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	FE	FE	FE	FE	FE	FE	FE	FE
intensive free paper	0.181***	0.181***	0.158***	0.158***	0.231***	0.231***	0.248***	0.248***
readership	(0.054)	(0.054)	(0.037)	(0.037)	(0.026)	(0.026)	(0.021)	(0.021)
young	-0.161***	-0.161***						
	(0.016)	(0.018)						
free paper	0.227***	0.227***						
x young	(0.060)	(0.064)						
less educated			-0.173***	-0.173***				
			(0.014)	(0.016)				
free paper			0.123***	0.123***				
x less educated			(0.040)	(0.046)				
low income					-0.094***	-0.094***		
					(0.009)	(0.010)		
free paper					0.022	0.022		
x low income					(0.027)	(0.032)		
no commuters							-0.069***	-0.069***
							(0.011)	(0.010)
free paper							-0.041	-0.041
x no commuters							(0.031)	(0.025)
Constant	0.813***	0.813***	0.791***	0.791***	0.788***	0.788***	0.754***	0.754***
	(0.016)	(0.016)	(0.014)	(0.013)	(0.008)	(0.008)	(0.007)	(0.007)
fixed effects	(1)-(8): market, market x group, time, time x group							
N	1880	1880	1880	1880	1880	1880	1880	1880

Standard errors in parentheses. Standard errors are clustered on the county level and on county-group level in odd columns and even columns, respectively.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

B.4 Figures

Figure B.1: Free Newspaper Readership in Switzerland, 1999-2008

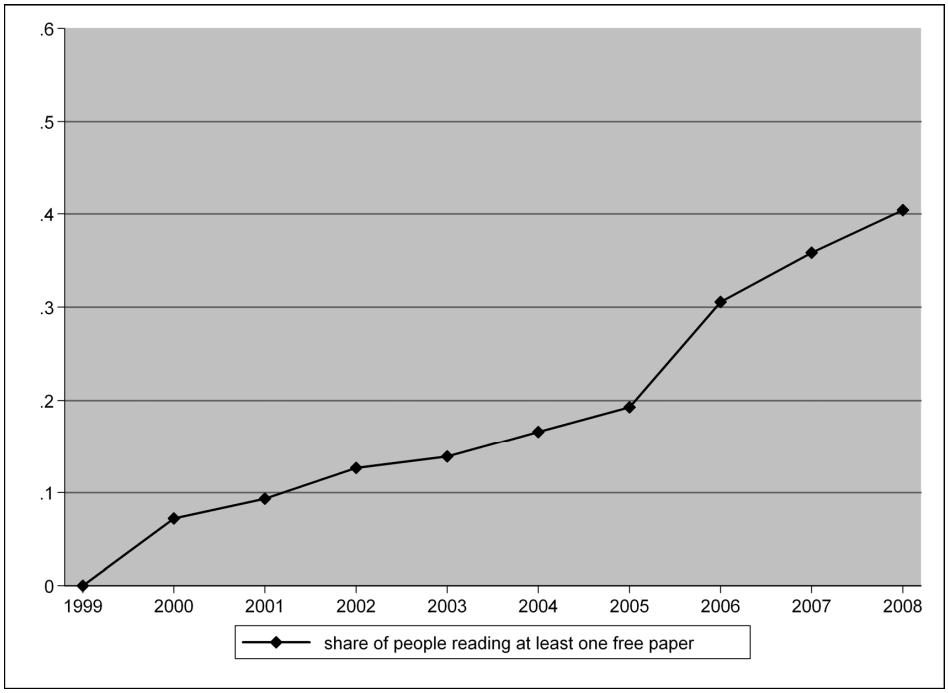


Figure B.2: Paid-for Newspaper Circulation in Switzerland (x1000), 1999-2008

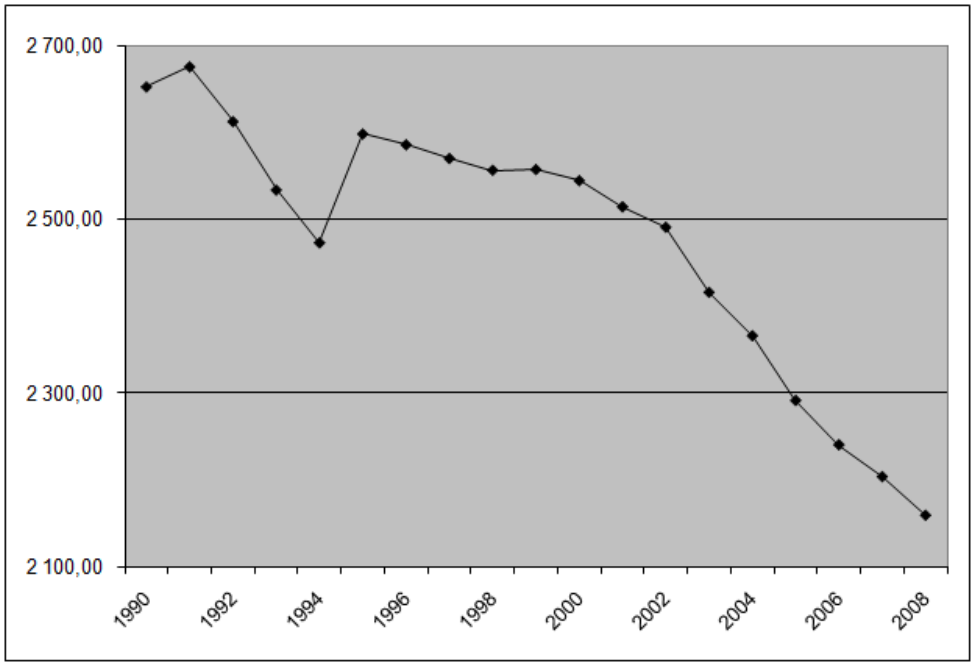


Figure B.3: Traditional Newspaper Readership by Age, 1999-2008

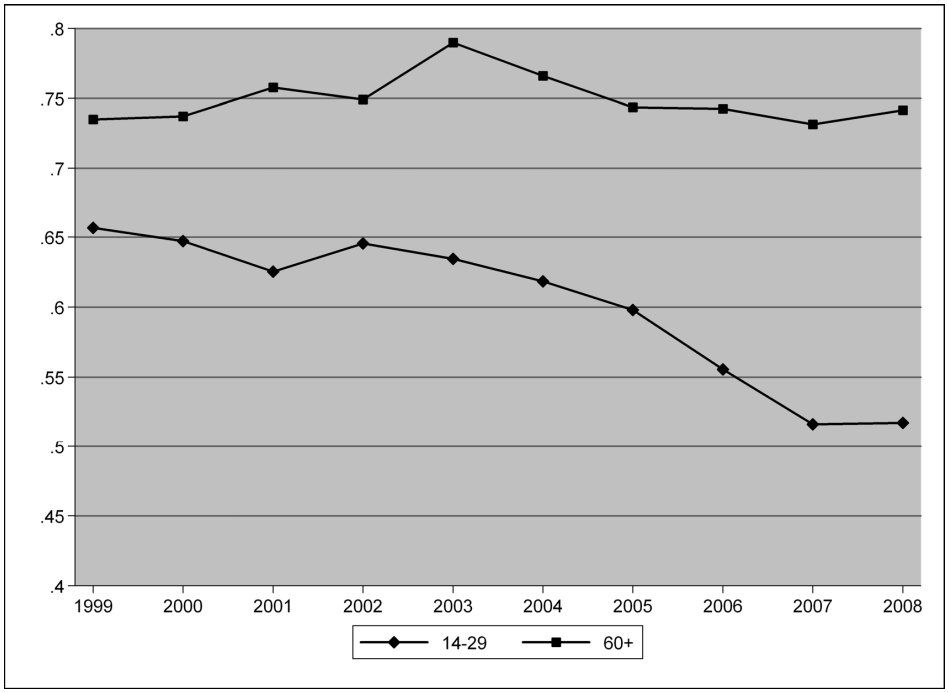


Figure B.4: Traditional Newspaper Readership by Education, 1999-2008

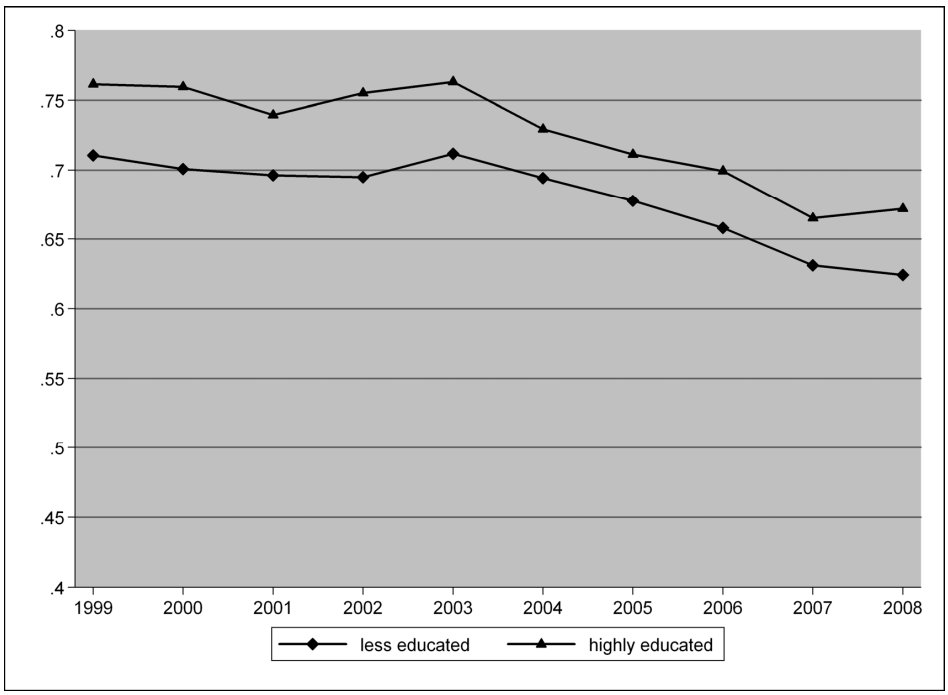


Figure B.5: Traditional Newspaper Readership by Commuter Status, 1999-2008

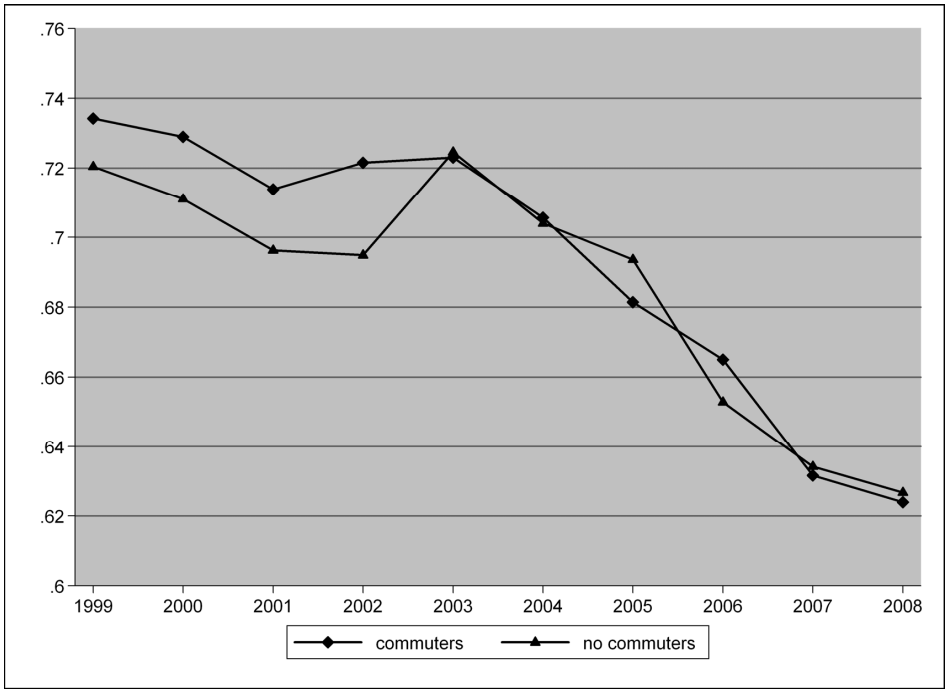


Figure B.6: Traditional Newspaper Readership by Income, 1999-2008

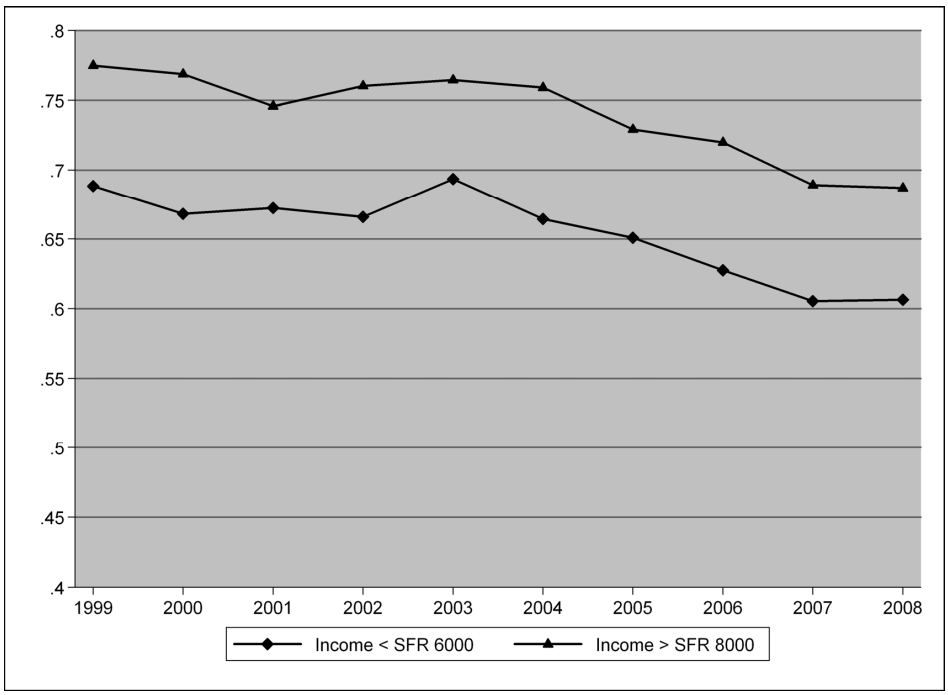
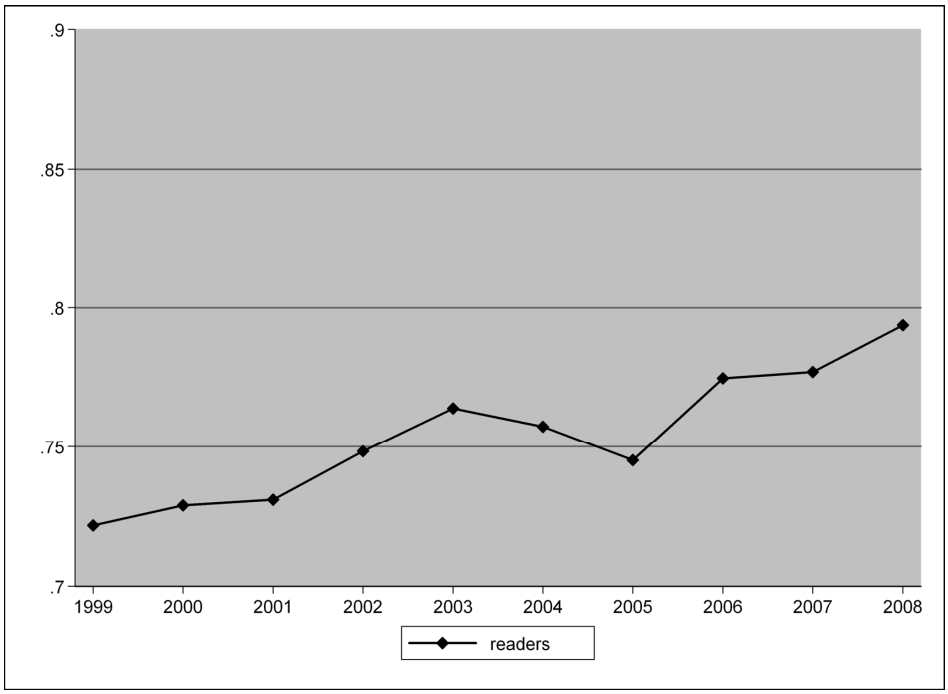


Figure B.7: Readers of print media, 1999-2008



Appendix C

Appendix to Chapter 3

C.1 Tables

Table C.1: Variables Description

Variable	Measurement
Firm's output (y)	Sales
Labor	Number of Employees
Capital	Working Capital
Majority	owner with more than 50 %
Monitored majority	owner with more than 50% and at least one other shareholder with more than 10%
Controlling minority	owner with more than 10% and this stake is larger than the sum of all identifiable stakes
Combined controlling minority	two owners with a combined share of 50%
Size	ln Total Assets
Debt	Total Liabilities Total Assets (in percent)
Age	Number of years from a firm's incorporation

Table C.2: Description and distribution of industries (manufacturing)

NACE	Industry	Obs.	Share
	Manufacturing: High-technology		
30	Manufacture of office machinery and computers	327	0.16%
32	Manufacture of radio, television and communication equipment and apparatus	1 255	0.63%
33	Manufacture of medical, precision and optical instruments, watches and clocks	1 487	0.75%
Total		3 069	1.54%
	Manufacturing: Medium-high-technology		
24	Manufacture of chemicals and chemical products	1 709	0.86%
29	Manufacture of machinery and equipment n.e.c.	5 748	2.89%
31	Manufacture of electrical machinery and apparatus n.e.c.	3 519	1.77%
34	Manufacture of motor vehicles, trailers and semi-trailers	924	0.47%
35	Manufacture of other transport equipment	499	0.25%
Total		12 399	6.24%
	Manufacturing: Medium-low-technology		
25	Manufacture of rubber and plastic products	3 021	1.52%
26	Manufacture of other non-metallic mineral products	2 453	1.23%
27	Manufacture of basic metals	1 022	0.51%
28	Manufacture of fabricated metal products, except machinery and eqp.	9 166	4.61%
Total		15 662	7.88%
	Manufacturing: Low-technology		
15	Manufacture of food products and beverages	4 605	2.32%
17	Manufacture of textiles	1 578	0.79%
18	Manufacture of wearing apparel; dressing and dyeing of fur	1 041	0.52%
19	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	404	0.20%
20	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	2 802	1.41%
21	Manufacture of pulp, paper and paper products	753	0.38%
22	Publishing, printing and reproduction of recorded media	2 634	1.33%
36	Manufacture of furniture; manufacturing n.e.c.	2 208	1.11%
37	Recycling	327	0.16%
Total		16 352	8.23%
	Unasigned sectors		
1	Agriculture, hunting and related service activities	9 004	4.53%
2	Forestry, logging and related service activities	890	0.45%
14	Other mining and quarrying	389	0.20%
40	Electricity, gas, steam and hot water supply	984	0.50%
41	Collection, purification and distribution of water	523	0.26%
45	Construction	16 392	8.25%
Total		28 182	14.19%
Total (manufacturing)		75 664	38.09%

Table C.3: Description and distribution of industries (services)

NACE	Industry	Obs.	Share
	Knowledge-intensive services (KIS)		
64	Post and telecommunications	587	0.30%
65	Financial intermediation, except insurance and pension funding	269	0.14%
70	Real estate activities	7 530	3.79%
71	Renting of machinery and equipment without operator and of personal and household goods	1 096	0.55%
72	Computer and related activities	4 233	2.13%
73	Research and development	510	0.26%
74	Other business activities	21 495	10.82%
80	Education	963	0.48%
85	Health and social work	1 622	0.82%
92	Recreational, cultural and sporting activities	1 412	0.71%
Total		39 717	19.99%
	High-tech KIS		
64	Post and telecommunications	587	0.30%
72	Computer and related activities	4 233	2.13%
73	Research and development	510	0.26%
	Market KIS (excludes financial intermediation and high-tech services)		
70	Real estate activities	7 530	3.79%
71	Renting of machinery and equipment without operator and of personal and household goods	1 096	0.55%
74	Other business activities	21 495	10.82%
	Less Knowledge-intensive services (LKIS)		
50	Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel	4 988	2.51%
51	Wholesale trade and commission trade, except of motor vehicles and motorcycles	38 475	19.37%
52	Retail trade, except of motor vehicles and motorcycles; repair of personal and household goods	27 353	13.77%
55	Hotels and restaurants	4 890	2.46%
60	Land transport; transport via pipelines	3 829	1.92%
63	Supporting and auxiliary transport activities; activities of travel agencies	1 651	0.83%
90	Sewage and refuse disposal, sanitation and similar activities	1 456	0.73%
93	Other service activities	624	0.31%
Total		83 266	41.92%
	Market services less KIS		
50	Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel	4 988	2.51%
51	Wholesale trade and commission trade, except of motor vehicles and motorcycles	38 475	19.37%
52	Retail trade, except of motor vehicles and motorcycles; repair of personal and household goods	27 353	13.77%
55	Hotels and restaurants	4 890	2.46%
60	Land transport; transport via pipelines	3 829	1.92%
63	Supporting and auxiliary transport activities; activities of travel agencies	1 651	0.83%
Total (services)		122 983	61.91%
Total (manufacturing+services)		**198 647**	

Table C.4: First step - efficiency frontiers by two-digit NACE industry (Manufacturing)

2-Digit NACE	Constant Coef.	Constant Std. Err.	Working capital Coef.	Working capital Err.	Number of employees Coef.	Number of employees Err.
High-technology manufacturing						
Office machinery and computers	11.511***	0.260	0.250***	0.037	0.802***	0.057
Radio, television and communication equipment and apparatus	11.627***	0.145	0.284***	0.018	0.543***	0.030
Medical, precision and optical instruments, watches and clocks	11.234***	0.163	0.313***	0.021	0.502***	0.035
Medium-high-technology manufacturing						
Chemicals and chemical products	11.226***	0.158	0.358***	0.019	0.510***	0.029
Machinery and equipment n.e.c.	11.944***	0.111	0.300***	0.013	0.411***	0.020
Electrical machinery and apparatus n.e.c.	11.824***	0.114	0.252***	0.014	0.544***	0.023
Motor vehicles, trailers and semi-trailers	11.367***	0.230	0.324***	0.023	0.631***	0.036
Other transport equipment	10.169***	0.291	0.333***	0.035	0.705***	0.052
Medium-low-technology manufacturing						
Rubber and plastic products	11.637***	0.129	0.319***	0.016	0.492***	0.024
Other non-metallic mineral products	11.240***	0.147	0.334***	0.017	0.528***	0.027
Basic metals	11.982***	0.209	0.362***	0.022	0.364***	0.033
Fabricated metal products, except machinery and equipment	12.079***	0.095	0.238***	0.012	0.500***	0.019
Low-technology manufacturing						
Food products and beverages	12.296***	0.114	0.268***	0.013	0.483 ***	0.020
Textiles	10.722***	0.157	0.395***	0.019	0.422***	0.031
Wearing apparel; dressing and dyeing of fur	11.636***	0.171	0.281***	0.020	0.363***	0.034
Tanning and dressing of leather; luggage, handbags, saddlery, harness and footwear	11.817***	0.288	0.243***	0.036	0.517***	0.059
Wood and of products of wood and cork, except furniture; articles of straw and plaiting materials	11.490***	0.119	0.272***	0.015	0.561***	0.025
Pulp, paper and paper products	11.721***	0.260	0.361***	0.029	0.410***	0.043
Publishing, printing and reproduction of recorded media	12.244***	0.110	0.201***	0.014	0.546***	0.025
Furniture; manufacturing n.e.c.	11.546***	0.147	0.263***	0.018	0.498***	0.027
Recycling	12.371***	0.232	0.259***	0.029	0.510***	0.061

Notes: We use industry classification according to OECD-Eurostat (Laafia 2002). It is also available at: `http://epp.eurostat.ec.europa.eu/cache/ITY_SDDS/Annexes/htec_esms_an2.pdf`.
***, **, * denote significance at the 1%, 5%, and 10% levels respectively.

Table C.5: First step - efficiency frontiers by two-digit NACE industry (Service)

2-Digit NACE	Constant Coef.	Constant Std. Err.	Working capital Coef.	Working capital Err.	Number of employees Coef.	Number of employees Err.
Knowledge-intensive services						
Post and telecommunications	12.592***	0.164	0.218***	0.020	0.609***	0.037
Financial intermediation, except insurance and pension funding	13.114***	0.242	0.040*	0.024	1.225***	0.059
Real estate activities	11.903***	0.087	0.220***	0.011	0.579***	0.018
Renting of machinery and equipment without operator and of personal and household goods	12.570***	0.150	0.182***	0.018	0.611***	0.032
Computer and related activities	11.989***	0.100	0.226***	0.012	0.560***	0.023
Research and development	11.774***	0.248	0.188***	0.032	0.614***	0.055
Other business activities	12.132***	0.082	0.223***	0.010	0.549***	0.016
Education	11.643***	0.138	0.221***	0.018	0.404***	0.039
Health and social work	12.101***	0.136	0.146***	0.017	0.560***	0.028
Recreational, cultural and sporting activities	12.866***	0.124	0.186***	0.015	0.608***	0.028
Less-knowledge-intensive services						
Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel	11.850***	0.106	0.338***	0.012	0.559***	0.022
Wholesale trade and commission trade, except of motor vehicles and motorcycles	12.081***	0.081	0.322***	0.010	0.476***	0.015
Retail trade, except of motor vehicles and motorcycles; repair of personal and household goods	11.845***	0.082	0.275***	0.010	0.516***	0.016
Hotels and restaurants	11.233***	0.096	0.242***	0.013	0.585***	0.021
Land transport; transport via pipelines	12.421***	0.105	0.205***	0.013	0.583***	0.022
Supporting and auxiliary transport activities; activities of travel agencies	13.020***	0.112	0.159***	0.014	0.673***	0.027
Sewage and refuse disposal, sanitation and similar activities	12.851***	0.152	0.192***	0.016	0.440***	0.030
Other service activities	10.771***	0.177	0.271***	0.025	0.656***	0.047

Notes: We use industry classification according to OECD-Eurostat (Laafia 2002). It is also available at:
`http://epp.eurostat.ec.europa.eu/cache/ITY_SDDS/Annexes/htec_esms_an2.pdf`.
***, **, * denote significance at the 1%, 5%, and 10% levels respectively.

Table C.6: Ownership effects in manufacturing industries, all years

Ownership category	Technology			
	High	Medium-high	Medium-low	Low
Majority	-0.021**	-0.036***	-0.047***	-0.021***
	(0.009)	(0.005)	(0.004)	(0.005)
Monitored majority	-0.081***	-0.044***	-0.051***	-0.031***
	(0.016)	(0.009)	(0.007)	(0.008)
Controlling minority	-0.083***	-0.039***	-0.079***	-0.094***
	(0.017)	(0.008)	(0.007)	(0.007)
Combined controlling minority	-0.079***	-0.051**	-0.057***	-0.047***
	(0.017)	(0.007)	(0.007)	(0.007)
log(Total assets)	0.035***	0.048***	0.060***	0.063***
	(0.002)	(0.001)	(0.001)	(0.001)
Debt ratio (percent)	0.037***	0.005***	0.010***	0.014***
	(0.004)	(0.002)	(0.002)	(0.001)
Age of the firm	0.005***	-0.002***	-0.004***	-0.004***
	(0.001)	(0.000)	(0.000)	(0.000)
Constant	-0.341 ***	-0.402***	-0.527***	-0.566***
	(0.032)	(0.017)	(0.015)	(0.015)
R-squared	0.159	0.169	0.236	0.258
N	1352	7415	8122	14968

Note: The dependent variable is the firm-level inefficiency obtained from the estimation of equation 3.4. The explanatory variables are dummy variables for the various ownership types, firm age, the debt ratio, and the logarithm of total assets for each firm. The definition of each explanatory variable can be found in Table C.1.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table C.7: Ownership effects in service sectors; all years

Ownership category	Knowledge-intensive services (KIS)	High-tech KIS	Market KIS	Less Knowledge-intensive services (LKIS)	Market LKIS
Majority	-0.017***	-0.019**	-0.011*	-0.022***	-0.018***
	(0.004)	(0.009)	(0.005)	(0.003)	(0.003)
Monitored majority	-0.003	-0.016	-0.010	-0.009	-0.005
	(0.009)	(0.017)	(0.011)	(0.006)	(0.006)
Controlling minority	-0.052***	-0.075***	-0.062***	-0.066***	-0.059***
	(0.009)	(0.019)	(0.011)	(0.006)	(0.006)
Combined controlling minority	-0.020***	-0.041***	-0.021**	-0.023***	-0.019***
	(0.007)	(0.013)	(0.009)	(0.005)	(0.005)
log (Total assets)	0.058***	0.054***	0.060***	0.070***	0.068***
	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
Debt ratio (percent)	0.011***	0.044***	0.011***	0.017***	0.000***
	(0.001)	(0.004)	(0.001)	(0.001)	(0.000)
Age of the firm	-0.007***	0.003***	-0.009***	-0.002***	-0.003***
	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)
Constant	-0.436***	-0.496***	-0.463***	-0.659***	-0.598***
	(0.013)	(0.036)	(0.016)	(0.010)	(0.010)
R squared	0.191	0.185	0.199	0.212	0.204
N	39670	5327	30085	81496	81067

Note: The dependent variable is the firm-level inefficiency obtained from the estimation of equation 3.4. The explanatory variables are dummy variables for the various ownership types, firm age, the debt ratio, and the logarithm of total assets for each firm. The definition of each explanatory variable can be found in Table C.1.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

C.2 Figures

Figure C.1: Ownership effects - Distance from efficiency frontier (majority vs. minority)

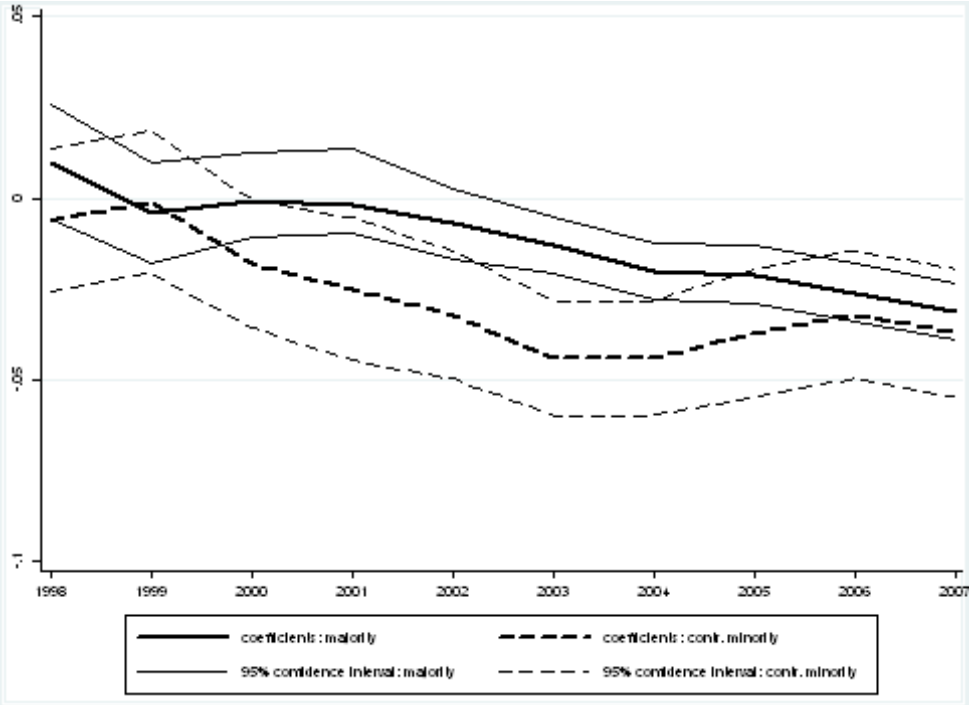
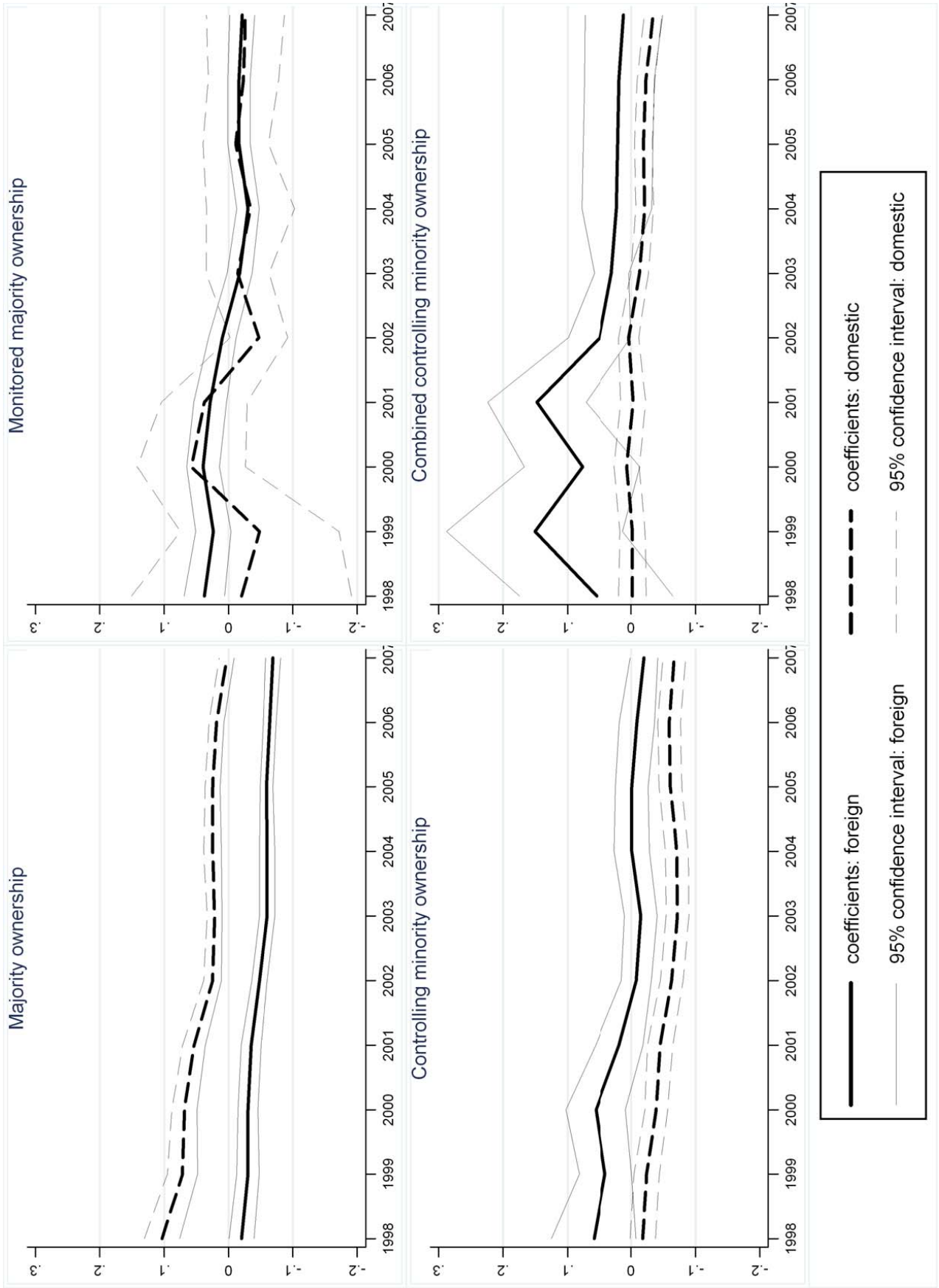


Figure C.2: Ownership effects - Distance from efficiency frontier



List of Tables

List of Figures

Bibliography

Aghion, P., and P. Howitt (2007): "Capital, innovation, and growth accounting," *Oxford Review of Economic Policy*, 23(1), 79–93.

Ahrens, H.-J. (1999): "Kostenloser Vertrieb meinungsbildender Tagespresse. Zum Prognosedilemma des Wettbewerbsrichters," *Wettbewerb in Recht und Praxis*, 45(2), 123–129.

Aigner, D., C. Lovell, and P. Schmidt (1977): "Formulation and estimation of stochastic frontier production function models," *Journal of Econometrics*, 6(1), 21–37.

Aitken, B. J., and A. E. Harrison (1999): "Do domestic firms benefit from direct foreign investment? Evidence from Venezuela," *American Economic Review*, 89(3), 605–618.

Areeda, P., and L. Kaplow (1988): *Antitrust Analysis. Problems, text, cases.* Little Brown and Company.

Armstrong, M. (1999): "Competition in the Pay-TV Market," *Journal of the Japanese and International Economics*, 13, 257–280.

Arnold, J. M., and B. S. Javorcik (2009): "Gifted kids or pushy parents? Foreign direct investment and plant productivity in Indonesia?," *Journal of International Economics*, 79(1), 42–53.

Arya, A., B. Mittendorf, and D. E. M. Sappington (2008): "Outsourcing, vertical integration, and price vs. quantity competition," *International Journal of Industrial Organization*, 26, 1–16.

Aussenegg, W., and R. Jelic (2007): "The Operating Performance of Newly Privatised Firms in Central European Transition Economies," *European Financial Management*, 13(5), 853–879.

Bakker, P. (2007): "The impact of free daily newspapers on the circulation of paid newspapers," Paper presented to the ICA Conference, San Francisco, May 24-28.

Bartelsman, E. J., and M. Doms (2000): "Understanding Productivity: Lessons from Longitudinal Microdata," *Journal of Economic Literature*, 38(3), 569–594.

Battese, G. E., and T. J. Coelli (1995): "A model for technical inefficiency effect in a stochastic frontier production function," *Empirical Economics*, 20, 325–332.

Bernheim, B. D., and M. D. Whinston (1998): "Exclusive Dealing," *Journal of Political Economy*, 106(1), 64–103.

Besanko, D., and M. K. Perry (1993): "Equilibrium Incentives for Exclusive Dealing in a Differentiated Products Oligopoly," *RAND Journal of Economics*, 24(4), 646–668.

——— (1994): "Exclusive dealing in a spatial model of retail competition," *International Journal of Industrial Organization*, 12(3), 297–329.

Bjørnskov, C., P. Meinen, J. U.-M. Nielsen, and J. H. Schröder (2009): "Lobbying for anti-dumping measures: Does distance from Brussels matter?," .

Blomström, M. (1988): "Labor productivity differences between foreign and domestic firms in Mexico," *World Development*, 16(11), 1295–1298.

Blomström, M., S. Globerman, and A. Kokko (2001): "The determinants of host country spillovers from foreign direct investment: review and synthesis of the literature," in *Inward investment, technological change and growth: the impact of multinational corporations on the UK economy*, ed. by N. Pain. Palgrave.

Bloom, N., and J. Van Reenen (2010): "Why Do Management Practices Differ across Firms and Countries?," *The Journal of Economic Perspectives*, 24(1), 203–224.

Bolton, P., and P. Aghion (1987): "Contracts as a Barrier to Entry," *American Economic Review*, 77(3), 388–401.

Boycko, M., A. Shleifer, and R. W. Vishny (1996): "A Theory of Privatisation," *The Economic Journal*, 106(435), 309–319.

Brada, J. C., and A. E. King (1994): "Differences in the technical and allocative efficiency of private and socialized agricultural units in pre-transformed Poland," *Economic Systems*, 18(4), 363–376.

Brada, J. C., A. E. King, and C.-Y. Ma (1997): "Industrial economics of the transition: determinants of enterprise efficiency in Czechoslovakia and Hungary," *Oxford Economic Papers*, 49, 104–127.

Brown, D. J., J. S. Earle, and A. Telegdy (2006): "The productivity effects of privatization : Longitudinal estimates from Hungary, Romania, Russia, and Ukraine," *Journal of political economy*, 114(1), 61–99.

Buehler, S., and A. Schmutzler (2008): "Intimidating competitors - Endogenous vertical integration and downstream investment in successive oligopoly," *International Journal of Industrial Organization*, 26, 247–265.

Coase, R. H. (1974): "The Market for Goods and the Market for Ideas," *The American Economic Review*, 64(2), 384–391.

Coelli, T. J. (1995): "Recent Developments in Frontier Modelling and Efficiency Measurement," *Australian Journal of Agricultural Economics*, 39(3), 219–245.

Crinò, R. (2005): "Wages, Skills and Integration in Poland, Hungary and the Czech Republic: an Instry-Level Analysis," *Transition Studies Review*, 12, 432–445.

Cullmann, A., and C. Von Hirschhausen (2008): "From transition to competition Dynamic efficiency analysis of Polish electricity distribution companies," *Economics of Transition*, 16(2), 335–357.

de Fontenay, C. C., J. S. Gans, and V. Groves (2010): "Exclusivity, competition and the irrelevance of internal investment," *International Journal of Industrial Organization*, 28(4), 336 – 340.

Demsetz, H. (1983): "The Structure of Ownership and the Theory of the Firm," *Journal of Law and Economics*, 16, 375–390.

Demsetz, H., and K. Lehn (1985): "The Structure of Corporate Ownership: Causes and Consequences," *Journal of Political Economy*, 93, 1153–1177.

Djankov, S., C. McLiesh, T. Nenova, and A. Shleifer (2003): "Who Owns the Media?," *The Journal of Law and Economics*, 46(2), 341–382.

Djankov, S., and P. Murrell (2002): "Enterprise Restructuring in Transition: A Quantitative Survey," *Journal of Economic Literature*, 40(3), 739–792.

Downs, A. (1957): *An Economic Theory of Democracy*. Boston, MA: Addison-Wesley.

Estrin, S., J. Hanousek, E. Kocenda, and J. Svejnar (2009): "The Effects of Privatization and Ownership in Transition Economies," *Journal of Economic Literature*, 47(3), 699–728.

Evans, D. S. (2003): "The Antitrust Economics of Multi-Sided Platform Markets," *Yale Journal of Regulation*, 20, 325–381.

FCC (2001): *FCC initiates proceeding to review newspaperbroadcast cross-ownership rule, Press Release*Federal Communications Commission, Press release: September 13.

Filistrucchi, L. (2005): "The Impact of Internet on the Market for Daily Newspapers in Italy," Working Paper ECO2005/12, European University Institute.

Frasco, G. (1991): *Exclusive dealing: A comprehensive case study*. University Press of America.

Frydman, R., C. Gray, M. Hessel, and A. Rapaczynski (2000): "The Limits of Discipline: Ownership and Hard Budget Constraints in the Transition Economies," *Economics of Transition*, 8(3), 577–601.

Fumagalli, C., M. Motta, and T. Ronde (2009): "Exclusive dealing - the interaction between foreclosure and investment promotion," Discussion Paper DP7240, CEPR.

Funke, M., and J. Rahn (2002): "How efficient is the East German economy? An exploration with microdata," *Economics of Transition*, 10(1), 201–223.

Gabszewicz, J. J., and J. F. Thisse (1980): "Entry (and exit) in a differentiated industry," *Journal of Economic Theory*, 22(2), 327 – 338.

Gentzkow, M. (2007): "Valuing new goods in a model with complementarity: Online newspapers," *The American Economic Review*, 97(4), 713–744.

Gentzkow, M., and J. M. Shapiro (2008): "Competition and Truth in the Market for News," *Journal of Economic Perspectives*, 22(2), 133–154.

George, L., and J. Waldfogel (2003): "Who Affects Whom in Daily Newspaper Markets?," *The Journal of Political Economy*, 111(4), 765–784.

George, L. M. (2008): "The Internet and the Market for Daily Newspapers," *The B.E. Journal of Economic Analysis & Policy*, 8(1), Article 26.

George, L. M., and J. Waldfogel (2006): "The "'New York Times"' and the Market for Local Newspapers," *The American Economic Review*, 96(1), 435–447.

Gompers, P., J. Ishii, and A. Metrick (2003): "Corporate Governance and Equity Prices," *The Quarterly Journal of Economics*, 118(1), 107–156.

Gorodnichenko, Y., and M. Schnitzer (2010): "Financial constraints and innovation: Why poor countries don't catch up," Working Paper 15792, National Bureau of Economic Research.

Gugler, K. (2003): "Corporate governance, dividend payout policy, and the interrelation between dividends, R&D, and capital investment," *Journal of Banking and Finance*, 27, 1297–1321.

Haas, M. (2005): *"'Die geschenkte Zeitung"' Bestandsaufnahme und Studien zu einem neuen Pressetyp in Europa*. Münster, LIT Verlag.

Haddad, M., and A. E. Harrison (1993): "Are there positive spillovers from direct foreign investment? Evidence from panel data for Morocco," *Journal of Development Economics*, 42(1), 51–74.

Hájková, D., and J. Hurník (2007): "Cobb-Douglas Production Function: The Case of a Converging Economy," *Czech Journal of Economics and Finance*, 57 (9-10), 465–476.

Hanousek, J., E. Kocenda, and P. Ondko (2007b): "The Banking Sector in New EU Member Countries: A Sectoral Financial Flows Analysis," *Czech Journal of Economics and Finance*, 57(5-6), 200–224.

Hanousek, J., E. Kocenda, and J. Svejnar (2007a): "Origin and concentration," *Economics of Transition*, 15(1), 1–31.

Harbord, D., and M. Ottaviani (2001): "Contracts and Competition Contracts and Competition in the Pay-TV Market," *mimeo*.

Hausman, J. A., A. Pakes, and G. L. Rosston (1997): "Valuing the Effect of Regulation on New Services in Telecommunications," *Brookings Papers on Economic Activity. Microeconomics*, 1997, 1–54.

Hill, C. W. L., and S. A. Snell (1989): "Effects of Ownership Structure and Control on Corporate Productivity," *The Academy of Management Journal*, 32(1), 25–46.

Ickes, B., and R. Ryterman (1993): "Entry Without Exit: Economic Selection Under Socialism," Working Papers No. 10-93-4a, Pennsylvania State - Department of Economics.

Inderst, R., and T. Valletti (2009): "Price discrimination in input markets," *The RAND Journal of Economics*, 40(1), 1–19.

Jandik, T., and C. G. Rennie (2008): "The Evolution of Corporate Governance and Firm Performance in Transition Economies: The Case of Sellier and Bellot in the Czech Republic," *European Financial Management*, 14(4), 747–791.

Jullien, B., and P. Rey (2007): "Resale Price Maintainance and Collusion," *RAND Journal of Economics*, 38, 983–1001.

Kaiser, U. (2006): "Magazines and their Companion Websites: Competing Outlet Channels?," *Review of Marketing Science*, 4, Article 3.

Khovanskii, A., and Y. Burda (2008): "Degree of rational mappings, and the theorems of Sturm and Tarski," *Journal of Fixed Point Theory and Applications*, 3, 79–93.

Khumbhakar, S. C. (1990): "Production Frontiers, Panel Data and Time-Varying Technical Inefficiency," *Journal of Econometrics*, 46, 201–211.

Klein, B. (1988): "Vertical Integration as Organizational Ownership The Fisher Body General Motors Relationship Revisited," *Journal of Law, Economics and Organization*, 4, 199–213.

Konings, J., and A. Repkin (1998): "How Efficient are Firms in Transition Countries? Firm-Level Evidence from Bulgaria and Romania," CEPR Discussion Papers 1839, C.E.P.R. Discussion Papers.

Korn, G. A., and T. M. Korn (1968): *Mathematical Handbook for scientists and engineers: Definitions, Theorems, and Formulas for Reference and Review.* McGraw-Hill Book Company, New York.

Krueger, A. B., and L. H. Summers (1988): "Efficiency Wages and the Inter-Industry Wage Structure," *Econometrica*, 56(2), 259–293.

Krugman, P. R. (1979): "Increasing returns, monopolistic competition, and international trade," *Journal of International Economics*, 9(4), 469 – 479.

La Porta, R., F. L. de Silanes, and A. Shleifer (1999): "Corporate ownership around the world," *Journal of Finance*, 54, 471–517.

Laafía, I. (2002): "Employment in High Tech and Knowledge Intensive Sectors in the EU Continues to Grow in 2001," *Eurostat, Statistics in Focus: Science and Technology*, 9(4), 1–8.

Levinsohn, J., and A. Petrin (2003): "Estimating Production Functions Using Inputs to Control for Unobservables," *The Review of Economic Studies*, 70(2), pp. 317–341.

Mahoney, K. P., and J. H. Collins (2005): "Consumer Newspaper Choice in Markets with Free Print Options: Are Free Daily Newspapers Competition or Opportunity for Traditional Paid Products?," Readership research by New York Times and Scarborough Research.

Marschak, J., and J. Andrews, William H. (1944): "Random Simultaneous Equations and the Theory of Production," *Econometrica*, 12(3/4), 143–205.

Marvel, H. P. (1982): "Exclusive Dealing," *Journal of Law and Economics*, 25(1), 1–25.

Masten, S. E., and E. A. Snyder (1993): "United States versus United Shoe Machinery Corporation On the Merits," *Journal of Law and Economics*, 36(1), 33–70.

Mathewson, G. F., and R. A. Winter (1984): "An Economic Theory of Vertical Restraints," *RAND Journal of Economics*, 15, 27–38.

Meeusen, W., and J. van den Broeck (1977): "Efficiency estimation from Cobb-Douglas production functions with composed error," *International Economic Review*, 18(2), 435–444.

Morck, R., D. Wolfenzon, and B. Yeung (2005): "Corporate Governance, Economic Entrenchment, and Growth," *Journal of Economic Literature*, 43(3), 655–720.

Motta, M. (2004): *Competition Policy: Theory and Practice*. Cambridge: University Press.

Olley, G. S., and A. Pakes (1996): "The Dynamics of Productivity in the Telecommunications Equipment Industry," *Econometrica*, 64(6), pp. 1263–1297.

Pavitt, K. (1984): "Sectoral patterns of technical change: towards a theory and a taxonomy," *Research Policy*, 13, 343–373.

Petrin, A. (2002): "Quantifying the Benefits of New Products: The Case of the Minivan," *Journal of Political Economy*, 110(4), pp. 705–729.

Pivovarsky, A. (2003): "Ownership Concentration and Performance in Ukraine's Privatized Enterprises," *IMF Staff Papers*, 50(1), 10–42.

Posner, R. A. (1986): "Free Speech in an Economic Perspective," *Suffolk University Law Review*, 20(1), 1–54.

Prat, A., and D. Strömberg (2005): "Commercial Television and Voter Information," Working Paper 4989, CEPR.

Price, C. L. (2003): "Threats and Opportunities of Free Newspapers," INMA Report 2(3), 2-66.

Rasmusen, E. B., J. M. Ramseyer, and J. S. Wiley (1991): "Naked Exclusion," *American Economic Review*, 81(5), 1137–1145.

Rey, P., and J. Stiglitz (1995): "The role of exclusive territories in producers' competition," *The RAND Journal of Economics*, 26(3), 431–451.

Sabirianova Peter, K., J. Svejnar, and K. Terrell (2005): "Foreign Investment, Corporate Ownership, and Development: Are Firms in Emerging Markets Catching up to the World Standard?," Discussion Papers No. 1457, IZA.

Segal, I. R., and M. D. Whinston (2000): "Exclusive contracts and protection of investments," *RAND Journal of Economics*, 31, 603–633.

Shleifer, A., and R. W. Vishny (1997): "A Survey of Corporate Governance," *Journal of Finance*, 52(2), 737–783.

Sinani, E., D. C. Jones, and N. Mygind (2007): "Determinants of Frim-level Technical Efficiency: Evidence Using Stochastic Frontier Approach," mimeo.

Singh, N., and X. Vives (1984): "Price and Quantity Competition in a Differentiated Duopoly," *The RAND Journal of Economics*, 15, 546–554.

Stoll, M. (2005): "http://www.gradethenews.org/2005/freepapers3.htm," online, accessed: 03.12.2011.

Sturm, C. F. (1829): "Mémoire sur la résolution des équations numériques," *Bulletin des Sciences de Férussac*, 11, 419–422.

Syverson, C. (2011): "What Determines Productivity?," *Journal of Economic Literature*, 49(2), 326–65.

Telser, A. (1960): "Why Should Manufacturers Want Fair Trade?," *Journal of Law and Economics*, 3, 86–105.

Temouri, Y., N. L. Driffield, and D. Añón Higón (2008): "Analysis of Productivity Differences among Foreign and Domestic Firms: Evidence from Germany," *Review of World Economics*, 144, 32–54.

Thomsen, S., and T. Pedersen (1998): "Industry and ownership structure," *International Review of Law and Economics*, 18, 386–404.

Uzagalieva, A., E. Kocenda, and A. Menezes (2011): "Technological Imitation and Innovation in New European Union Markets.," *Emerging Markets Finance and Trade*, Forthcoming.

Van Biesebroeck, J. (2008): "The Sensitivity of Productivity Estimates," *Journal of Business and Economic Statistics*, 26(3), 311–328.

Waldfogel, J. (2003): "Preference Externalities: An Empirical Study of Who Benefits Whom in Differentiated-Product Markets," *The RAND Journal of Economics*, 34(3), 557–568.

——— (2004): "Who Benefits Whom in Local Television Markets?," *Brookings-Wharton Papers on Urban Affairs*, pp. 257–284.

Whinston, M. (2008): *Lectures on Antitrust Economics*, Cairoli Lectures. MIT Press.

Winter, R. A. (1993): "Vertical Control and Price versus Nonprice Competition," *The Quarterly Journal of Economics*, 108(1), 61–76.

Eidesstattliche Versicherung

Ich versichere hiermit eidesstattlich, dass ich die vorliegende Arbeit selbständig und ohne fremde Hilfe verfasst habe. Die aus fremden Quellen direkt oder indirekt übernommenen Gedanken sowie mir gegebene Anregungen sind als solche kenntlich gemacht. Die Arbeit wurde bisher keiner anderen Prüfungsbehörde vorgelegt und auch noch nicht veröffentlicht.

16.12.2011

Michal Mašika

Curriculum Vitae

seit September 2007	wissenschaftlicher Mitarbeiter am Seminar für Komparative Wirtschaftsforschung Promotionsprogramm in Volkswirtschaftslehre Munich Graduate School of Economics Ludwig-Maximilians-Universität, München
Dezember 2006	Diplom in Volkswirtschaftslehre Ludwig-Maximilians-Universität, München
Oktober 2002 - Dezember 2006	Studium der Volkswirtschaftslehre Ludwig-Maximilians-Universität, München
Mai 2002	Abitur Gymnasium, Cheb, Tschechien
Oktober 1982	Geboren in Cheb

München, den 16.12.2011

Michal Mašika