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EMPIRICAL STUDIES OF PRICING

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What first put the idea of Ph.D.-studies in my head were two brilliant young teaching assistants,[15] they were the most intelligent people I had ever met (OK, this was in 1993...), they could actually explain the Coase Theorem! I figured that if studying economics made you that bright, I had to venture into higher degrees. Well, today I have been around for a while, but I am still confused...

For the comfort of those of you who feel left out because you were only mentioned in a footnote of my acknowledgements, I would like to cite an anonymous referee:
-It is really the footnotes that make the paper!

Stockholm, April 2001
Niklas Strand

[15] Ingela Brundin and Magdalena Andersson

Introduction

The price is at the very core of the market economy, all characteristics of the product, quality, quantity, timing, options etcetera, are embodied in this one single number. The starting point of industrial economics is the notion of a market with perfect competition. In this setting, all firms are price takers; they simply do not set prices (which may come as a surprise to those of you who go out and buy stuff now and then) and competition drives prices down to marginal cost. Fortunately, there are many very good models of imperfect competition that allows for more elaborate firm behavior and more realistic pricing. This dissertation is in its entirety focused on evaluating and to a minor extent, extending, theories on monopoly and oligopoly pricing.

The data in all of the essays originates from the Swedish daily newspaper markets. There are several advantages with choosing these markets. First there are many, more than one hundred, geographically separated markets for virtually the same product. All of these markets are either monopolies or duopolies, which allows for testing for the effects of market structure and competition on prices and pricing behavior. The quality of data is very good since several parties have an interest in the gathering of data. Advertisers demand the exact coverage of the newspaper in all markets, coverage and advertising prices are gathered and published by Tidningsstatistik AB. Some newspapers receive government subsidies and a government agency, Presstödsnämnden, monitors the economic performance of the daily newspapers. These financial data are readily available. Finally, Tidningsutgivarna, the publishers union, have provided subscription price data.

The first essay "Pricing Contracts With Different Duration: The Role of Switching Costs" analyzes how prices of contracts with different duration are affected by the degree of "lock-in". We extend a model by

Glazer and Hassin (1982) by adding switching cost. We use the daily newspaper data to test propositions from the model. The essay also analyzes the use of second-degree price discrimination, in the form of different contract durations, by newspapers, and finds that more competition yields more price discrimination. This result has been found in other industries such as airlines, see Borenstein and Rose (1994).

The second essay "Prices, Margins and Liquidity Constraints: Swedish Newspapers 1990-1996" analyzes an example of how the financial situation of firms may affect their product market pricing decisions. When consumers have switching costs, they are to some extent "locked in" and can be exploited. If a firm finds itself in financial distress it may have to resort to raising prices to cover short run expenses, thus sacrificing long run profits, Chevalier and Sharfstein (1996).

The third essay "Pricing Pre-Announcements and Price Leadership in the Swedish Daily Newspaper Industry" analyzes the publication and price setting behavior in the advertising markets. We find that duopoly markets use the information exchange in a way that differs from monopolies. Price leadership is prevalent in many of the duopoly markets. Price leadership can be of different types, barometric, Cooper (1996), collusive, Rotemberg and Saloner, (1990) or dominant-firm. The price leadership observed in these markets is most likely barometric.

The fourth essay "Third-Degree Price Discrimination in Oligopoly: Evidence from Swedish Newspapers" addresses the question of how competition affects the use of third-degree price discrimination. We find that duopolies and firms with weak market positions use more third degree price discrimination. The results are in line with recent theory, e.g. Chen (1997) and Villas-Boas (1999).

The econometric package used throughout the dissertation is LIMDEP in its windows version, a program that can be highly recommended for its ease of use and a built-in help manual that is superior to most econometrics textbooks, its only flaw is that text labels can not be handled.

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Pricing Contracts with Different Duration: The Role of Switching Costs*

Niklas Strand

Abstract

This paper analyzes the pricing of subscription contracts and examines the relative prices of short- and long-term contracts. In a simple model we show that customers must pay a premium to buy a short contract rather than a long, and that products with a larger switching cost will exhibit a smaller short contract premium. This prediction is supported by data from the Swedish daily newspaper industry for the years 1975-1994. The paper also analyzes the use of second degree price discrimination, and finds that markets with more competition exhibit more price discrimination.

Keywords: Price Discrimination, Subscriptions, Switching Costs, Newspaper Industry

JEL codes: D42, L11, L82

1 Introduction

A general observation on the pricing of subscription contracts is that shorter contracts are always more expensive than longer ones. Subscription is a very common form of contract, if meaning any contract where the customer pays for repeated delivery of a non-storable product. Examples include magazines, TV-channels and telephone services, as well as season tickets and car leases. The premium is usually larger, the shorter the contract.

*I wish to thank Marcus Asplund, Tore Ellingsen, Rickard Eriksson, Karl Erik Gustavsson, Arvid Nilsson, Sten Nyberg, and seminar participants at the Research Institute of Industrial Economics, EARIE 2000 annual conference, EEA 2000 annual conference, Econometric Society World Meeting 2000 and at the SSE for valuable comments and Bodil Gidlund, Tidningsutgivarna, and Håkan Westergren, presstödsnämnden, for supplying data. Financial support from Jan Wallander's and Tom Hedelius' Foundation is gratefully acknowledged.

An influential paper on the economics of subscriptions is Glazer and Hassin (1982). They show that under some very general conditions, a monopoly firm will want to sell both single tickets and subscriptions. In their model, heterogenous consumers have ex ante private information about their reservation values and the individual consumers' valuation varies between periods. In this setting, they show that firms will use subscriptions and single tickets as a means of price discrimination. Consumers with high average valuation will buy subscriptions and those with low average valuation will buy single tickets. The single ticket consumer can examine each ticket and determine whether her willingness to pay for this particular one is high. This privilege demands a premium, the price of single tickets are always higher than the subscribers' price. In a related work, Gabszewics and Sonnac (1997) looks at subscriptions as a price dicriminatory device and their general conclusions are the same. They model consumers as differing in their preferred reading frequency, which seems less intuitive than consumers differing with respect to reservation price as in Glazer and Hassin (1982).

The present paper extends the analysis of Glazer and Hassin by adding switching costs, a feature that has been shown to have a significant impact on pricing.[1] We study a simple two-period model of a monopoly which can offer its product at different contract lengths. The monopoly may use different contract lengths to price discriminate between buyers and let shorter contracts have a higher unit price. In our model, all consumers have the same information, short contract consumers cannot investigate the product prior to purchase. Consumers who purchase in the first period will develop a switching cost for the second period which can be exploited by the firm in the second period. We show that a higher switching cost reduces the short contract price premium. Similar to Glazer and Hassin's results, the low valuation customers will purchase the shorter contract and end up paying a higher unit price.

The intuition is straightforward. If a customer is profitable, the firm would rather sell a long contract that ensures future profits than a short contract and risk losing the customer in the next period. This induces the firm to raise short contract prices slightly in order to steer the marginal[2] customers into the longer contract. When there are switching costs, short contract customers are more likely to purchase again, and the larger the switching cost, the more likely is the return of the consumer. Thus, a larger switching cost reduces the incentive to steer customers into longer contracts

[1] See for instance Beggs and Klemperer (1992), Padilla (1995) and the survey article by Klemperer (1995).

[2] Customers indifferent between the short-term and the long-term contract.

and thereby reduces the price premium on the shorter contracts.

The hypothesis of a negative relationship between the size of the switching cost and the short-contract premium is tested against data from the Swedish daily newspaper markets. The reason for considering daily newspapers is that newspapers with higher frequency, six or seven issues per week rather than three or four, can be expected to have larger switching costs and will thus exhibit smaller short contract premiums. Newspapers that issue only once or twice a week are excluded, they are read only as a local or political additive to the regular paper and do not operate in the same market. A number of other predictions on pricing behavior are also included in the testing. Since not all firms offer contracts of all durations, we might encounter selection bias problems. To correct for sample selection bias, we use a Heckman two-stage estimation procedure. The results show that newspapers with a larger number of issues per week do exhibit smaller premiums for shorter contract durations.

In the second part of the paper we investigate the related question of how competition and market power affect the firms' use of second degree price discrimination. Earlier studies on price discrimination and competition, such as Borenstein and Rose (1994) and Stavins (2000) find that price discrimination increases with increased competition. Hayes and Ross (1998) finds no straightforward connection between market structure and and price discrimination. All of these works analyses U.S. airline prices. Giulietti (1999), on the other hand, finds that Italian grocery stores use more price discrimination the stronger their market position. We look at the number of alternative contracts offered and find that markets with more competition exhibit more price discrimination.

The following section presents the model and the predictions that can be drawn from it. The section also discusses additional aspects of subscription pricing that have been mentioned in the literature. Section 3 presents the daily newspaper industry and the data. In Section 4 we estimate price premium regressions for different contract durations. Section 5 contains the disussion and estimations on the relation between market structure and price discrimination. Section 6 concludes.

2 The model

The model is similar to Glazer and Hassin's (1982), but switching costs are added. We work in a two-period setting to make the model tractable; a monopoly sells one product only and may offer it at two different contracts, a two-period contract or a one-period contract.

Consumers live for two periods and consumption of the product in period one increases the consumer willingness to pay in the next period by s, the switching cost. This way of modelling switching cost is appropriate for a habit-forming product. The benefit of a short contract in this model is that it allows the consumer to terminate the subscription if the product turns out not to be that valuable to her. This is not the same as the selling of "single tickets"; these short contract consumers cannot investigate the product before purchase. The initial consumer decision, short/long, is made with the same information, regardless of choice.

A number of different strategies are available to the firm. It could choose to pool consumers and sell only long or short contracts at the same price to all consumers. We denote this a *pooling contract offer,* and the optimal price charged is P^{PL}, for the two-period contract, or, if the firm sells only short contracts, P^{PS} for the short pooling contract.

Alternatively, the firm could set prices so high that only high-type consumers will buy. We call the prices in a *high-type only contract offer,* P^{LH}, if only long contracts are sold or P^{SH}, if only short contracts are sold.

Since this outcome is the one observed in practice, the most interesting case is when both long and short contracts are sold and the firm separates the two consumer groups. We define a *separating contract offer* to be a price pair $\left[P^S, P^L\right]$ offered by the firm which has a positive probability of sales at both prices. Further, we only investigate the simplest case where firms are constrained to the same prices in both periods and there is no discounting and it is assumed that contracts cannot be resold.

The value of the product to a consumer in period t is denoted by θ_t The valuation in period 1, θ_1, can take either of two values, θ^H with probability π^i or θ^L with probability $(1-\pi^i)$, where $\theta^H > \theta^L$.

There are two types of consumers, H and L, that differ in their probability π^i of having a high valuation θ^H, with $\pi^H > \pi^L$. The individual knows if she is a high-type, $\pi^i = \pi^H$, or a low-type, $\pi^i = \pi^L$, when entering the market. A fraction α of the population is high-type and $(1-\alpha)$ is low-type. The valuation in period 2, θ_2, is dependent on the consumer action in period 1. It can be written

$$\theta_2 = \begin{cases} \theta_1 \text{ if no purchase is made in period 1;} \\ \theta_1 + s \text{ if purchase is made in period 1,} \end{cases}$$

where s is the switching cost developed after period 1.

Let $u_t^k = \theta_t - P^k$ be the utility a consumer with a valuation of θ_t enjoys after a purchase at price P^k. The consumer has three available actions: purchasing a long contract, purchasing a short contract or purchasing no contract at all. The short contract adds the possibility to buy or not in

period two, depending on the actual value of the product, θ^H or θ^L, for the particular consumer. A consumer who does not buy in the first period will not have her actual valuation revealed and will not find it optimal to buy in the second period either[3]. For ease of exposition we will use $\theta^H = 1$ and $\theta^L = 0$ henceforth.

Both types of consumers are assumed to have a reservation utility of zero. The expected utility of a short contract when viewed from the beginning of period 1, when the purchase decision is made, can be written

$$\begin{aligned} E\left(U^S\right) &= E\left(u_1^S\right) + E\left(u_2^S\right) \\ &= \pi^i\left(2+s\right) - \left(1+\pi^i\right)P^S, \end{aligned}$$

and the expected utility of a long contract can be written

$$\begin{aligned} E\left(U^L\right) &= E\left(u_1^L\right) + E\left(u_2^L\right) \\ &= 2\pi^i + s - 2P^L. \end{aligned}$$

We start by investigating the separating contract offer. For the problem to be nontrivial, we must have that only those consumers who find a realized $\theta = \theta^H$ purchase again in period two. Otherwise, everyone would prefer the longer, cheaper, contract. If we define a probability of high valuation,

$$\underline{\pi} \equiv \frac{P^S}{2\theta^H + s - P^S},$$

then only consumers with a $\pi^i \geq \underline{\pi}$ will make a purchase in the first period. Moreover, if we define a probability of high valuation

$$\overline{\pi} \equiv 1 - 2\frac{P^S - P^L}{P^S - s},$$

the consumer with $\pi^i \geq \overline{\pi}$ will prefer purchasing a long rather than a short contract. Note that when prices are equal, $\overline{\pi} = 1$ and every buyer chooses the

[3]If she decides not to buy in period 1

$$p^i\left(\theta^H - P^S\right) + \left(1-p^i\right)\left(\theta^L - P^S\right) + p^i\left(\theta^H + s - P^S\right) < 0,$$

and then we know that with certainty

$$p^i\left(\theta^H - P^S\right) + \left(1-p^i\right)\left(\theta^L - P^S\right) < 0,$$

and she will not find it optimal to purchase in period two only.

short contract. From the above, we see that given a *separating contract offer* $\left[P^S, P^L\right]$, consumers with $\pi^i < \underline{\pi}$ will not buy, consumers with $\underline{\pi} < \pi^i < \overline{\pi}$ will buy short contracts and consumers with $\pi^i > \overline{\pi}$ will buy long contracts.

The firm's problem in offering a separating contract is to maximize

$$\alpha\left(P^L + P^L\right) + (1-\alpha)\left(P^S + \pi^L P^S\right).$$

The separating contract offer is subject to four constraints: the individual participation constraint for the high-type consumer,

$$2\pi^H + s - 2P^L \geq 0, \qquad (IP^H)$$

the individual participation constraint for the low-type consumer

$$\pi^L(2+s) - \left(1+\pi^L\right)P^S \geq 0, \qquad (IP^L)$$

the incentive compatibility constraint of the high-type consumer,

$$s - 2P^L + \pi^H P^S + P^S - \pi^H s \geq 0, \qquad (IC^H)$$

and the incentive compatibility constraint of the low-type consumer,

$$\pi^L s + 2P^L - s - \pi^L P^S - P^S \geq 0. \qquad (IC^L)$$

A successful strategy for the firm must leave low-type consumers indifferent, (IP^L) is binding, otherwise the firm could just raise the short-contract price, P^S. Thus, the short-contract price is

$$P^S = (2+s)\frac{\pi^L}{1+\pi^L}. \qquad (1)$$

An optimal separating contract offer must have the high-type consumer indifferent between short and long contracts, (IC^H) is binding, otherwise the firm could just raise the long contract price. Thus, the long contract price is

$$P^L = \frac{\left(1+\pi^H\right)\pi^L + \frac{s}{2}\left(1+2\pi^L-\pi^H\right)}{1+\pi^L}. \qquad (2)$$

That (IP^H) is nonbinding follows from the fact that (IP^L) and (IC^H) bind and that $\pi^H > \pi^L$. Inserting the P^S and P^L from above into (IC^L), we can now write (IC^L) ;

$$\left(2\pi^L - s\right)\left(\pi^H - \pi^L\right) \geq 0.$$

This shows that a separating contract offer is feasible when switching costs are small, $s < 2\pi^L$. However, to further clarify when separating contract offers will actually be used, we must first determine when profits are higher with a separating contract offer than with a pooling contract offer or a high-type only contract offer.

Proposition 1 *There are parameter values such that a separating contract offer is optimal.*

Proof. We start by comparing the separating contract offer to the pooling alternatives. The optimal price in a short contract pooling equilibrium, P^{PS}, is the price that makes the (IP^L) bind, which is the same as the short contract price P^S, in the separating equilibrium. The profit from a separating contract offer is higher than the pooled short contract offer if:

$$\begin{aligned} \Pi_{Separating} &> \Pi_{Pooling,Short} \\ \alpha 2P^L + (1-\alpha)\left(1+\pi^L\right)P^S &> \alpha\left(1+\pi^H\right)P^{PS} + (1-\alpha)\left(1+\pi^L\right)P^{PS}, \end{aligned}$$

which simplifies to

$$2\pi^L\left(\pi^H - \pi^L\right) + s\left(\pi^L\left(1-\pi^L\right) + \left(1-\pi^H\right)\right) > 0,$$

which is always true under our assumptions. The short contract pooling equilibrium is never the best option for the firm.

The optimal price in a long-contract pooling equilibrium is the price P^{PL} that leaves the low-type consumer indifferent between purchasing a long contract and not participating. The profit from a separating contract offer is higher than the pooled long contract offer if:

$$\begin{aligned} \Pi_{Separating} &> \Pi_{Pooling,Long} \\ \alpha 2P^L + (1-\alpha)\left(1+\pi^L\right)P^S &> +\alpha 2P^{PL} + (1-\alpha)2P^{PL} \end{aligned}$$

which simplifies to

$$2\alpha\pi^H\pi^L - 2\alpha\left(\pi^L\right)^2 - s\left((1-\alpha)\left(1-\left(\pi^L\right)^2\right) + \alpha\left(\pi^H - \pi^L\right)\right) > 0 \qquad (3)$$

A small enough s is sufficient for (3) to hold, for s close to zero the separating contract offer dominates the pooling contract offer.

To show that the separating contract offer is sometimes the best, it must also be shown that it is at the same time better than the strategy of selling only to high-type consumers. The optimal price when only selling short contracts to high-type consumers is the price P^{SH} that solves

$$\pi^H\left(1-P^{SH}\right) + \left(1-\pi^H\right)\left(-P^{SH}\right) + \pi^H\left(1+s-P^{SH}\right) = 0,$$

namely

$$\frac{2\pi^H + \pi^H s}{1+\pi^H} = P^{SH}.$$

The optimal price when only selling long contracts to high-type consumers is the price, P^{LH}, that solves

$$2\pi^H - 2P^{LH} + s = 0,$$

namely

$$\pi^H + \frac{s}{2} = P^{LH}.$$

It turns out that when only selling to the high-type consumer, it is always better to sell long contracts, since

$$2P^{LH} > \left(1 + \pi^H\right) P^{SH},$$

if and only if

$$s\left(1 - \pi^H\right) > 0.$$

Thus, we only have to compare the profit from the *separating contract offer* with the *long contract, high-only offer*. The profit from a separating contract offer is higher than the long high-only contract offer if:

$$\Pi_{Separating} > \Pi_{Long,High-only}$$

i.e., if

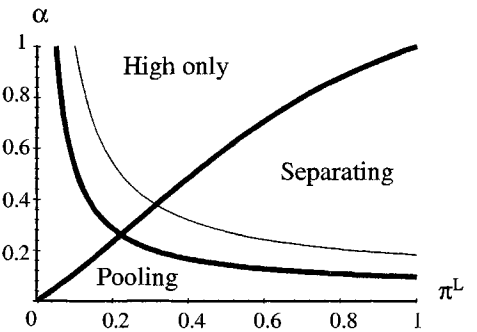
$$\alpha 2P^L + (1-\alpha)\left(1 + \pi^L\right) P^S > \alpha 2P^{LH},$$

which simplifies to

$$(2+s)\left(\left(\left(\pi^L\right) + \left(\pi^L\right)^2\right) - \alpha\left(\pi^H + \left(\pi^L\right)^2\right)\right) > 0 \tag{4}$$

We immediately see that a low α, few high-type consumers, is sufficient for the separating contract offer to be more profitable than the high-only long contract offer for the firm. A separating contract offer is the best alternative for the firm only when both (3) and (4) are true. Figure 1 shows the firm's optimal contract choices for a range of π^L and α in a numerical example where $\pi^H = 1$, and $s = 0.1$. The thin line represent a situation with an increased switching cost, $s = 0.2$.

Figure 1 : Optimal Contract Offers



■

For a market with a large fraction of high-types and a low π^L the high-only contract offer dominates. The pooling contract offer is naturally more attractive when there are few high-type consumers. In our numerical example it is clear that a small switching cost will make the separating contract offer more attractive than the pooling contract offer. In the extreme, when s approaches zero, it is always better to use separating contracts. A larger switching cost will unambiguously make the region where the separating contract is the optimal choice smaller.

Proposition 2 *An increased switching cost will make the separating contract offer less attractive.*

Proof. Taking the derivative of the left-hand side of (3) with respect to s yields

$$-(1-\alpha)\left(1-\left(\pi^L\right)^2\right)-\alpha\left(\pi^H-\pi^L\right)$$

which is always smaller than zero, indicating that an increased switching cost makes the separating contract offer less attractive compared to the pooling long contract offer.

The boundary between the separating contract offer and the high-only contract offer, equation (4), is unaffected by changes in the switching costs.

■

In the above picture, an increasing switching cost will always reduce the separating region for any parameter values. An increased switching cost will shift the pooling contract border upwards and to the right. Proposition 2

delivers a testable prediction; products with larger switching costs will offer fewer contract alternatives, that we will further explore in Section 5. We expect firms selling products with higher switching costs to offer, at most, the same number of contracts as firms with lower switching costs.

Proposition 3 *Given a separating contract, the premium to the short contract,* $\frac{P^S}{P^L}$ *is decreasing in the switching cost.*

Proof. Considering (1) and (2) once more we see that

$$\frac{P^S}{P^L} = \frac{2\pi^L + s\pi^L}{(1+\pi^H)\pi^L + s\pi^L + \frac{s}{2}(1-\pi^H)}$$

which means that

$$\frac{d}{ds}\left(\frac{P^S}{P^L}\right) = 4\pi^L \frac{-(1-\pi^H)(1+\pi^L)}{(2\pi^L + 2\pi^L\pi^H + s + 2s\pi^L - s\pi^H)^2} < 0$$

■

The intuition for this effect of switching costs on pricing behavior is simple. If the firm makes positive profits from selling a contract, it would rather sell a long contract than risk losing the customer when the short contract runs out. The higher the switching cost, the more likely short contract customers are to purchase again and there is less incentive to steer the marginal consumer into longer contracts by raising the prices of contracts with shorter durations. Proposition 3 delivers a testable prediction, that will be further investigated in Section 4. Note that both prices and profits are higher, the larger the switching cost.

2.1 Some Other Theoretical Predictions

Potentially, many factors influence the size of the short contract premiums. Some simple reasoning on the economics of subscriptions has been provided by other authors. In a study of Australian magazines, Bentick and Round (1997) find that a subscription is, in general, cheaper than spot purchases, and they propose a number of reasons why subscriptions would be cheaper than spot purchases. Part of their reasoning can also be applied also to the pricing of contracts of differing length. Below, we will give some intuitive reasons why the short contract premium varies between firms and over time.

2.1.1 Consumer Inflow

If there is a large inflow of consumers to the market, we expect some of the introductory pricing effect from switching cost markets to show emerge. The intuition is that firms will reduce prices in order to catch new customers, who will later develop switching cost for this particular brand, see e.g. Klemperer (1995). Firms will have to balance between exploiting "locked in" customers and investing in new ones. A period with a high inflow of new customers is a good time to invest, i.e. to reduce the price, which means a smaller premium on short contracts in order to catch the consumers for your particular brand. We expect larger consumer inflows to be associated with smaller premia on short contracts. Our measure, IMMIG, is the fraction of people having moved into the paper's main market during the previous year. INHABITANTS, our measure of market size, is the number of inhabitants (divided by 10^6) of the market, i.e. the town or city, where the firm has its main coverage.

2.1.2 Bankruptcy uncertainty

The consumer that has purchased a subscription carries the risk that the quality of the product will deteriorate or that the firm will go totally bankrupt. There is no refund when a firm goes bankrupt or delivers an inferior product. This uncertainty regarding the value of future delivery will tend to reduce the price on the longer contracts. Firms with the largest bankruptcy risk will have to reduce prices more on the longest contracts, resulting in a larger premium on shorter contracts. Thus, a low lagged profit margin will be associated with a larger premium on short contracts. Our measure of bankruptcy risk is LOWMARG1, a dummy variable taking the value one, if the profit margin of the firm was less than 5 percent the preceeding year.

2.1.3 Inflation

If we make the reasonable assumption that consumers are more worried about uncertainty than firms and that higher inflation is correlated with greater uncertainty regarding inflation, customers will have a stronger preference for long contracts in times of high inflation. The long contract insures the consumer against future price fluctuations. Thus, in times of high inflation, a higher demand for long contracts will result in a lower premium on short contracts. Another effect of inflation comes from its level. When inflation is high and prices for shorter contracts posted January 1st are valid for a longer period, these prices must incorporate some of the expected inflation; an effect which will raise short contract prices in periods of high inflation. In our

estimation, we will use the nominal inflation, INFLATION, as an explanatory variable in the regressions to explain the variation in the short contract premiums. There is no apriori obvious sign to the parameter, however.

3 The Daily Newspaper Industry and Data

Daily newspapers have well defined geographical markets and very similar products are sold in the different regional markets. We have gathered data on subscription prices for contracts of one, three, four, six, and twelve months duration for daily newspapers in Sweden during the years 1975-1994. The data set contains all Swedish daily newspapers, somewhere between 100 and 150 in any given year, and their coverage in all of Sweden´s almost 300 municipalities. There is large variation in the size of firms in the data set, the largest firm having a daily circulation of 126000, seven days a week and the smallest only 1400, three times a week. Another thing difference is the number of issues per period. A "daily" newspaper does not have to be issued every day; the frequency of "daily" newspapers varies between 3/week and 7/week. This is largely exogenous, determined by the size of the city or town where the paper has its major coverage. We claim that the frequency has an effect on the switching costs of the consumers. After subscribing to a newspaper for a period t, the reader of a 6/week have met the product twice as many times as the 3/week reader. The 6/week subscriber will have developed a larger switching cost after any period length, an assumption which is crucial for the testing of proposition 3 of the model.

Every firm has a home market, the market with its largest coverage. We have gathered population data such as number of households, and number and age profile of inhabitants. For each market we calculate the Herfindahl index, HINONATW, and the market shares, MSHARE, based on the total number of papers circulated in the market, excluding national papers. We do not include the national papers in these measures, since they do not compete in the same fashion as local papers; they have no local advertising and no local news. In most markets, the coverage of national papers is very small. As of 1996, there are 288 municipalities, 69 of which are the home market of one newspaper only and 27 are the home market of two papers. No municipality has more than two local newspapers, however. This implies that in most municipalities, there will only be a few newspapers with positive circulation, but the market structure will differ substantially. Some markets are monopolies, asymmetrical duopolies are common and we also observe a few symmetrical duopolies. There are never more than two main firms in any market, so every firm has market power.

Table 1: Descriptive Statistics

	Mean	Std.Dev.	Min	Max	No Obs.
MARGIN	0.08	0.09	-0.42	0.62	2110
LOWMARGIN_1	0.23	0.42	0	1	2110
IMMIG	0.032	0.0078	0.013	0.064	2110
MARKETSHARE	0.59	0.25	0.072	1	2110
POPULATION18_25	0.11	0.011	0.079	0.15	2110
INFLATION	0.068	0.035	0.0048	0.14	2110

POPULATION18_25 is a variable that gives the fraction of inhabitants in the market (municipality) that are beween 18 and 25 years of age. We have defined the dummy variables NWEEK3 to select newspapers selling three, four, five, six and seven issues per week, respectively. NWEEK=3 is the group where customers will have the lowest switching cost. Newspapers that issue 3/week constitute 15% of our sample, 4/week and 5/week, around 6 percent each.

Table 2: Descriptives, dummy variables

NWEEK=3	299
NWEEK=4	133
NWEEK=5	122
NWEEK=6	1413
NWEEK=7	143
	2110
LOWMARGIN1=1	484

For the estimation we group the 4/week and 5/week into one to get a group, NWEEK45, of a reasonable size. We have also grouped the 6/week and 7/week into a common reference group for two reasons. First, because changing the frequency between 6 and 7/week is quite common among firms, and second because not all subscribers to 7/week receive their paper seven times a week; some subscribers in the countryside will receive their Sunday paper in the Monday mail.

3.1 Cost differences

Interpreting variations in price as evidence of price discrimination requires that the costs of producing the differently priced products are the same. Producing newspapers entails economies of scale as shown by Dertouzos and Trautman (1990) but we do not investigate price levels, only the relative price between long and short contracts. Here, economies of scale are not interesting since only the marginal cost is of importance, which is the same for long and short contracts.

There is no reason for believing firms with different size or geographical location to have different costs for providing contracts of different length. This problem might arise in selling single copies at newsstands where the distribution system might differ between firms, and thus costs, as in Bentick and Round's (1997) paper on subscription versus single-copies. Single copies, the very shortest contract, are not included.

All firms offer a twelve-month subscription; almost all offer a one-month subscription and a subscription for three, four or six months. In this industry, there are different contracts length for exactly the same product. The likelihood that consumer will develop switching costs and again purchase the same brand is of course larger, the longer the contract. Pricing is such that shorter contracts demand a premium, which is increasing the shorter the contract.

Table 3: Descriptives, Short Contract Premiums

	Mean	Std.Dev.	Minimum	Maximum	No.Obs.
PREM6	1.10	0.04	1.00	1.23	338
PREM4	1.12	0.06	1.00	1.63	1352
PREM3	1.17	0.08	1.03	1.53	540
PREM1	1.25	0.14	1.04	2.00	1489

The pricing pattern over contract length is obvious and very general, the shorter the contract, the higher the price. Purchasing two six-month contracts instead of one twelve-month contract is, on average, ten percent more expensive, and twelve one-month contracts are, on average, 25 percent more expensive. Some of this differential could be accounted for by an additional costs of providing the shorter contracts, a billing cost. Selling twelve one-month contracts rather than a single one-year contract means an extra cost in sending out bills and keeping track of payments. A billing cost uniform over firms will increase the short contract premium more for a paper with a

low price than for a paper with a high price. This will tend to give papers with lower frequency a higher premium on short contracts, since they are generally cheaper. This is also the effect predicted from switching costs in Proposition 3. In order to claim that the effect comes from switching costs, we must control for the billing costs. We show the intuition by a simple example; assuming that firms use cost pricing, the price per period will be;

$$P^S = mc + b,$$

for the short contract and;

$$P^L = mc + \frac{b}{n}$$

for the long one, where mc = marginal cost, b = billing cost and n the number of periods covered by the long contract. The short contract price can be written as;

$$P^S = P^L + \frac{(n-1)}{n} b,$$

and the variable we are interested in, the short contract premium, can be written

$$\frac{P^S}{P^L} = 1 + \frac{(n-1)}{P^L n} b.$$

It is clear that the first derivative with respect to price is nonzero;

$$\frac{d\left(\frac{P^S}{P^L}\right)}{dP^L} = -\frac{(n-1)}{(P^L)^2 n} b,$$

and that this effect will work in the same direction as the switching cost explanation from Proposition 3. Thus, we have to correct for this effect somehow. The average price of a 6/week paper is SEK 1310 at the end of the sample period, the average 3/week price is SEK 712. The mean premium for six-month contracts is 10 percent; if the entire premium is to be explained by the billing cost, this implies a billing cost of approximately SEK 70-130. Twelve one-month contracts demand a 24 percent premium, implying a billing cost of SEK 15-25.

We argue the billing cost to be smaller, somewhere below SEK 10 at the end of the sample period, and the same in real terms at the beginning of the period. Some short contract customers pay by automatic transfers from their bank account,thereby imposing almost no additional cost on the firm. To correct for the effects of billing costs we simply deduct the assumed uniform billing costs, SEK 9 at the end of the period and SEK 2 at its beginning, from the prices of shorter contracts, before performing estimation on the remaining premiums.

4 Estimation of Short Contract Premiums

We regress the premiums for one, three, four and six-month contracts on a number of firm specific, market and economy-wide characteristics. Not all firms in the sample offer contracts of all lengths, every contract length contains a different subsample n of all N firms. Sample selection bias can arise when some components of the offering decision are relevant to the subsequent pricing decisions, that is, when some of the determinants of the offer decision also influence the nominal price. These problems are discussed in a survey article by Vella (1998).

If the relationship between offering and pricing was purely through observables, this could be controlled for by including the appropriate conditioning variables in the pricing equation. When unobservable characteristics affecting the offering decision are correlated with unobservable characteristics affecting the final pricing decision, our inference will be incorrect if we do not include an estimate of the unobservables of the offering decision in the pricing equation. A bias will then be introduced because of the sample selection. In this case the unobservables may include the age profile of the population, occupation or political preferences.

The standard sample selection model has the form:

$$
\begin{aligned}
y_i^* &= x_i'\beta + \epsilon_i, && (5)\\
d_i^* &= z_i'\gamma + v_i, && (6)\\
d_i &= 1 \; if \; d_i^* > 0; \; d_i = 0 \text{ otherwise}, && (7)\\
y_i &= y_i^* d_i, && (8)
\end{aligned}
$$

where y_i^* is a latent endogenous variable with the observed counterpart y_i, and d_i^* is a latent variable with the associated indicator function d_i, reflecting whether the primary dependent variable is observed. The relationships between d_i and d_i^* and y_i and y_i^* are shown in (7) and (8). The relation of primary interest is described by (5) and equation (6) is the reduced form of the variable capturing sample selection, x_i and y_i are vectors of exogenous variables, β and γ are vectors of unknown parameters, and ϵ_i and v_i are zero mean error terms with $E[\epsilon_i \mid v_i] = 0$. The standard OLS estimation of (5) will lead to biased estimates when $E[\epsilon_i \mid v_i, d_i = 1] \neq 0$, the conditional mean of y, is misspecified. A frequently employed measure to correct for this is a two step procedure proposed by Heckman (1976, 1979). The strategy is to overcome the misspecification by including a correction term accounting for $E[\epsilon_i \mid v_i, d_i = 1]$ into equation (5).

The equation of interest for the subsample n where $d_i = 1$ can be written:

$$y_i = x_i'\beta + \epsilon_i, \; i = 1, ..., n. \qquad (9)$$

If we take the conditional expectation of (9), we get:

$$E\left[y_i \mid z_i, d_i = 1\right] = x_i'\beta + E\left[\epsilon_i \mid z_i, d_i = 1\right];\ i = 1, ..., n.$$

Now, if we assume that ϵ_i and v_i, $i = 1, ..., N$ are independently and identically distributed, $N(0, \Sigma)$ where

$$\Sigma = \begin{pmatrix} \sigma_\epsilon^2 & \sigma_{\epsilon v} \\ \sigma_{\epsilon v} & \sigma_v^2 \end{pmatrix},$$

and ϵ_i and v_i are independent of z_i, then using the formula for the conditional expectation of a truncated variable, we can derive that

$$E\left[\epsilon_i \mid z_i, d_i = 1\right] = \frac{\sigma_{\epsilon v}}{\sigma_v^2}\left\{\frac{\phi\left(z_i'\gamma\right)}{\Phi\left(z_i'\gamma\right)}\right\}.$$

Here, $\phi(\cdot)$ and $\Phi(\cdot)$ denote the probability density and cumulative distribution function of the standard normal distribution. The term in the curly brackets is known as the inverse Mills ratio. To obtain an estimate of the inverse Mills ratio, we need the unknown parameters γ and σ_v, and the fraction γ/σ_v can be estimated by Probit. The two-step procedure suggested by Heckman (1976, 1979) is to first estimate γ over the entire N observations by maximum likelihood Probit and then construct an estimate of the inverse Mills ratio. β can then be consistently estimated over the n observations reporting values for y_i by including an estimate of the inverse Mills ratio as an explanatory variable into the second stage OLS.

We follow this procedure, first estimating a Probit, equation (7) above, for each contract length, six-, four-, three- and one-month, for the choice of offering a price for a contract of a specific length. The dependent variable is a dummy variable coded one if the firm quotes a price for a contract length of n months. The results of these Probit regressions are given in the Appendix. The inverse Mills ratios are kept and enter into the second stage OLS where we arrive at what is the ultimate issue here, that is, the short contract premiums. Using our theory and the reasoning developed in section two, we estimate an OLS for each contract duration, using White's robust covariance matrix. The results are given in Table 4. Using fixed effects or random effects regression in the second stage requires stronger assumptions about the sample selection process to yield consistent estimates..

Table 4: Regression Results, Short Contract Premia

	PREM1	PREM3	PREM4	PREM6
NWEEK45	0.075***	0.077***	0.016***	0.024***
	(0.011)	-0.0098	-0.0056	(0.0063)
NWEEK3	0.094***	0.036***	0.031***	0.0026
	(0.012)	(0.0065)	(0.0056)	(0.0049)
LOWMARG1	0.038***	0.026***	0.0031	-0.018***
	(0.0076)	(0.0066)	(0.0032)	(0.0049)
IMMIG	0.52	-1.1***	-1.2***	-0.53**
	(0.49)	(0.38)	(0.19)	(0.27)
INFLATION	0.53***	0.0099	0.10	-0.57**
	(0.18)	(0.12)	(0.069)	(0.23)
INVMILLS	0.13***	0.046***	0.023***	0.056***
	(0.028)	(0.010)	(0.0072)	(0.0187923)
TIME	0.010***	0.0068***	0.0064***	0.0046***
	(0.00087)	(0.000775)	(0.00043)	(0.0027)
ONE	0.87***	0.98***	1.0***	0.97***
	(0.030)	(0.026)	(0.012)	(0.060)
Adj. R2	0.24	0.33	0.30	0.11
No Obs	1386	540	1342	337

****,** and * denotes significance at the one, five and ten percent level respectively*
Standard errors in parenthesis, White het. adj.

The regressions give some support to Proposition 3 in the model, that is the claim that the short contract premium is decreasing with an increasing switching cost. The papers with only three or four/five issues per week have significantly larger premiums on shorter contracts than those papers with an issuing frequency of six or seven per week. From proposition 3, we expect the largest parameter estimate on NWEEK3 and the smaller on NWEEK45. This is the case for the one- and four-month contract regressions but not for the other contracts. The one- and four-month contracts are the ones used

by most firms. The effect of higher premiums for firms with lower issuing frequency is robust; we have tried a number of specifications similar to the above, and this result comes through in all of them.

The LOWMARG1 as a measure of bankruptcy risk gives the results predicted by the reasoning in Section 2. Premiums to longer contracts are smaller and premiums to the shorter contracts are larger. This can be interpreted as consumer demand being different for newspapers with weak finances, shying away from long contracts in unstable newspapers. There is indeed some real risk of bankruptcy, several newspapers went bankrupt in the early nineties.

IMMIG, the consumer inflow variable, does show an interesting pattern. For one-month contracts the estimate is not significant. For the three-, four- and six–month regressions, there is a negative and significant, sign on the IMMIG variable. The interpretation is that one-month contracts are not used to catch new customers, to the same extent as the others. If one-month contracts are mainly sold to summer residents with no prospect for the firm of catching them for the future, there is no need to reduce prices on one-month contracts.

Inflation, INFLATION, has a positive influence on the premiums of the shortest contracts, which suggests that the inflation-level has an influence on prices. In the markets examined, prices are adjusted twice a year at most and usually just once a year. If inflation is high and prices are infrequently updated, firms will have to set the shorter contract prices to include some of the future inflation, since payment for the long contracts is received today but some of the short contracts will be sold at this price almost a year from now.

Premiums show an increase over time, thus TIME is puzzlingly consistently positive and significant. This may be explained by increasing billing costs over the sample period, but the measures for the billing cost do not show a dramatic increase over the period. The TIME effect is larger than ten percent and real wages increase by less than five percent and postage (for sending bills) almost perfectly follows inflation. One possible explanation may be that the advent of computers has made it easier to fine tune price discriminatory schemes over time.

The INVMILLS variable turns out to be significant for those regressions with some selection bias to control for, thereby indicating that the two-stage procedure was warranted. The correction term is positive, meaning that the prices observed are upward biased. This is as expected; if a firm's optimal three-month price is low enough to steal customers from its one- and four-month contracts, the firm will choose not to offer this price to the public. Thus, there is an upward bias in the observed prices.

5 The Use of Price Discrimination

In a perfectly competitive market, every firm is a price taker and thus, no firm has price discrimination at its power. A monopolist, on the other hand can use whatever information is available to discriminate between consumers, as long as there is no reselling between consumers or prohibitive menu costs. The intermediate cases of various types of oligopolistic competition are not as directly determined. Recent theoretical research is divided on the issue whether more competitive markets will exhibit more or less price discrimination and/or price dispersion.

Valetti (1998) analyses a model where consumers have heterogenous preferences, both over a horizontal parameter (brand) and a vertical one (quality). The model analyzes both monopolistic and oligopolistic situations. He finds that price dispersion, the observed range of prices, increases almost everywhere as competition is introduced on the market. Further, he shows that for a large range of parameter values, discriminatory contracts only exist in the competitive environment. Stole (1995), on the other hand, finds the opposite result in his model with customer private information regarding vertical as well as horizontal preferences. In his model, as competition increases, the resulting price and quality dispersions decrease.

There are a number of empirical studies of price dispersion in product markets; examples of which are Walsh and Whelan (1999), Shepard (1991), Dahlby and West (1986) and Pratt et al. (1979). It must be noted that price dispersion is not equivalent to price discrimination. Imagine a situation where a monopolist sells a product at ten different prices, using some clever scheme, and a duopoly in an identical market would only quote two prices where the highest price is the same, but the lowest duopoly price is lower than the lowest monopoly price. Given this outcome, it must be concluded that the monopoly uses more price discrimination but the duopoly exhibits more price dispersion. With our data, we can make an inference on exactly the type of price discrimination described here. Empirical studies of price discrimination are more rare. In a study of the pricing behavior of American airlines, Borenstein and Rose (1994) find that when the number of competitors in a market grows, price discrimination increases. Hayes and Ross (1998), also analyzing U.S. airline prices, do not find a straightforward connection between market shares and price dispersion.

In line with Borenstein and Rose, Stavins (2000) finds that price discrimination increases with competition. Her result, also on airlines, is explained by the fact that increased competition will have a larger impact on the cheapest fares, while more expensive tickets remain relatively unchanged. This may be a particular feature of the airline industry; Giulietti (1999), analyz-

ing the Italian grocery trade, finds that firms with larger market shares use more price discrimination while Joyce (1990) finds no clear relation between market power[4] and the use of price discrimination in academic journals.

This section asks the question to which extent pricing is fine-tuned under different competitive regimes and by firms with different market power. Our measure of the extent of price discrimination is simply the number of prices quoted, i.e. the number of different contract durations offered. This number ranges from one to five. We estimate an ordered probit model where the dependent variable, PRICES, is the number of different prices offered. All newspapers sell one-year contracts. If a newspaper quotes prices for all six-, four-, three- and one-month contracts, PRICES will take the value four. If the newspaper does only sell one-year contracts, PRICES is zero.

Table 5 : Descriptives, No. of Prices

0	306
1	147
2	1123
3	96
4	176

We use a small number of variables to explain the difference in the number of prices. NWEEK is the issuing frequency, measured as numbers per week, and we also use an assessment of the firm's market situation encoded into a dummy variable. Our sample includes a number of newspapers that may be viewed as local monopolies, as well as others engaged in close competition with a rival. We have categorized firms according to the competitive situation and define a monopoly newspaper, MONOPOLY, to be one which is the only local news and advertising provider. There may be a presence, in a MONOPOLY market, of larger national newspapers, but their coverage is usually small and they do not have any local advertising or newscoverage. Duopoly markets are markets with two local newspapers. In some cases, the size of newspapers in duopoly markets vary considerably and we therefore define DUOPLARGE and DUOPSMALL to be the newspapers with the larger and smaller circulation in the home market, respectively. As can be seen from the table below, their respective marketshares differ considerably. Some markets are closely matched duopolies where both firms have close to

[4]His measure of market power is the number of citations.

a fifty percent market share; these newspapers are denoted DUOPSYMM.

Table 6: Descriptive Statistics: Firm Types

	NW	MSHARE	PRICES	No.Obs.
MONOPOLY	5.2	0.73	1.80	1036
DUOPLARGE	6.0	0.73	1.83	275
DUOPSMALL	6.1	0.24	1.76	282
DUOPSYMM	6.0	0.52	2.05	255

We use these variables to run a maximum likelihood ordered Probit with PRICES as the dependent variable. The results are given below.

Table 7 : Regression Results, Number of Prices Quoted

	PRICES
NWEEK	-0.096***
	(0.027)
DUOPLARGE	0.078
	(0.082)
DUOPSMALL	0.043
	(0.075)
DUOPSYMM	0.34***
	(0.084)
CONSTANT	1.45***
	(0.15)
No. Obs.	1848
Pseudo R2	0.79
CHI2	28.5

****, ** and * denotes significance at the one, five and ten percent level respectively*
Standard errors in parenthesis.
Pseudo R-squared based on McKelvey and Zavoina.

There is a significant difference in the number of prices quoted by firms with different issuing frequency, and different switching costs. We find some support for the claim in Proposition 2 that a larger switching cost will make

separation of consumers less attractive. But the regression does not support the notion that firms with more market power use more price discrimination. On the contrary, firms with a strong market position, MONOPOLY and firms in asymmetric duopolies DUOPLARGE and DUPOPSMALL, have a significantly smaller number of prices than those in the DUOPSYMM category. The DUOPSYMM firms operate in the most competitive markets, which turns out to be where the markets where the largest number of choices are avilable.

In some earlier studies, on airline prices, it has been shown that more competition leads to more price discrimination but that the effect may stem from increased competition only at the lower end of the price range. With our data, we do not face that type of problem, we can unambiguously say that there is more price discrimination, more contracts are offered, in the more competitive markets.

6 Conclusions

The model of a monopolist selling subscriptions predicts that the price premium to short contracts is decreasing in switching cost. We test this prediction by using data from the Swedish newspaper industry for the years 1975-94, and using the proxy that papers with a lower issuing frequency will create smaller switching costs for their readers. We find that firms with a lower issuing frequency have larger premiums for short contracts, as predicted from the model. Other variables also affect the short contract premiums. It appears that some shorter contracts are, to some extent, underpriced to "introduce" new customers to the product. We find that in a market or period with an unusually high inflow of possible new customers, firms reduce the relative price of some contract durations in order to attract new customers.Inflation has a positive influence on the price premiums of the shortest contracts, in times of high inflation firms must include some of the expected inflation into the prices of shorter contracts. The financial status also affects the relative prices between short and long contracts.

In the second part of the paper we look at a related issue, the number of prices quoted by the firms, which is a direct measure of the use of second degree price discrimination. It is evident in our sample that the markets with more closely matched duopolies exhibit more price discrimination than monopolies and duopolies with firms with inequal market shares.

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Appendix

Table A1: Regression Results, Probit on existence of prices

	EXIST1	EXIST3	EXIST4	EXIST6
NWEEK45	0.37***	0.26***	-0.36***	0.029
	(0.11)	(0.095)	(0.098)	(0.11)
NWEEK3	0.76***	0.66***	-0.11	-0.055
	(0.11)	(0.092)	(0.092)	(0.12)
LOWMARG1	0.31***	-0.063	0.29***	0.097
	(0.081)	(0.075)	(0.075)	(0.091)
IMMIG	-26***	-8.5**	-23***	2.7
	(4.16)	(4.1)	(4.1)	(4.7)
MSHARE	0.74***	-0.072	1.2***	0.71***
	(0.14)	(0.14)	(0.14)	(0.16)
INHABITANTS	-0.062	3.8***	-4.5***	0.83
	(0.63)	(0.59)	(0.71)	(0.71)
POP18_25	32***	-2.2	42***	0.13
	(3.5)	(3.3)	(3.4)	(3.7)
INFLATION	13***	-1.7*	7.3***	-14***
	(0.97)	(0.89)	(0.89)	(1.1)
Constant	-3.52***	-0.34	-4.3***	-0.76**
	(0.37)	(0.34)	(0.36)	(0.38)
No Obs	2110	2110	2110	2110
R2 ML	0.19	0.04	0.18	0.098
Chi-squared	441	91	415	217

****,** and * denotes significance at the one, five and ten percent level respectively*
Standard errors in parenthesis.

Table A2: Predictions from Probit model in Table A1

EXIST1 Predicted

Actual	0	1	
0	255	355	610
1	114	1386	1500
	369	1741	2110

EXIST3 Predicted

Actual	0	1	
0	1564	5	1569
1	526	15	541
	2090	20	2110

EXIST4 Predicted

Actual	0	1	
0	333	414	747
1	161	1202	1363
	494	1616	2110

EXIST6 Predicted

Actual	0	1	
0	1756	15	1771
1	339	0	339
	2095	15	2110

Prices, Margins and Liquidity Constraints: Swedish Newspapers 1990-1996*

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Abstract

Using firm level data from the Swedish daily newspaper industry, we test theories on the effects of liquidity constraints on prices in markets with consumer switching costs. The newspaper industry is of particular interest, since firms set prices in two markets, the subscription market, where switching costs are high, and the advertising market, where switching costs are low. When Sweden enters a recession, we find a relative increase in subscription prices and margins for liquidity constrained firms, which is not the case for advertising prices.

Key words: Liquidity constraints; switching costs; price adjustment; newspaper industry.
JEL classification: D43; E32; G33; L82.

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1 Introduction

Several hypotheses have been advanced to explain how price-cost margins vary over the business cycle. In particular, economists have provided a number of reasons why firms have the incentive to keep prices relatively low in times of high demand and vice versa, which would tend to amplify economic fluctuations. These explanations can broadly be classified into three categories. First, recessions are often accompanied by a tight credit market and some firms face liquidity constraints. Provided that consumers have switching costs, firms can boost short-run profits by increasing prices to avoid default at the cost of foregone future profits, see e.g. Chevalier and Scharfstein (1996). Second, periods of high demand are associated with an inflow of new, unattached customers. In order to capture these for the future, firms use aggressive pricing behavior, Bils (1989). Third, firms gain more by deviating from fully collusive prices in high demand states than when demand is low. To sustain an implicitly collusive equilibrium, the prices in high demand states must be lower than fully collusive prices, Rotemberg and Saloner (1986). These hypotheses and empirical tests on intra-industry data are discussed in more detail below.

To test the hypotheses, we provide an empirical examination of price adjustments in an industry having experienced times with radically different macroeconomic conditions: the Swedish newspaper industry in 1990 to 1996. In 1990, Sweden entered a deep recession, with a falling real GDP for three consecutive years, a quadrupling of unemployment, and a tightening of credits which leading to a threefold increase in bankruptcies. A strong recovery began in 1994 with three years of high/medium-high GDP growth and a gradual loosening of credit. Such broad changes in macroeconomic conditions may, at a first approximation, affect all newspapers to an equal extent, and the question is therefore if they all responded in a similar manner. We test whether the patterns of price adjustments for subscriptions and advertising space depended on local and/or newspaper specific factors. The local factors for which we control are demand factors, such as the development of income and population. Newspaper specific factors include market position and, in particular, liquidity constraints.

Our most important result is that newspapers with weak financial standings showed the highest increases in subscription price during the recession, which improved their margins in the short run. Financial variables could not explain differences in the price increases for advertising space, however. This suggests that newspapers with liquidity constraints attempted to raise short-term profits by exploiting readers, who are believed to have high switching costs, but could not improve their profitability at the expense of advertisers, who are less attached to a particular newspaper. We find no significant differences between monopoly and competitive markets. Finally, our results suggest that in the recovery period, the development of prices and margins were due to unobservable idiosyncratic factors.

2 Theories and Tests of Pricing over the Business Cycle

A priori price-cost margins are expected to be pro-cyclical: in times of high demand, prices are also high. However, it is conceivable that margins are counter-cyclical, or at least have a counter-cyclical tendency. This possibility has spurred a significant empirical literature.[1] In this section, we briefly set out the theories and previous empirical works. We also discuss the predictions that can be tested on our sample of local newspapers. This discussion motivates specifications in the empirical part, where we regress the changes in subscription prices, advertising prices and margins in 1990-1992 and 1994-1996 on a number of independent variables.

2.1 Switching Costs and Liquidity Constraints

In the models of Chevalier and Scharfstein (1996), Gottfries (1991), and Klemperer (1995), consumers incur a switching cost when changing supplier. In the short run, this will reduce the price sensitivity of the firm's customers. Effectively, this allows a firm to exploit captured customers by setting a high price to raise short-run profits. In the long run, a high price will induce consumers to search for other alternatives, and customers once lost are costly to win back. Clearly, when firms have access to capital markets, i.e. are able to borrow against future profits, they will not sacrifice long-run

[1] Most of the early empirical studies, e.g. Domowitz et al (1988), employed aggregate inter-industry data and found preciously little evidence of counter-cyclical tendencies. Rotemberg and Woodford (1999) give references to more recent work in this vein. Schmalensee (1989, p.987) takes as a stylized fact that "price-cost margins tend to be more strongly procyclical in more concentrated industries".

profits for short-run gains. However, liquidity constraints, for instance in recessions, could leave firms with little choice but to raise prices to meet debt repayments.

In their empirical application, Chevalier and Scharfstein (1996) used samples of supermarkets in the U.S. to test their hypothesis that liquidity-constrained firms tend to increase their prices, see also Chevalier (1995). They measured the importance of liquidity constraints by i) the market share of local chains compared to national chains in areas hit by a sharp drop in oil prices, ii) the market share of chains that had recently undertaken leveraged buy-outs[2] and iii) whether firms had undertaken leveraged buy-out. The evidence suggests that firms more likely to be liquidity constrained raised their prices in economic downturns. Compared to other firms, however, the difference in pricing is only in the range of a few percent. The results in Phillips (1995) also suggest that financial constraints often lead to price increases. However, Borenstein and Rose (1995) find that airlines, in or close to, bankruptcy lower their prices, but they find no effect on prices or sales of rival firms. Kennedy (2000) finds that there are adverse effects on the profits and sales of rival firms before a bankruptcy, but afterwards the rival firms' profits recover quickly.

Some features of the present data make a test of the predictions on liquidity constraints and customer markets attractive. First, as noted in the introduction, when Sweden fell into a recession in 1990, credits were tightened as a result of very large credit losses for all major banks. Using accounting information from newspaper firms, we can by their solvency, i.e. the ratio of own equity to total assets, broadly categorize them as being more or less liquidity constrained.[3] Firms with low solvency are likely to be most affected in the event of a tightening of credit markets. Solvency is measured one year prior to the period in question, which might be treated as exogenous, given that the recession was unexpected. Second, the revenue of a representative local newspaper roughly splits equal between the sales of subscriptions and advertising space. We argue that the average buyer of advertising space is much less attached to a particular newspaper, i.e. has lower switching costs, than the average subscriber. This is motivated by the ease with which advertisers can change source in

[2] There is an issue whether ii) is a valid test group. The reason is that leveraged buy-outs are not exogenous and a change in ownership may lead to substantial changes in firm strategy, not directly related to liquidity constraints.

response to a change in the cost of reaching consumers.[4] The reader, on the other hand, has grown accustomed to a newspaper's content and style, and is therefore unwilling to switch due to modest increases the subscription price. This conjecture is supported by studies of newspapers which usually find a highly inelastic relation between circulation and subscription price in the short-run; see references quoted in Lewis (1995).

Sales of subscriptions and advertising space are interrelated. As advertisers have a preference for newspapers with a large circulation, increasing the subscription price will involve a trade off between a higher subscription revenue and a loss of advertising revenue.[5] However, with circulation being insensitive to the subscription price in the short run, the newspaper has the option of increasing its total revenue by raising the subscription price. Given that this only has a minor effect on circulation, the advertising price may not need to be adjusted. This motivates our empirical specification, which treats the growth rate of the subscription price as independent of the growth rate of the advertising price.[6]

The prediction from the model of Chevalier and Scharfstein (1996) is that firms with the lowest solvency in 1989 should have the highest price increases for subscriptions in the 1990-1992 recession. It is not immediately clear that any prediction can be made for the 1994-1996 recovery. First, as the general economic conditions improved during this period, it gradually became easier to obtain new credits even for firms with low solvency. Second, it may be too costly for newspapers that have lost subscribers in a recession to win some back by lowering their prices. In

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[3] Studies of investment behavior have used profit margins, dividend payouts or differences in solvency, e.g. due to leveraged buy-outs, to measure the extent of liquidity constraints; for references see Hubbard (1998).

[4] Advertisers in national newspapers and on TV, usually producers of branded consumer products and large retail chains, are likely to have more long-term relationships that are costly to terminate, for instance due to quantity discounts. However, the advertising content of local newspapers is dominated by occasional promotions by local businesses, which suggests a reliance on short-term contracts.

[5] There is mixed evidence of the magnitude of the relation between subscription price and advertising sales. Thompson (1989) and Dertouzos and Trautman (1990), among others, have estimated systems of equations for cross section data. Using US data, Dertouzos and Trautman find some effects of subscription price on sales of advertising, with a price elasticity of -0.45. This is the long run effect however, since they use cross-section data for one year only. Using British and Irish data, Thompson finds no clear price-quantity relationship for either subscription or advertising price.

[6] In practice, of course, a newspaper will offer a large menu of advertising possibilities depending on the size and place of the ad, and often also sells subscriptions of different duration. The prices we use, annual full price subscription and price per millimeter for non-specified placement, are those on which people in the industry usually rely in their comparisons.

both periods, prices for advertising space should be essentially independent of the financial position.

2.2 Customer Flows

The demand functions might be more elastic during booms. If demand is more elastic in high demand states, prices, collusive as well as non-collusive, should be kept relatively low. One reason why demand is more elastic is that in high demand states, there is an inflow of new consumers, i.e. consumers who have not previously bought the product. If these consumers develop switching costs after their initial purchase, this induces firms to cut prices in high demand states in order to capture these new consumers for future exploitation; see Bils (1989) and Klemperer (1995). However, the argument rests on the assumption that the demand increase stems from an inflow of new customers, not higher demand from repeat purchasers, which would lead to higher prices.

Our data allows us to discriminate between high demand per consumer and a large inflow of new consumers. Although an upturn in the economy affects the demand per consumer in all local markets, certain areas will benefit relatively more. We measure this variation at the market level by the growth rate in the average per capita disposable income. To measure the importance of an inflow of consumers, we use statistics on migration patterns within the country. From this hypothesis, we expect to find lower subscription price increases in markets with a high inflow of consumers, measured as a percentage of the population. For the advertising market, on the other hand, large inflows would lead to higher demand for advertising from local business and would be more likely to raise than to lower advertising prices.

2.3 Implicit Collusion and Market Structure

It is often stated that the intensity of competition varies with demand conditions, and that firms have difficulties in sustaining implicitly collusive agreements when demand is unstable. Rotemberg and Saloner (1986) formalized the intuition in a model where demand fluctuates randomly between high and low states, but where firms can observe the realization of demand. The key intuition behind their result that price-cost margins may have a counter-cyclical tendency is that firms have a greater incentive to

deviate when the value of future collusive profits is low, compared to the value of a current deviation. With no correlation in demand, it may be impossible to sustain fully collusive prices in periods with high demand. Empirically, this can be contrived as demand fluctuating randomly between high and low demand states; the issue of the temporal dependence of demand shocks has been addressed in several extensions of the model. Bagwell and Staiger (1997) consider the effects of randomness in the growth rates in demand.[7] Under the empirically plausible assumption of positive correlation of growth rates in demand, they show that price-cost margins tend to be pro-cyclical rather than counter-cyclical. Green and Porter (1984) model a situation where firms cannot observe the state of demand. This might lead to an equilibrium with temporal punishments following a low demand state, which could be observed as a pro-cyclical tendency of price-cost margins.

A number of studies have attempted to test predictions from the models of implicit collusion. One of the most comprehensive studies to date is Ellison's (1994) structural model of supply and demand in a railway shipping cartel in the 1880's, designed to test predictions from competing models of implicit collusion. He finds little of support for the mechanism in Rotemberg and Saloner (1986) but some evidence in favor of that in Green and Porter (1984). Borenstein and Shepard (1996) study the dynamics of prices and margins in regional retail gasoline markets in the U.S., using the fact that demand fluctuates over the year and that there is a delayed pass-through of some cost components. They find that predictable increases in future demand (cost) tend to increase (decrease) price-cost margins, which is consistent with models suggesting that implicitly collusive agreements are more difficult to sustain when the gains from deviation are large.

The bottom line is that the theories of implicit collusion are sensitive to the fine details of the game. While it is possible in some cases to argue that the assumptions of a specific model are satisfied, it is more common, as is done here, to treat them as unobservables. The most robust prediction of models based on implicit collusion is that the pattern of price adjustments should vary with the market structure, in the sense that monopoly firms do not need to take such considerations into

[7] See also Kandori (1991) for the case with correlated demand shocks, and Haltiwanger and Harrington (1991) for the case with deterministic fluctuations in demand.

account.[8] The data contains a number of newspapers that can be considered as pure monopolies, and there are also cases where a local newspaper has a very high market share and only faces weak competition from other local and/or national newspapers. Other markets are characterized by close competition between two newspapers. In the regressions, we use a dummy variable to capture the effects of market structure.

3 Data

The Swedish daily newspaper industry is well documented. Advertisers have an interest in knowing the circulation and geographical coverage of newspapers as well as prices for advertising. This information is provided by Tidningsstatistik AB. The Swedish association for newspaper publishers, Tidningsutgivarna, collects information on subscription rates. The government subsidizes some newspapers and a government agency, Presstödsnämnden, monitors the publishers' economic performance. In addition to these sources, we employ census data from Statistics Sweden (Statistiska Centralbyrån). The full data set contains information on all (133, as of 1992) newspapers in Sweden over the period 1975-1996.[9] Our analysis, covering the turbulent period 1990-1996, is restricted to local morning newspapers with three or more issues per week, which gives a sample of approximately 90 newspapers in each of the years.[10]

[8] Prices and margins might only gradually adjust to new conditions and it is possible that the speed of the adjustment process depends on the market structure. Fisher and Konienczny (1995) find that monopoly newspapers adjust their prices more frequently, and by smaller nominal amounts than newspapers with one competitor. However, Thompson (1988) found no evidence of market structure or circulation being important determinants of the speed of adjustment of advertising prices. While it is conceivable that our market structure dummy also picks up differences in the speed of adjustment, we believe the two-year intervals we use to be sufficiently long for prices to be fully adjusted to new conditions.

[9] The balance sheet variables used to measure liquidity constraints are only recorded from 1989 to 1996, thus we are forced to restrict attention to the 1990-1996 period.

[10] We have excluded four evening newspapers, sold almost exclusively as single copies, since these only compete with local morning newspapers to a minor extent. The second group excluded is morning newspapers with coverage in a very large number of local markets. This group includes three large national morning newspapers, and two newspapers tied to religious and political organizations, which cover most of the country but have very low local market shares. Finally, we do not consider 37 newspapers with only one or two issues per week, read as a local or political additive to a regular newspaper and viewed as distinctly different by government agencies and people involved in the industry. The exact numbers vary slightly over the years, the numbers above are for 1992.

3.1 The Economy over the Sample Period

Most of the changes in cost and demand conditions, such as wages, interest rates, paper costs and general inflation affect newspapers irrespective of the local market in which they operate. We ignore changes in such general conditions as our analysis is aimed at explaining differences across newspapers. In the years prior to our sample period, GDP growth rates were high and unemployment low. The beginning of the 1990's saw a very severe recession, with a falling real GDP for three consecutive years, 1991-1993, and a dramatic increase in unemployment. Tightening of firm credits was a prominent feature of the recession. All major banks suffered considerable credit losses and had a large *ex ante* probability of bankruptcy, with the total sum of credit losses amounting to 5% of GDP in 1992. The government had to intervene to save a number of banks from bankruptcy. The total number of firm bankruptcies almost tripled from 1989 to 1992. This recession was followed by a recovery, although unemployment remained at a high level. The development of the economy is depicted in Figure 1. Naturally, there is some ambiguity as to when exactly the recession ended and the recovery began and we therefore split the sample into two sub-periods: 1990-1992 and 1994-1996. Prices are measured in January each year and for most newspapers, a price change takes place in January. The recession began in 1990 but was not anticipated in January that year.

[FIGURE 1 ABOUT HERE]

3.2 Market Level Data

Our definition of a market follows the standard Swedish municipal classification. We define a newspaper's home market as the municipality where it has its largest circulation.[11] The median firm has sixty-two percent of the total circulation in its home market. A newspaper's market level data is from its home market[12] and includes demographic and income statistics. In the regressions we use the change in disposable

[11] In one case only does the municipality where a firm has it its largest circulation change. Since this newspaper has roughly the same circulation in the two municipalities, we let its home market remain the same over the sample period.

[12] The economies in neighboring municipalities are likely to be closely connected. To simplify the empirical analysis, we assume that the economic conditions in all municipalities where a newspaper has circulation are perfectly correlated.

income per capita over the periods expressed as a percentage,[13] denoted *INCGROWTH*. According to customer market theories, e.g. Bils (1989), the level of immigration affects the price level and thus, a change in the number of new consumers will cause a change in prices which we capture with the change in the ratio of immigration to total population, *IMMIGDIFF*.

3.3 Newspaper and Firm Level Data

To measure the development of nominal prices during the two periods, we use the annual subscription price and the price per millimeter for ads with a non-specified placement as of January 1.[14] The dependent variables are the growth rates of the two nominal prices *PSUBGROWTH* and *PADVGROWTH*, defined as 100*(P[t]-P[t-2])/P[t-2]. Note that it is irrelevant whether nominal prices or prices deflated by CPI are used, as general inflation is the same for all newspapers. The data also includes information from the income statement (e.g. total revenues and costs and goverment subsidies) and some balance sheet variables (e.g. own equity and total debt). Certain owners control several local newspapers[15] but for the vast majority, accounting data are broken down per newspaper, as most newspapers are individual firms. In the cases where no separate figures exist, we assume the accounting variables to be the same for all newspapers in the same firm. The income statement gives our next dependent variable, that is the change in price-cost margin, *MARGDIFF*, defined as 100*(PMC[t]-PMC[t-2]), where PMC is total revenues, including government subsidies, minus total costs, divided by total revenues. This measure is admittedly crude and is also the same for newspapers in the same firm, but it can give an indication of whether a newspaper's short-run performance improved or deteriorated during a certain period.

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[13] Disposable income is aggregated over the year and is measured on December 31. It is an issue whether *INCGROWTH* should be measured as 100*(X[t]-X[t-2])/X[t-2] or 100*(X[t-1]-X[t-3])/X[t-3] for t=1992, 1996. In the regressions, we use the former definition, but this is not material to the results reported below. Similarly, we measure *IMMIGDIFF* by 100*(X[t]-X[t-2]).

[14] Subscription rates often remain unchanged for periods up to a year, potentially leading to a measurement problem in the dependent variable. However, most newspapers adjust prices in January such that this problem is likely to be of minor importance. Advertising rates are adjusted more frequently.

[15] As of 1994, some local newspaper had the same owner. One owner owned nine local newspapers, one owned seven, one owned five, two owned four and three owned three. In some cases, all newspapers are within the same firm, in other cases there are several separate firms. Matching the accounting data with circulations and subscription prices suggests that the major part of the firms' revenue stems from the industry, i.e. they seem to have very limited exposure to activities in other industries.

We are interested in whether a newspaper's behavior depends on its market position. As noted above, some municipalities are the home market for only one local newspaper, while others have two local newspapers. There are no municipalities with more than two local newspapers with three or more issues per week. If there is no competing local[16] newspaper, the newspaper is referred to as a monopoly and the dummy variable *MONOPOLY* takes on the value one. Monopoly markets tend to be small in terms of population and, consequently, monopoly newspapers have a low total circulation. The competitive situation for newspapers with one local competitor may differ depending on their relative market shares, but no attempt is made here to make a finer distinction between newspapers in this category[17].

As the theory predicts that solvency should only play a role for newspapers facing a bankruptcy risk we use a dummy variable, *LOWSOLVENCY*, as a measure[18] of liquidity constraints.[19] The cutoff level is a solvency of 15 percent, but we have also experimented with values between 10 and 20.[20] For newspapers with one local competitor, there might be interaction in the pricing decisions. For instance, if a liquidity constrained newspaper raises its subscription price, it may also open the possibility for its rival to raise prices. This is captured by the variable *RIVAL_LOWSOLVENCY,* which takes the value one if the newspaper competes in the same market as a newspaper with solvency below 15 percent

The dummy variable *BANKRUPT* denotes four newspapers, all belonging to the same owner and having low solvency in 1989, in the sample that have actually

[16] In most of the monopoly markets, there is one or more non-local newspapers with a household coverage of more than three percent. As the home market accounts for 62.5 (62.3) percent of the total circulation for the average (median) newspaper, we expect there to be little strategic interaction between a local and a non-local newspaper.

[17] We have, however, tried to assign a dummy variable to each newspaper according to its position in the home market. There is considerable heterogeneity among newspapers in the duopoly markets. Some duopoly markets have two newspapers with roughly the same coverage. Furthermore, there are asymmetric duopoly markets where one of the newspapers has significantly larger coverage. Preliminary regressions showed no evidence of differences in the pricing pattern between different types of duopoly newspapers.

[18] As mentioned above, several newspapers may have the same owner. In one case, the owner, Nya Wermlandstidningen, owns a subsidiary whose solvency was low in 1989, and eight subsidiaries with high solvency in that year. We treat all newspapers with this owner as having high solvency. This is motivated by our intention to let low solvency be a measure of bankruptcy risk. If the owner has a strong financial position it could, if needed, make a capital infusion to save a subsidiary from bankruptcy.

[19] The reason for not using a continuous variable is that for a firm with high solvency, the bankruptcy risk is negligible, and it is irrelevant if solvency is e.g. 50 or 80 percent.

[20] If the cutoff level is set at 10 percent, 14 firms are in the *LOWSOLVENCY* category, at 15 percent there are 19 firms and at 20 percent, there are 27 firms.

become bankrupt in 1992. They are still present in the market and quote prices for this year. However, we do not have any financial data, such as margins, for these firms for 1992; thus they are missing in the *MARGDIFF* regression. Bankrupt newspapers may face different demand conditions due to consumer uncertainty regarding future publication and quality of the newspaper. These newspapers were reconstructed in 1993, but had a significantly lower circulation in the 1994-1996 period. The strategic interaction in the local market may also be affected by the bankruptcies. To control for the possibility of such effects, we introduce the dummy *RIVAL_BANKRUPT*.

[TABLE 1 ABOUT HERE]

As seen in Table 1, the sample contains 19 newspapers whose solvency was below 15 percent in 1989, four of which were bankrupt in 1992. The low solvency newspapers are over represented in the duopoly markets, 12/34 compared to 7/53. There is, however, no difference in the average size, measured as total circulation, between those with high and low solvency. Note that monopoly newspapers are, on average, smaller than duopoly newspapers. Market structure is largely exogenous, a smaller city cannot support more than one newspaper and larger cities tend to be duopolies.

[TABLE 2 ABOUT HERE]

Table 2 reveals that the average increases in the nominal price were higher in the first than in the second period, both in the subscription and the advertising market. Margins improved by, on average, 2.5 percent over the recession and declined by, on average, 5.5 percent in the recovery.[21] In the first period, it is obvious that firms that eventually go bankrupt have much smaller price increases, 14 percent, than the average 22 percent. Other firms with low solvency exhibit subscription price increases

[21] The differences in averages across periods can partly be attributed to growth in CPI and input costs. Growth in CPI, measured as of January, was 16 percent between 1990 and 1992, and 4 percent between 1994 and 1996. Hence, real prices increased by roughly 6 percentage points in each of the periods. In the two periods, journalist wages increased by 7 and 3 percent, and the newsprint price declined by 5 percent in the recession and increased by 26 percent in the recovery. The improvements in margins in the recession and the decline in the recovery thus, to some extent seem to be caused by the movements in newsprint price.

that are three percent higher than the average, but advertising price increases that are close to average. A mirror image to that the group of firms with low solvency managed to increase their margins by 4.8 percentage points, or 2.2 percentage points more than the sample average. Interestingly, the growth rates of advertising prices show no important differences across newspaper types in the recession. For the second period, price changes are strikingly similar across groups of newspapers of different characteristics as well as for subscriptions and advertising markets. The only striking feature is a sharper fall in the margins in the monopoly group.

An important assumption in the analysis is that readers have switching costs and that circulation is relatively insensitive to price in the short run, such that it is possible to improve, temporarily, margins. We perform some simple checks to see whether this maintained assumption is satisfied for our sample. Although our data is insufficient to estimate demand functions for the newspapers, e.g. we lack measures of their quality, it is still possible to use information about circulation to provide some evidence. During the recession, average circulation fell by 1.5 percent only while nominal subscription prices rose by 22 percent, while CPI increased by 16 percent only. The correlation coefficient for growth in the subscription price and the change in circulation was -0.28. In the same period, the correlation between the change in margins and the growth in subscription price was 0.34. Altogether, this suggests that price sensitivity was indeed low, and that the newspapers increasing their subscription prices the most, were able to improve their margins substantially.

[TABLE 3 ABOUT HERE]

Table 3 gives the means and standard deviations of the independent variables. Most importantly, we see that there is very little variation in *INCGROWTH* and *IMMIGDIFF*. The fraction of firms categorized as *MONOPOLY* has risen from 60.3 percent in 1992 to 64.4 percent in 1994, due to the bankruptcies of three duopoly newspapers.

4 Results

Following the discussion above, our basic specification for the estimation of changes in prices is

$$Y_t = \beta_0 + \beta_1 LOWSOLVENCY + \beta_2 RIVAL\_LOWSOLVENCY + \\ + \beta_3 BANKRUPT + \beta_4 RIVAL\_BANKRUPT + \\ + \beta_5 IMMIGDIFF + \beta_6 INCGROWTH + \\ + \beta_7 MONOPOLY + \varepsilon$$

where Y=*PSUBGROWTH, PADVGROWTH* and *MARGDIFF*, t=1992,1996, is the end of the period for which the price changes are estimated and ε is an error term.[22]

The results for the two periods are shown in Tables 4a and 4b.[23] Newspapers in bankruptcy do not report any financial variables for 1992. Thus, we have no observations for changes in margins for these firms and *BANKRUPT* is excluded as an explanatory variable. No firms went bankrupt in the second period, hence the variables *BANKRUPT* and *RIVAL_BANKRUPT* are excluded in the second set of regressions. The variables included can help explain the development of prices and margins for the 1990-1992 period.[24] However, the adjusted R-square for the 1994-1996 period is practically zero. Hence, only in the sharp downturn are there any differences across newspapers in their pricing behavior and the development of margins. Stated differently, in the recovery period, price changes follow from idiosyncratic changes in cost or demand conditions. In the following, we therefore focus our discussion to the former period.

[TABLES 4a AND 4b ABOUT HERE]

[22] The raw correlation between the rates of change of the subscription and advertising price is 0.15 and 0.01 for the 1990-1992 and 1994-1996 period, respectively. The correlation between the error terms in the subscription price and the advertising price regressions are 0.02 and 0.05. This supports our specification that treats the rates of price changes in the two markets as nonrelated.

[23] The difference in the number of observations in Table 4a is due to missing accounting data for the firms for 1992; hence it is not possible to compute the margin. In four cases, the lack of accounting data is due to bankruptcy. In Table 4b, the difference in number of observations is due to missing accounting information for one newspaper.

[24] Using 1991-1993 to capture the downturn does not change the results qualitatively, using the period 1989-1991 is not possible due to the lack of data on solvency for 1988.

4.1 Switching Costs and Liquidity Constraint

Newspapers with low solvency raised their subscription prices significantly more than did others. In nominal terms, the difference is 3.6 percentage points, which is 17 percent more than at the means (21.7 percentage points). In contrast, we found no difference in pricing between the financially constrained firms and those with good solvency in the advertising market.[25] The margins of the financially constrained firms rose by 2.5 percentage points more than those of the others. This is a sharp improvement, which should be attributed to the higher subscription prices, as there was no significant difference in the development of the advertising price. Hence, we find evidence that firms with a high default risk can, and do, exploit their customer base in an attempt to raise short-run profits. Firms competing with liquidity constrained firms also exhibit significantly larger increases in prices. The main results from the three regressions on the 1990-1992 data conform to those reported in Chevalier and Scharfstein (1996).

The newspapers that went bankrupt in 1992 had much smaller price increases than the average.[26] There may be two explanations to this finding. First, if it becomes clear to readers that a newspaper will inevitably become bankrupt in the near future, then the demand for subscriptions will drop. In order to upkeep its circulation, the newspaper may be forced to lower its subscription prices. Second, these firms may have gone bankrupt just because they did not raise prices sufficiently. A closer examination of price changes for the periods 1990-1991 and 1991-1992 suggest that it is in the latter year that the bankrupt newspapers behave differently. Between January 1 1991 and January 1 1992, the bankrupt newspapers increased their subscription prices by only 3.6 percent compared to 10.7 for the sample average, and 12.6 for those with low solvency that avoided bankruptcy. In the prior year, there were no

[25] Using 10 percent as the cutoff level for *LOWSOLVENCY* changes the estimates for *LOWSOLVENCY* to 2.48**(1.26) and 2.20(1.68) and for *RIVAL_LOWSOLVENCY* to 1.47(0.0239) and 2.96*(1.80), in Table 4a, columns (1) and (3), respectively.
Using 20 percent as the cutoff level changes the estimates for *LOWSOLVENCY* to 3.00** (1.20) and 2.05 (1.37) and for *RIVAL_LOWSOLVENCY* to 2.53 (1.93) and 3.50*(1.88), in Table 4a, column (1) and (3) respectively. Estimates in Table 4b are essentially unchanged.

[26] The estimates in the *PSUBGROWTH* regression for 1990-1992 do not change a great deal if *BANKRUPT* is excluded; the point estimate for *LOWSOLVENCY* changes to 3.63***(1.29). For the *PADVGROWTH* regression for 1990-1992, adjusted R-square almost falls to zero, which is not surprising since *BANKRUPT* is the only significant variable in that regression.

pronounced differences between the pricing behavior of different types of newspapers, although the ones with low solvency raised their prices by 2 percent more than the sample average. For the full sample, circulation fell by 1 percent, on average, in each of the years 1990-1991 and 1991-1992. The circulation for the newspapers that went bankrupt in 1992 fell by 14 percent and 15 percent in each of the two years, respectively. Altogether, this indicates that readers may have realized already in 1990-1991 that some newspapers would not survive, and that these were therefore forced to limit price increases in 1991-1992.

4.2 Customers Flows

Markets with large inflows of new consumers should exhibit lower prices according to customer market theories. A change in consumer inflows will then cause a change in the price. However, we find no evidence of such an effect.[27] One reason may be the newspapers' ability to directly target new subscribers with discounted introductory offers, without having to cut their regular subscription prices. Another explanation is that the number of new consumers, compared to the total, is too small to make it profitable to cut subscription prices in order to capture them.[28] Contrary to our expectations, the estimated coefficient on *INCGROWTH* is negative in both the *PSUBGROWTH* and *MARGDIFF* regression. The likely reason for this is that small local differences in the economic conditions make it difficult to trace any effect.

4.3 Implicit Collusion and Market Structure

We find no significant differences in either subscription price or advertising price, or in price cost margins, between firms facing competition and monopolies in any of our regressions. For subscription prices these findings are not surprising, as any newspaper can rapidly detect the moves of its rivals, which is contrary to a basic assumption in the model. Whether the same is true for advertising prices is unclear. The prices in our data are list prices per millimeter of non-specified placement, but the

[27] Further testing of the prediction on other subsamples from the full data set from 1975 to 1996, has not provided any more substantive support.

[28] In our companion paper, Asplund, Eriksson and Strand (2001), we show that newspapers in areas with a high proportion of new consumers have a higher proportion of subscriptions sold at a rebate.

possibility remains that some large advertisers get secret discounts. According to people in the industry, this is quite common for the period studied.[29]

5 Conclusions

In this paper, we have examined the behavior of prices and margins in the Swedish newspaper industry during a sharp economic downturn and a following recovery. The purpose was to evaluate some mechanisms that could lead to a countercyclical tendency of prices and margins, such that prices are relatively high in periods of low demand. In particular, we focused on the effects of liquidity constraints in a recession that more than tripled the number of bankruptcies in the economy.

We find that newspapers with low solvency at the beginning of the recession increased their subscription prices and that their margins improved, relative to other newspapers. Our interpretation is that their low solvency implied a bankruptcy risk, which could only be avoided by exploiting readers whose switching costs were high. In the same period, increases in advertising prices did not depend on financial strength, consistent with the notion that buyers of advertising space have great freedom to switch supplier in response to a price increase. In the recovery, when credit conditions gradually eased, measures of solvency could not explain any of the variation in pricing behavior. These results are consistent with the predictions of Chevalier and Scharfstein (1996). We also examined whether pricing patterns differed between monopoly newspapers and duopoly newspapers, as might be expected if the possibility to sustain implicitly collusive agreements depends on the state of demand, see e.g. Rotemberg and Saloner, 1986, and Green and Porter, 1984. However, we find no evidence for this hypothesis. Neither were the pricing pattern dependent on regional differences in migratory patterns and income growth, as suggested by models along the lines of Bils (1989).

[29] Interview with Madelaine Skedung, Dagens Nyheter AB.

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Table 1. Descriptive statistics by firm type as of 1992, regression sample.

	# (1992)	Mean Circulation	#LOW-SOLVENCY	#RIVAL_LOW-SOLVENCY	#BANK-RUPT	#RIVAL_-BANK-RUPT
All newspapers	87	27600	19	11	4	5
		(33200)				
LOWSOLVENCY=1	19	27500	19	2	0	0
(Solvency<15%)		(20300)				
BANKRUPT=1	4	13000	4	0	4	0
		(4400)				
BANKRUPT=0	15	33500	15	2	0	0
		(67700)				
LOWSOLVENCY=0	68	26700	0	9	0	5
(Solvency>15%)		(20500)				
MONOPOLY=1	53	20400	7	0	0	0
		(15200)				
MONOPOLY=0	34	39100	12	11	4	5
		(48200)				

Standard errors are in parenthesis.

Table 2. Descriptive statistics by firm type as of 1992, regression samples

	PSUBGROWTH		*PADVGROWTH*		*MARGDIFF*	
	1990-92	1994-96	1990-92	1994-96	1990-92	1994-96
All newspapers	22.5	9.94	16.5	9.77	2.58	-5.57
	(5.59)	(6.55)	(4.07)	(4.30)	(5.45)	(6.55)
LOWSOLVENCY=1	23.4	10.2	14.6	8.78	4.79	-5.26
(Solvency<15%)	(6.25)	(7.67)	(4.92)	(5.05)	(5.42)	(8.43)
BANKRUPT=1	14.3		8.87			
	(3.28)		(6.96)			
BANKRUPT=0	25.8		16.1		4.79	
	(4.27)		(2.97)		(5.42)	
LOWSOLVENCY=0	21.8	9.88	16.6	10.0	2.07	-5.64
(Solvency>15%)	(5.61)	(4.17)	(4.28)	(4.13)	(5.37)	(6.11)
MONOPOLY=1	22.0	9.53	17.1	9.89	2.01	-6.38
	(5.26)	(4.23)	(3.10)	(3.37)	(5.56)	(5.78)
MONOPOLY=0	23.2	10.6	15.5	9.56	3.53	-4.08
	(5.99)	(6.02)	(5.15)	(5.69)	(5.22)	(7.67)

Standard errors are in parenthesis.

Table 3. Descriptive statistics, independent variables 1990-1992, 1994-1996.

	1990-1992	1994-1996
LOWSOLVENCY	0. 218	0.184
	(0. 415)	(0.389)
RIVAL_LOWSOLVENCY	0.126	0.0805
	(0.334)	(0.273)
BANKRUPT	0.0460	
	(0.211)	
RIVAL_BANKRUPT	0.0575	
	(0.234)	
IMMIGDIFF	-0.489	-0.230
	(0.416)	(0.405)
INCGROWTH	18.1	2.19
	(1.38)	(1.02)
MONOPOLY	0.602	0.644
	(0.491)	(0.482)

Standard errors are in parenthesis.

Table 4a. Regression Results, Prices and Margins 1990-92

Variable	*PSUBGROWTH*	*PADVGROWTH*	*MARGDIFF*
CONSTANT	27.2***	15.9***	22.6**
	(7.68)	(4.72)	(9.13)
LOWSOLVENCY	3.61***	-0.725	3.47**
	(1.30)	(1.09)	(1.57)
RIVAL_LOWSOLVENCY	4.13**	0.209	3.18
	(2.03)	(1.87)	(1.97)
BANKRUPT	-11.5***	-7.03**	
	(2.00)	(3.35)	
RIVAL_BANKRUPT	-0.215	-0.00171	1.94
	(2.11)	(2.20)	(2.6)
IMMIGDIFF	0.607	0.781	0.947
	(1.46)	(0.960)	(2.09)
INCGROWTH	-0.298	0.103	-1.15**
	(0.421)	(0.265)	(0.481)
MONOPOLY	-0.550	1.01	-0.404
	(0.67)	(1.51)	(1.89)
Adj R^2	0.168	0.117	0.069
Number of obs.	87	87	81

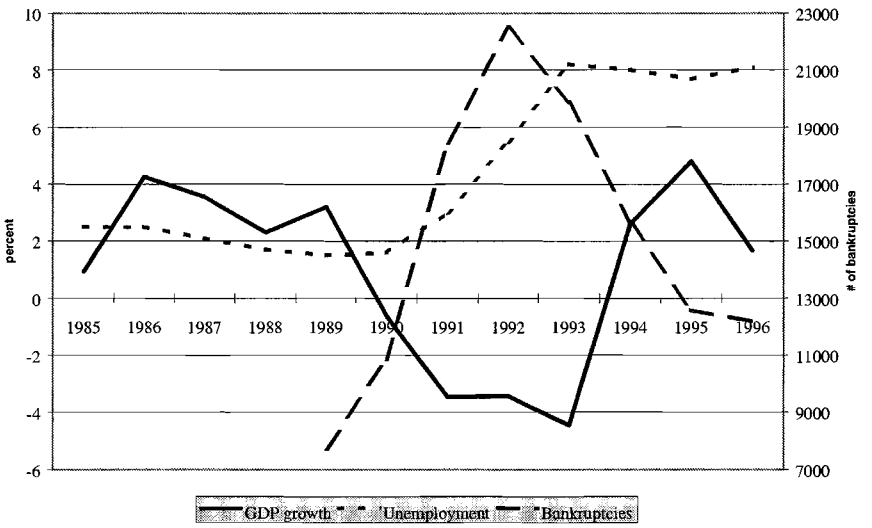
Standard errors, using White's robust covariance matrix, are in parenthesis.
Variables starred *** are significant at the 1% level, with ** at the 5% level and with * at the 10% level.

Table 4b. Regression Results, Prices and Margins 1994-96

Variable	*PSUBGROWTH*	*PADVGROWTH*	*MARGDIFF*
CONSTANT	3.31**	9.61***	-5.30**
	(1.49)	(1.65)	(2.26)
LOWSOLVENCY	-0.170	1.32	-0.249
	(1.61)	(1.32)	(2.12)
RIVAL_LOWSOLVENCY	-0.664	-2.85	-4.06
	(2.19)	(2.07)	(2.79)
IMMIGDIFF	-2.06	1.07	-1.31
	(1.35)	(0.889)	(1.35)
INCGROWTH	-0.139	-0.236	-0.490
	(0.390)	(0.385)	(0.712)
MONOPOLY	-1.21	-0.263	-2.95
	(1.21)	(1.32)	(1.81)
Adj R^2	-0.011	-0.007	0.006
Number of obs.	87	87	86

Standard errors, using White's robust covariance matrix, are in parenthesis.
Variables starred *** are significant at the 1% level, with ** at the 5% level and with * at the 10% level.

Figure 1. The Swedish economy 1985-1996.



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Pricing Pre-Announcements and Price Leadership in the Swedish Daily Newspaper Industry *

Niklas Strand

Abstract

In the Swedish daily newspaper industry, prices of advertising space are published in a trade journal, sometimes four months in advance. We study the timing of advance publication of prices using data from 1981-1996. We find that duopolies exhibit pre-reporting behaviour that differ from monopolies. Price leadership is used frequently in duopoly markets and market share is the dominant factor in deciding the role of price leader. We find no clear relation between the use of price leadership and real price levels and conclude that the observed price leadership may be purely barometric.

Keywords: Information Exchange, Price Leadership, Duopoly, Newspaper Industry

JEL codes: D43, L11, L13, L82

1 Introduction

Firms are sometimes making their prices or production plans known in advance. The announcement of plans can be either public or made only to other firms within the industry. The present paper is an empirical investigation of the pre-announcements of advertising prices and the nature of price leadership in the Swedish daily newspaper industry. The industry is characterized by approximately 90 geographically separated markets where every market is either a monopoly or a duopoly. Advertising prices are published

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in advance in a trade journal, "Annonstaxa", which is read by competitors, intermediaries and buyers of advertising space. It is warranted to say that the future prices are made "public". We find that the price pre-reporting behavior differ substantially between firms with different market positions. Price leadership behavior is observed in many of the duopoly markets in our sample, forty percent of the price changes in duopoly markets are leader-follower price changes. A firm with a larger market share is more often price leader but even the firms with the weakest market position sometimes initiate price changes. In the literature, three types of price leadership is described; dominant firm, barometric and collusive price leadership. We use predictions from models described in Section 2 to analyze which type of price leadership is used in the advertising space markets. A number of earlier studies find that monopolies exhibit less flexible prices than duopolies. We use the number of price changes as a measure of the degree of collusiveness in the price leading behavior. The only difference found is that large firms in asymmetric duopolies undertake more price changes. The symmetric duopoly markets, which we expected to be the most competitive, does not change their prices more often than monopolies. Looking at the real advertising prices, we fail to find any effect on price levels from the share of lead-follow price changes in the market. Taken together, we can not exclude that the price leadership observed in these markets is purely of the barometric type.

2 Theories and Previous Empirical Studies

There is a substantial literature that addresses the general problem of information sharing, e.g. Gal-Or (1985a, 1985b), Li (1985), Cason (1994), and the related topic of trade associations, which is often the device by which information is shared; see Kirby (1988). There are two views on why firms will want to share information. One view is that when it is costly to gather information, and firms live in an uncertain environment, firms will be able to better meet market conditions if they have access to information regarding demand or cost parameters gathered by other firms. The costs of acquiring information is also minimized if only one firm invests in information and then shares its information. According to this view, the information exchange may be beneficial to overall welfare. The idea is stated formally by Novshek & Sonnenschein (1982) and Raith (1996).

Opposing this view is the idea that information sharing is used by the firms to simplify coordination on lower production levels or higher prices, and that the losses that the consumers incur outweigh the benefits to the producers.

The focus in this paper is on the price leadership type of information sharing, and we will discuss a number of theoretical and empirical works on price leadership. In the literature on price leadership, starting with Stigler (1947) and Markham (1951), three types price leadership is identified; dominant firm, barometric and collusive. As in the general information sharing literature, some types of price leadership may be welfare enhancing while others are not.

Dominant firm price leadership can occur when one firm is dominant in the customary sense of the word, controlling at least more than half of total output in the market while the other firms in the market are small. The dominant firm simply sets its price knowing what the responses from the other firms will be, and then allows the other firms in the market to sell what they can at this price. The small firms in the fringe find it optimal to wait and see what the price the large firm will set, see e.g. Tasnadi (2000).

If dominant firm price leadership may be reasonable in markets that are close to monopoly, barometric and collusive price leadership models are applicable to less concentrated markets. Under barometric price leadership, the price leader acts as a barometer of the prevailing demand or cost conditions for other firms in the market. The barometric price leader is not necessarily the largest firm in the market. As market conditions change, all firms would like to be as informed as possible and adapt prices to the changing conditions, and delaying the adjustment is costly. Cooper (1996) shows that if information gathering is costly, the firm with the lowest cost of gathering information may take the role of price leader. The price leader invests in information and changes its price ahead of the other firms, thus it gives away information to the other firms, but prefer this situation to postponing its price changes. Barometric price leadership may increase overall welfare since costly information gathering is minimized. Barometric leadership of this kind is most likely to occur when it is easy and cheap to observe the other firms' action but costly to gather own information.

Collusive price leadership is most likely to occur in markets with only a few firms. Rotemberg and Saloner (1990) model price leadership as a collusive device. The price leader announces a price which other firms then match, often to the penny. As long as the followers does not deviate from the tacitly collusive agreement by undercutting, the arrangement is beneficial to both parties. In related work, Deneckere & Kovenock (1992) analyze a duopolistic price-setting game where firms have capacity constraints. The high-capacity firm endogenously emerges as the price-leader and the price-leader equilibrium prices are higher than under simultaneous price setting.

Empirical work on price leadership and information sharing is relatively scarce. An important piece of empirical evidence on information sharing is

provided by Albaek et al (1997) who show that prices in the Danish market for ready-mixed concrete soared when firm-specific actual invoice prices where made public on a regular basis by the national competition authority. They also find that prices converged significantly. In this case, it seems as if making pricing information public served as a collusive device. The authors argue that prior to the publishing scheme, firms were uncertain as to what prices competitors were actually using and this uncertainty lead them to lower their own prices. When the uncertainty was lifted firms could more easily coordinate on higher prices.

Other empirical studies include Doyle and Snyder (1999) who investigate information sharing in the U.S. motor vehicle industry. Firms in this industry published their production plans in advance in a trade journal. It is found that firms change their plans in response to the information embodied in competitors announcements, indicating that firms do announce meaningful information. The authors conclude that it is hard to distinguish benign motives from collusive ones based on the observed behavior. Kirman and Schueller (1990) writes on price leadership in the European national car markets and find that the domestic producers are often price leaders. If the domestic firm is a high-cost firm it will lead the competitors to higher price levels compared to other markets. Experiments on price leadership have been conducted by Cason (1994), and he shows that depending on the structure of the game, players will use information sharing non-cooperatively or to facilitate tacit collusion.

Given that price leadership is prevalent in the markets for advertising space, we would like to investigate what type of price leadership is used, dominant firm, barometric or collusive? Which of these views is the correct one is of considerable interest to competition authorities as the barometric type of price leadership may be beneficial to general welfare while collusive price leadership is not. We claim that one way to discriminate between the different types of price leadership is the number of price changes undertaken in the markets.

There are a number of works on price rigidity and market concentration. The overwhelming majority of empirical studies find significantly greater price rigidity in more concentrated markets, Stigler (1947) across industries, Simon (1951) in magazines, Primeaux and Bomball (1974) in electricity, Carlton (1986) in heavy industries and Hannan & Berger (1991) in banking; see Fisher and Konieczny (1995) for more references.[1] The intuition is that changing the price for a monopoly will have only a second order effect on

[1]There are examples that do not fit the stylized fact of less flexible monopoly prices. Fisher and Konieczny (1995), analyze data from Canadian daily newspaper markets and find that oligopolies change subscription prices less often than monopolies. It is not clear

profits but for the Cournot or Bertrand duopoly the effect will be first order. If changing price is associated with any fixed cost, the duopoly firms will have larger incentives to change prices in response to changes in demand or cost.

The empirically observed rigidity of monopoly prices is modeled by Rotemberg and Saloner (1987). They formalize earlier intuitions and construct a model of a duopoly competing in a non-collusive Bertrand style. The behavior of the duopoly is then compared to a monopoly under the same conditions. The model shows that for demand (cost) changes duopolies (monopolies) have larger incentives to change their prices. For most reasonable mixes of cost and demand changes the duopolies will indeed exhibit more flexible prices.

In a later paper, the same authors, Rotemberg and Saloner (1990), show that the result of more flexible duopoly prices may not be true for a collusive duopoly under price leadership. If the firms sell differentiated products, they will have different preferences about what is the best price. In their model, the firm that is the price leader earns a higher profit, i.e., both firms would prefer to be the leader. Rotemberg and Saloner show that with sufficiently asymmetric information, the less informed firm prefers to be the follower. Price rigidity emerges as a result. For the follower to accept to be following, it is not optimal for the leader to react to all unilateral shocks. Thus a collusive price leadership-duopoly will have less flexible prices than the non-collusive duopoly.

There are other models that address price leadership and price rigidities. Deneckere and Kovenock (1992) model price leadership in a duopoly where firms have capacity constraints. Under price leadership, prices are unambiguously higher than under simultaneous price setting and prices are changed less frequently under price leadership than under simultaneous price setting. Deneckere, Kovenock and Lee (1992) model a duopoly price setting game in which firms have loyal customers, some customers will not buy from the other firm at any price. They find that the firm with the smaller segment of loyal customers prefers to be price follower. The price leader provides an "umbrella" under which the other firm may price and prices are higher under price leadership than under simultaneous price setting. The prices in the price-leadership equilibrium are less flexible than under simultaneous price setting.

The above models all predict a combination of collusive prices, or at least supernormal prices, and less flexibility in prices in the duopoly. The price rigidity result is not present in models of non-collusive price leadership. In

however, how the presence of switching costs in the subscribtion markets or customer loyalty would affect the number of price adjustments in a duopoly or monopoly.

Cooper (1996), who writes on barometric price leadership, there is nothing to suggest that the duopoly will not react to all changes in demand or cost under purely barometric price leadership.

In van Damme and Hurkens (1998) model of endogenous price leadership it is the firm with the lowest marginal cost that emerges as a price leader. Prices are higher than in the Nash equilibrium but the flexibility of prices are not discussed. Thus inflexible duopoly prices seems sufficient but not necessary to conclude that there is less than perfect competition.

In the light of the literature on the frequency of price adjustments for a diverse group of industries and the models on price leadership, we believe that the number of price adjustments may be a deciding factor between barometric and collusive price leadership. If the price leadership is purely barometric, with no collusive component, we expect the duopolies to change prices more often than the monopolies, in line with previous findings. A collusive duopoly using price leadership will exhibit less flexible prices. A dominant firm price leader will exhibit the same pricing frequency as a monopoly, given that the fringe really has no influence on prices.

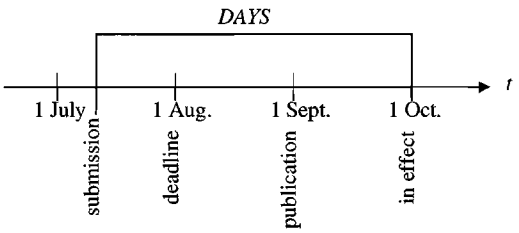
To complement the findings on price flexibility we analyze the real price levels of advertising space. If the use of price-leadership is purely barometric we expect to find no relation between price levels and the number of lead-follow price changes. If the price leadership is collusive, there will be a positive relation between the use of price leadership and the price levels.

3 The Data and the Markets

Our data originates from a monthly trade journal, "Annonstaxa", published by a private company called Tidningsstatistik AB (TS). TS claims to be "an objective link between sellers and buyers of advertising space". TS gathers information on price changes and prices for advertising space for almost all of Sweden's daily newspapers. We have information on the prices and the date when a price change was reported to TS and the date when it subsequently came into effect. The newspapers are supposed to report their prices to be published in annonstaxa one month before they come into effect, the deadline is in turn usually 3-4 weeks before publishing, thus a "normal" prereporting is around 60 days[2]. We define the variable DAYS to be the number of pre-reporting days.

[2] A price change is published by TS as soon as possible, if it is reported early it can be published several months in advance.

Figure 1: A typical scheme of reporting and publication of prices



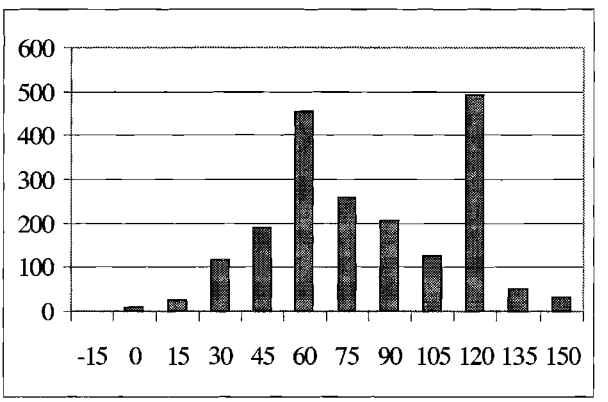
The Swedish daily newspaper market is subdivided into a number of separated local markets. All local daily newspaper markets are either monopolies or duopolies. We categorize all firms into one of four market position groups. By monopoly, denoted MONOPOLY, we mean a newspaper with a monopoly on local news and advertising. In some of the markets characterized as MONOPOLY, there is a presence of national papers, sometimes with a larger market share than the local paper. The crucial factor is whether newspapers present in the local market interact strategically, and national newspapers does not consider local markets in their pricing decisions. The national papers contain no or very little local advertising and news. Thus, if there is no local competitor, we denote the firm MONOPOLY.

There are two distinct types of duopoly markets in the Swedish daily newspaper industry, asymmetric or symmetric. An asymmetric duopoly has one newspaper, denoted DUOPLARGE, which has more than approximately 60-65 per cent market share and one newspaper, denoted DUOPSMALL, with less than 30 percent market share. In a symmetric duopoly, both firms, both denoted DUOPSYMM, have close to 50 percent market share.

The overall distribution of pre-reporting days (DAYS) can be seen in Figure 2. In its instructions to the newspapers, TS encourages firms to provide prices changes early enough to be published "at least" three months ahead of the date when it comes into effect, this explains the spike of reports at around 120 days.[3]

[3]There are no explicit rewards or punishments associated with early or too late reporting.

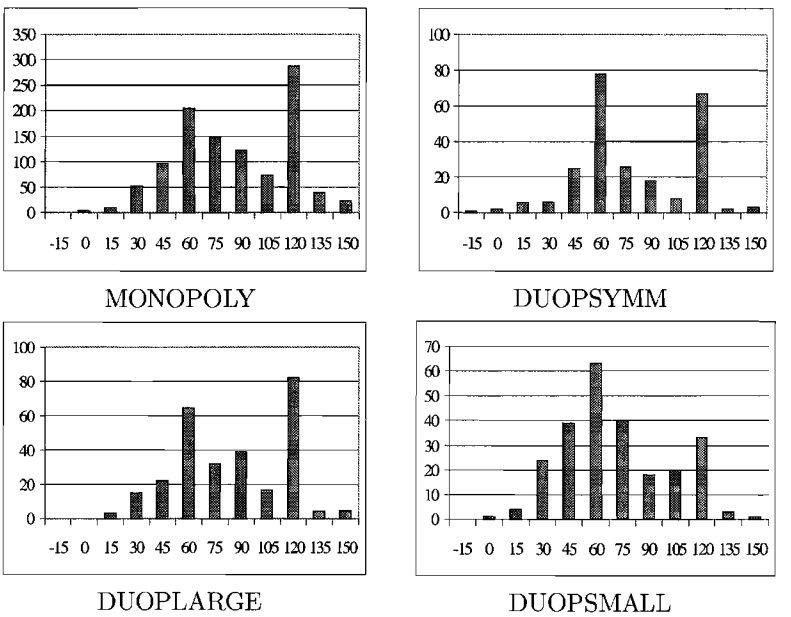
Figure 2: Distribution of Pre-reporting days, All firms



If we subdivide the pre-reporting days by the competitive position, as discussed above, we can directly note some features of the data, evident in Figure 3. The small firms in asymmetric duopolies (DUOPSMALL) have a distribution that visibly differs from the large firms in duopolies. The symmetric duopolies (DUOPSYMM) exhibit more polarized reporting times than the other categories, being either early or just in time. The distribution for the large firms in asymmetric duopolies (DUOPLARGE) is indistinguishable from the monopoly (MONOPOLY) however.

Since there are absolute deadlines in the publishing of Annonstaxa, a continuous variable, or almost continuous like DAYS, may not be the most appropriate description of behavior. Using the prereporting days (DAYS), we code the observations into dummy variables depending on whether they will make it into the normal edition, be late, or early enough to make it into an earlier edition. A report is considered either EARLY, TIMELY or LATE where DAYS<50 codes LATE=1, 50<DAYS<110 codes TIMELY=1 and DAYS >110 codes EARLY=1.

Figure 3: Distributions of Pre-reporting days, by competitive position

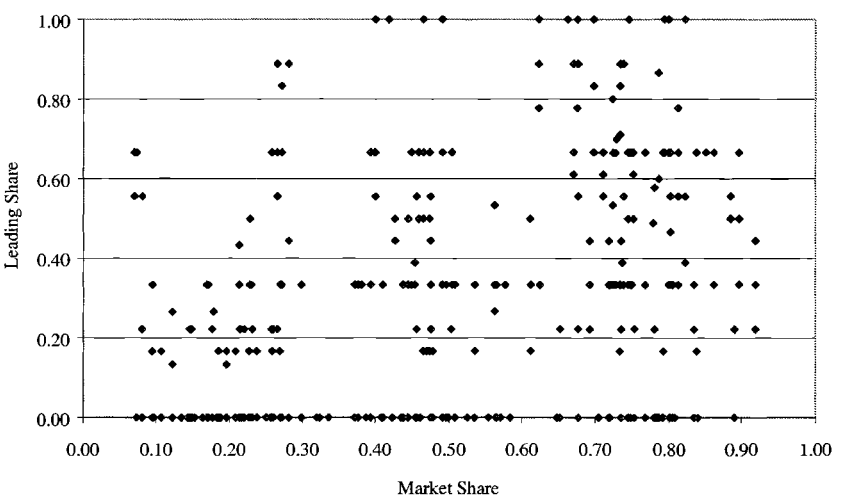


We will use both DAYS and the dummy variables as dependent variables in a number of regressions to see whether the reporting behavior differ with market structure. There are naturally other factors that may influence the pre-reporting behavior. The reporting behavior may differ depending on the size and direction of the price changes. We construct two variables regarding price changes, where POSCHANGE is equal to the size of the nominal price change that is announced, as long as it is positive, DECREASE is a dummy variable for the cases of price cuts. Only a small number of price changes are price decreases, but they may exhibit a radically different pre-reporting pattern, thus we allow for separate treatment of price decreases.

There may be strategic considerations in the pre-reporting behavior in duopoly markets, typically in the form of price leadership. There are two types of lead-follow price changes in our data. One type is when a firm announces a price change, e.g., to Jan. 1, which is followed within two months by a price change from the other firm, i.e., before March 2. The second type is when both of the duopoly firms announce a price change to come into effect at the same date but the pre-reporting is made earlier by

one of the firms which we then consider to be the price-leader. In the second type of leading price changes we do not require the leading price change to be published before it is followed to be counted as leading. There are two reasons, first it is possible for a firm to call Tidningsstatistik to enquire about its competitors pricing status, second there might be communication outside of Annonstaxa.[4] The share of price changes that are lead by the firm is denoted LEADSHARE. Figure 3 shows the fraction of price changes that are being lead by the firm as a function of market share for all the duopolies in our sample 1981-1996. Since there are normally only one or two price changes each year, in order to be meaningful, the picture shows the moving average for three years.[5] During the period, in duopoly markets, we observe a total of 551 price changes, of which approximately 40% are lead-follow price changes.

Figure 4: Leading Share of Price Changes vs Market Share, 3 year moving average



One interesting feature in the data, obvious from Figure 3, is that even the smallest firms in our sample are sometimes price leaders. We also add the leading share of price changes, LEADSHARE, for the two firms in the

[4]We can not exclude the possibility that firms communicate directly with each other.

[5]In only 2% of the newspaper-years are there zero price changes, 2% is also the number of newspaper-years in which there are three price changes. There are never more than three price changes by any newspaper in any year.

duopoly markets, giving the total share of lead-follow price changes in the duopoly market, MLEADSHARE. The number of price changes by a firm in a year is the variable YEARLYCHANGES and the real advertising price is denoted PADVR. We have excluded national papers from our sample since they do not compete in the same fashion as the strictly local newspapers. Market share, MARKETSHARE, is only calculated every third or fourth year and interpolated.

Table 1: Descriptive statistics by market position

	MONOPOLY	DUOPLARGE	DUOPSYMM	DUOPSMALL	All
CIRCULATION	18400	45900	22100	22900	23800
	(13900)	(26800)	(11100)	(20300)	(19700)
MARKETSHARE	0.70	0.72	0.53	0.23	0.62
	(0.21)	(0.13)	(0.13)	(0.099)	(0.24)
LEADSHARE	0	0.40	0.21	0.15	0.36
	(0)	(0.094)	(0.12)	(0.11)	(0.13)
MLEADSHARE	0	0.57	0.44	0.61	0.61
	(0)	(0.10)	(0.084)	(0.15)	(0.13)
YEARLYCHANGES	1.43	1.55	1.39	1.51	1.45
	(0.555)	(0.60)	(0.55)	(0.60)	(0.57)
PADVR	1.87	2.34	1.92	2.16	2.00
	(0.379)	(0.61)	(0.35)	(0.60)	(0.49)
DAYS	78.4	73.4	72.7	60.3	74.4
	(31.6)	(29.6)	(33.7)	(29.4)	(31.9)
EARLY	0.31	0.24	0.31	0.10	0.27
	(0.46)	(0.43)	(0.46)	(0.30)	(0.44)
TIMELY	0.48	0.51	0.38	0.49	0.47
	(0.50)	(0.50)	(0.49)	(0.50)	(0.50)
LATE	0.21	0.25	0.32	0.40	0.26
	(0.41)	(0.43)	(0.47)	(0.49)	(0.44)
CAPACITY	9.92	27.5	13.3	13.8	13.6
	(8.84)	(16.1)	(6.6)	(12.2)	(12.2)
DISPOSABLE	0.97	1.00	0.99	0.99	0.98
	(0.10)	(0.10)	(0.11)	(0.10)	(0.11)
no of obs	965	258	225	227	1675

Standard deviations in parenthesis

DISPOSABLE denotes the average real disposable income of the citizens in the municipality where the newspaper has its largest circulation. An additional measure of firm size, apart from circulation, is CAPACITY, which is the number of issues per weeks times CIRCULATION/10000.

4 The Econometric Estimations

The econometric treatment is divided into two sections. First, we analyze the pre-reporting behavior and then look at the use of price leadership. On the pre-reporting data, we run two sets of regressions, first with DAYS as the dependent variable in a standard OLS and a random effects model and then Probit regressions on each of the dummy variables, EARLY, TIMELY and LATE. Second, we look more closely at the use of price leadership in the duopoly markets, we try to establish who is the price leader and what effect the use of price leadership has on price adjustments and real advertising price levels.

4.1 The Pre-reporting Behavior

At a first glance it seems that the discrete dependent variable approach, using EARLY, TIMELY and LATE, is the more sensible when looking at report behavior. Since if a report is early enough to make it into an earlier edition of the price publication, Annonstaxa, it does not matter whether the pre-reporting time is 90 or 110 days. This is not always true though. In some cases newspapers call "Tidningsstatistik" to inform themselves of other newspapers prices ahead of the publication. This behavior is not encouraged by TS and is not common or used systematically by any newspaper. But the possibility that the publication dates are not fully binding warrants estimation with DAYS as the dependent variable. The specification we use is simply:

$$\begin{aligned} DAYS &= \alpha + \beta_1 DUOPLARGE + \beta_2 DUOPSYMM \\ &\quad + \beta_3 DUOPSMALL + \\ &\quad + \beta_4 POSCHANGE + \beta_5 DECREASE + \epsilon_{it}. \end{aligned}$$

We estimate both a standard OLS and random effects regression with the individual newspaper random effects, the MONOPOLY newspapers group is the reference, the results are given in Table 2.

Table 2: Regression results, Pre-reporting number of days

	DAYS (OLS)	DAYS (RE)
DUOPLARGE	-5.2**	-2.8
	(2.2)	(3.6)
DUOPSYMM	-6.0***	-4.8
	(2.3)	(4.2)
DUOPSMALL	-19***	-18***
	(2.3)	(4.0)
POSCHANGE	140***	140***
	(23)	(22)
DECREASE	1·1	7.7
	(7.0)	(6.6)
Constant	68***	68***
	(1.9)	(2.4)
n	1675	1675
T	16	16
Adj. R2	0.055	0.056

Standard errors in parenthesis
***,** and * denotes significance at the one, five and ten percent level respectively

From Table 2 it is clear that, averaging over all firms, larger positive price changes are reported earlier. POSCHANGE is the percentage change in price, a fifteen percent increase is thus on average fourteen days earlier than a five percent increase. It seems that newspapers like to "warn" their customers and competitors of larger price increases in good time.

The price cuts, DECREASE, does not seem to be characterized by any particular reporting behavior. The small firms in asymmetric duopoly, DUOPSMALL, are on average later than monopolies. This is the only market structure variable significant in both the OLS and random effects regressions.

We run a second set of regressions that uses the dummy variables EARLY, TIMELY and LATE as dependent variables in a probit model. The probit model for a binary outcome is:

$$\begin{aligned} y_i^* &= \beta' \mathbf{x}_i + e_i, \quad \text{where} \\ y_i &= 0 \; if \; y_i^* \leq 0 \\ y_i &= 1 \; if \; y_i^* > 0 \\ e_i &\sim N(0,1). \end{aligned}$$

We use the same explanatory variables as in the OLS regressions above, the results are given below. The predictions from the respective regression are reported in the Table 1A in the Appendix.

Table 3: Regression results, Probit on Pre-reporting Dummy variables

	EARLY	TIMELY	LATE
DUOPLARGE	-0.22**	0.079	0.13
	(0.097)	(0.089)	(0.096)
DUOPSYMM	-0.017	-0.25***	0.32***
	(0.098)	(0.095)	(0.098)
DUOPSMALL	-0.85***	0.094	0.55***
	(0.12)	(0.094)	(0.096)
POSCHANGE	8.1***	-6.7***	-0.24
	(1.0)	(0.99)	(1.0)
DECREASE	0.88***	-0.83***	0.14
	(0.29)	(0.29)	(0.30)
Constant	-1.1***	0.41***	-0.78***
	(0.086)	(0.079)	(0.084)
T	16	16	16
n	1675	1675	1675
Pseudo R-square	0.40	0.41	0.36
CHI2	110	58	37

Standard errors in parenthesis.

***,** and * denotes significance at the one, five and ten percent level respectively

Pseudo R-squared based on McKelvey and Zavoina (1975)

The result that large price increases are reported early is confirmed by the probit regressions, the POSCHANGE variable has a positive and highly significant coefficient in the EARLY regression and a negative in the TIMELY regressions. The power in the OLS regression seems to stem from the fact that larger price increases are more often EARLY. Marginal effects at the mean of POSCHANGE is 2.6, -2.6 and -0.07 in the regressions above, a one percent larger increase will have a 2.6 percent larger probability of being early, EARLY. The price cuts, DECREASE, show up positive in the EARLY regression and negative in the TIMELY regression. It seems that the "early warning" story for large price increases is valid for price cuts as well. The small duopolies DUOPSMALL have a reporting behavior that differ significantly from the monopolies. They are significantly more often late and significantly less often early. Overall, the results indicate that differences in the information flows depending on market structure.

4.2 The Price Leadership Behavior

From Figure 3 it is rather obvious that there is a positive relation between market share and price leader status. To state the facts from Figure 3 more formally we run a set of regressions on the data depicted. The dependent variable is the three-year moving average of LEADHARE. In addition to MARKETSHARE we add firm size, measured as total circulation, CIRCULATION, as an explanatory variable. We allow the circulation to have a nonlinear effect, including squared circulation, CIRCULATIONSQ. In the model by Deneckere and Kovenock (1992) the role of price leader is entirely determined by size, the larger firm is always the price-leader. In van Damme and Hurkens (1998) the price leader is the firm with the lowest marginal cost, which is likely to be related to size. Since more than half of the observations on LEADSHARE are zeros we use a Tobit regression as well as ordinary least squares and a newspaper random effect. Using a Hausman test, the random effects regression is preferred to the fixed effects regression (not reported), the random effects regression can be rejected only at the fourteen percent level.

Table 4: Regression result, Leading Share of Price Changes

	LEADSHARE OLS	LEADSHARE RE	LEADSHARE Tobit
MARKETSHARE	0.38***	0.36**	0.69***
	(0.076)	(0.14)	(0.17)
CIRCULATION	0.036*	0.042	0.077
	(0.020)	(0.038)	(0.048)
CIRCULATIONSQ	-0.0021	-0.0032	-0.0046
	(0.0017)	(0.0033)	(0.0039)
CONSTANT	0.0093	0.018	-0.48***
	(0.035)	(0.066)	(0.092)
Adj.R2	0.15	0.15	
n	447	447	447

Standard errors in parenthesis

***,** and * denotes significance at the one, five and ten percent level respectively

The regressions all show that there is a clear relation between having a large market share and being the price leader, there is only weak evidence that circulation adds to the price leader role.

The analysis thus far does not determine whether the duopoly firms use the price leadership mechanism as a barometer to share information on cost and demand condition alone, or if price leadership is used to coordinate on

higher prices. The stylized fact from a number of works as discussed above, is that monopolies exhibits less flexible prices. In the model of collusive price leadership by Rotemberg Saloner (1990) price stickiness emerges endogenously when firms have a low degree of informational asymmetry. We run an ordered probit regression with the yearly number of price changes, YEARLYCHANGES, as the dependent variable. If we find that the duopolies exhibit more flexible prices as monopolies, this would indicate that the price leadership is of the barometric type. The ordered probit that we fit is:

$$\begin{aligned} y_i^* &= \boldsymbol{\beta}'\mathbf{x}_i + e_i, \quad \text{where} \\ y_i &= 0 \; if \; y_i^* \leq \mu_0 \\ y_i &= 1 \; if \; \mu_0 < y_i^* < \mu_1 \\ &\ldots \\ y_i &= J \; if \; y_i^* > \mu_{(J-1)}, \\ \text{and } e_i &\sim N(0,1). \end{aligned}$$

As independent variables we use the market position dummies as defined above and other variables. The level of inflation, INFLATION, is likely to drive the number of price changes. Real prices are eroded faster and a higher level of inflation is associated with more frequent price changes. If the price leading behavior is of the collusive type it may affect the number of price changes, MLEADSHARE, If there are any fixed costs to price adjustments, the size of operations measured by CAPACITY, is likely to influence the price changing frequency. If a newspaper is present in many markets this may have a dampening effect on price changes, if the price is supposed to be right on average and the markets are not perfectly correlated the average will be less volatile for a firm present in many markets. The number of markets where the newspaper has a registered circulation (>100 subscribers) is denoted MARKETS. To summarize, we run the regression

$$\begin{aligned} YEARLYCHANGES_{it}^* = \; & \alpha + \beta_1 DUOPLARGE + \beta_2 DUOPSMALL + \\ & + \beta_3 DUOPSYMM + \beta_4 INFLATION + \\ & + \beta_5 MLEADHSHARE + \beta_6 CAPACITY + \\ & + \beta_7 MARKETS + \epsilon_{it}. \end{aligned}$$

The monopoly firms is the reference group and we expect the duopoly firms

to exhibit more price changes. The results are

Table 5 : Ordered Probit regressions, Number of Price Changes

	YEARLYCHANGES	*YEARLYCHANGES*
DUOPLARGE	0.24*	0.32**
	(0.13)	(0.15)
DUOPSMALL	0.020	0.13
	(0.15)	(0.16)
DUOPSYMM	-0.10	0.025
	(0.14)	(0.17)
INFLATION	0.034	0.039
	(0.16)	(0.17)
MLEADSHARE	0.010	0.0095
	(0.016)	(0.016)
CAPACITY		-0.067
		(0.33)
MARKETS		-0.013
		(0.010)
CONSTANT	2.4***	2.4***
	(0.17)	(0.18)
chi2	8.4	10
significance level	0.14	0.18
n	1136	1280

Standard errors in parenthesis

***,** and * denotes significance at the one,

five and ten percent level respectively

There is some indication that the large duopolies, DUOPLARGE, have more flexible prices than monopolies, significant only at the five percent level. This result would indicate that the price leadership is of the barometric rather than the collusive type. The result is muddled by the fact that the small firms in the same markets, DUOPSMALL, does not exhibit more price changes than monopolies. The symmetric duopolies, which are supposedly the most competitive markets, does not have a price changing frequency that can be distinguished from monopolies. The effect of INFLATION is not very significant but has the right sign. Our controls for size and dispersion add nothing. The regressions as a whole does a rather poor job, significant only at nine and three percent and they predict only two price changes for the entire sample.

Finally, we model a reduced form regression of the real advertising prices, PADVR on a number of variables including MLEADSHARE. If there is a

collusive element in the price leading behavior, we do not believe it to be established overnight. Thus, the independent variable MLEADSHARE that we use is averaged over the past three years. By using this measure we lose two years at the beginning of the period in our duopoly regressions. The value of one millimeter of advertising space is largely determined by how many readers the newspaper has and the disposable income of the readers.[6] We use the variable DISPOSABLE, which is the average real disposable income per capita in the municipality where the newspaper has its largest coverage, as an explanatory variable. If the price leading behavior is purely barometric, the use of price leadership will have no effect on the price levels. We include the market share, MARKETSHARE, of the firm since equally large firms may price differently depending on the position they have in the market. The regression equation becomes

$$\begin{aligned} PADVR &= \alpha + \beta_1 MLEADSHARE + \beta_2 MARKETSHARE + \\ &\quad + \beta_3 CIRCULATION + \beta_4 CIRCULATIONSQ + \\ &\quad + \beta_5 DISPOSABLE + \epsilon_{it}. \end{aligned}$$

which is estimated using OLS, fixed- and random-effects models.

First, we run the regressions on the whole sample including the monopoly newspapers, for reference, and then we run regressions on all duopoly markets. The results are given in Table 6. The complete sample regressions indicate that, apart from circulation, the MARKETSHARE is important for real price levels. Looking at the random effects regression, an increased market share by 25 percent increases the average real price by 0.04. This effect is not very large, since the average real price is 2.0 in our sample, but there is undoubtedly evidence of some market power. The effect of real disposable income, DISPOSABLE, is consistently significant and positive. The average of DISPOSABLE is close to one indicating that an increase in average real income by one percent will translate into a real price increase of approximately 0.01 which is about one half of a percent in real price.

[6] See the Figure 1A in Appendix.

Table 6: Regression Results, Real Advertising Prices

	PADVR All OLS	PADVR All FE	PADVR All RE	PADVR Duopolies OLS	PADVR Duopolies FE	PADVR Duopolies RE
MLEADSHARE				0.11***	-0.0066	-0.0080
				(0.036)	(0.017)	(0.017)
MARKETSHARE	0.15***	0.17**	0.19***	-0.088	0.60**	0.33**
	(0.027)	(0.067)	(0.057)	(0.063)	(0.23)	(0.15)
CIRCULATION	0.32***	-0.011	0.12***	0.27***	0.051	0.18***
	(0.013)	(0.034)	(0.028)	(0.024)	(0.074)	(0.054)
CIRCULATIONSQ	-0.034***	-0.0081*	-0.013***	-0.025***	-0.017*	-0.023***
	(0.0020)	(0.0049)	(0.0041)	(0.0031)	(0.0092)	(0.0069)
DISPOSABLE	1.12***	1.19***	1.18***	1.12***	1.06***	1.09***
	(0.058)	(0.030)	(0.028)	(0.112)	(0.053)	(0.052)
CONSTANT	0.28***		0.52***	0.44***		0.55***
	(0.057)		(0.049)	(0.11)		(0.10)
AdjR2	0.56	0.93	0.56	0.48	0.92	0.48
n	1633	1633	1633	495	495	495

Standard errors in parenthesis

***,** and * denotes significance at the one, five and ten percent level respectively

The duopoly regressions show that, when the sample is viewed as a cross-section in the OLS regressions, the duopoly markets with higher degree of price leadership exhibit significantly higher real advertising prices. The other variables enter as expected, there is a strong but decreasing effect from circulation and a higher disposable income per capita will raise real advertising prices. When using the panel data feature of the data and looking at the fixed and random effects, the influence from MLEADSHARE is none. The effects on real price attributed to price leadership in the OLS regression seems to stem from other, market specific, unobserved factors. This result leads us to conclude that we cannot exclude that the price leadership used in these markets are purely of the barometric type. There is small variation in the total circulation, thus circulation is to a large extent attributed to the firm specific fixed effect and does not give a significant parameter estimate in the fixed effects regression. The Hausman test for testing random against fixed effects rejects the random effects at the three percent level only. The parameter estimate for MARKETSHARE is clearly larger in the duopoly regressions, both with fixed and random effects. An increase in market share has more than twice the effect on real prices for the duopoly firm compared to the

monopoly. An interesting extension would be to see to what extent changes in the rival's market share affects the real price of the firm. The effect of real disposable income is consistently positive and significant but of a smaller magnitude than when analyzing the whole sample.

5 Conclusions

We find that the firms in the Swedish daily newspaper markets strategically use the publication of firm-specific advertising rates. Duopoly markets exhibit a price reporting pattern different from monopolies. On average, newspapers report large price increases and price cuts earlier than normal price changes. We find that market share is the dominating factor in deciding the role of price leader. We find inconclusive results regarding the flexibility in duopoly prices compared to monopoly prices. Looking at real price levels we find that the effect of market share is far more important in duopoly markets than in monopoly markets. We fail to find evidence that the use of price leadership increases real price levels. Thus, we cannot reject the idea that the price leadership observed in these markets is of the purely barometric variety.

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Appendix

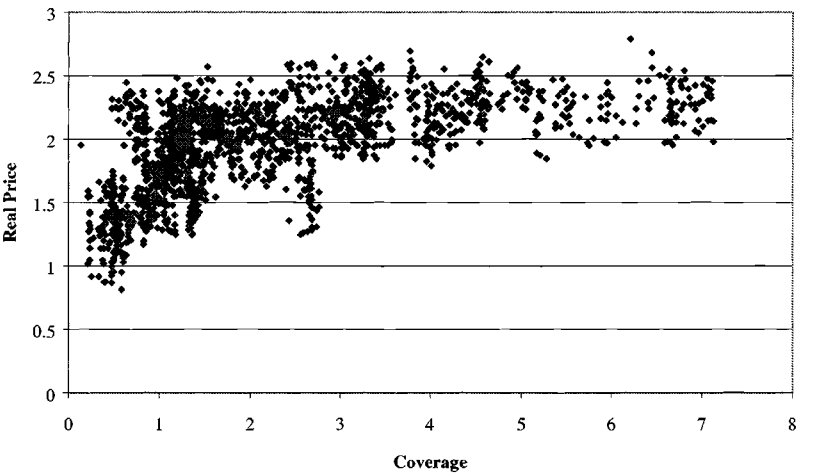
Table A1: Predictions from Probit regression in Table 3

EARLY	Predicted		
Actual	0	1	*Total*
0	1199	27	*1226*
1	429	20	*449*
Total	*1628*	*47*	*1675*

TIMELY	Predicted		
Actual	0	1	*Total*
0	574	307	*881*
1	396	398	*794*
Total	*970*	*705*	*1675*

LATE	Predicted		
Actual	0	1	*Total*
0	1243	0	*1243*
1	432	0	*432*
Total	*1675*	*0*	*1675*

Fig A1: Real Advertising Price vs Coverage



Third-degree Price Discrimination in Oligopoly: Evidence from Swedish Newspapers[1]

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Abstract

This paper provides an empirical examination of third degree price discrimination in the Swedish local newspaper markets. We measure the extent of price discrimination by the fraction of subscriptions that a newspaper sells at a discount. The results show that price discrimination is more prevalent in competitive markets and among newspapers with low market shares. We find weak evidence that newspapers operating in markets with larger inflows of new consumers, and those that cover diverse geographical areas, offer more discounts. Overall, our findings are consistent with predictions from recent theoretical work, including Chen (1997) and Villas-Boas (1999), which suggests that firms attempt to poach consumers from rivals by offering targeted discounts.

Keywords: Price discrimination, oligopoly, newspaper industry.
JEL codes: D43, L13, L82.

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1. Introduction

Until recently, treatments of price discrimination have focused primarily on the monopolist's pricing decision. Casual observation, however, suggests that the practice is prevalent also in more competitive environments. Lately, several studies have examined third degree price discrimination in oligopoly, yielding a number of new insights. The most significant differences compared to the monopoly case arise when consumers in oligopoly markets differ in their relative valuations of the firms' products, due to differences in preferences, income, or geographical location. When firms can condition their prices on, e.g., each consumer's location, it is possible that equilibrium prices for all consumers are lower than under uniform pricing, see Corts (1998), something that will never occur in a monopoly setting. Thus, oligopoly firms' ability to price discriminate may actually hurt their profits so much that they may wish to pre-commit to non-discriminatory pricing. Another effect arises when firms can condition their prices on a consumer's purchasing history. For example, firm A may target firm B's consumers with discounts, as they have revealed that their valuations for firm A's product are low, see Fudenberg and Tirole (2000) and Villas-Boas (1999). Alternatively, with consumer switching costs, firm A needs to offer a lower price in order to induce any of firm B's consumers to switch, see Chen (1997), Shaffer and Zhang (2000) and Taylor (1999). In either case, the incentive to offer discounts is decreasing in a firm's market share. Below we discuss the various models and their empirical implications in more detail.

The predictions from the new theoretical models have not, to the best of our knowledge, been tested empirically. In this paper we address this with evidence on third degree price discrimination from Swedish newspaper markets. The newspapers in our sample offer discounted subscriptions to some consumers. The industry contains a sizable number of geographical markets, some of which has one single local newspaper while others are large enough to support two. This variation in market structure, together with other market specific factors, is used to explain the wide differences across newspapers in their use of discounts. In particular, we test whether duopoly newspapers sell more subscriptions at a discount than monopolies. We also test if there is a relation between a firm's market share and its use of price discrimination.

Our results show that third degree price discrimination is more widespread in duopoly markets and that the smaller newspaper sells a greater fraction of its subscriptions at a discount. These results are related to some findings in studies of price dispersion in airline

markets. For instance, Borenstein and Rose (1994) and Stavins (2000) find that price dispersion in ticket prices tends to increase with the number of airlines that serve a route. However, this price dispersion is likely to follow primarily from second-degree price discrimination (due to various ticket restrictions e.g. Saturday night stays) rather than from different prices for identical products, as in the case of our newspaper subscriptions.

2 Theories and Previous Empirical Studies

Third degree price discrimination in monopolies has been thoroughly studied; for references see Varian (1989). A monopolist who can identify consumer groups with different demand functions will always choose to price discriminate (provided, of course, that consumer arbitrage can be prevented), and by doing so, will make larger profits. In this section we consider some of the additional issues that arise in an oligopoly setting. We begin by a discussion of single period price setting and then proceed to the multi-period case. First, however, note that there is a close analogy between the monopolist's decision and an oligopoly firm's decision: holding the rivals' prices fixed, the firm has a residual demand curve for each consumer group and therefore always the incentive to price discriminate.

Holmes (1989) considers the case where the two consumer groups' preferences are symmetric[2] such that, for both firms, demand in one of the markets is more price sensitive (the 'weak' market) than demand in the other (the 'strong' market). He shows that the uniform price in a duopoly will necessarily lie between the discriminatory prices, as in the monopoly case. Corts (1998) generalizes Holmes' model to allow for situations where the consumer groups have asymmetric rankings of the firms' products. In this case the weak market for one firm is the strong market for the other, and vice versa. Here it is possible that discriminatory prices to both groups are lower, or higher, than under uniform pricing. When both discriminatory prices are lower than the uniform price, firms' ability to price discriminate leads to an all-out competitive outcome with lower profits for both firms. Hence, firms would like to commit to a uniform pricing strategy if possible, and it may even be profitable to unilaterally employ a uniform pricing strategy if it is credible to pre-commit to one.[3] From the firms' point of view, the all-out competitive outcome exhibits too much price discrimination.

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[2] Symmetric, in this case, means that the demand of Firm A when it sets the price p and firm B sets price p* is the same as B's demand when prices are reversed; $q^A(p, p^*) = q^B(p^*,p)$.

[3] Corts (1998) suggests that "no haggle" policies and "everyday low price" programs are evidence of such behavior.

An example of asymmetric valuations is found in markets with spatial differentiation. For instance, consumers in town A will have a higher valuation for the product offered in their hometown than for a (physically) identical product in town B. Hence, a firm in town B would like to set a lower price in market A than in market B, and the incentives are reversed for the firm in town A. Borenstein (1985) examines, with numerical simulations, spatial price discrimination in circular city model.[4] His results show that consumers located further away from the firm, in the more competitive territory, will be offered lower prices. Related work by Lederer and Hurter (1986) considers spatial price discrimination in a more general setup.

We now turn to multi-period models where firms can condition on past purchasing history (sometimes referred to as behavioral pricing).[5] The consumers' previous purchasing behavior can be used to map the consumers into categories that can be targeted with selective price offers. The purchasing history is important for two reasons. First, it may reveal the customer willingness to pay, even though a purchase does not alter his future valuations. Second, in the presence of switching costs, or habit formation, an earlier purchase changes the future valuation, for a comprehensive treatment of effects of switching costs, see Klemperer, (1995).[6]

A two period model is used by Fudenberg and Tirole (2000) to examine the case of pure behavioral pricing (i.e. where history only reveals information). The information from first period choices leaves the firm with two types of consumers in the second period: its own past customers and those of its competitor. The competitor's customers have revealed a lower willingness to pay for the firm's product and can thus be targeted with discounts in the second period (referred to as "poaching"). A firm with a small revealed customer base will have a larger pool to poach from and will exhibit a more aggressive discounting behavior, i.e. a small market share gives incentives to more discounting. Villas-Boas (1999) extends the Fudenberg and Tirole model to an overlapping generations model and the general results remain. In

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[4] His model allows for free entry unlike the other models we discuss. It is shown that free entry alone will not generally prevent price discrimination.

[5] "Behavioral pricing" is a not easily categorized into either second or third degree price discrimination. Clearly identifiable customer categories are offered different prices by the firm, third degree, but in an earlier stage consumers can to some extent self-select which category they will eventually end up in, second degree. It is widely believed that the advent of the new information technology will better enable firms to tailor prices and offers based on past purchases or even browsing patterns.

[6] In some of these markets firms can differentiate between entirely new customers and those who have been a customer at some point in the past. The distinction is relevant if, as in Nilssen (1992), there are two types of switching costs, *learning costs*, which is borne only the first time a product is bought, or *transaction costs*, which is borne at every switch. In the newspaper market the learning cost is likely dominating, but the issue is not addressed in any other of the models we discuss.

equilibrium, each firm will offer discounts to the other firm's customer, and the firm with the smaller market share will use more discounts.

Chen (1997) models a situation where consumers have a direct cost of switching to another supplier. He constructs a two-period model of a duopoly, where firms can use discounts to induce switching by customers "attached" to the other firm in period two. Chen finds that both firms will offer discounts to the customers with a history of purchasing from the other firm. In equilibrium, both firms will charge the same prices and give the same nominal discount. Hence, in the case of asymmetric market shares, the smaller firm will have more customers switching to it, and will thereby sell a larger share of its output at a discount. Shaffer and Zhang (2000) extend the work of Chen (1997) by generalizing the demand side. They find that if the loyalties of customer groups differ, it may be optimal for a firm to offer discounts to its own customers (loyalty premiums) rather than poaching customers from competitors.[7] Taylor (1999) extends Chen's (1997) work in another direction by allowing for an arbitrary number of periods and randomly varying switching cost. The modeling of many periods enables Taylor to be explicit about strategic switching on the consumer side. This occurs when a customer switches solely to establish a history of being a "switcher" and thereby securing better future offers from his suppliers.[8] However, the basic results remain: firms will offer discounts to the other firm's current customers and the firm with smaller market share will be using more discounting.

The existence of third degree price discrimination is well documented for a variety of products, e.g. fresh fish, Graddy (1996) and mortgage lending Ladd (1998). The studies of European car markets by Verboven (1996) and Goldberg and Verboven (1998) show that part of the cross country price differentials are in fact due to third degree price discrimination. However, these studies do not relate third degree price discrimination directly to market structure.

There are a number of studies that analyze prices in the U.S. domestic flights markets. In a seminal paper, Borenstein and Rose (1994) find that when the number of competitors in a market grows, the observed price dispersion increases. The prices they analyze are a mix of special fares offered to exclusive groups, such as students, and a menu of fare classes available to all. Thus, both second and third degree price discrimination is observed and

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[7] If firm B's strong market (B) is composed of not very loyal customers then both firm A and firm B may end up giving discounts to the disloyal (B) group.

[8] Both Fudenberg and Tirole (2000) and Taylor (1999) give examples where firms have discovered that their poaching programs and competitors programs are used by "supplier surfers" that systematically switch between suppliers to get the best deals.

impossible to untangle.[9] Stavins (2000), using similar data, also finds that price discrimination increases with competition. She explains her findings by noting that adding competition will have a larger competitive impact on the cheapest fares while more expensive tickets remain relatively unchanged. In the light of this, it is surprising that she finds, conditional on market concentration, that firms with larger market shares use more price discrimination.[10] However, the earlier study by Hayes and Ross (1998) does not find a straightforward connection between market shares and price dispersion.

As noted, in the airline industry the observed price dispersion is likely to be due largely to second degree rather than third degree price discrimination. Joyce (1990) provides a cleaner example of the latter. He considers pricing of academic journals that are sold at higher prices to libraries than individuals. In particular, he examines the importance of market power, measured as the number of citations rather than market share, on the use of price discrimination. No clear relation between market power and use of third degree price discrimination is found, which might be attributable to the fact that the number of citations is also a measure of the journal's quality.

3 Data Description

We examine price discrimination using data from the Swedish daily newspaper industry. We restrict attention to local morning newspapers with three or more issues per week, which gives a sample of approximately 100 newspapers over the period 1979-1994.[11] More detailed information on the industry can be found in Asplund et al. (2001).

The circulation figures, collected by Tidningsstatistik AB, (TS), distinguish between subscriptions that are sold at full price and those sold at a discount.[12] A discounted

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[9] The price dispersion may also have cost based explanations. It could also be due to differences in travel agent's mark-ups, and differences in the date when the ticket was bought.

[10] This finding is mirrored in Giulietti (1999), who analyzes the Italian grocery trade, and also find that firms with larger market shares use more (second degree) price discrimination.

[11] We have excluded four evening newspapers, sold almost exclusively as single copies. The second group excluded is morning newspapers with coverage in a very large number of local markets. This group includes three large national morning newspapers, and two newspapers tied to religious and political organizations, which cover most of the country but have very low local market shares. Finally, we do not consider 37 newspapers (most of them have very low circulation) with only one or two issues per week, read as a local or political additive to a regular newspaper and viewed as distinctly different by government agencies and people involved in the industry. The exact numbers vary slightly over the years, the numbers above are for 1992.

[12] A common objection is that what appears to be "price discrimination" can be explained by differences in costs of providing the good or to serve different types of consumers; see Lott and Roberts (1991). Subscriptions are physically identical such that there are no differences in production costs. There could, however, be differences in the cost of serving different consumers. We argue below that this is unlikely to be a relevant feature for the industry at hand.

subscription is one that is sold at a price at most 25 percent below the regular annual subscription price.[13] Our primary dependent variable, *DISCOUNTS*, is defined as the percentage of a newspaper's total circulation that is sold with at most 25 percent discount. As seen in Table 1, the mean of *DISCOUNTS* is 6.3 percent. However, there is substantial variation across newspapers: from zero discounted subscriptions up to 38 percent of circulation. We also have information on a third category, 'free' subscriptions, which are either given away for free to, e.g., employees at the newspaper or carry a discount above 25 percent. There is a potential risk of measurement errors in these subscriptions, as they are not audited by TS. Nevertheless, we define a broader measure of the use of price discrimination as the ratio of all subscriptions that are 'sold' at a price below the regular price to the total circulation, denoted *DISCOUNTS_ALL*. The mean of *DISCOUNTS_ALL* is 9.5 percent with a maximum of 47 percent.[14] Note that both our measures are quantity based, rather than price based, as we do not know the exact distribution of the prices paid for subscriptions. We can not calculate an exact measure of the value of discounts given. Hence, we cannot use the average price of a subscription relative to the listed price, pay-degree, as a dependent variable.

Each of the newspapers in our sample covers a relatively small geographical area. Our market definition is based on Swedish municipalities; the most disaggregated regional classification for which demographic statistics is readily available. We define a newspaper's primary market to be the municipality where it has its largest circulation; the median newspaper has 62 percent of its total circulation in its primary market.[15] Its secondary markets are all other municipalities where it has a measured presence (more than 100 annual subscriptions).

The newspapers in the sample have very different market positions which, following the discussion in the previous section, may give rise to differences in their use of price discrimination. In 1992 there were 288 municipalities out of which 69 (27) were primary markets for one (two) newspaper(s); no municipality outside the three largest cities is the

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[13] The discount may not be larger than 25 percent (until 1995) for a subscription to be counted as a part of the newspapers' audited circulation. One possible reason for this is that advertisers place a lower valuation on readers of discounted subscriptions. In 1995 TS changed its definition of the 'true' circulation and as a consequence started to subdivide the discounted subscriptions into those that were sold at 1-25 percent discount and those that were discounted 25-50 percent.

[14] There is a positive and high (0.52) correlation between *DISCOUNTS* and (*DISCOUNTS_ALL* - *DISCOUNTS*). Hence, a newspaper that sells a large fraction at a low discount also tends to sell many at a high discount.

[15] In one case only does the municipality where a firm has it its largest circulation change. Since this newspaper has roughly the same circulation in the two municipalities, we let its home market remain the same over the sample period.

primary market for more than two newspapers. The municipalities with two newspapers usually have a larger population than those with one. The remaining municipalities are generally too small to support a local newspaper, and are served by nearby newspapers as secondary markets.

The newspapers that do not face any local competition in their primary market are presumably the newspapers with most market power, and we expect them to behave approximately as monopolists in their pricing decisions. We denote this category *MONOPOLY* and newspapers that face a local competitor as *DUOPOLY*.[16] The newspapers in the latter category are divided into three sub-categories depending on their market shares.

The percentage market share variable, *MARKETSHARE*, is constructed as follows. We weigh the circulation of each newspaper that is present in a municipality (i.e. this includes national newspapers and others that are not included in our sample) with a factor X/7 where X is the number of issues per week. The newspaper's market share is then its weighted circulation in its primary market divided with the total weighted circulation of all newspapers present in this municipality.[17]

[16] The are two newspapers that form exceptions to this. Falun is the primary market for Falu-kuriren, and Borlänge is the primary market for Dalademokraten, but both have very strong presence in each others primary market. We treat these as (symmetric) duopoly newspapers.

[17] Note that this definition can result in 'monopoly' newspapers having relatively low market shares. This will happen when e.g. the monopoly newspaper has three or four issues per week and there are national newspapers, with seven issues per week, that have a strong presence in its primary market.

Figure 1: Discounts and market share for monopolies and duopolies, 1988

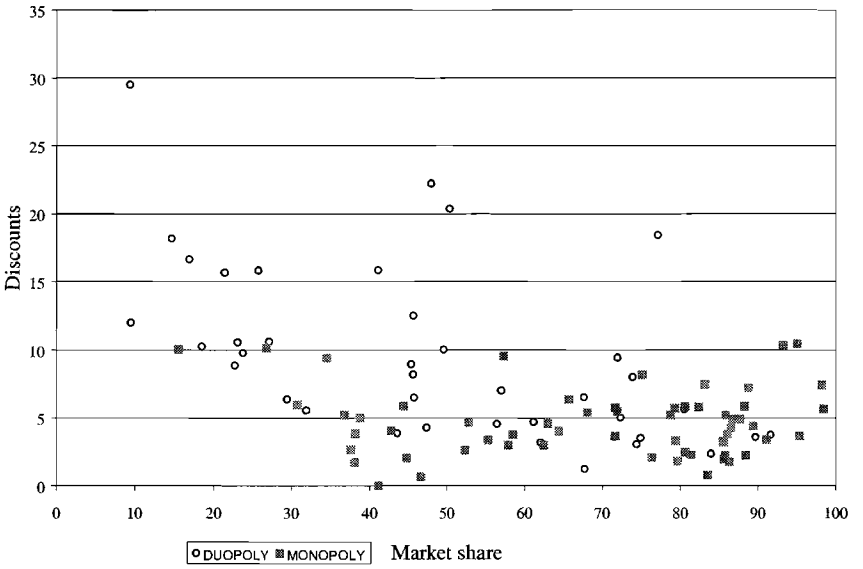
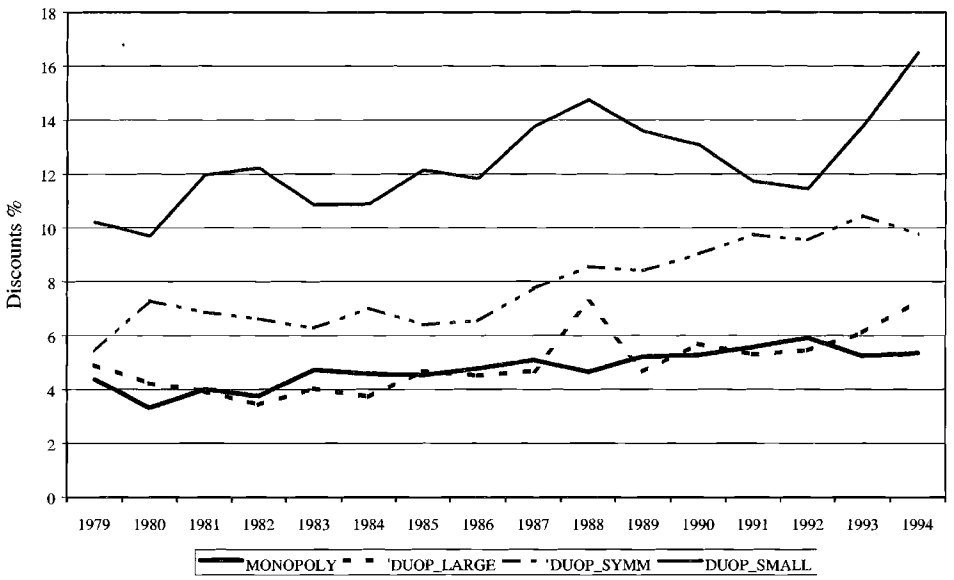


Figure 1, which gives the relation between *DISCOUNTS* and *MARKETSHARE* for 1988, indicates that the discounts are related to market share in the duopolies but not in the monopolies.

Some primary markets are symmetric duopolies where both newspapers have close to fifty percent of the market, these newspapers are denoted *DUOPSYMM.* These markets are thought by a government agency, Presstödsnämnden, which administrates subsidies to the newspaper industry, to be the most competitive in our sample. Other duopoly markets contain two newspapers with asymmetric market shares where the small, *DUOPSMALL,* firm has below 40 percent of the market and the large, *DUOPLARGE*, usually 60-85 percent.

Figure 2: Mean discounts by market position



In Figure 2 we show the time pattern of *DISCOUNTS* for the different newspaper types. There is evidently some variation over time but the basic observation is that small duopolies tend to have far larger fraction of subscriptions sold at a discount than others. Monopolies and the large newspaper in an asymmetric duopoly have very similar development, with the exception of 1988. It is clear that there is a slight upward trend in the use of price discrimination for each of the newspaper types.

As noted above, each newspaper is assigned a primary market but most also have a presence in nearby municipalities. The local content of the newspaper is focused on the primary market and will be of less value to consumers at other locations. In order to sell in the neighboring markets, newspapers can offer discounts on the subscription price. The prediction is that *DISCOUNT* is an increasing function of the newspaper,s regional dispersion. Two measures are used to capture this aspect. The first measure is the logarithm of the number of markets where the newspaper sells more than 100 subscriptions, *LNMARKETS*; as seen in Table 1, the average newspaper is present in seven markets. A presence in many local markets increases the room for third degree price discrimination based on location. The drawback of this measure is that it does not account for whether the firm faces different demand conditions in the local markets or not. If a firm is present in many local markets, but demand conditions

are the same, there may be no reason for price discrimination. Another drawback is that markets of different size carry equal weight in the definition of *LNMARKETS*. One way of measuring differences in demand conditions is to see if the markets shares are about the same or very different for a newspaper in the local markets where it is present.[18] We do that by using the weighted mean deviation from the weighted average market share, *UNEVEN*, which for newspaper i active in markets m=1,...,M is defined as:

$$WMARKETSHARE_i = \sum_{m=1}^{M} MARKETSHARE_{i,m} \times \frac{CIRCULATION_{i,m}}{CIRCULATION_i}$$

$$UNEVEN_i = \sum_{m=1}^{M} \left| MARKETSHARE_{i,m} - WMARKETSHARE_i \right| \times \frac{CIRCULATION_{i,m}}{CIRCULATION_i}$$

The sum of deviations in market share (weighted by the newspaper's circulation in the local market) from the weighted mean market share adds up to *UNEVEN*. The value of *UNEVEN* is zero if a newspaper has the same market share in all local markets, and a high value of *UNEVEN* indicates that the firm is present in markets with differing demand conditions. The weighting by circulation in the calculation of *UNEVEN* ensures that a deviation from mean market share in a market where the firm has a large circulation adds more to *UNEVEN*, than a deviation in a market where the firm has a low circulation.

[18] The listed price for local newspaper subscriptions is the same in all markets, so differences in market shares mainly reflect differences in demand. The only supply side effect is the use of discounts, which we have to abstract from since data on discounts only are available on newspaper level. Since discounted sales account for below ten percent of all subscriptions, it is reasonable to assume that differences in market shares, in local markets, for a newspaper mainly reflect differences in demand.

Table 1. Descriptive statistics by market position. (Standard errors in parenthesis)

	ALL	*MONO-POLY*	*DUO-POLY*	*DUOP LARGE*	*DUOP SYMM*	*DUOP SMALL*	*Number of obs.*
DISCOUNTS	6.27	4.76	8.38	4.72	7.82	12.4	1640
	(4.79)	(3.28)	(5.70)	(2.96)	(5.05)	(5.73)	
max.	38.0	21.2	38.0	14.5	29.5	38.0	
min.	0	0	0	0	0	0	
DISCOUNTS_ALL	9.53	7.52	12.4	7.25	11.5	18.0	1640
	(5.90)	(3.74)	(7.11)	(3.36)	(5.56)	(6.98)	
max.	46.7	27.3	46.7	19.2	34.8	46.7	
min.	0	0	2.33	2.33	2.41	4.28	
CIRCULATION	21900	16900	29000	43300	22400	21400	1640
	(18800)	(13500)	(22600)	(26600)	(11300)	(19700)	
MARKETSHARE	59.6	67.1	49.0	72.8	51.9	23.8	1640
	(24.2)	(21.5)	(23.8)	(13.9)	(13.1)	(10.4)	
LNMARKETS	1.70	1.52	1.95	2.14	1.59	2.10	1640
	(0.770)	(0.650)	(0.850)	(0.810)	(0.828)	(0.805)	
UNEVEN	19.9	18.9	21.5	16.4	21.4	26.9	1599
	(11.5)	(11.5)	(11.2)	(7.21)	(13.6)	(9.46)	
IMMIG	3.16	3.14	3.19	3.15	3.18	3.24	1640
	(0.756)	(0.745)	(0.771)	(0.797)	(0.731)	(0.783)	
Number of obs.	1640	960	680	225	218	237	

One main group targeted with discounted subscriptions, according to people in the industry, is people that have recently moved into the local market.[19] We capture this by the percentage of inhabitants that migrated into the local market during the year, *IMMIG*. Our prediction is that *DISCOUNT* is increasing in *IMMIG*.

In the first row of Table 1 we show *DISCOUNTS* for the classification of newspapers according to their market position. It is immediately clear that there is an ordering in the fraction of discounts between the groups. Monopolies sell about 4.7 percent of their subscriptions at a discount, which is similar to the large duopoly newspapers. The small duopoly newspapers sell on average 12.4 percent at a discount. The table immediately suggests that there is a negative relation between the use of price discrimination and market shares.

[19] National newspapers also offer discounts to students, but this is uncommon among local newspapers. We have, however, tried to explain the use of price discrimination with the fraction of young people in the primary market but the coefficient was never significant.

4 Econometric Results

We estimate the use of discounts as a function of market position, the dispersion of circulation and the inflow of new customers using standard least squares regressions.[20] We estimate separate regressions for each year. Thus, in this first cut at the data, we do not utilize the panel structure of the data. Neither do we consider the dynamic aspects of discounting that arise if e.g. firms increase their use of discounting in response to changes in total circulation or rivals' actions. In the concluding section we outline some of the questions that we will address with a more structural specification. Our reduced form specification is:

$$DISCOUNTS_i = \alpha + \beta_1 DUOPOLY + \beta_2 MARKETSHARE * MONOPOLY + \\ + \beta_3 MARKETSHARE * DUOPOLY + \beta_4 LNMARKETS + \beta_5 IMMIG + \varepsilon_i .$$

Results for four of the years are given in Table 2; the results on the market structure variables for the other years are very similar. This specification has also been estimated with the broader measure of discounts, *DISCOUNTS_ALL*. The results of those regressions are given in Table A1 in the Appendix and the key parameter estimates remain qualitatively unchanged.

In Table 2, the coefficient on *DUOPOLY* is positive and highly significant. The interaction terms, *MARKETSHARE*MONOPOLY* and *MARKETSHARE*DUOPOLY* allow the effects of market shares to be different for monopolies and duopolies. The results show that market share does not affect the use of discounts for monopoly firms. However, for duopoly firms, market share is very important for the use of discounts. The point estimates on *MARKETSHARE*DUOPOLY* suggest that an increase in market share with ten percentage points decreases *DISCOUNT* by more than one percentage point. These results confirm the pattern found in Figure 1: a large effect of market share for duopolies, but no effect for monopolies.

[20] The dependent variable is bounded between zero and one. As evident in Table 1, there are some zero observations, which suggests that a Tobit model, rather than a least squares estimator, should be used. However, there are only a few percent zeros and the results from the two estimators are virtually identical.

Table 2. Least squares regression results for different years

	(2:1) *DISCOUNTS 1979*	(2:2) *DISCOUNTS 1984*	(2:3) *DISCOUNTS 1989*	(2:4) *DISCOUNTS 1994*
CONSTANT	2.74	2.19	-1.57	5.72*
	(2.62)	(2.49)	(2.29)	(3.24)
DUOPOLY	7.56***	9.17***	9.48***	8.88**
	(2.66)	(2.18)	(2.03)	(3.39)
*MARKETSHARE *MONOPOLY*	-0.00202	0.0117	-0.0106	-0.0447
	(0.0281)	(0.0234)	(0.0216)	(0.0337)
*MARKETSHARE *DUOPOLY*	-0.102***	-0.122***	-0.135***	-0.138***
	(0.0277)	(0.0263)	(0.0264)	(0.0293)
LNMARKETS	-0.0510	0.151	1.34**	1.26*
	(0.587)	(0.602)	(0.618)	(0.645)
IMMIG	1.29**	0.477	1.56***	0.351
	(0.605)	(0.616)	(0.541)	(0.609)
Number of obs.	104	106	101	96
Adj R^2	0.218	0.247	0.444	0.380

Standard errors, using White's robust covariance matrix, are in parenthesis.
Variables starred *** are significant at the 1% level, with ** at the 5% level and with * at the 10% level.

The results, for 1984 data, for some alternative specifications are reported in Table 3. The difference is that *LNMARKETS* is replaced with *UNEVEN* in regression (3:2). *DUOPOLY* and that the interaction terms are replaced by three dummy variables for market position in regressions (3:3) and (3:4). The two latter regressions confirm the ordering of use of discounts observed in Figure 2. The newspapers with weakest market position, *DUOPSMALL*, and those in symmetric duopoly markets, *DUOPSYMM*, sell significantly more of their output at a discounted price. Large duopoly newspapers, *DUOPLARGE*, do not use discounts to a significantly larger degree than monopolies do.

The coefficients on the remaining two variables in Table 2, *LNMARKETS* and *IMMIG*, are only significant in some of the years. Moreover, the point estimates are unstable. A further examination of the results for all the 16 years shows that *LNMARKETS*, has a significant positive coefficient at the ten (five, one) percent level in eight (four, one). The effect of dispersion is of a rather small magnitude. With a coefficient for *LNMARKETS* of one (a higher value seems unlikely given the yearly regression results), an increase in the number of markets where a newspaper is present from seven (the sample mean) to eight, only increases *DISCOUNTS* by 0.13 percentage points. Although insignificant in the two regressions reported in Table 3, (3:2) and (3:4), our other measure of dispersion, *UNEVEN*, also gives some weak support for the hypothesis of a positive relationship between dispersion and the use of discounts. The coefficient for *UNEVEN* is positive for all years, and significantly

positive at the ten (five, one) percent level in nine (five, two) of the years in the sample. In all, there is some indication that newspapers covering many local markets sell relatively more subscriptions at a discount. We interpret this result as giving statistically weak evidence that newspapers give discounts to consumers in neighboring areas. This interpretation is consistent with the view of people in the industry. A similar examination shows that the coefficient on *IMMIG* is positive for all but one year and significant at the ten (five, one) percent level in six (four, two) of the years in the sample. This lends some, if weak, support to the notion that discounts are given to individuals moving in to the local market.

Table 3. Least squares regression results for different specifications.

	(3:1) *DISCOUNTS 1984*	(3:2) *DISCOUNTS 1984*	(3:3) *DISCOUNTS 1984*	(3:4) *DISCOUNTS 1984*
CONSTANT	2.19	1.84	3.15*	2.94*
	(2.49)	(2.43)	(1.77)	(1.65)
DUOPOLY	9.17***	8.98***		
	(2.18)	(2.32)		
*MARKETSHARE *MONOPOLY*	0.0117	0.0119		
	(0.0234)	(0.0225)		
*MARKETSHARE *DUOPOLY*	-0.122***	-0.117***		
	(0.0263)	(0.0251)		
DUOPLARGE			-0.933	-0.777
			(0.780)	(0.714)
DUOPSYMM			2.36*	2.33*
			(1.23)	(1.23)
DUOPSMALL			6.19***	6.10***
			(1.35)	(1.36)
LNMARKETS	0.151		0.0881	
	(0.602)		(0.563)	
UNEVEN		0.0439		0.0265
		(0.0344)		(0.0337)
IMMIG	0.477	0.380	0.438	0.380
	(0.616)	(0.609)	(0.579)	(0.594)
Number of obs.	106	106	106	106
Adj R^2	0.247	0.258	0.261	0.265

Standard errors, using White's robust covariance matrix, are in parenthesis.
Variables starred *** are significant at the 1% level, with ** at the 5% level and with * at the 10% level.

5. Concluding Remarks

Price discrimination in various guises exists in every industry and is used by virtually every firm. In this paper we explain differences in the use of price discrimination across firms that operate in the same industry, but in different geographical markets, by a number of firm- and market- specific factors. We analyze the use of discounts in the Swedish local newspaper markets. The observed price discrimination is third-degree, where firms can condition their prices on e.g. the buyer's geographic location or previous purchasing history.

We show that newspapers with a local monopoly position sell relatively fewer subscriptions at a discount than do others. Stated differently, competition tends to give rise to price discrimination beyond the level that is optimal for a monopoly. We also find that, in competitive markets, newspapers with low market share sell a larger fraction of their subscriptions at a discount. These results are broadly consistent with the recent work by Chen (1997), Fudenberg and Tirole (2000), Taylor (1999), and Villas-Boas (1999). In their models, a firm can target the buyers of a rival's product with low prices, referred to as "poaching", in order to increase its market share. It is the firm with the smallest customer base that has the highest incentive to offer discounts to attract new customers.

So far, we have only provided a first cut at the data employing a reduced form specification. Presumably, more information could be extracted from a structural estimation of firms' strategies. We wish to conclude this paper by outlining some further issues that we intend to address in future work. An obvious limitation with the econometric approach in this paper is that we have ignored any interdependence between rival newspapers. As noted above, there are several local markets that have two newspapers. It is plausible that if one of the duopolists increases its use of price discrimination it will force the rival firm to respond. Alternatively, if one of the firms has a strategy of selling a large fraction at a discount (either in an attempt to increase it's market share, or due to some inherited disadvantage) it is likely that the rival will respond. As of now, we have only begun to examine the time path of price discrimination in the competitive markets. There are some features that are evident from an inspection of these markets. First, in most markets there are fairly stable ratios with the smaller newspaper giving relatively more discounts. Second, in the cases where one of the newspapers' increases it use of price discrimination the rival follows. However, the rival's response is usually delayed one to two years. Similarly, if a newspaper reduces its use of price discrimination, the rival cuts back as well, again usually within a few years.

The dependent variable used in the regressions was the ratio of discounted subscriptions to total circulation. The motivation for this was that the ratios for most newspapers were relatively stable over time. This suggests that changes in total circulation accrue from largely proportional changes in full and discounted subscriptions. Nevertheless, it would be interesting to compare in more detail the cases where the ratio does change and relate this to changes in circulation.

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Appendix

Table A1. Least squares regression results.

	DISCOUNTS_ ALL 1979	*DISCOUNTS_ ALL 1984*	*DISCOUNTS_ ALL 1989*	*DISCOUNTS_ ALL 1994*
CONSTANT	4.43	5.94**	1.86	9.20**
	(2.99)	(2.99)	(2.67)	(3.76)
DUOPOLY	11.0***	12.2***	13.5***	12.1***
	(3.02)	(2.59)	(2.50)	(3.91)
MARKETSHARE	-0. 00209	-0.00154	-0.0195	-0.0562
**MONOPOLY*	(0.0313)	(0.0282)	(0.0249)	(0.0389)
MARKETSHARE	-0.157***	-0.186***	-0.202***	-0.187***
**DUOPOLY*	(0.0357)	(0.0329)	(0.0360)	(0.0349)
LNMARKETS	0.104	0.619	1.38*	1.36*
	(0.724)	(0.724)	(0.731)	(0.747)
IMMIG	0.780	0.234	1.57***	0.304
	(0.659)	(0.737)	(0.569)	(0.743)
Number of obs.	104	106	101	96
Adj R^2	0.274	0.345	0.525	0.445

Standard errors, using White's robust covariance matrix, are in parenthesis.
Variables starred *** are significant at the 1% level, with ** at the 5% level and with * at the 10% level.

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