KONKURRENSVERKET
Swedish Competition Authority

Ansökan om forskningsmedel

Observera att ansökan med bilagor endast ska skickas elektroniskt
till konkurrensverket@kkv.se

Datum

2015-01-30

1 Sökande (huvudansvarig för projektet)

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Bankgiro/Plusgiro

3 Projektbeskrivning

Projekttitel *För att radbryta texten, använd Alt + Enter*

Evaluating the Reform of Swedish Pharmacy Retailing: Effects on Prices and Product Availability of Non-Prescription Drugs

Projektet avses starta, datum

2015-07-01

Projektet beräknas vara slutfört, datum

2017-06-30

Sammanfattning av projektets syfte, betydelse och genomförande (högst 1400 tecken).
För att radbryta texten, använd Alt + Enter

Fem år efter omregleringen av apoteksmarknaden i Sverige 2009 är det önskvärt och möjligt att utvärdera effekterna av införande av konkurrens mellan apotek. Ett syfte med forskningsprojektet är att estimera värdet för konsument av prisförändringar, ökad tillgänglighet och förändrat sortiment genom att studera ett antal marknader för icke-receptbelagda läkemedel med en empirisk efterfrågemodell och oligopolistisk prissättning. Detaljerad statistik över apotekens försäljning och lokalisering gör det dessutom möjligt att studera tillgänglighetens kostnader.

Ett annat syfte är att undersöka hur återförsäljningsledet påverkar konkurrens mellan tillverkare. Konkurrensen mellan tillverkare påverkas i hög grad av hur återförsäljning till slutkund ser ut. Återförsäljares köparmakt kan exempelvis motverka en tillverkares dominans eller negativa effekter av ett förvärv. Före omregleringen hade Apoteket AB en helt passiv prissättningsstrategi på receptfria läkemedel, med ett givet procentuellt påslag på alla varor, vi ket i prakt ken innebar att tillverkarna bestämde priset till slutkund. Omregleringen har resulterat i återförsäljare med aktiv prissättning och introduktion av nya produkter. En empirisk modell möjliggör en analys av i vilken grad prisförändringar beror på introduktion av nya produkter, ökad konkurrens mellan tillverkare och ökad konkurrens mellan apotek.

Bifoga en utförligare projektbeskrivning (max 10 A4–sidor).

4 Kostnadsredovisning

Fyll i de ofärgade cellerna med för projektet gällande information, så uppdateras de färgade automatiskt. Ge akt på de felmeddelanden i rött som visas vid överträdelse av Konkurrensverkets riktlinjer för anslag till forskningsprojekt.

Projektår 1 Personalnamn, akademisk titel **(bifoga CV)**	Månadslön enligt KKV:s riktlinjer	Anställningstid i projektet, månader	Arbetstid i procent av heltid	Lönekostnad inkl. sociala avg.
Jonas Björnerstedt, docent	42000	12	75%	559 440
	Summa övriga kostnader (hämtas från tabell 4a)			155 000
	Total kostnad inklusive sociala-, och förvaltningsavgifter			964 494

Projektår 2 Personalnamn, akademisk titel **(bifoga CV)**	Månadslön enligt KKV:s riktlinjer	Anställningstid i projektet, månader	Arbetstid i procent av heltid	Lönekostnad inkl. sociala avg.
Jonas Björnerstedt, docent	42000	12	75%	559 440
	Summa övriga kostnader (hämtas från tabell 4a)			25 000
	Total kostnad inklusive sociala-, och förvaltningsavgifter			788 994

Projektår 3 Personalnamn, akademisk titel **(bifoga CV)**	Månadslön enligt KKV:s riktlinjer	Anställningstid i projektet, månader	Arbetstid i procent av heltid	Lönekostnad inkl. sociala avg.
	Summa övriga kostnader (hämtas från tabell 4a)			0
	Total kostnad inklusive sociala-, och förvaltningsavgifter			0

4a Redovisning övriga kostnader

	År 1	År 2	År 3
Material och utrustning			
Resor	25 000	25 000	
Övriga kostnader	130 000		
Summa	155 000	25 000	0

Observera! Summan av de övriga kostanderna för något av åren överstiger den i riktlinjerna fastslagna övre gränsen för övriga kostnader, med hänsyn till antalet projektmedlemmar samt deras akademiska titlar.

5 Kostnadssammanfattning (anges i kronor) för nu sökt anslag

Total projektkostnad

1 753 488

Därav söks från

Konkurrensverket	Annan anslagsgivare *
1 753 488 kr	

*Anslagsgivarens namn

**Anslagsgivarens namn

Tidigare erhållna anslag från

Konkurrensverket	Annan anslagsgivare **

Ansökan inlämnad, datum	Sökt belopp

Ansökan bevi jad, datum	Beviljat belopp

6 Övriga projekt som samtidigt kommer att ledas av huvudansvarig

Projekttitel *För att radbryta texten, använd Alt + Enter*

* KKV Project, 2013-2014, Modeling Uncertainty in Merger Simulation (with Jonas Björnerstedt)

* Fund for Scientific Research (Flanders) Onderzeeksproject, promotor, 2011-2015: "A Retailer's Private-Label Portfolio: Budget, Standard and Premium Private Labels":

* KU Leuven Programmafinanciering "Centre of Excellence", promotor, 2010-2017: "Governments & Markets: Institutions and Regulation in a Changing World".

Namn och institution på personer som beviljas forskningsbidrag kommer att publiceras på Konkurrensverkets webbplats.

Research proposal –

Retailing, Entry and Competition - Evidence From the Reform of Swedish Pharmacy Distribution

Jonas Björnerstedt and Frank Verboven

In 2009 the regulation of pharmacy retailing in Sweden was reformed. Two thirds of the pharmacies of the legal monopolist Apoteket AB were sold and the sale of many non-prescription drugs was allowed in other stores than pharmacies. The stated purpose of the reform was to improve the efficiency of pharmacy retailing through the introduction of competition.

Five years after the reform, it is desirable and feasible to evaluate the effects of the introduction of competition in pharmacy retailing. Assessing how it has affected welfare is not obvious, however. A careful analysis requires the consideration of many effects of the reform on competition, some of which are difficult to study. However, the combined welfare effects can be assessed for product introduction, increased ease of access and product and retail competition. The project aims to do this in markets for non-prescription drugs, using an empirical demand model with oligopolistic competition.

In this project we propose to evaluate the effects of the reforms in Swedish pharmacy retailing on consumer welfare and total welfare. Regarding the effects on consumers, we will distinguish between consumer gains from reduced prices and increased product availability. Regarding the effects on total welfare, we will consider the costs from, possibly, excessive product availability. The reform affected consumer welfare and total welfare through various possible channels, which we now discuss in more detail.

On the one hand, the reform led to a large increase in the number of pharmacies and hence increased geographic availability to consumers. New pharmacies are often located close to existing ones, however. The most important benefit to the consumer in this case might not be reduced travel distance, but the increase in the level of competition. Pharmacies close to each other can be expected to compete, reducing prices when these are not regulated, and improving their service level. There is reason to believe that the reform can also have had an effect on the competition between manufacturers, with lower consumer prices as a result.

On the other hand, however, the increase in the number of pharmacies comes at a cost. Establishing a pharmacy entails an investment in fixed costs. The benefits of additional pharmacies to consumers should therefore be balanced against the duplicated fixed costs. The economic literature has shown there may be excessive entry, if entry mainly involves business stealing.[1] For a complete welfare analysis, it is thus not only important to understand the consumer demand, but also the entry process of establishing pharmacies and the associated fixed costs.

Empirical analysis of pharmacy retailing can also shed light on how the vertical structure of retailing affects competition. Competition between manufacturers is often indirect, with both retail prices and the choice of products to market set by retailers. The degree of competition between products thus depends on the structure of retailing. The countervailing buyer power of retailers can for instance mitigate the dominance of a firm in a product market. The effects of mergers or abuse of dominance in a product market thus depend on the behavior of retailers.

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[1] See for example Mankiw, G & M Whinston, 1986, "Free Entry and Social Inefficiency", *RAND Journal of Economics*, 17:48-58

One implication of pharmacy reform was a change in the behavior of retailers. Prior to the reform, the monopolist Apoteket AB had a very passive role in the pricing and product selection of non-prescription drugs, with a fixed percentage margin on all products. With the deregulation and the introduction of competition, this behavior changed. The pharmacy market can thus be used to study the effects of retailing on competition.

The pricing of non-prescription drugs after the merger changed, empirically. In the first two years after the deregulation 2009, much of the focus of the new competitors was on the establishment of new pharmacies. The number of pharmacies increased by around 30 percent over the period. After 2012 the focus of the retailers on pharmacy products increased, with the introduction of private labels and greater price dispersion of non-prescription drugs.

The reform has affected product pricing. The evolution of prices of one sector, non-prescription painkillers, is shown in Figure 1 below[2]. One can note that the variability of prices increase in the post-deregulation period, especially in the last three years. In addition, after deregulation there has been a substantial increase in both the number of products and the number of producers of painkillers.

Figure 1. Consumer prices for painkillers before and after the pharmacy reform
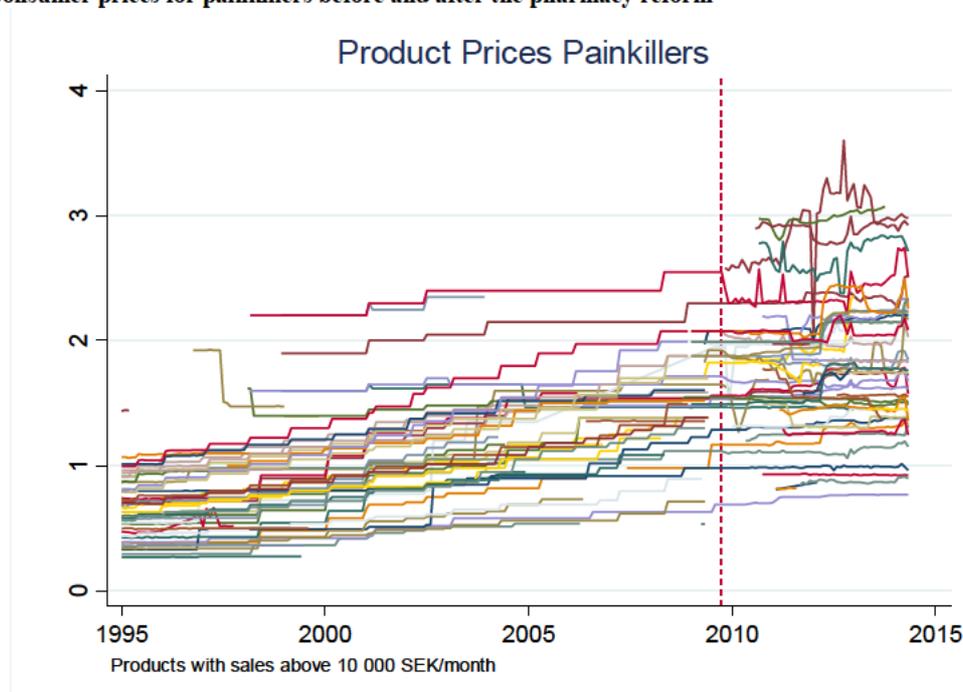
The Swedish pharmaceutical market is a very good candidate to study retailing. Empirical analysis of retailing based on non-prescription pharmacy data has some major advantages.

- The reform of the market in 2009 allows for a comparison of market outcomes under two very different retail structures.
- Pharmacies sell several different types on non-prescription drugs, with distinct demands.
- The data collected by eHälsomyndigheten is comprehensive and of excellent quality, both prior and post deregulation.

Based on this dataset and an empirical model of demand and oligopolistic pricing, we will analyze the effects of deregulation on consumer welfare, through increased geographic coverage, new product introduc-

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[2] The figure includes 30-50 painkiller products: tablets and fizzy tablets for adults of the substances paracetamol, ASA and ibuprofen with monthly sales above 10 000 SEK

tion, increased competition and changed vertical relationships between retailers and producers. We will also consider the effects on total welfare, by considering whether deregulation led to too much entry and duplication of fixed costs.

This analysis will involve handling some methodological problems, important in their own right. Perhaps the most important issue in demand estimation is how to handle the endogeneity of explanatory variables, especially price. It will be addressed in various ways; in addition to using cost and product characteristics as instruments, Hausman instruments will be tested[3]. The use of choice experiments as a method of testing instrumentation will also be investigated.

The effects of retailing on consumer welfare and total welfare are of a broader academic and policy interest. The academic literature has long been pre-occupied with the distortionary effects of free entry on product diversity. Seminal contributions showing there may be excessive entry are Spence (1976), and Dixit and Stiglitz (1977).[4] More recently, there has been a strong interest in applying these insights using methodology from empirical industrial organization; see for example Nevo (2001), Petrin (2002)[5]. In the context of retailing and distribution, relevant applied work on the impact of entry regulations in retailing and distribution includes Schivardi and Viviano (2011) and, for pharmacy distribution, Schaumans and Verboven (2008).[6] Finally, our work relates to recent interest to perform thorough sector investigations, such as recent investigations to understand market power and competition in UK supermarket sector.

Project goals

The project aims to study how the degree of competition between producers has been affected by the change in pharmacy retailing in Sweden. The project aims to study

1. how active retailing affects competition and consumer prices, through an empirical demand analysis of several markets for non-prescription drugs
2. how the reform has affected consumers of non-prescription drugs through increased access
3. the fixed cost and process of pharmacy establishment
4. some methodological issues such as instrumentation and inclusion of costs in estimation

The goals will be described in the following three sections.

Project outline

The project will have a duration of two years, directed by Professor Frank Verboven, University of Leuven, Belgium, in collaboration with docent Jonas Björnerstedt. Financing is only required for Jonas Björnerstedt. In order to study issues of entry and market conduct, financing of access to pharmaceutical data from eHälsomyndigheten is also required.

Previous work

In a one-year project funded by Konkurrensverket 2013-14, methodological issues of merger simulation were studied. The main focus of the research project was to incorporate the role of uncertainty into mer-

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[3] See Hausman, J , G Leonard & D Zona, 1994, "Competitive analysis with differentiated products" *Annales d'Economie et de Statistique,* 34:159-80
[4] Spence, M , 1976, "Product selection, fixed costs and monopolistic competition", *Review of Economic Studies*, 43(2), 217-235 Dixit, A & J Stiglitz, 1977 "Monopolistic competition and optimum product diversity", *American Economic Review*, 67(3), 297-308
[5] Nevo, A , 2001, "Measuring market power in the ready-to-eat cereal industry", *Econometrica*, 69(2), 307-342 Petrin, A , 2002, "Quantifying the benefits of new products: the case of the minivan", *Journal of Political Economy*, 110(4) 705-729
[6] Schaumans, C & F Verboven, 2008, "Entry and Regulation: evidence from health care professions", *Rand Journal of Economics*, 39(4), 949-972 Schivardi, F & E Viviano, 2010, "Entry barriers and retail trade", *Economic Journal*, 121(551), 145-170

ger simulation on a systematic basis, to make the economic assumptions more realistic (regarding demand, conduct and entry) and to build a user-friendly, freely available package for merger simulation.

1. Retailing and product competition

In the above overview, we discussed that we aim to analyze the effects of the pharmacy deregulation on consumer welfare through different channels. The effect of the reform on consumer welfare is either through price changes or product availability:

- Consumer welfare can increase due to lower prices, either due to reduced costs or due to reduced markups from increased competition. Increased competition in turn depends on the conduct of competitors and is also influenced by vertical relationships between retailers and producers.
- Consumer welfare can also increase because of increased geographic availability and new product introduction (including private labels).

We will analyze these welfare effects for a variety of different non-prescription medicines. There are at least a dozen[7] rather distinct types of non-prescription medicines sold in Sweden, such as drugs for: digestive problems, allergies, nicotine tablets, infections and anti-inflammatory medicines. Demand for different categories of non-prescription drugs are relatively independent. One can expect the substitutability between for example painkillers and nicotine tablets to be relatively small. For example, changes in the price of nicotine tablets can be expected to have a marginal effect on the demand for products in other categories.

There are several reasons for studying several markets for non-prescription drugs in pre- and post-reform periods at the same time. One would expect that the deregulation would affect markets both through increased price competition, and through the introduction of private labels by the pharmacy chains. By studying several different markets, we can see if changes between pre- and post-deregulation periods depend on the market structure, i.e. varying degrees of concentration of producers across the markets. One can also use the similarities between markets in demand estimation, using prices in other markets as instruments to account for endogenous price-setting behavior.

1.1. Lower prices

Prior to the deregulation in 2009, the state pharmaceutical monopoly Apoteket AB had an extremely transparent and passive pricing policy for non-prescription drugs. All products had the same markup, with the prices set by producers passed on as retail prices. Apoteket AB also had a rather passive strategy in regard to which products to shelf. One justification of this strategy was as a compliance to the non-discriminatory requirements of the European common market on a state monopoly. With prices set nationally and with no variation in product choice, the price of competitors could be verified by looking at the shelf price in any pharmacy. Transparency in price-setting could facilitate tacit collusion between producers.

One particular issue we observed in the market for analgesics was the degree of tacit collusion, with Alvedon being the price leader. The price of the competing paracetamol and ASA brands, Panodil and Treo, closely followed the price of the Alvedon brand in the period 1995-2008, with price increases of competing brands following a month or two after those of Alvedon. As Figure 2 below illustrates, most price changes of other brands in this period are 0-2 months after Alvedon price increases.

[7] The actual choice of markets to study will be done in the project

Figure 2. Alvedon price leader

Alvedon price leader 1995-2008

Time lag of price increase compared to Alvedon

Average number of months between Alvedon price changes: 9.88

The price leadership behavior of Alvedon has disappeared after the reform. As can be seen in Figure 1 on page 2, after 2010 prices of painkillers have become more volatile, reflecting price dispersion between chains and changing market shares. In addition to providing information about the pre-merger demand elasticities, the post-merger market can thus also potentially provide information about the degree of tacit collusion prior to the merger.

Whether competition post-regulation has affected consumer prices remains to be studied. As Figure 3 below illustrates, prices have increased over time in real terms. Prices increased in 2009 after the acquisition of the Alvedon brand by GlaxoSmithKline. As shown in Björnerstedt & Verboven (2015)[8], a smaller part of this increase can be ascribed to a regulatory requirement to reduce package sizes of paracetamol and ASA painkillers.

Figure 3. Price of paracetamol and ASA products increased after GSK merger

Prices

Paracetamol — Ibuprofen
ASA

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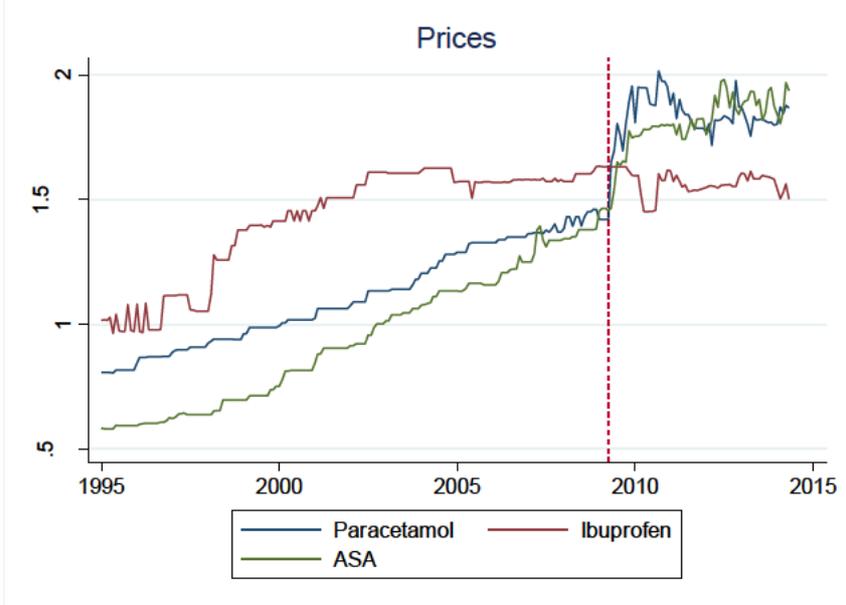
[8] Björnerstedt, J and F Verboven, 2015, "Predicting the price effects of horizontal mergers - An application to the market for painkillers in Sweden", revised version

In the period after 2010, prices increase at a slower rate, however. Paracetamol prices have even decreased in this period. It remains to be seen to what extent this is due to increased competition and lower markups, or whether this is due to improved efficiency and reduced costs.

COMPETITION AND CONDUCT

The methods developed in empirical industrial organization (as applied in for example merger simulation) can be used to study why prices have changed in response to the reform. We can study whether prices changed because of increased firm efficiency (reduced marginal costs), or because of increased competition (reduced markups). Increased competition can stem from changes in consumers' price sensitivity, or from changes in the degree of collusion, i.e. incorporate coordinated effects. The standard method of determining the marginal costs of firms in merger analysis is to use the estimated demand and assumptions on market competition. It is assumed that firms set prices above their marginal costs, with a margin that depends on demand and competition. Given observed demand and a calculated margin, costs can thus be calculated in the other direction.

Given the degree of price leadership displayed in the painkiller market, the assumption of non-cooperative price-setting might be too strong. If the degree of competition is low, the firms will have high margins. Calculating costs from prices under this assumption will result in lower costs than those calculated under the assumption of a competitive market. Similarly if calculations are based on markets being competitive before and after the reform, while the markets have in fact become more competitive, this will result in calculated costs appearing to decrease with the reform. An increase in competition can thus be revealed in an analysis of calculated costs.

Comparing the development of calculated costs post-reform with costs as forecasted by pre-reform costs can also be used to quantify the effect of the reform on consumer prices and welfare. It should be noted that the changes can be due either to a change in the conduct of manufacturers or to a lower retail margin of the pharmacies. The model can identify how the combined effect of increased competition between manufacturers and between retailers affect prices and consumer surplus. Methods to identify each separately will be discussed in the next section.

1.2. Product availability

The establishment of new pharmacy chains has affected competition, for example through the introduction of private labels such as Apofri. The price effect of such entry can be studied using the methodology of merger simulation, and in the case of painkillers also using the market analysis of Björnerstedt and Verboven (2012)[9]. By studying several non-prescription markets, the effects of the change in the structure of retailing on competition and consumer prices are easier to separate from effects specific to one market.

Both the number of brands and the number of manufacturers in the painkiller market have increased substantially in the years after the reform. Among the new brands are both private labels and brands sold in several pharmacy chains. Entry of new manufacturers increases competition, and the introduction of new brands affects the substitution possibilities and thus price elasticities.

The methodology outlined in the previous section will be used to analyze the effects of increased competition between producers on prices and welfare. Through demand estimation one can also study how consumers value the effect of the increase in the number of retail outlets of non-prescription drugs.

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[9] Björnerstedt, J and F Verboven, "Predicting the price effects of horizontal mergers - An application to the market for painkillers in Sweden", (2012), CEPR Discussion Paper No DP9027

The most noticeable result of the pharmacy deregulation is the increase in availability of non-prescription drugs. Not only have the number of pharmacies increased by more than thirty percent, but many drugs are also available in other stores than pharmacies.

Increased availability can be expected to affect demand of non-prescription drugs, as the implicit cost of obtaining them has decreased. Demand for painkiller tablets has indeed increased in the last 2-3 years as shown in Figure 4 below. A possible explanation for this rather dramatic increase in demand is ease of access.

Figure 4. Painkiller demand increased after the reform
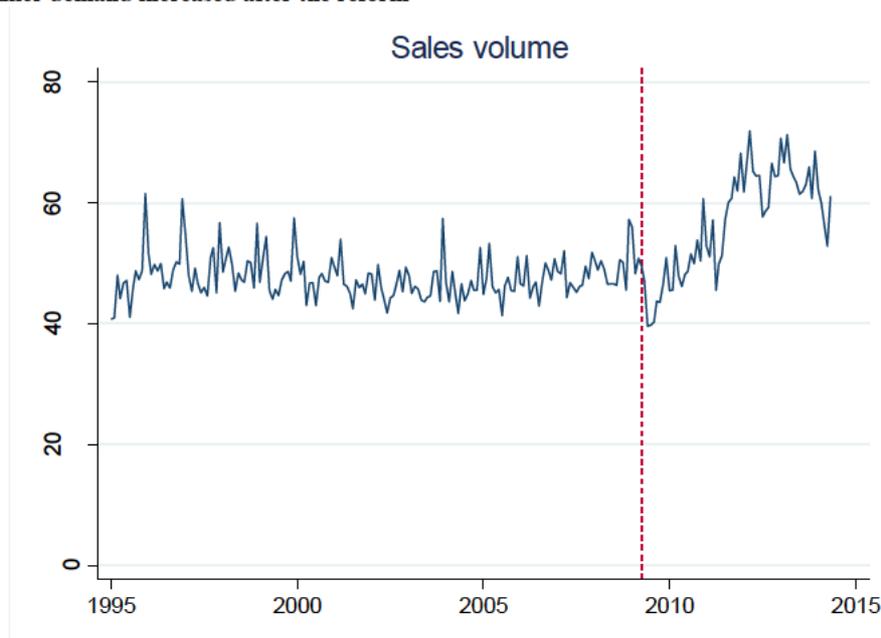
The effect of the change in number of retail outlets on demand and consumer surplus can be estimated using the methods of Nurski & Verboven (2014)[10]. They show how to include alternative measures for geographic availability (the number of pharmacies in relation with total surface area) in a model that can be estimated with aggregate demand data. Alternatively, it is possible to use data at the level of local markets (municipalities) and estimate a more disaggregate spatial demand model, as in Davis (2006)[11] or Nurski and Verboven (2013)[12].

Identifying the consumer's valuation of accessibility of pharmacy products is not only important in order to evaluate the pharmacy reform. It can also shed light on how to determine the regulated margin of prescription drugs. Both sales prices and the sales margin of pharmacies of prescription drugs are regulated in Sweden. The level of this sales margin is a determinant of the profitability of pharmacies in the short run. In the long run, however, a higher sales margin will lead to the establishment of more pharmacies. In effect the sales margin is the cost to society of access. The optimal level of this regulated margin should correspond to the value of accessibility to society. An estimate of the consumers valuation of increased access to non-prescription drugs can provide some input into this regulatory problem.

Consumer welfare is also affected by an increase in variety. As noted above, the number of different products sold has increased following the reform. The demand model can also be used to assess the consumer welfare of this increased variety of new products.

[10] Nurski, L & F Verboven, 2014, "Incumbency Advantages, Distribution Networks and Exclusivity – Evidence from the European Car Markets", *International Journal of Industrial Organization*, 2014, 34, 75-79

[11] Davis, P , 2006 "Spatial competition in retail markets", *RAND Journal of economics*, 37:964-82

[12] Nurski, L & F Verboven, 2013, "Exclusive Dealing as an Entry Barrier – Evidence from the Car Market"

Finally, in addition to the effects of entry on consumer demand and consumer welfare, we can also assess the determinants of the entry process using an empirical model of entry. We aim to consider the approach of Eizenberg (2014).[13] He estimates a demand model, and subsequently considers the effects on variable profits from removing or adding additional products. This enables him to derive bounds on the fixed costs of entry. We will estimate a regional demand model, using data on pharmacy sales of prescription drugs and localization. Based on these demand estimates, we can then simulate the effects of introducing more pharmacies or additional products on variable profits. The simulated variable profit increase provide a lower bound on the fixed costs of setting up a new pharmacy or introducing a new product. Conversely, we can simulate the effects of removing pharmacies or products on variable profits. These simulated variable profit decreases provide an upper bound on fixed costs.

2. Methodology and implementation

To address the questions discussed in the previous section, a framework of demand and oligopolistic pricing will be developed. This requires addressing a variety of methodological questions, with analysis of different types of instrumentation, multiple data sources and additional market assumption.

2.1.   Modeling and Estimation

PRICE ENDOGENEITY

The central difficulty in estimating demand is the endogeneity of prices. The primary methodological focus of the project is on how to handle endogeneity in demand estimation. Using the fact that demand for different types of non-prescription drugs are relatively independent while costs can be expected to be rather similar, Hausman instruments will be tested[14]. Within the scope of logit demand models, prices of for example allergy tablets will be used as cost instruments for painkillers, and vice versa. Prices in other markets will in this case be driven by similar changes in costs, while the independence of demand in the other market will ensure exogeneity.

Costs for different non-prescription drugs can be expected to be driven by similar factors. Costs of packaging, distribution and imports are similar, and the cost of the active substance in non-prescription drugs is relatively small. . This makes it possible to account for price endogeneity using instruments as in Hausman et al (1994).

The method of incorporating prices of other pharmacy markets will differ from Hausman et al in implementation, however. As products and brands differ between markets, brand level instruments cannot be used. Using price per package size is one possibility.

MICRO DATA

The merger simulation of Björnerstedt & Verboven (2015) was based on aggregate market data. There are several reasons why the tools should be extended to handle individual level data. There is increasing availability of scanner data with individual consumer choices. There are also consumer panel data available[15], that use a small panel of consumers that report demand choices. It is also possible to use sales data at a more detailed spatial level, for example the county or municipality, and match this with location of pharmacies and other retailers.

The use of choice experiments is another method of gathering data. Within the context of a survey of consumers, choices based on hypothetical prices are gathered. The major advantage of such a method is

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[13] Eizenberg, A , 2014, "Upstream innovation and product variety in the United States home PC market", *Review of Economic Studies*, 81, 1003-1045
[14] See Hausman, J , G Leonard & D Zona, 1994, "Competitive analysis with differentiated products" *Annales d'Economie et de Statistique* 34:159-80
[15] One example is the GfK ConsumerScan household panel

that issues of endogeneity are avoided. A disadvantage of choice models is that the set of products must in practice be rather restricted.

In the KKV investigation of the painkiller merger, a choice experiment was also performed to empirically test the price sensitivity of demand. It was not used in the demand analysis at the time. The project will extend the package mergersim to incorporating estimates based on micro data.

A methodological innovation that this project will investigate is whether and how a choice experiment can be used in conjunction with traditional analysis based on market data - to test the instrumentation. There is no method of testing whether the instruments used to identify demand are exogenous. The estimate and confidence intervals depend on their exogeneity. As the estimate of market demand will predict consumer behavior with a restricted choice of products, a choice experiment could be used to check the exogeneity of instruments.

COSTS

Another way to improve the estimation of demand is by incorporating cost data or making stronger assumptions on costs, for example that they are nonnegative. The project will extend demand analysis to incorporate such cost information, with joint estimation of demand and supply functions. Analysis and estimation of costs is important in the project, as changes in the calculated costs will be used to determine whether competition has increased post-deregulation.

Specifically, based on cost data from pharmacies prior to the reform, we will also aim to obtain direct estimates of the cost function of pharmacies, from which we will estimate marginal costs and fixed costs. We can then compare the fixed costs with the economic fixed costs implied by our entry model, based on the approach of Eizenberg (2014) described above.

COMPLEMENTARITY

The basic assumption of most discrete choice models is that individuals purchase only one product. Björnerstedt & Verboven (2012) used a constant expenditure model, where individuals purchase a constant expenditure of a chosen good instead of buying one unit. An extension of this model to allow degrees of complementarity between goods will be investigated in the project.

CONDUCT

One way to model a lower level of competitiveness, used in Björnerstedt & Verboven (2012), is to allow firms to take the profits of competitors into account, with a conduct parameter specifying the level with which this is done. If costs appear to decrease after the deregulation, one can calculate the change in conduct that would be required in order for costs not to change. We start from our previous approach, with a conduct parameter for partial cooperative behavior. But we will also use other models of pricing, in particular models with vertical relationships, including Villas-Boas (2007) [16], Brenkers & Verboven (2006) [17], or Dubois & Bonnet (2010)[18] . One purpose of this work is to disentangle the effects of increased competition between manufacturers in setting wholesale prices and between retailers in setting the retail margin.

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[16] Villas-Boas, S 2007, "Vertical Relationships Between Manufacturers and Retailers", *Review of Economic Studies*, 74:625-52

[17] Brenkers, R & F Verboven, 2006, "Liberalizing a Distribution System: the European Car Market", *Journal of the European Economic Association* 4(1):216-51 Bonnet, C & P Dubois, 2010, "Inference on Vertical Contracts between Manufacturers and Retailers Allowing for Non Linear Pricing and Resale Price Maintenance", *RAND Journal of Economics*, 41(1), 139-164

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2.2. Implementation

The project will continue extend the tools of analysis with the incorporation of more demand models. Both research in and the practice of competition economics benefit from the development of tools for empirical market analysis. Within the scope of the project, tools developed previously will be extended. In a previous project, the Stata package *mergersim* was created and distributed[19]. The goals of current project motivate extensions to this package. A Matlab package that can handle numerically more difficult issues, will also be improved.

Simple demand models are important in demand and merger analysis. With limited data, other assumptions can be used to assess market effects. In our previous project, PCAIDS was added as a simple demand model[20]. Adding a nesting structure to PCAIDS improves this model in practice. Adding a simple log linear demand model is also a planned extension.

Income is often an important determinant of demand, as the consumption patterns of different income categories often differ. As health related behavior seems to depend on socio-economic categories, the demand for pharmaceuticals can be expected to depend on income. The project will extend demand to include empirical distributions of income, in the analysis of demand by district (län).

The nested logit demand implemented in the mergersim package is the most commonly used demand model. It depends however on a hierarchy of demand characteristics being nested. In contrast, the random coefficient (or mixed) logit has unnested characteristics. The complexity of implementing the nonlinear estimation of this model has raised issues of robustness, however[21]. The product characteristics choice model of Bresnahan et al[22] is here an alternative. Although requiring non-linear estimation, it does not depend on the simulation of individual demands of a population.

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