The effect of pharmacies' right to negotiate discounts on the market share of parallel imported pharmaceuticals[*]

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Abstract

The market share for parallel imports when pharmacies can negotiate discounts with parallel traders and sellers of locally sourced products is analyzed both theoretically and empirically. The theoretical model shows that, with discount negotiations, pharmacies will sell locally sourced products to all consumers that prefer these or are indifferent between these and parallel imported products. The explanation is that the parallel traders have cost disadvantages because of their repacking and trading costs. Sellers of locally sourced products will therefore always underbid the marginal prices of parallel traders and this gives pharmacies an incentive to sell locally sourced products. The empirical results show that a reform allowing discount negotiations reduced the market share for parallel imports by about 11 percentage points to reach 31%. The most important mechanism is that the reform has reduced the probability that pharmacies offer consumers cheaper parallel imported substitutes.

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1. Introduction

Parallel import can arise when a producer sell products at different prices to wholesalers in different countries. For example, in attempt to price discriminate, Pfizer might charge less from wholesalers in low-income countries than it charges for the same product from wholesalers in high-income countries. Parallel traders can take advantage of the price differences by buying products intended for low-price countries and selling them to wholesalers in high-price countries. Parallel trade of pharmaceuticals is allowed within the European Economic Area (the 27 EU member states and Island, Liechtenstein and Norway) towards fulfilling the objective of creating a single market and parallel traders do not require authorization of the patent holder. Parallel imports have the same active ingredient in the same amount and the same dosage form (e.g., tablet or capsule) as the locally sourced pharmaceuticals. However, parallel imports might differ from true brands in packaging, or in some cases even in the name.[1] Drugs that are sold directly to wholesaler in the country where they are bought by consumers, i.e. products that are not parallel imported, are called locally sourced drugs.

This paper studies how the possibilities of pharmacies to negotiate discounts with producers and parallel traders affect the probability that parallel imported products are sold instead of locally sourced products. To reduce the costs of prescription drugs, pharmacies in most countries have a right or obligation to suggest substitution of prescribed drugs with cheaper, generic or parallel imported substitutes. Pharmacies have a potentially large impact on pharmaceutical costs since their information to consumers about generics and parallel imports and the extent they keep them in stock influences which products that are sold. Still, to the best of my knowledge, only Brekke et al. (2010) have studied the pharmacies' role in promoting cheaper alternatives.

Brekke et al. (2010) analyzed the brand-name market shares for off-patent drugs in Norway. Using monthly data on average margins for brand-name and generics for different substances and pharmacy chains, they found that the brand-name market shares were positively related to the margins on brand-names and negatively related to the margins on generics. This paper complements Brekke et al.'s (2010) by studying the effects of a reform that changed pharmacies' incentives and by analyzing the other part of the market, that for on-patent drugs.

The theoretical model derived in this paper shows that when pharmacies are able to negotiate on prices and quantities it will be profitable for sellers of locally sourced products to give large enough discounts so that pharmacies sell their products to all consumers that prefer these or are indifferent between these and parallel imported products. Locally sourced products will also be of interest to consumers who would, without costly persuasion by

[1] For example, parallel imported Diovan Comp is marked as "Diovan Comp" as well as "Co-Tareg", one of the many trade names under which it is available in the EU. Similarly, parallel imported Nexium is marketed in Sweden both as "Nexium" and "Axagon".

pharmacy personnel, be prepared to pay more for a parallel imported product, if only both were available at the pharmacy.[2]

The empirical analyses are based on prescription-level data from the county of Västerbotten, Sweden, for the years 2007-2011. On July 1, 2009, pharmacies got the right to negotiate discounts on the wholesale prices of pharmaceuticals without generic substitutes, while a government agency continued to determine maximum wholesale and retail prices. Before that date, pharmacies' margins were determined by the government agency, and nearly identically for locally sourced and parallel imported products. Pharmacies also got the right to sell parallel imports at prices lower than the maximum retail prices, but the data reveal that this possibility was almost never used.

On July 1, 2009, it also became legal to open private pharmacies in Sweden, and the following months more than half of the government-owned pharmacies were sold out. The data identifies pharmacy chains, which enables me to study differences between pharmacies that were kept in government ownership and private pharmacies.

In accordance with the theoretical predictions, parallel importers do not seem to be able to match with the offers of producers. The results show that the reform has reduced the market shares of parallel imports with about 11 percentage points, from 42% to 31%. There is heterogeneity across pharmacy chains, but on average the private pharmacy chains are nearly as likely as the remaining government-owned pharmacies to sell parallel imports. The results support the conclusion of Brekke et al.'s (2010) that pharmacies have indeed an important role in determining which products that are sold.

The largest part of the reduction in the market share of parallel imports is achieved due to that pharmacies after the reform are less likely to offer consumers cheaper parallel imported alternatives. There are also no indications that pharmacy personnel have persuaded consumers not to buy those products, for example, by expressing doubts about the quality of parallel imports. However, a part of the reform effect is explained by that consumers have become more likely to buy locally sourced products despite that they are prescribed parallel imported products and that such products are available at the pharmacy. This indicates that the reform has increased the probability that pharmacies inform consumers about their right to buy other substitutes than the prescribed product or the cheapest available substitute.

This paper relates to many studies on determinants of choices between medically equivalent pharmaceuticals, even though these studies have focused on the choice between brand-name and generics and primarily analyzed the role of physicians. Hellerstein (1998) analyzed physicians' choices between branded and generic products for off-patent pharmaceuticals and

[2]The results in Granlund and Rudholm (2012) as well as in the present paper indicate that many consumers prefer to buy the product written on prescription. One-fourths of prescriptions analyzed in this study were for parallel imported products, and it is therefore reasonable to assume that some consumers prefer to buy parallel imported products. That some physicians prescribe parallel imported products is likely explained by the fact that locally sourced and parallel imported versions are listed separately by the computer system physicians use to write prescriptions. Some physicians say that they just choose the first product on the list of medically equivalent products.

found that physicians are important agents in the choice between branded and generic products. Coscelli (2000) used information about doctor and patient characteristics, as well as information about when and how patients switch physicians, to estimate the probability of a switch of pharmaceutical brands. Her results show that there is persistence in the use of pharmaceuticals for both patients and physicians.

Using survey data on 3000 prescriptions from pharmacies in a Midwestern state, Mott and Cline (2002) found that pharmacy random effects accounted for 43% of the variation in the occurrence of generic substitution. This might, like the results of Brekke et al. (2010), indicate that pharmacies have an important role in determining whether a cheaper alternative is dispensed, but the random effects might also capture local variations in attitudes towards generics. Another result of Mott and Cline (2002) is that the probability of generic substitution was increasing in the number of years generic products of the drug had been available, which is consistent with the results of Ching (2010), who estimated how aggregated learning affects diffusion rates.

Leibowitz, Manning and Newhouse (1985) and Hellerstein (1998) found that the choice between prescribing brand-name or generic pharmaceuticals was not a function of the insurance plan. On the other hand, Lundin (2000) found that patients with low copayment rates were more likely to receive brand-name pharmaceuticals. Mott and Cline (2002) found that insured patients were more likely to receive prescription that did not allow generic drug use, and Granlund (2009) got the same result for patients with low copayment rates. There is also a literature focusing on the incentives for pharmaceutical firms that showed that reference pricing and substitution reforms have reduced pharmaceutical prices, costs and brand-name market shares (see, e.g., Pavcnic, 2002, Brekke et al., 2011, Granlund and Rudholm, 2011).

The theoretical literature regarding parallel trade includes Pecorino (2002), Ganslandt and Maskus (2004), Maskus and Chen (2004), Jelovac and Bordoy (2005), and Chen and Maskus (2005), which show, among other things, that parallel imports should create price competition and cause prices to fall in the destination country. This is supported empirically by Ganslandt and Maskus (2004) and Granlund and Köksal (2011), whose instrumental variable results show that competition from parallel imports reduced prices on locally sourced drugs by 12-19% and 15-17%, respectively. Using OLS, which do not account for the potential endogeneity in the entry decisions of parallel traders, Ganslandt and Maskus (2004), Kyle (2011), and Granlund and Köksal (2011) report smaller but still statistically significant price effects. Kyle (2011) also found results consistent with pharmaceutical firms adjusting their product portfolios to reduce parallel trade. On the other hand, Kanavos and Costa-Font (2005) estimated the effect of the market share of parallel imports on price competition and found no statistically significant effect.

The following section presents the theoretical model. Section three describes institutional characteristics of the Swedish pharmaceutical market with special focus on the pharmacy reform, and section four describes the data. The empirical analyses, including hypotheses to be tested, specifications and results, are presented in section five. Finally, section six concludes the paper.

2. Theoretical model

This section analyzes pharmacies' marginal purchase prices and the market shares for locally sourced and parallel imported products when pharmacies can negotiate on prices and quantities.[3]

Assume that there is one source (low-price, exporting) country where parallel imports are bought and one destination (high-price, importing) country where parallel imports are sold. In the destination country, there is one pharmacy selling one drug for which there is one locally sourced product and one parallel imported product. There is a continuum of consumers normalized to unity, each consumer buying one package of the drug, which implies that the total demand is also normalized to unity. In the destination country, there is also a common maximum retail price normalized to 1 for both products and that this is binding at least for the locally sourced product.

The competition is imperfect, which imply that the prices charged are decision variables for the producer and the parallel trader. Let p_s be the price the producer charges from the wholesaler in the source country. The producer's profit will increase if the pharmacy sells more locally sourced products instead of parallel imports as long as the producer's revenue on the marginal unit exceeds p_s. At the margin, the producer is, therefore, prepared to sell at p_s. To see this, let q_s denote the demand in the source country, q_{ls} the demand for locally sourced products in the destination country, R the producers' revenues from q_{ls}, and mp the marginal price on locally sourced drugs in the destination country. The producer's profit function can then be written

$$\pi = p_s[q_s(p_s) + 1 - q_{ls}(p_s, mp)] + R(p_s, mp). \quad (1)$$

Here, $R = \int_0^{q_{ls}(p_s,mp)} P(i)di$ is the area under the demand curve for locally sourced drugs. The first-order condition with respect to mp becomes

$$\frac{\partial \pi}{\partial mp} = \left(-p_s + \frac{\partial R}{\partial q_{ls}}\right)\frac{\partial q_{ls}}{\partial mp} = 0. \quad (2)$$

Assuming $\frac{\partial q_{ls}}{\partial mp} \neq 0$, this only holds if $\frac{\partial R}{\partial q_{ls}} = p_s$. Note that the marginal revenue in the destination country equals what the producer charges for the last package since the producer can condition discounts on quantity; thus $\frac{\partial R}{\partial q_{ls}} = mp = p_s$. For an analysis of the price setting

[3] Note that this situation is fundamentally different as compared to one where the negotiation is only about an official list price. Sellers of locally sourced drugs are less likely to reduce their official price in a country than to give discounts since a lower official price implies: 1) lower revenues from the quantity they anyway would have sold in that country, 2) lower revenues from other countries where the official price from the country in question is used as an external reference price, and 3) lower revenues from countries which could become recipients of parallel imports from the country in question. Depending on the rules in the country, it might also be more difficult to increase an official price than to reduce a discount, which is a fourth argument in favor of giving a discount instead of lowering the official price.

in the source country, see, e.g., Jelovac and Bordoy (2005). For the purpose of this paper, it is sufficient to assume that p_s is low enough for parallel trade to take place.

Let $r>0$ denote the sum of: the extra transportation cost per package that occurs when the drug instead of being directly shipped to the destination country first is shipped to the source country; the unit repacking cost; and the margin of the wholesaler in the source country. The lowest price at which a parallel trader can sell the drug to the pharmacy in the destination country without making losses is then p_s+r. Whether r remains constant or increase with the demand for parallel imports does not affect the qualitative result of this analyses.

Since the producer, at the margin, is prepared to sell at p_s while the parallel trader charges p_s+r, the pharmacy will never want to promote parallel imports. Therefore, the pharmacy will not sell the parallel import at a lower price than the maximum price. Thus, the prices of the parallel imported product will equal that of the locally sourced product.

In a simple case where all consumers consider the locally sourced and the parallel import product to be perfect substitutes, pharmacies would just buy the product that is cheaper, which implies that the market share for the parallel import would be zero. In this case, the pharmacies and the producer would agree on a purchase price between p_s and p_s+r depending on their negotiation powers.

2.1 Heterogeneous preferences

Consumers do, however, have heterogeneous preferences. This can be caused by, for example, state dependence (see, e.g., Coscelli, 2000, Dubé et al., 2010) or by that many consumers prefer to get exactly the product written on the prescription (Granlund and Rudholm, 2012).

Let us assume that the share of consumers buying the parallel imported product (m) depends on the effort (e) employed by the pharmacy, measured in monetary terms, to convince consumers to buy the locally sourced product and assume that $m'(e)<0$ and that $m''(e)>0$. Let $C_{ls}(1\text{-}m(e))$ and $C_{pi}(m(e))$ be functions describing how pharmacies' total purchase cost for locally sourced and parallel imported products depend on m. Then, the profit function of the pharmacy can be written as

$$\Omega = 1 - C_{ls}\,(1 - m(e)) - C_{pi}\,(m(e)) - e. \tag{3}$$

The pharmacy will choose e to maximize profits. Considering that the marginal prices offered by the producer and the parallel importer are p_s and p_s+r, the Kuhn-Tucker conditions become

$$\frac{\partial \Omega}{\partial e} = -r\frac{\partial m}{\partial e} - 1 \leq 0; \tag{4}$$

$$e\left(r\frac{\partial m}{\partial e} + 1\right) = 0. \tag{5}$$

Thus, the pharmacy will choose e so that $m'(e) = -1/r$ or choose e = 0 if $m'(e) \geq -1/r$ (i.e. $|m'(e)| \leq 1/r$) already when $e = 0$. If the solution is interior, it implies that the locally sourced product will not only be sold to thus who without persuasion preferred that product or was indifferent between the two products, but that it will also be sold to some of the consumers that preferred the parallel imported product before coming to the pharmacy. Since $m''(e)>0$, the Kuhn-Tucker conditions also reveal that, for interior solutions, the effort and hence the market share of locally sourced products is increasing in r. That is, the larger the cost advantage of the locally sourced product, and hence the larger the difference in marginal prices offered to the pharmacy, the smaller will be the market share for the parallel imported products.

It is quite reasonable that some consumers are easily persuaded by the pharmacy personnel to buy a certain product. On the other hand, some consumers have strong preference for a given product. In the data used in this paper, 11% of the consumers paying extra to get the product they preferred paid more than SEK 50 extra (approximately 6 Euros). Thus, it might seem reasonable to assume that $m'(e)$ is initially negative enough so that the optimal e is positive, and that $m''(e)$ is sufficiently positive so that the market share for the parallel imported product does not become zero. Pharmacies might, however, have other instruments at its disposal that are less costly than persuasion. One obvious candidate is raising the generalized price for the parallel imported product.

2.2 Raising the generalized price of parallel imports

The generalized price also includes the costs of consumers' traveling and waiting. The pharmacy can raise the generalized price for the parallel imported product by simply not keeping it in stock and telling consumers that if they insists of getting that product they have to come back to the pharmacy when the pharmacy have ordered and received that product.

When the total demand facing the pharmacy is exogenously given, as it is in this model, the cost of raising the generalized price for the parallel imported product is zero. Let us, however, assume that there is a limit for how much the generalized price can be raised. Such a limit might be caused by rules requiring the pharmacy to be able to dispense the product a consumer prefers within a few days. For example, the Swedish rules require that pharmacies should deliver prescribed pharmaceuticals they do not have in stock within 24 days unless special circumstance motivates longer time (Ministry of Health and Social Affairs, 2009c).

The pharmacy will clearly raise the generalized price of parallel imports as much as possible, since this is costless. The increase in generalized price do not affect the way the Kuhn-Tucker conditions for e are written, but it will affect the value of $m'(e)$ when $e = 0$ since the effort is directed towards another part of the population. Consumers who without persuasion are prepared to pay a higher generalized price (for example, to come back to the pharmacy the next day) is perhaps less easily persuaded to buy the locally sourced product. That is, although adding the additional instrument will not alter the form of the Kuhn-Tucker conditions, it might reduce the absolute value of $m'(e)$ so much that the optimum becomes a corner solution with $e = 0$.

To sum up, the model shows that the marginal purchase price will be lower for the locally sourced product than for the parallel imported one. This implies that pharmacies will sell the locally sourced product to all that initially preferred that product or were indifferent between the two products, as well as to some of the consumers that initially preferred the parallel imported product. When total demand facing the pharmacy is inelastic, the pharmacy will increase the market share of the locally sourced product by increasing the generalized price of parallel imports. It is, however, not clear that the parameter values in reality are such that pharmacies in addition will devote efforts to persuading consumers to buy locally sourced products.

This model can also help us understand other markets where parallel importing is important. It does not, however, inform about pharmacies' incentives on off-patent pharmaceutical market since we do not know the relationship between brand-name firms' and generic firms' marginal costs.

3. Institutional setting

All Swedish residents are covered by a mandatory and uniform pharmaceutical benefit scheme where the co-payment rate is a decreasing function of pharmaceutical cost and reaches zero when the costs exceed SEK 4300 during a 12-month period. In the data used for this study, consumers paid 17% of the total costs, and in 38% of the observations the consumers paid nothing.

Since October 2002, substitution of exchangeable products has been mandatory. Unless the physician prohibits substitution for medical reasons[4], pharmacy personnel are required to inform consumers if substitute products are available, and that the cheapest available substitute product will be provided within the Swedish pharmaceutical benefits scheme. If consumers oppose substitution or choose to switch to another substitute than the cheapest available, the entire extra cost will be charged to them.[5] The Swedish Medical Products Agency defines a product as a substitute if it has the same active substance, strength, and form (e.g. pills or oral fluid) as the prescribed product and if its package sizes can approximately sum up to the prescribed quantity. For parallel imports, available substitutes are defined as

[4] If the physician prohibits the substitution, the consumer is still reimbursed based on the full price of the more expensive prescribed product. Physicians only prohibited substitution for 1.35% of the prescription in this dataset. The national average during October 2002 to December 2003 was 3% (National Corporation of Swedish Pharmacies et al., 2004).

[5] After July 1, 2009, consumers who switch to substitute products other than the cheapest available and the prescribed one should, according to the rules, pay the full price of that product (Ministry of Health and Social Affairs, 2009b). At least for on-patent drugs, this rule is not followed. In the dataset used for this paper, consumers who were prescribed parallel imported products chose to buy locally sourced products in, at least, 1630 cases during 2010 and 2011 despite that cheaper alternatives were available. However, only one of these consumers had to pay the full cost of the product without it being included in the pharmaceutical benefit scheme as the rules stipulate.

those in stock at the pharmacy in question (Dental and Pharmaceutical Benefits Agency, 2009).[6]

Pharmaceutical producers and parallel traders are free to set their own prices, but in order to be included in the pharmaceutical benefits scheme, the price must be approved by the Dental and Pharmaceutical Benefits Agency–Tandvårds och Läkemedelsförmånsnämnden (TLV). TLV is reluctant to allow price increases, unless the requested price does not exceed the price of the most expensive substitute product. In the latter case, the price increase is always approved, implying that parallel imports always are allowed as high price as locally sourced products (Pharmaceutical Benefits Agency, 2003, 2006).[7]

For pharmaceuticals within the pharmaceutical benefits scheme, TLV determines both maximum pharmacy purchase prices and retail prices, and hence the pharmacies' guaranteed margins. During the study period, the guaranteed margins were continuously increasing in the pharmacy purchase price.[8] Pricing of both products outside the benefit scheme and merchandises is unrestricted (Pharmacy Restructuring Corporation, 2009).

3.1 The pharmacy reform

Until February 2010, all prescription pharmaceuticals in Sweden were sold through a nationwide government-owned monopoly, Apoteket AB, which at all times charged a nationwide uniform price for each pharmaceutical product.

On 29 April 2009, the Swedish parliament voted in favor of a new law allowing private pharmacies to be opened in Sweden from July 1, 2009 (Ministry of Health and Social Affairs, 2009a). They also decided to sell around half of Apoteket AB's pharmacies. Of about 500 pharmacies remaining, up to 200 should be reserved for sale to small businesses by transferring them to a government-controlled company, Apoteksgruppen.

Since July 1, 2009, pharmacies are also allowed to buy pharmaceuticals without generic substitutes at lower prices than those determined by TLV, if they can negotiate a discount with the sellers (Ministry of Health and Social Affairs, 2009b). The government stated in the bill (Ministry of Health and Social Affairs, 2008) that the purpose was to achieve cheaper parallel import and to increase the quantity of parallel imports. They expected that pharmacy chains would get discount on parallel imports but not on locally sourced products. It is not

[6] The effects of substitution reforms on prices and costs have been studied by Andersson et al. (2005), Granlund (2010), Granlund and Rudholm (2011), and Granlund and Köksal (2011). Andersson et al. (2005) found that the actual saving for six indicator drugs was 60% of the potential saving and that it was largely dependent on the extent to which the pharmacies kept the cheapest product in stock. Granlund (2010) and Granlund and Rudholm (2011) estimated that the substitution reform increased the effect of generic competition and reduced average unweighted prices by 4%, and average weighted prices by 10%. The results from Granlund and Köksal (2011) indicate that the substitution reform increased the effect of competition from parallel imports only by 0.9 percentage points.

[7] The Dental and Pharmaceutical Benefits Agency (TLV) replaced the Pharmaceutical Benefits Agency (LFN) in July, 2008, when a dental care reform went into effect.

[8] For patent-protected pharmaceuticals, the maximum retail price in SEK (RP) depended on the maximum purchase prices in SEK (PP) according to the formula: $RP = PP*1.20+31.24$ if $PP \leq 75$, $RP = PP*1.03+44.00$ if $75 < PP \leq 300$, $RP = PP*1.02+47.00$ if $300 < PP \leq 6000$, $RP = PP+167.00$ if $PP > 6000$.

entirely clear why the government did not expect discounts on locally sourced products, but the government argues that the producers' strong negotiation positions would reduce the probability of them giving discounts. This would be true if producers lack interest to give pharmacies incentives to sell locally sourced drugs, but the government was informed by the Swedish Competition Authority and others that the producers might have such incentives (Ministry of Health and Social Affairs, 2008).

The government did not want to allow pharmacies to negotiate prices of pharmaceuticals with generic substitutes because this would jeopardize the price pressure achieved by the substitution reform (Ministry of Health and Social Affairs, 2008). Pharmacies are also allowed to sell parallel imported pharmaceuticals without generic substitutes at lower prices than the retail prices determined by TLV, and the government expected that this possibility would be used (Ministry of Health and Social Affairs, 2008).The overall purpose of the pharmacy reform was to: improve the availability of pharmaceuticals (by increasing the number of pharmacies and prolonging opening hours), improve service to customers, improve supply of services, and to achieve lower pharmaceutical costs (The Committee on Health and Welfare, 2009).

In November 2009, it was declared that 208 of Apoteket AB's pharmacies would be sold to Apotek Hjärtat, 171 to Kronans Droghandel, 62 to Medstop Apotek, and 24 to Vårdapoteket. On 17 January 2010, the first new pharmacy company started running a pharmacy, which was a pharmacy bought from Apoteket AB, and in December 2010, 23 companies had received approval from the Medical Products Agency to run pharmacies. DocMorris was, with is 47 pharmacies in December 2010, the largest pharmacy company that had not acquired previously stated-owned pharmacies (Swedish Competition Authority, 2010).

During the study period, six chains operated pharmacies in the county of Västerbotten. Apoteket AB had over 40 pharmacies before the sellout and 11-12 pharmacies after, and the affiliated government-owned chain Apoteket Farmaci AB operated two hospital pharmacies after the reform. Apotek Hjärtat and Kronans Droghandel took over their pharmacies in February 2010. Apotek Hjärtat, owned by the risk capital fund Altor Fund III, has 11 pharmacies in Västerbotten. Kronans Droghandel, owned to 80% by Oriola-KD (which also owns the wholesaler KD Pharma[9]), has 18 pharmacies in Västerbotten. DocMorris, owned by Celesio, opened its only pharmacy in Västerbotten in October 2010. Two pharmacies were during a period owned by the chain Apoteksgruppen but were taken over by private owners in October 2010 (the one located in Malå, see Map A1 and Table A1 in Appendix A) and March 2011 (the one located in Norsjö). In addition, Bramsäter Medicalshop AB opened one pharmacy in May 2011.

The county of Västerbotten (population 259,286; December 31, 2010) consists of fifteen municipalities. The largest cities are Umeå (population 79,594), Skellefteå (population 32,775), and Lycksele (population 8,513). Besides Umeå and Skellefteå, the county is

[9] In Sweden, there are two dominating wholesale traders: Tamro AB and KD Pharma (Swedish Competition Authority, 2010).

sparsely populated with a population density of less than 5 residents per square kilometer. In Umeå and Skellefteå, there have been several competing pharmacy chains since the beginning of the reform. When DocMorris opened its pharmacy in October 2010, Lycksele got its second pharmacy chain, but in the other 12 municipalities only one pharmacy chain was present.

4. Data and descriptive statistics

The prescription dataset used in this study was provided by the county council of Västerbotten. It contains all prescriptions sold in Sweden to residents of the county, from January 2007 through December 2011. Similar datasets covering 2000-2006 were used to identify the first month parallel imported version of a drug was sold to the residents of Västerbotten. The datasets were merged with datasets from IMS Health containing indicators for parallel imported and generic drugs, patent expiration dates, national sales figures, and names of firms that sold each product to wholesalers in Sweden.

Prescriptions of pharmaceuticals packed in patient-doses were excluded since patients were not asked if they opposed substitution in these cases and since Apoteket AB retained a monopoly in this market after the reform. Non-pharmaceutical prescriptions were excluded from the analyses as well as prescriptions for vitamins, minerals, orphan drugs and drugs that were not approved for the Swedish market and only could be sold to patients for whom the Swedish Medical Products Agency had granted an exception. Also prescriptions for drugs not included in the pharmaceutical benefit scheme were excluded since the price setting for these drugs is unrestricted.

As stated above, the price regulations differ depending upon if the pharmaceuticals are exchangeable towards generics. Therefore, the study excluded products if a generic with the same active ingredient was sold the current month or earlier in Sweden or if the patent had expired according to data from IMS Health.[10] This implies that, besides excluding drugs with direct generic competition, drugs with potential generic competition and drugs that are close, but not perfect, substitutes with generic products were also excluded. With these exclusion criteria, I avoid having to control for changes in demand and prices that can occur due to potential direct or indirect generic competition.[11]

The observations where the prescriber has opposed substitution were also excluded, since pharmacies and consumers in these cases could not choose which product that was dispensed. This reduced the population size by 1-2% each month after which nearly two million prescriptions remain. These prescriptions were for over a 1000 different drugs where a drug is defined as a unique active substance-strength-form combination. Thus, there can be different

[10]For the last six months of the study period, I lacked access to national figures on generic sales and instead excluded all observations with the same active substance as any drug that has lost its patent protection.
[11] If generic products of drug *j*, with the same active ingredient but different strength and/or form than drug *i*, became available, drug *i* likely loses a part of price-sensitive consumers, which might negatively affect the market share for parallel imported products of drug *i*. To estimate this effect is beyond the scope of this paper.

package sizes of a drug. For many of the drugs with relatively less sales, no parallel imported product was sold during the study period. The study used fixed drug-specific effects in the analyses. This leaves us with 675,648 prescriptions for 218 different drugs.

Table 1 presents descriptive statistics for the entire population as well as separately for prescriptions of locally sourced products (LS) and prescriptions of parallel imported products (PI). Observations are weighted using the average of the product prices as weight. For the dummy variables, the percentage belonging to each category is presented, and for continuous variables, means and standard deviations are presented as well as minimum and maximum values for the entire population.

Table 1. Descriptive statistics

Variable	Population	LS is prescribed	PI is prescribed	Min	Max
PI	36.92	23.88	78.40		
Reform	42.96	42.74	43.61		
March2010	29.83	28.99	32.34		
Euro	9.65±0.61	9.66±0.62	9.61±0.50	8.79	11.17
Time	832.26±509.67	826.28±505.57	848.72±521.24	1	1826
PI_presc	24.00	0	1		
NotMD	0.25	0.18	0.46		
Child	1.56	1.53	1.66		
Age	58.54±18.26	58.94±17.85	56.80±19.33	0	106
Women	52.97	52.87	53.14		
CMonth	6.42±3.46	6.40±3.46	6.48±3.48	1	12
Demand LS	3.64	4.47	1.19		
*Choice**	38.08	26.38	75.14		
*Demand LS if Choice**	9.68	16.96	1.58		
Nmpi_drug	38.41±27.80	33.20±27.76	53.70±21.40	0	72
ln*Nmpi_drug*	2.98±1.57	2.69±1.66	3.81±0.76	0	4.28
Nmpi_drug_tr	24.58	19.57	39.18		
Nmpi_subs	55.53±34.91	50.97±35.71	69.08±28.59	0	131
ln*Nmpi_subs*	3.48±1.46	3.27±1.59	4.09±0.66	0	4.88
Nmpi_subs_tr	0.11	00.09	0.16		

Note: *The number of observations is 675,648 for the entire population except that there are 662,684 observations for *Choice* and *PI_presc*, and 266,657observations for *Demand LS if Choice*. There are 489,109 observations when locally sourced drugs are prescribed, except for 146,952 for *Demand LS if Choice*, while the corresponding figures when parallel imported products are prescribed are 173,575 and 119,705.

The variable *PI* takes the value 1 in the 37% of the observations when a parallel imported product was dispensed. When a parallel import is prescribed, such products are dispensed in 78% of the observations, which indicates that the prescribers' choice among medically equivalent products might be important despite that pharmacies should suggest substitution if cheaper alternatives are available. *Reform* takes the value 1 from July 2009 when discounts were allowed, and *March2010* takes the value 1 from March 2010 when the new pharmacy

chains had taken control over previously government-owned pharmacies. *Euro* is the monthly average of number of SEK required to buy 1 Euro, and *Time* is the number of days from the start of the study period.

PI_presc takes the value 1 in 24% of the observations when a parallel imported product was prescribed. Information on *PI_presc* is missing for about 13,000 prescriptions when the prescribed product was one that is not sold in Sweden during the years 1992-2011 that the IMS datasets cover. *NotMD* equals 1 in the few cases when the prescription was written by someone other than a medical doctor (e.g., a dentist or a nurse). *Child* indicates that the prescription was for a patient 15 years or younger. Table 1 further shows that the mean age of patients was 59 years, and that 53% were women. *CMonth* indicates in which of the 12 calendar months the prescription was dispensed.

Demand LS equals 1 if the consumer paid extra to get a locally sourced drug instead of a parallel imported product that is cheaper. Table 1 reveals that this is more common when locally sourced products are prescribed. When parallel imported products are prescribed, pharmacies are not required to inform consumers that they can get the locally sourced product if they pay the price difference, but still *Demand LS* equals 1 for 1% of the prescriptions of parallel imported products.

Choice is a dummy variable that takes the value 1 if the consumer has an opportunity to buy a parallel imported product that is cheaper than the locally sourced one. We see that consumers had this opportunity for 75% of the prescriptions for parallel imports but only for 26% of the prescriptions for locally sourced products. This variable was created using *PI_presc* and a variable that equals 1 if the consumer paid extra to get some other product than the cheapest available. Also, price information was used to code *Choice* as 0 in 6% of the cases when a sold parallel imported product was as expensive as or more expensive than the locally sourced product. In nearly 20% of the observations where a parallel imported product was sold, the relative price is unknown. For these observations, *Choice* is coded as 1, but in some robustness analyses, these observations are instead excluded. *Demand LS if Choice* reveals that 17% of the consumers who were prescribed a locally sourced product and had a choice paid extra to get the locally sourced product instead of a cheaper parallel imported alternative. Consumers who were prescribed parallel imported products paid extra to get a locally sourced product in less than 2% of the cases when they had a choice.

Nmpi_drug is defined as the number of months since a parallel imported product of the drug was first sold to a resident of Västerbotten. It is truncated at 72 due to lack of access to variables that identify drugs before January 2000. If a parallel imported product is not sold before the current month, *Nmpi_drug* is 0 and so is ln*Nmpi_drug*, which otherwise is defined as the natural logarithm on *Nmpi_drug*. *Nmpi_drug_tr* indicates that these two variables are truncated. *NMpi_subs*, ln*NMpi _subs* and *NMpi_subs_tr* are defined correspondingly as measures of the number of months since a parallel imported product of a given substance was sold in Sweden, but *NMpi_subs* and ln*NMpi _subs* are truncated at 131. Table 1 shows that all these six variables have higher means for prescriptions of parallel imports than for prescriptions of locally sourced products, which indicates that physicians are more likely to

prescribe parallel imported products that have been available for a long time.

For five key variables, the development over time is illustrated in Figure 1. To fit on the same scale, Euro is here divided with 20. Figure 1 reveals a clear positive trend in the share of consumers opposing to substitute prescribed locally sourced drugs for parallel imports. *Choice* and *PI* move closely together, suggesting that being offered a cheaper parallel imported alternative strongly affects the probability that a parallel imported product is bought. We also see that the Swedish currency was unusually weak relative to the Euro in 2009 (months 25-36), and at least for part of that year there was a drop in *Choice*, *PI*, and *Pi_presc*. Around the time of the reform, *PI* started to increase, but since the Euro started to decrease around the same time this reveals little about the reform effect.

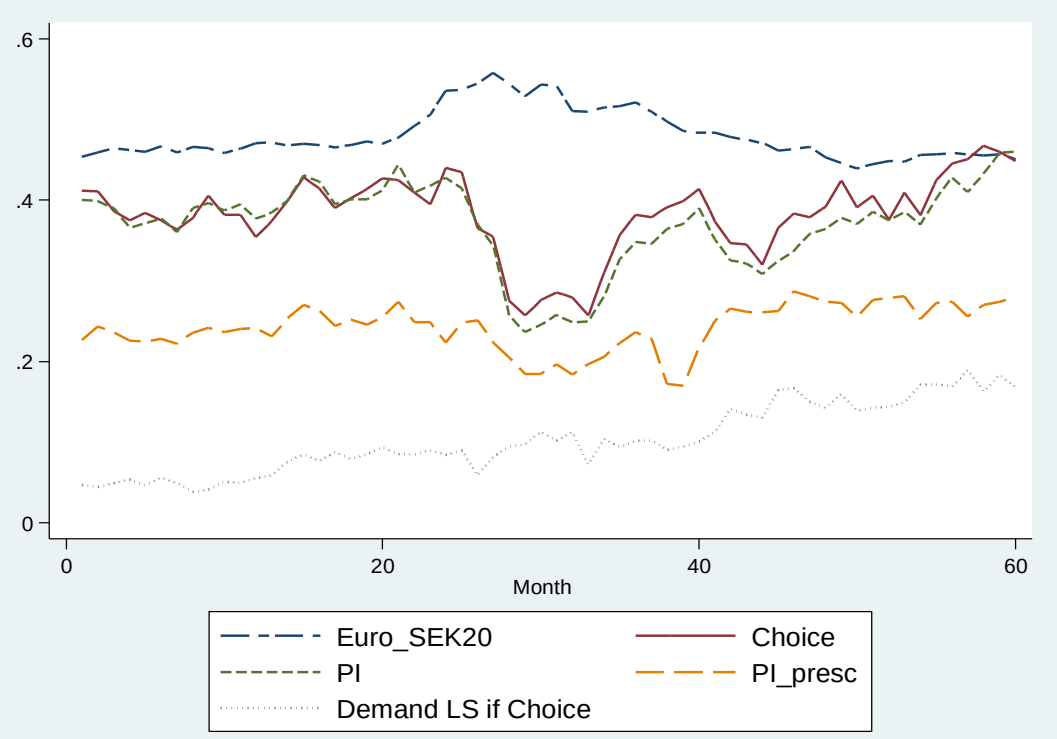

Figure 1. Key variables

Table 2 presents the weighted percentage of observations dispensed in March 2010 or later belonging to 10 different pharmacy categories: three single pharmacies (Malå private, Norsjö private and Bramsäter Medicalshop AB), six pharmacy chains, and one group (Other) including single pharmacies and pharmacy chains outside the county. We see that the three pharmacy chains, Apoteket AB (government owned), Kronans Droghandel and Apotek Hjärtat, together had a market share of 96%.

Figure 2 shows that drugs that were parallel imported 1 month on average (unweighted) were parallel imported by 1.9 firms. The total number of parallel traders ranged from 12 to 22 per month, but many of the parallel traders did only import a few packages to the Västerbotten population. If one excludes firms importing less than 25 packages each month, the remaining parallel traders are between 5 and 11 per month, with an average of 8.3 before July 2009 and

7.2 after, which is a statistically significant decline. If one includes the small parallel traders, the number has increased during the study period and is significantly larger after the reform.

Table 2. Average post-reform market shares

Apoteket AB	34.17
Apoteksgruppen	1.31
Apoteket Farmaci AB	0.50
Bramsäter Medicalshop AB	0.34
DocMorris	0.60
Kronans Droghandel	37.59
Malå private	0.54
Norsjö private	0.51
Apotek Hjärtat	24.12
Others	0.32

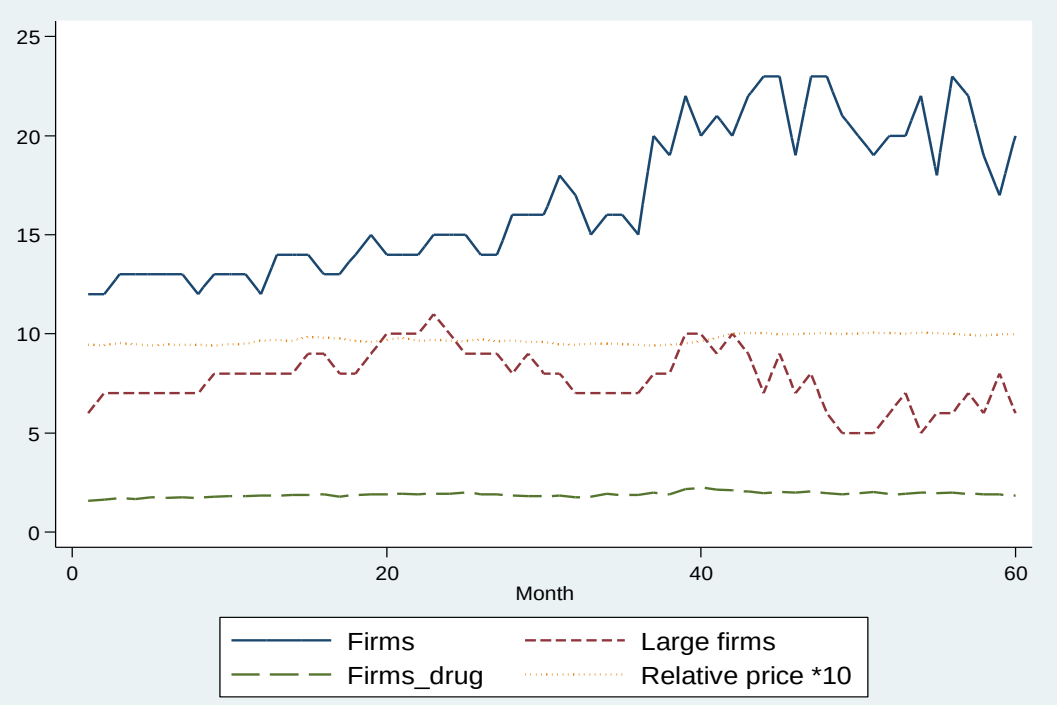

Figure 2. Number of parallel traders and relative price of parallel imports

Figure 2 also includes the average (unweighted) relative price of parallel imports relative to the corresponding locally sourced products. It is multiplied by 10 to make it easier to see changes. The relative price was only calculated for 73% of the observations where a parallel imported product was dispensed since locally sourced product with the exact same package sizes was not sold for the other observations. The average relative price was 96% before July 2009 and 98% after, which is a statistically significant increase. That the relative price is not 100% after the reform can be explained by that it can be in the parallel traders' incentive to have lower prices and since it is the parallel traders, not the pharmacies, who suggest the maximum prices to TLV.

The dataset indicates that some consumers have been charged the wrong amount for their prescriptions. For locally sourced drugs, this is the case in about 0.05% of prescriptions on average, but it is unevenly distributed across drugs.[12] This likely has a negligible effect on the average relative prices, but it means that the highest price observed during a price-period cannot be used to study if parallel imports after July 2009 were sold at discounted prices to consumers. For example, if one parallel imported package was sold at the price of the locally sourced product and this price was even slightly higher, all other packages of the parallel imported product would deem to be sold at discounts. If instead we count the number of cases where the price was below the 75th percentile of prices for the current price-period, we find that this was only the case in 0.65% of prescriptions where parallel imports were sold and no important differences in this respect were found across pharmacy chains or across municipalities.[13] This indicates that pharmacies in Västerbotten only seldom used the right to sell parallel imports at lower prices than the maximum price. Dental and Pharmaceutical Benefit Agency (2012) stated that pharmacies never used the right to sell parallel imports at lower prices and explained this with that consumers are not that price-sensitive because of the pharmaceutical benefit scheme.

5. Empirical analyses: hypotheses, specifications and results

5.1 The market share for parallel imports

The theoretical model predicts that pharmacies after the reform will have lower marginal purchase prices for locally sourced drugs, and therefore have higher marginal margins on locally sourced drugs, since these are not sold at lower prices than parallel imported products. Before July 2009, the pharmacies' margins were nearly the same for locally sourced and parallel imports.[14] Therefore, in accordance with the theoretical model, the main hypothesis is that the market share for parallel imports has been reduced by the reform.

This hypothesis is tested by estimating how the reform has affected the probability that a consumer buys a parallel imported product. The reform can have affected the probability that a pharmacy has a parallel imported product in stock and/or the probability that a consumer chooses to by that product if it is in stock. The mechanisms are analyzed later, but to test the main hypothesis, the total reform effect, irrespective of its mechanism, is first estimated.

The baseline specification (specification 1) used to test the main hypothesis is

[12]For parallel imports, I cannot identify these cases since after the reform it was allowed to sell parallel imports at different prices and since the data before 2010 do not make it possible to distinguish between packages of the same drug (substance, form and strength) and size imported by the same parallel trader but imported from different counties and thus possibly sold at different prices.

[13]Five percent of parallel imports were sold at lower prices than highest price of the product for the price--period. The corresponding figure for locally sourced products, which are not allowed to be sold with discount to consumers, is 1%, which indicates that the highest prices cannot be used.

[14] Before July 2009, the price of locally sourced products was on average 4% higher than the price of the exchangeable parallel imports. The higher price led to that pharmacies' margins, on average, were 1%, or SEK 0.75 (approximately Euro 0.08), higher on locally sourced drugs. The margins on locally sourced drugs were more than 5% higher in only 5% of the observations.

$$\Pr(PI_i = 1) = F\Bigg(\beta_1 Reform_i + \beta_2 Euro_i + \beta_3 Time_i + \beta_4 PI\_presc_i + \beta_5 NotMD_i + \beta_6 \ln Nmpi\_drug_i + \beta_7 Nmpi\_drug\_tr_i + \beta_8 \ln Nmpi\_subs_i + \beta_9 Nmpi\_subs\_tr_i + \beta_{10} Child_i + \beta_{11} Age_i + \beta_{12} Age_i^2 + \beta_{13} Women_i + \sum_{c=2}^{10} \gamma_p \, Chain_{pi} + \sum_{m=2}^{12} \theta_m \, CMonth_{mi} + \sum_{r=2}^{15} \rho_r \, Mun_{ri} + \sum_{d=2}^{218} \alpha_d \, Drug_{di} + \varepsilon_i\Bigg), \quad (6)$$

where *Chain* indicates the pharmacy category and *Mun* is the municipality of residence of the consumer. In all specifications, unless otherwise noted, prescriptions dispensed during the reform period, July 1, 2009, to February 28, 2010, were excluded, and the estimations were conducted using a maximum-likelihood logit estimator where the error terms (ε_i) were allowed to be heteroskedastic and correlated within months.

I control for the Euro exchange rate since many parallel importers have a large part of their transportation and repacking costs in Euros and since possible margins of wholesalers in source countries in most cases are in Euros.[15] When *Euro* takes a high value (i.e. the Swedish currency is weak), parallel traders' expenses measured in Swedish Kronas will increase, and they will find it less profitable to import to Sweden. A negative effect of Euro is, therefore, expected. Note that according to the theoretical model, the Euro is not expected to affect the market share for parallel imports by affecting the price that the wholesaler in the source country pays, measured in Swedish Kronas. The reason is that this price should have the same effect on the marginal prices offered by producers and parallel traders.

Time controls for a linear time trend in the probability that a parallel imported product is dispensed. I control for if a parallel imported product is prescribed (*PI_presc*) since some consumers prefer to get exactly what is prescribed. *NotMD* is included since the consumers' attitude towards substitution might depend on perceptions about the prescriber's ability to evaluate different pharmaceutical treatments.

The variables ln*Nmpi_drug*, *Nmpi_drug_tr*, ln*Nmpi_subs*, and *Nmpi_subs_tr* are included since the results of Mott and Cline (2002) and Ching (2010) indicate that the time a product has been available has a positive effect on the probability that it is bought. Note that since the

[15]A large part of the transportation cost is assumed to be in Euros since important source countries like Italy, Greece and Spain all use Euros and since transportation between many of the source countries and Sweden likely goes through countries that either have adopted the Euro or have fixed their exchange rates to the Euro. The majority of parallel imported pharmaceuticals sold in Västerbotten were repacked in Denmark that has fixed their exchange rate to the Euro. Other important repacking countries are Poland and Great Britain, but the exchange rates against the Zloty and Pound sterling had no significant effect and had only minor effect on the results and were, therefore, omitted.

natural logarithm of 1 is 0, none of these variables changes value the first time a parallel import is bought, which means that there is no risk of within-observation endogeneity.[16]

Controlling for the four variables describing the consumer's age and gender likely does not affect the estimates for the total reform effect so much since these variables are relatively stable over the study period. Instead, the main reason for including these variables is to control for differences in consumer mix across pharmacy categories. Indicators for the pharmacy categories are included to study differences between the private pharmacies and the control group that is the government-owned Apoteket AB. Since Apoteket AB was the only pharmacy chain before the reform, the effects of other pharmacy categories are considered to be part of the total reform effect.

I control for the calendar month the prescription was dispensed because the first six calendar months are overrepresented before the reform (because the rules were changed in July and not in January). Municipality dummies are controlled for to avoid that time-invariant differences between the municipalities affect the estimates for pharmacy dummies. This could otherwise be a problem since, for example, after March 2010 Apoteket AB runs only one pharmacy in a rural municipality but has several pharmacies in the two urban municipalities.

The drug-specific fixed effects control for time-invariant differences between the drugs. This includes difference in the severity of the conditions the drug is prescribed against, which might affect that probability that consumers accept a parallel import. The drug-specific effects also partly control for the variation in quantities sold and price differences for locally sourced products between Sweden and other countries in the European Economic Area, which affects the probability that products are parallel imported.

For three reasons, I do not control directly for the relative consumer prices of locally sourced and parallel imported alternatives. The most important is that when a locally sourced product is dispensed one cannot know which parallel imported alternatives were available at the pharmacy and the prices of these. Secondly, as mentioned in the data section, there are some errors in the price data. The third reason is that the relative prices are affected by the reform and, therefore, cannot be included as an exogenous explanatory variable. The relative prices that are available do not indicate any important changes over time apart from what can be controlled for by the linear time trend and that caused by the reform, which suggests that not controlling for relative prices does not bias the estimators.

The results of specification 1 and three alternative specifications are presented in Table 3. In specification 2, prescriptions dispensed between July 2009 and March 2010 are included, as well as the dummy variable *March2010*. In specifications 3 and 4, the populations are restricted to prescriptions of only locally sourced and only parallel imported products,

[16] Since the variables can be functions of previous values of the dependent variable within the study period and since drug-specific effects are included, an endogeneity problem of the same type as when lagged dependent variables are included in panel data estimations might exist. As Baltagi (2001) explains, the endogeneity problem is decreasing in the number of observations per fixed-effect unit. In this case, the average number of observations per drug exceeds 3000, implying that the problem should be negligible.

respectively. Key results from other specifications used for robustness analyses are presented and discussed in Appendix B.

The results are presented in terms of average marginal effects and their average standard errors, both multiplied with 100, as well as asterisks indicating the significance of the coefficient estimates.[17] For specification 1, estimates for calendar month and municipalities are reported in Table A1 in Appendix B. Corresponding estimates for other specifications as well as parameter estimates for the drug-specific fixed effects are available from the author upon request.

The estimation results for *Reform* (top of Table 3) show the reform effect for the government-owned Apoteket AB, while the estimates for the nine pharmacy categories (*Apoteksgruppen-Others*) show how the reform effect for these nine categories differs from that of Apoteket AB. *Total reform eff.* (bottom of the table) is the weighted average of the reform effects over all pharmacy categories, using their market shares after March 2010 as weights. As Table 2 reveals, the market shares in the population were 38% for Kronans Droghandel, 34% for Apoteket AB, and 24% for Apoteket Hjärtat, while the remaining six pharmacy categories together had a market share of 4%.

The results for specification 1 show that the reform reduced the market shares for parallel imports at pharmacies owed by Apoteket AB with 11.3 percentage points. The reform effect is about 2 percentage points larger in absolute size for Kronans Droghandel, while it is 5-6 percentage points smaller for Apoteket Hjärtat. The point estimates for the total reform effect over all pharmacy chains is -10.5 percentage points. As shown in Appendix B, these results are quite robust; for example, the estimated total reform effects presented in Table A3 are all between -13 and -8 percentage points. Thus, the results support the main hypothesis that the reform has reduced the market share for parallel imports. The reduction is quite large considering that the predicted market share for parallel imports if the reform had not taken place was 42% according to specification 1.

The estimates for the nine pharmacy categories reveal that there are significant differences across pharmacies. Except the private pharmacy in Norsjö, all pharmacy categories are, according to the point estimates, less likely to sell parallel imports than Apoteket AB would have been without the reform, but the differences are not significant for *Apoteksgruppen*, *DocMorris* and *Malå private*. The estimate for *Apoteket Farmaci AB* is likely affected by selection, since this company only operates hospital pharmacies; the large negative estimate for this group can reflect that consumers who buy drugs in connection to hospital visits are less inclined to buy parallel imported products. For the other pharmacy categories, the drug-specific fixed effects and the demographic variables, including the municipality dummies, likely control for most of the selection of consumers.

[17]Marginal effect and standard errors are calculated using the command margins in Stata SE 11.1 where the delta method is used to estimate the standard errors.

Table 3. Marginal effects multiplied with 100 for specifications 1-4.

	1. Baseline	2. No window	3. LS is presc.	4. PI is presc.
Reform	-11.34***	-6.28***	-11.64***	-11.84***
	(3.11)	(1.42)	(4.50)	(4.50)
March2010		-5.04**		
		(2.23)		
Euro	-6.18***	-6.13***	-5.78***	-4.66***
	(1.07)	(0.98)	(1.00)	(1.39)
Time.mult. with 10000 instead of100	-0.09	-0.06	-0.18	-0.38
	(0.27)	(0.25)	(0.25)	(0.37)
PI_presc	24.54***	25.64***		
	(1.38)	(1.21)		
NotMD	-3.62***	-3.72***	-1.12	-3.23***
	(0.70)	(0.66)	(0.94)	(0.76)
ln*Nmpi_drug*	9.05***	9.23***	8.89***	2.00
	(0.92)	(0.81)	(0.73)	(1.63)
ln*Nmpi_drug_tr*	3.81***	4.02***	2.24	9.03***
	(1.46)	(1.20)	(1.64)	(1.81)
ln*Nmpi_subs*	1.97	1.34	3.03**	-7.71***
	(1.28)	(1.17)	(1.23)	(2.25)
ln*Nmpi_subs_tr*	3.51	3.97	3.03	5.94*
	(3.50)	(3.16)	(3.47)	(3.01)
Child[#]	-3.01***	-2.37***	-3.08***	-3.05***
	(0.72)	(0.75)	(0.69)	(0.99)
Age[##]*.mult. with 10000 instead of 100*	0.41***	-0.03***	-0.56***	3.48
	(0.51)	(0.47)	(0.58)	(0.80)
Women	-0.54***	-0.51***	-0.78***	-0.00
	(0.13)	(0.12)	(0.15)	(0.24)
Apoteksgruppen	7.81***	6.63***	6.75***	10.06***
	(2.01)	(1.67)	(2.21)	(1.85)
A. Farmaci AB	-21.31***	-21.04***	-17.60***	-29.02***
	(1.27)	(1.14)	(0.99)	(4.03)
Bramsäter	2.23	1.57	-3.60*	8.25***
	(1.36)	(1.42)	(1.83)	(1.92)
DocMorris	6.94***	5.62***	4.76***	10.22***
	(1.49)	(1.49)	(1.73)	(1.03)
Kronans Drogh.	-1.98***	-2.06***	-1.85***	-0.49
	(0.58)	(0.52)	(0.70)	(0.78)
Malå private	7.44***	7.41***	6.44***	9.00***
	(1.49)	(1.49)	(1.63)	(1.68)
Norsjö private	18.48***	18.13***	15.50***	17.09***
	(1.59)	(1.59)	(1.77)	(1.38)
Apotek Hjärtat	5.74***	4.85***	6.31***	4.02***
	(1.37)	(1.27)	(1.66)	(0.79)
Others	-2.32	-3.35	-1.73	-1.46
	(2.38)	(2.33)	(2.47)	(3.03)
Total reform eff.	-10.53***	-10.79***	-9.69***	-10.85**
	(2.77)	(2.73)	(2.44)	(4.48)
Number of obs.	575,413	662,684	421,204	149,485
Pseudo R2	0.4860	0.4810	0.4500	0.3630

Note: [#]*Child* is evaluated at the mean age for children, which is 11.3 years. [##] The coefficient estimates for *age* are positive and those for age^2 are negative, and both are significant at the one percent level in specifications 1-3 but not at all significant in specification 4. The marginal effects for age for specifications 1-3 reflect that the total positive effect of age among the young are of about the same importance as the total negative effect of age among the old. All specifications include controls for calendar months and municipality of residents of the consumer as well as drug-specific fixed effects.

Specification 2 reveals that the full effect of the reform did not come in July 2009. Instead, the results of specification 2 suggest that about half the estimated reform effect came around July 2009, while the rest came later. Results presented in Table A4 in Appendix B indicate that pharmacies might also have started to adjust to the new rules before July 2009.

The results of specifications 3 and 4 show that the reform effects are of similar absolute size irrespective of whether the prescription is for a locally sourced or a parallel imported product. On the other hand, in relative terms, the reform effect is much larger for prescription of locally sourced products since the predicted market share for parallel imports in this subpopulation if the reform had not taken place is 29%, while it is 83% for prescriptions for parallel imports.

Looking on the other results, we see, as expected, that the market share for parallel imports is significantly reduced by a depreciation of the Swedish Krona against the Euro. There is, however, no significant time trend. Consumers are far more likely to buy a parallel import if a parallel imported product is prescribed, which is consistent with the result of Granlund and Rudholm (2012), showing that what the physician has written on the prescription has a significant effect on consumers' choices between medically equivalent pharmaceuticals.

If the prescriber is not a medical doctor, this reduces the likeliness that a parallel import is bought. Specifications 2 and 3 suggest that this is primarily caused by the effect *NotMD* has when parallel imports are prescribed. The estimates for the four variables controlling for the number of months parallel imported products have been available are consistent with the results of Mott and Cline (2002) and Ching (2010), which showed that the time a product of a drug has been available has a positive effect on the probability that it is bought. The only exception is the negative estimate for ln*Nmpi_subs* in specification 4.

The coefficient estimates (not reported) for age and age^2 from specification 1 reveal that age, up to an age of 62, has a positive influence on the probability that a parallel import is bought. For higher ages, the effect is reversed. The estimates for *Child* show that children are even less likely to get a parallel imported product than what is predicted by their young age according to the estimates for age and age^2. Women are, ceteris paribus, less likely to buy a parallel imported product, and specifications 3 and 4 suggest that this is explained by that women are less inclined to switch product when a locally sourced product is prescribed.

The descriptive statistics in Figure 1 show that the market share for parallel imported products has increased considerably after the reform: from 25% in June 2009 (the last month before the reform) to 46% in December 2011 (the last month in the study period). That the estimated total reform effect still is significantly negative is mainly explained by the depreciation of the Euro against the Swedish Krona: *Euro* was reduced from nearly 11 in June 2009 to 9 in December 2011. Simulations based on specification 1 suggest that this should have increased the market share for parallel imports with 13 percentage points. Similarly, the increases in the variables ln*Nmpi_drug*, *Nmpi_drug_tr*, ln*Nmpi_subs* and *Nmpi_subs_tr* are predicted to have increased the market share with 10 percentage points, of which the increase in ln*Nmpi_drug* accounts for 8 percentage points. Other important control variables explaining the increase in

the market share for parallel imports between June 2009 and December 2012 is the calendar month dummies (5 percentage points) and *PI_presc* (3 percentage points).[18]

5.2 The probability that consumers can choose a cheaper parallel imported product and the probability that they still choose a locally sourced product

A second hypothesis is that the pharmacy reform has reduced the probability that pharmacies offer consumers to buy cheaper parallel imported products instead of locally sourced ones. This hypothesis is based on the theoretical prediction that pharmacies, because of the reform, will want to have higher generalized prices on parallel imports than on locally sourced products. Higher generalized prices can be accomplished by making parallel traders increase their list prices and by not keeping parallel imports in stock.

The second hypothesis is tested by estimating the probability of *Choice* as a function of the same explanatory variables as in specification 1, and the results are presented in Table 4. The hypothesis is tested separately depending on whether the prescriptions are for a locally sourced product (specification 5) or for parallel imported products (specification 6).

A related question is, whether the reform has made pharmacies more likely to convince consumers to buy locally sourced products instead of cheaper alternatives? This is tested by estimating the probability of *Demand LS* as a function of the same explanatory variables as in specification 1 but only for observation where consumers had a choice. Also this is tested separately depending on whether the prescriptions are for a locally sourced product (specification 7) or for parallel imported products (specification 8).

As predicted by the theoretical model, the results in Table 4 show that the reform has reduced the probability that a consumer who was prescribed a locally sourced product was offered a cheaper parallel imported substitute. On the other hand, for consumers who were prescribed parallel imported products, the reform's negative effect on the probability that they are able to buy parallel imported products that are cheaper than the locally sourced products is not statistically significant. A possible explanation is that the reform mostly has affected the probability that pharmacies keep parallel imported products that are seldom prescribed in stock, since it can create bad will among consumers not to have the product they are prescribed in stock. An alternative explanation is that part of the reform effects in specification 5 is caused by pharmacies breaking the rules by acting as if not keeping cheaper parallel imported alternatives even if they have them in stock. That is, that pharmacy personnel after the reform not always ask consumers if they would like to buy a cheaper alternative even though such products are available at the pharmacy. It appears less likely that

[18] 13+8+5+3 plus the estimated reform effect of -11 percentage points equals 18 and not 21 (which is the actual increase in percentage points) because of the effect of the other control variables, prediction errors, rounding errors, and because of the non-linearity in the logit model that imply that the individual variables' contribution to the change does not sum up to the total predicted change. If I exclude the most important control variable, i.e. the *Euro*, and neither include the exchange rates between SEK and the other major currencies within the European Economic Area, the estimated total reform effect becomes insignificantly different from zero. On the other hand, excluding the four *Nmpi* variables reduces the reform effect with less than a half percentage point, since *Time* then works as a proxy for the *Nmpi* variables.

the pharmacy personnel, when a parallel imported product is prescribed, lie by claiming that they do not have the prescribed product in stock.

Table 4. Marginal effects multiplied with 100 for specifications 5-9.

	5 *Choice* LS is presc.	6 *Choice* PI is presc.	7 *Demand LS* LS is presc.	8 *Demand LS* PI is presc.
Reform	-10.10***	-3.58	0.81	3.84***
	(3.46)	(4.40)	(1.87)	(1.35)
Euro	-5.58***	-2.28*	-0.66	0.46
	(1.14)	(1.38)	(0.48)	(0.31)
Time.mult. with 10000 instead of 100	0.13	-1.01***	0.52***	0.05
	(0.31)	(0.37)	(0.14)	(0.08)
NotMD	-0.68	-3.08***	4.56*	-0.13
	(0.96)	(0.87)	(2.83)	(0.34)
ln*Nmpi_drug*	8.44***	3.30*	-3.95***	-0.67
	(0.77)	(1.76)	(0.75)	(0.55)
ln*Nmpi_drug_tr*	3.54**	8.67***	11.38***	0.32
	(1.63)	(1.65)	(1.46)	(0.32)
ln*Nmpi_subs*	3.51***	-8.45***	4.92***	0.94
	(1.30)	(2.47)	(1.17)	(0.72)
ln*Nmpi_subs_tr*	4.32	11.53***	7.47***	-0.70
	(3.86)	(3.05)	(2.78)	(0.67)
Child[#]	-0.38	0.49	4.60**	0.50
	(0.60)	(1.00)	(2.36)	(0.49)
Age[##]*.mult. with 10000 instead of 100*	-0.70**	0.10	5.22***	0.35***
	(0.54)	(1.00)	(1.00)	(0.33)
Women	0.05	0.33	3.02***	0.05
	(0.16)	(0.27)	(0.18)	(0.07)
Apoteksgruppen	7.73***	12.01***	-7.73***	-0.38
	(2.49)	(2.58)	(1.43)	(0.49)
A. Farmaci AB	-21.84***	-34.40***	-8.74	-1.23
	(1.07)	(3.98)	(6.25)	(0.58)
Bramsäter	-0.11	8.56***	4.83**	0.02
	(1.55)	(1.74)	(2.29)	(1.03)
DocMorris	6.55***	9.01***	-3.75**	-1.94***
	(1.94)	(1.62)	(1.59)	(0.16)
Kronans Drogh.	-0.47	-0.97	0.09	0.27
	(1.03)	(1.00)	(0.64)	(0.33)
Malå private	10.64***	10.76***	-3.38**	0.30
	(1.94)	(2.06)	(1.59)	(1.02)
Norsjö private	16.77***	19.16***	-11.94***	-1.01
	(2.01)	(1.58)	(0.98)	(0.65)
Apotek Hjärtat	5.59***	1.46*	-8.55***	-1.66***
	(1.67)	(0.81)	(0.91)	(0.19)
Others	-1.72	-2.92	-1.65	-0.57
	(2.70)	(3.44)	(0.91)	(0.90)
Total reform eff.	-8.76***	-3.37	-1.45	3.52***
	(2.91)	(4.38)	(1.80)	(1.31)
Number of obs.	424,628	149,646	123,413	90,694
Pseudo R2	0.4507	0.3693	0.3421	0.2860

Note: [#]*Child* is evaluated at the mean age for children, which is 11.3 years. [##] The coefficient estimates for *age* are positive and those for age^2 are negative, and both are significant at the one percent level in specifications 7 and 8 and at the five percent level in specifications 5, but they are not significant in specification 6. All specifications include controls for calendar months and municipality of residents of the consumer as well as drug-specific fixed effects.

Looking at the estimate for *Total reform eff.* from specification 7, we see that consumers across all pharmacies did not become more likely to reject to substitute a prescribed locally sourced product for a cheaper parallel imported alternative. That is, we see no evidence for that the increase in market share for locally sourced product when such products are prescribed is explained by that pharmacies because of the reform are more likely to persuade consumers to buy locally sourced products. Instead, the mechanism seems to be that when pharmacies gained higher relative marginal margins on locally sourced products, they became less likely to offer consumers other alternatives.

The results from specification 8 show that the reform has increased the probability that consumers who are prescribed parallel imported products pay extra to instead get a locally sourced product. One interpretation is that pharmacy personnel because of the reform have become more likely to tell consumers that they have the right to buy other substitutes than the prescribed product or the cheapest available substitute.

Table A5 in Appendix B shows that the main results from specifications 5-8 are not sensitive towards excluding all observations where a parallel imported product with unknown relative price is dispensed.

We see that the estimated reform effects from specifications 6 and 8 together only can explain a part of the estimated reform effect from specification 4 (i.e., for prescriptions of parallel imported products). The same is true for prescriptions of locally sourced drugs: the estimated reform effects from specifications 5 and 7 do not explain the entire reform effect according to specification 3, even though the result from specification 5 explains a large part. The main reason is that the reform also has affected the probability that consumers buy a parallel imported product that is *not* cheaper than the locally sourced product. The data do not reveal if consumers who bought a locally sourced product had the opportunity to buy an equally expensive parallel imported product, which means that it is not possible to analyze the mechanism through which the reform reduced the probability that consumers buy parallel imported products that are *not* cheaper than their locally sourced alternatives.

The results above are consistent with the theoretical prediction that when pharmacies can negotiate their purchase prices, the marginal purchase prices become lower for locally sourced products than for parallel imports. In other words, the producers give larger marginal discounts than given by parallel traders. Another question is if parallel traders at all give discounts. According to the theoretical model, this is expected if the pharmacies' maximum purchase price for parallel imports exceeds p_s+r. Results presented and discussed in Appendix C indicate that the reform has significantly increased the probability that pharmacies only sell product from one parallel trader for each drug. These results are obtained after controlling for the quantity of parallel imports sold and are consistent with that pharmacies negotiate prices also with parallel traders and, for each drug, only sell the product from the parallel trader who offered them the best deal.

6. Conclusion

The theoretical model in this paper shows that negotiations on discounts will lead to a low market share for parallel imports since producers always will be able to underbid the offers of parallel traders. Parallel imports will only be sold to part of the consumers who without costly persuasion by pharmacy personnel would be prepared to pay more for a parallel imported product than for a locally sourced one if both were available at the pharmacy. This might seem surprising since parallel imports in many countries are low-priced alternatives, but it is explained by that parallel traders always have a cost disadvantage relative to producers; in addition to buying products that are initially sold by the producers, parallel traders also have cost for repacking and trading. For interior solutions, the market share of parallel imports will be a negative function of their cost disadvantage.

The empirical results show that allowing discount negotiations when pharmacies' margins initially were regulated and nearly identical for locally sourced and parallel imported products reduced the market shares for parallel imports by about 11 percentage points. The results are robust and are obtained using a unique prescription-level dataset that includes consumer, prescriber, and pharmaceutical variables. The most important mechanism is that the reform has reduced the probability that consumers are offered a cheaper parallel imported alternative. There are no indications that pharmacy personnel have reduced the market share for parallel imports by persuading consumers not to buy such products when locally sourced products are prescribed. However, the results suggest that a part of the reduction is explained by that pharmacies have become more likely to inform consumers who are prescribed parallel imported pharmaceuticals about the possibility to buy other substitutes than the prescribed product or the cheapest available substitute.

The results agree with Brekke et al.'s (2010) that pharmacies are not perfect agents for consumers and that pharmacy incentives have important effects on the choice between medically equivalent pharmaceuticals. The role of pharmacies has so far been nearly neglected, and to better understand the pharmaceutical market, more research effort should be devoted to study pharmacies' behavior.

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Appendix A: Map and tables

Map A1. Municipalities in the county of Västerbotten, Sweden.

Table A1. Pharmacy chains active in Västerbotten, March 2010 – December 2011.

Municipality	Pharmacy chain and number of pharmacies
Sorsele	KD 1
Storuman	KD 2
Vilhelmina	KD 1
Dorotea	KD 1
Malå	AG/Malå Private 1
Lycksele	♥ 1, DocMorris 0/1
Åsele	KD 1
Norsjö	AG/Norsjö Private 1
Vindeln	KD 1
Bjurholm	♥ 1
Vännäs	KD 1
Nordmaling	♥ 1
Skellefteå	♥ 5, KD 3, Apoteket AB 5,Apoteket Pharm. AB 1, Bramsäter 0/1
Robertsfors	Apoteket AB 1
Umeå	♥ 3, KD 7, Apoteket AB 4/5, Apoteket Pharm. AB 1

Note: KD = Kronans Droghandel, AG = Apoteksgruppen, ♥ = Apoteket Hjärtat (in English: PharmacyHeart).

Table A2. Additional estimation results for specification 1

Month		Municipality	
February	-0.65	Nordmaling	-1.14**
	(1.45)		(0.53)
March	0. 58	Bjurholm	0.81
	(1.65)		(0.72)
April	-1.01.	Vindeln	1.86***
	(1.84)		(0.55)
May	-3.39*	Robertsfors	1.28***
	(1.76)		(0.43)
June	-3.54**	Norsjö	-5.49***
	(1.41)		(0.75)
July	-2.60*	Malå	-0.58
	(1.54)		(0.62)
August	-2.28	Storuman	-2.27***
	(1.85)		(0.79)
September	-1.67	Sorsele	-0.28
	(1.83)		(0.85)
October	-1.65	Dorotea	-3.30***
	(1.93)		(0.82)
November	-0.80	Vännäs	3.00***
	(1.83)		(0.43)
December	0.82	Vilhelmina	-5.67***
	(2.81)		(0.80)
		Åsele	-3.14***
			(0.71)
		Lycksele	-3.75***
			(0.56)
		Skellefteå	-0.02
			(0.24)

January and Umeå are the omitted categories.

Appendix B: Robustness analyses

Table A3 presents key results from estimations that differ from the baseline specification by: not controlling for *PI_presc* (specification A1); also controlling for the other seven major currencies of the European Economic Area (specification A2); lagging *Euro* two months (specification A3); using probit instead of logit (specification A4); and clustering on year instead of months (specification A5). To facilitate comparison, the key result of specification 1 is also presented in Table A3.

The largest absolute total reform effect on the baseline population is obtained using specification A1, which does not control for whether the prescriptions are for parallel imports or not. This suggests that the probability that a parallel imported product is prescribed is negatively associated with the reform after controlling for the other explanatory variables, which is also supported by a logit estimation with *PI_presc* as dependent variable. One explanation to this association can be a causal one: that some products were stopped being parallel imported to Sweden because of the reform and, therefore, also was taken away from the prescription lists. However, the data reveal that products can be prescribed even when

they are no longer sold. If the bulk part of the association between PI_presc and the reform still is a causal effect of the reform, the result from specification A1 is a better estimate of the total reform effect than that from specification 1, since the estimate from specification 1 does not capture the effect that goes through PI_presc. Without having information about other factors affecting physicians' prescription, one cannot, however, conclude to which extent the reform has caused a reduction in the share of prescriptions for parallel imports. Specification A1 is estimated also using observations lacking data on PI_presc, but excluding these extra observations only has minor effects on the results.

Table A3. Robustness analyses for specification 1, marginal effects multiplied with 100.

	1. Baseline	A1. Not *PI_presc.*	A2. All exchange rates	A3. L2.Euro	A4. Probit	A5. Cl(year)
Reform	-11.34***	-13.36***	-10.81***	-9.07	-11.97***	-11.34***
	(3.11)	(3.00)	(3.17)	(3.12)	(3.13)	(3.26)
Kronans Drogh.	-1.98***	-2.38***	-1.93***	-1.95	-1.73***	-1.98*
	(0.58)	(0.65)	(0.56)	(0.58)	(0.60)	(1.05)
Apotek Hjärtat	5.74***	5.68***	5.74***	5.78	5.84***	5.74
	(1.37)	(1.47)	(1.37)	(1.38)	(1.35)	(3.73)
Total reform eff.	-10.53***	-12.72***	-9.98***	-8.23	-11.02***	-10.53***
	(2.77)	(2.63)	(2.99)	(2.79)	(1.35)	(2.13)
Number of obs.	575,413	586,729	575,413	575,413	575,413	575,413
Pseudo R2	0.4860	0.4379	0.4883	0.4872	0.4850	0.4860

The results from specification A2 show that controlling for the exchange rates between the Swedish Krona and currencies of the Czech Republic, Denmark, Hungary, Iceland, Norway, Poland, Romania, and the United Kingdom only reduces the estimated reform effect with a half percentage points in absolute value. The smallest estimate of total reform effect in absolute value is obtained when the second lag of Euro is used instead of the current exchange rate. Two month lag gives the highest pseudo R^2 of the lag lengths tested, and it also gives a higher pseudo R^2 value than specification 1. A two month lag can make sense if parallel traders do not have access to good forecast of the exchange rate and if it takes around two months to repackage and deliver products bought in the low-price countries. High correlation between different exchange rates and the possibility that the exchange rates also correlates with unmeasured variables, such as the consumers' perception of their own future income (the Swedish currency tends to depreciate when economic uncertainty increases), which might affect their choices, makes it hard to conclude which way is optimal to control for the exchange rates. To study this more carefully, one would preferably use data covering parallel imports to many countries. However, specifications 1, A2, and A3 as well as others not reported indicate that the main result is quite stable against changes in how exchange rates are accounted for.

Specification A4 reveals that the estimated reform effect is about a half percentage point larger in absolute value when probit is used instead of logit. Comparing specifications 1 and A5 reveals that different standard errors are affected in different directions by the choice of clustering unit. Clustering on year gives the largest standard errors for *Apotek Hjärtat* of the

clustering units tested, but the standard error for the total reform effect is smaller than when clustering on months. In two specifications that are not presented in tables, I have clustered on drug groups and the reform dummy, respectively. Also in both these specifications, the total reform effects are significant at the one percent level.

The four specifications presented in Table A4 are used to investigate whether the estimated reform effects are sensitive to the choice of time periods and if pharmacies started to adjust to the reform before July 2009. In specifications A6 and A7, the same window as in the baseline specification is used, i.e. prescriptions dispensed in July 2009-February 2010 are excluded, but in addition observations from 2007 are excluded in specification A6, and in specification A7, observations from the last six months of the baseline study period are excluded. I chose not to exclude all 12 months of 2011, since this would only leave 10 months after the reform for this study.

Since pharmacies knew about the reform before it came into effect, they could have started to adjust to the new rules before July 2009. If this was the case, we would expect to obtain larger estimates of the reform effect if the estimations were performed excluding observations from the months directly before the reform. To study the importance of this possibility, prescriptions dispensed from April 29, 2009, when the law regarding the pharmacy reform was passed by parliament, until March 2010 are excluded from specification A8, and prescriptions dispensed from February 19, 2009, when the bill was presented to parliament, until March 2010 are excluded from specification A9.

Table A4. Marginal effects multiplied with 100 for specifications 10-13, which differ in time periods covered

	A6. From 2008	A7. To July 2011	A8. Law, April 29	A9. Bill, Feb. 19
Reform	-11.79***	-7.35**	-12.91***	-15.16***
	(4.06)	(3.04)	(3.08)	(2.47)
Kronans Drogh.	-2.23***	-1.97***	-1.89***	-1.84***
	(0.62)	(0.72)	(0.56)	(0.55)
Apotek Hjärtat	6.03***	3.92***	5.79***	5.89***
	(1.46)	(1.31)	(1.34)	(1.34)
Total reform eff.	-11.00***	-6.98***	-12.04***	-14.23***
	(3.71)	(2.59)	(2.78)	(2.22)
Number of obs.	424,585	496,371	550,983	514531
Pseudo R2	0.4443	0.4800	0.4919	0.4933

Comparing the estimates from specifications A6 and 1 shows that excluding 2007 has only minor effects on the key results. Excluding the last six months of 2011, however, reduces the estimated total reform effect with 3.5 percentage points or about one-and-a-third standard errors. This might indicate that the reform effect continued to increase in absolute value during the study period. The results from specifications A8 and A9 reveal that the estimated reform effect becomes larger in absolute value the longer time period before the reform that is excluded. This is consistent with the idea that Apoteket AB could have started to adjust to the rules before they came into effect.

Table A5 shows that the main results from specifications 5-8 reported in Table 4 are not sensitive towards excluding all observations where a parallel imported product with unknown relative price is dispensed.

Table A5. Robustness analysis for specifications 5-8, marginal effects multiplied with 100.

	A10 *Choice* LS is presc.	A11 *Choice* PI is presc.	A12 *Demand* LS is	A13 *Demand* PI is presc.
Reform	-10.54***	-7.44	0.33	5.75***
	(2.99)	(5.14)	(1.98)	(2.00)
Kronans Drogh.	-0.07	-1.02	-0.08	0.23
	(0.91)	(1.13)	(0.67)	(0.47)
Apotek Hjärtat	5.30***	0.36	-9.30***	-2.31***
	(1.44)	(0.88)	(0.99)	(0.27)
Total reform eff.	-9.14***	-7.59	-2.19	5.24***
	(2.50)	(5.05)	(1.92)	(1.97)
Number of obs.	404,686	128,209	107,379	74,729
Pseudo R2	0.4796	0.3873	0.3360	0.2887

Appendix C: Share of parallel imports sold by the parallel trader with largest market share in the municipality

If all parallel traders have identical cost functions, it is possible that they would all give the same discounts and that all would retain the same share of the sales of parallel imports. However, if some parallel traders are able to offer a pharmacy lower purchase prices than its competitors, one would expect that the reform has increased the probability that a pharmacy only sell parallel imports from one parallel trader for each drug. For a given size of a pharmacy chain, one would then expect the reform to have increased the probability that a pharmacy chain only sells parallel imports from one parallel trader for each drug. But, since the reform increased the number of chains, it is better to look at sales of individual pharmacies instead of sales of pharmacy chains.

Except for the three pharmacy categories that include only one pharmacy each after the reform, the data do not identify single pharmacies. However, 11 of the 15 municipalities within the county only had only one pharmacy during the entire study period. For the subpopulation consisting of prescriptions bought by residents of these 11 municipalities, the municipality of residence identifies single pharmacies except for that some consumers do not buy pharmaceuticals at their home pharmacy.

The data show that 88.82% and 80.78% of the prescriptions bought by residents of Malå and Norsjö after that the pharmacies in these municipalities became privately owned were bought in Malå and Norsjö, respectively. Considering the geographical distances, one might suspect that these figures are approximately representative for all 11 municipalities with only one pharmacy. This implies that if one parallel trader captures 80-90% of the sales of parallel imports of one drug to residents of one of these municipalities, it is consistent with that the

parallel trader gets 100% of sales of parallel imports of that drug at the pharmacy in the municipality.

To investigate whether the reform has affected this probability, I estimate

$$\Pr(ShareX_{PDR} = 1) = F\left(\beta_1 Reform_P + \beta_2 Trend_P + \beta_3 Presc_{PDR} + \beta_4 Presc_{PDR}^2 + \sum_{m=2}^{12} \theta_m \, CMonth_{mP} + \sum_{r=2}^{11} \rho_r \, Mun_{rR} + \sum_{d=2}^{218} \alpha_d \, Drug_{dD} + \varepsilon_i\right), \quad (5)$$

where the subindexes *P*, *D*, and *R* refer to the period, drug, and the municipality of residence of the consumer. The dependent variable takes the value 1 if the parallel trader with largest market share within a period-drug-municipality observation has a market share that exceeds 75%, 80%, 85%, 90%, or 95%, respectively. The market share is defined as the number of prescriptions where parallel imported products delivered by the parallel trader with largest market share within the observation are dispensed, divided by *Presc*. *Presc* is the number of prescriptions where parallel imported products are dispensed. The period is chosen to be one month since the maximum purchase prices do not change within a month. *Trend* is the number of months since the start of the study period. *Presc*^{2} is the square of *Presc*, and the indicator variables are defined in the "Data and descriptive statistic" section. The population is restricted to the 11 municipalities with only one pharmacy during the entire study period, and observations where the number of prescriptions equals one are excluded since the market share in these cases cannot be anything other than one.

Table A6 presents the percentage where each dependent variable equals one as well as means, standard deviations and minimum and maximum values for *Presc* and *Presc*^{2}. Table A7 contains estimation results.

Table A6. Descriptive statistics

Variable	Population	Min	Max
Share75	59.43		
Share80	56.78		
Share85	54.84		
Share90	52.49		
Share95	50.97		
Presc	5.14±4.94	2	47
Presc^2	50.75±126.68	4	2209

Note: The number of observations is 8,743.

The results in Table A7 indicate that the probability that a pharmacy only buys parallel imported products of a drug from one parallel trader is significantly increased by the reform. The time trend is negative, but even if I do not control for the time trend, the reform effect is still statistically significant from zero at the 1 percent level for all five dependent variables,

but the point estimates are then 8 to 11 percentage points smaller. When estimating separately depending on whether the pharmacies in the municipalities after the reform is operated by Kronans Droghandel, Apoteksgruppen, Apoteket Hjärtat, or Apoteket AB, I found that the reform effect was significant for all groups.

Table A7. Estimation results for $ShareX_{PDR}$. Marginal effects multiplied with 100.

	$Share75_{PDR}$	$Share80_{PDR}$	$Share85_{PDR}$	$Share90_{PDR}$	$Share95_{PD}$
Reform	21.24***	22.26***	22.00***	20.77***	20.15***
	(4.83)	(4.88)	(4.81)	(4.73)	(4.71)
Trend	-0.27**	-0.31**	-0.33***	-0.33***	-0.35***
	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)
Presc[#]	-1.03***	-1.59***	-2.28***	-3.14***	-4.12***
	(0.33)	(0.35)	(0.35)	(0.33)	(0.29)
Number of obs.	8,743	8,743	8,743	8,743	8,743
Pseudo R2	0.1006	0.1078	0.1147	0.1301	0.1524

Note: [#]The coefficient estimates for *Presc* are negative and those for $Presc^2$ are positive, and all are significant at 1 percent level. All specifications include controls for calendar months and municipality of residence of the consumers as well as drug-specific fixed effects.