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Parallel Imports and Manufacturer Rebates

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Abstract

This paper studies the effect of a change in the mandatory manufacturer rebate on wholesale prices for pharmaceuticals on competition by parallel imports. First, it analyzes the effect of a manufacturer rebate on competition by parallel imports in a two-country model. An increase in the manufacturer rebate increases the market share of parallel imports. Second, the paper exploits a policy reform in Germany in 2010, which increased the manufacturer rebate by 10 percentage points. Using a data set with prescription drugs with competition from parallel imports, I estimate the effect of the change in the manufacturer rebate on competition by parallel imports. Estimation results suggest that an increase in the manufacturer rebate has increased the market share of parallel imports and the number of importers.

JEL Classification: F12, I11, I18

Keywords: parallel imports, manufacturer rebate, pharmaceuticals, regulation

1 Introduction

Parallel trade refers to the cross-border resale of goods without authorization of the manufacturer (Maskus, 2000). This is, wholesalers or parallel traders may resell goods that were placed on the market in one country in another country (Maskus, 2000). In the European Economic Area, parallel trade is legal. Parallel trade occurs if price differences between countries are sufficiently to cover the cost of parallel trading, e.g. distribution cost, licence cost, repacking cost etc. For pharmaceuticals, price differences in the European Union may reach up to 100%-300%

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(Kanavos & Costa-Font, 2005). Main reasons for price differences are manufacturers' price discrimination, vertical control structures and/or differences in pharmaceutical regulation make parallel trade profitable. Pharmaceutical manufacturers regularly price discriminate between countries based on differences in income, insurance coverage etc. (Danzon & Chao, 2000, Danzon & Furukawa, 2003). Pharmaceutical markets are characterized by numerous government interventions. In the European Union, health policy and including pharmaceutical regulation are national competence of EU member states (Art. 168 TFEU) and accordingly, regulatory instruments and the strictness of regulation differ across countries (see e.g. Espin & Rovira (2007) or Carone, Schwierz & Xavier (2012) for an overview). Typically, pharmaceutical manufacturers do not sell directly but through independent wholesalers (Taylor, Mrazek & Mossialos, 2004). Consequently, parallel trade in pharmaceuticals a common phenomenon in the European Union[1].

The extent of competition by parallel imports in the destination countries is driven by pharmaceutical regulation through three channels. First, regulatory differences between countries drive drug price differences. This is, regulatory differences determine the volume and direction of parallel imports. Second, pharmaceutical regulation in destination countries may change copayments and accordingly the choice between locally sourced versions and parallel imports. The design of the cost-sharing system, i.e. rules of copayment and reimbursement, seems to be an important factor in determining the competition by parallel imports (Kanavos et al., 2004; Enemark et al., 2006, Birg, 2018b). Third, regulation in destination countries may also affect competition between locally sourced version and parallel imports. For instance, Brekke et al. (2015) show that stricter price caps may reduce competition from parallel imports. Also regulation in pharmaceutical supply chains or the regulation of wholesale prices may drive competition, as it affects the difference between retail and wholesale prices and thus the profitability of parallel trade. Almost all European countries regulate wholesale margins or pharmacy margins (Carone, Schwierz & Xavier, 2012). In addition, Germany applies a mandatory manufacturer rebate on wholesale prices. This is, pharmaceutical manufacturers and wholesalers must provide a mandatory rebate for prescription drugs to the third party payer, the statutory health insurance. In 2010, a policy reform increased the mandatory manufacturer rebate by 10 per-

[1] Source countries of parallel imports are countries with rather low drug prices, such as Greece, Italy, Portugal, and Spain, destination countries are characterized by rather high drug prices, e.g. Denmark, Germany, the Netherlands, and Sweden (Kanavos & Costa-Font, 2005). In 2015, pharmaceutical parallel trade had a volume of € 5.3 bn (EFPIA, 2017). In the destination countries, the market share of parallel imports ranged between 8.2 % in the Netherlands, 9 % in Germany, 12 % in Sweden, and 24.9 % in Denmark (EFPIA, 2017).

centage points from 6% to 16%. This change in the manufacturer rebate is expected to affect the retail-wholesale margin and thus affect competition between locally sourced versions and parallel imports. By studying the effect of this reform, this paper analyzes one potential drivers of competition by parallel imports.

The literature on pharmaceutical regulation and parallel trade has mainly focused on the effect of parallel trade on regulatory choices at the retail level, suggesting that parallel trade may distort regulatory decisions (e.g. Pecorino, 2002, Grossman & Lai, 2008, Bennato & Valletti, 2014). Brekke et al. (2015) study the effect of pharmaceutical regulation on competition by parallel imports, suggesting that stricter regulation, i.e. lower price caps reduce competition from parallel imports. Similarly, Birg (2018a) suggests that lower reimbursement for drugs, this is, lower reference prices may reduce competition from parallel imports. The effect of wholesale level regulation, however, has received rather little attention in the literature. Costa-Font (2016) shows that parallel imports are not only driven by price differences but also by cross-country differences in distribution margins. He concludes that parallel trade can be regarded as "regulatory arbitrage". Birg (2017) studies externalities of different wholesale level regulation instruments which also affect the manufacturer's possibilities to limit competition from parallel trade. Brekke et al. (2013) show how product margins determine pharmacies' incentives to promote generic substitution, suggesting that generic and brand-name margins determine competition between brand-names and generics.

Against this background, this paper studies the effect of a change in the manufacturer rebate on competition by parallel imports. First, it analyzes the effect of a manufacturer rebate on competition by parallel imports in a two-country model with a vertical control structure following Ganslandt & Maskus (2007) and Birg (2017). A pharmaceutical manufacturer sells a drug in two countries through independent intermediaries. Parallel trade occurs as the intermediary in the foreign country may resell the drug in the manufacturer's home country. An increase in the manufacturer rebate increases the market share of parallel imports.

Second, the paper exploits a policy reform in Germany in 2010, which increased the mandatory manufacturer rebate by 10 percentage points. Using a data set with prescription drugs with competition from parallel imports, I estimate the effect of the change in the manufacturer rebate on competition by parallel imports. Estimation results suggest that an increase in the manufacturer rebate has increased the market share of parallel imports and the number of importers.

The rest of the paper is organized as follows. In the next section, the model is presented. Section 3 describes the institutional background. Section 4 presents the data set and section 5 studies the effect of a change in manufacturer rebates on competition by parallel imports. Section 6 concludes.

2 The Model

Consider the pharmaceutical market for an on-patent drug b. The drug is sold by a pharmaceutical manufacturer M in two countries j, $j = D, S$. In both countries, the manufacturer does not sell directly, but through independent intermediary ${I_j}^2$. The manufacturer charges each intermediary a wholesale price w_j per unit.

The intermediary I_D sells the authorized version b in country D. The intermediary I_S sells the authorized version b in country S and, in addition, may resell the drug b in D as a parallel import (hereafter denoted by β). This is, S is the source country, D is the destination country of the parallel import.

The locally sourced version of the drug b and the parallel import β are de facto identical but differ in sourcing. Assume that patients consider both versions to be identical, i.e. patients do not observe sourcing or they do not care [3].

Patients in both countries differ in their valuation of the drug θ, which is uniformly distributed on the interval $[0, 1]$. The consumer heterogeneity can be interpreted as differences in income, the severity of the condition, prescription practices or insurance coverage (see e.g. Brekke, Holmas & Straume, 2011). The total mass of consumers is 1 in both countries.

In both countries, consumers pay a fraction γ_j, with $\gamma_j \in (0, 1)$ of the drug price (coinsurance). This is, the drug copayment is $c_{ij} = \gamma_j p_{i,j}$ and third payer reimbursement is $r_{ij} = \left(1 - \gamma_j\right) p_{i,j}$. Assume for simplicity that the coinsurance rate is the same in both countries $\gamma_D = \gamma_S = \gamma$, i.e. countries do not differ in copayments [4].

Each consumer demands either one or zero units of the most preferred drug. Let

$$U\left(\theta, \gamma, p_j\right) = \theta - \gamma p_j \tag{1}$$

[2] The model set-up follows Ganslandt & Maskus (2007) and Birg (2017).

[3] Assuming that patients attribute a lower quality to the parallel import due to differences in appearance and packaging yields qualitatively similar results.

[4] This implies that parallel trade is not driven by differences in coinsurance rates. Assuming different coinsurance rates between countries yields qualitatively similar results.

be the utility of a consumer who buys one unit of drug, with p_j as the drug price in country j.

In country D, the marginal consumer who is indifferent between buying either the locally sourced version b or the parallel import β has a gross valuation $\widehat{\theta}_D = \gamma p_D$. Demand for the authorized product b and for the parallel import β is given by $q_D = 1 - \gamma p_D$, with $q_D = q_{D,b} + q_{D,\beta}$. In country S, the marginal consumer who is indifferent between buying the locally sourced version b and not buying (0) has a gross valuation $\widehat{\theta}_S = \gamma p_S$. Demand for the drug b is given by $q_S = 1 - \gamma p_S$.

Production technologies exhibit constant marginal costs, which are normalized to zero for simplicity. Profits are

$$\pi_M = w_D q_{D,b} + w_S q_{D,\beta} + w_S q_S, \tag{2}$$

$$\pi_{I_D} = (p_D - w_D)\, q_{D,b}, \tag{3}$$

$$\pi_{I_S} = (p_D - w_S)\, q_{D,b} + (p_S - w_S)\, q_S. \tag{4}$$

Consider a two-stage game: In the first stage, the manufacturer M charges each intermediary a wholesale price w_j per unit. In the second stage, intermediaries I_D and I_S set quantities.

2.1 Coinsurance

Consider a system with coinsurance as a benchmark.

In the second stage, intermediaries compete in quantities. In country D, intermediaries I_D and I_S maximize (3) and (4) with respect to $q_{D,b}$ and $q_{D,\beta}$. The profit maximizing quantities are

$$\begin{aligned} q_{D,b} &= \frac{1 - 2\gamma w_D + \gamma w_S}{3}, \\ q_{D,\beta} &= \frac{1 - 2\gamma w_S + \gamma w_D}{3}. \end{aligned} \tag{5}$$

In country S, the intermediary I_S maximizes (4) with respect to q_S. The profit maximizing quantity is

$$q_{b,S} = \frac{1 - \gamma w_S}{2}. \tag{6}$$

In the first stage, the manufacturer maximizes (2) with respect to w_D and w_S. Equilibrium wholesale prices are

$$w_D = w_S = \frac{1}{2\gamma}. \tag{7}$$

First stage equilibrium quantities are

$$\begin{aligned} q_{D,b} &= q_{D,\beta} = \frac{1}{6}, \\ q_{b,S} &= \frac{1}{4}. \end{aligned} \tag{8}$$

Drug prices are

$$p_D = \frac{2}{3\gamma},\ p_S = \frac{3}{4\gamma}. \tag{9}$$

The market share of the parallel import is

$$\chi = \frac{q_{D,\beta}}{q_{D,\beta} + q_{D,b}} = \frac{1}{2}. \tag{10}$$

2.2 Manufacturer Rebates

Consider now that the government in country D applies a manufacturer rebate ξ, with $\xi \in (0,1)$. Both intermediaries are subject to the rebate with their sales in country D. To prevent strategic price increases, the manufacturer rebate is combined with a wholesale price freeze in country D.

Profits are

$$\pi_M^{\xi} = w_D^{\xi} q_{D,b}^{\xi} + w_S^{\xi} q_{D,\beta}^{\xi} + w_S^{\xi} q_S^{\xi}, \tag{11}$$

$$\pi_{I_D}^{\xi} = \left(p_D^{\xi} - w_D^{\xi}(1+\xi)\right) q_{D,b}^{\xi}, \tag{12}$$

$$\pi_{I_{S,b}}^{\xi} = \left(p_D^{\xi} - w_S^{\xi}(1+\xi)\right) q_{D,\beta}^{\xi} + \left(p_S^{\xi} - w_S^{\xi}\right) q_S^{\xi}. \tag{13}$$

In the second stage, intermediaries compete in quantities. In country D, intermediaries I_D and I_S maximize (12) and (13) with respect to $q_{D,b}^{\xi}$ and $q_{D,\beta}^{\xi}$. The profit maximizing quantities are

$$\begin{aligned} q_{D,b}^{\xi} &= \frac{1 - 2\gamma w_D(1+\xi) + \gamma w_S(1+\xi)}{3}, \\ q_{D,\beta}^{\xi} &= \frac{1 - 2\gamma w_S(1+\xi) + \gamma w_D(1+\xi)}{3}. \end{aligned} \tag{14}$$

In country S, the intermediary I_S maximizes (13) with respect to q_S^{ξ}. The profit maximizing quantity is

$$q_S^{\xi} = \frac{1 - \gamma w_S^{\xi}}{2}. \tag{15}$$

In the first stage, the manufacturer maximizes (11) with respect to w_S^{ξ}. The wholesale price w_D is fixed by regulation. Equilibrium wholesale prices are

$$\begin{aligned} w_D^{\xi} &= w_D = \frac{1}{2\gamma}, \\ w_S^{\xi} &= \frac{2\xi + 7}{2\gamma\left(4\xi + 7\right)}. \end{aligned} \tag{16}$$

First stage equilibrium quantities are

$$\begin{aligned} q_{D,b} &= \frac{7 - 5\xi - 6\xi^2}{6\left(4\xi + 7\right)}, \\ q_{D,\beta} &= \frac{\xi + 7}{24\xi + 42}, \end{aligned} \tag{17}$$

$$q_{b,S} = \frac{6\xi + 7}{4\left(4\xi + 7\right)}. \tag{18}$$

Drug prices are

$$\begin{aligned} p_D &= \frac{14\xi + 3\xi^2 + 14}{3\gamma\left(4\xi + 7\right)}, \\ p_S &= \frac{10\xi + 21}{4\gamma\left(4\xi + 7\right)}. \end{aligned} \tag{19}$$

The market share of the parallel import is

$$\chi^{\xi} = \frac{\xi + 7}{2\left(7 - 2\xi - 3\xi^2\right)}, \tag{20}$$

Proposition 1 summarizes the effect of a change in the manufacturer rebate ξ on competition by parallel traders:

Proposition 1 *An increase in the manufacturer rebate ξ increases the market share of the parallel import:*$\frac{\partial \chi^{\xi}}{\partial \xi} > 0$.

3 Institutional Background

The German pharmaceutical market had a volume of € 38 bn. in 2015 (German Pharmaceutical Industry Association, 2016). In 2016, roughly 47,000 prescription drugs were listed for reimbursement in Germany (German Pharmaceutical Industry Association, 2016). The share of parallel imports in pharmacy market sales was 9% in 2015 (EFPIA, 2017)

In order to stabilize health expenditure borne by the statutory health insurance, pharmaceutical manufacturers, wholesalers, and pharmacists must provide a mandatory rebate for prescription drugs to the statutory health insurance.

In 2010, the Statutory Health Insurance Amendment Act (GKV-ÄndG) increased the mandatory manufacturer rebate from 6% to 16% (§ 130a (1) SGB V). At the same time, a price moratorium (price freeze) came into force. The reform only affected pharmaceuticals that are not subject to reference pricing. For all other pharmaceuticals, the mandatory rebate of 6%, which was already in force before the reform, was retained. The reform was in force for 3 years.

In a hearing of the relevant parliamentary committee in May 2010, experts discussed projects of the Federal Government that were published in March 2010. I cannot rule out the possibility that parts of the planned reform have been known to the industry since then at the latest.

4 Data and Descriptive Statistics

The panel data set from Insight Health covers all prescription drugs with competition from parallel imports sold in Germany from January 2005 to December 2011. For each drug, the data set contains information on the central pharmaceutical number, 3-digit ATC code, trade name, active ingredient, administration form, package size, DDD, strength, manufacturer, launch date, dispensing requirements, and the status as import or locally sourced version.

The data set comprises monthly data on sales by pharmacies to consumers (in units and in Euro, at the pharmaceutical manufacturer price), sales by wholesalers to pharmacies (in units), returns from pharmacies to wholesalers (in units), pharmaceutical manufacturer price, pharmacy retail price, and reference price.

An observation is identified by the central pharmaceutical number, representing a product with a certain active ingredient, administration, form, strength, and package size, sold by a certain firm and sold in a certain month.

The data set contains no information on source countries of parallel imports or purchase prices of wholesalers.

The analysis is based on a market definition where a market is defined by the active substance, package size, and dose strength. This maps substitution patterns at pharmacies, where locally sourced drugs may be substituted by parallel imports of the same active substance, package size, and dose strength. Table 1 shows the summary statistics.

Table 1: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
Markets	405.434	234.033	1	811	40653
Reference Price	60.611	30.545	12.9	190.83	8503
Number of Importers	4.732	3.829	1	30	23312
Sales Originals	4809.182	9368.472	1	300672	32138
Sales Imports	540.617	949.346	0	13286	23312
Market Share Originals	0.77	0.231	0	1	32138
Market Share Originals weighted by Prices	0.778	0.225	0	1	32138
Number of Products in ATC3 group	303.516	233.561	2	663	40653
Number of Products in Reference Price Group	91.891	193.261	0	595	40653
Market Size in Euro	478529.212	1097697.253	0	18794198	40653

I use observations of 84 months between 2005 and 2011 in 484 markets, of which 354 are affected by the reform.

5 Empirical Analysis

5.1 Empirical Strategy

The aim is to identify the effect of the reform described above on the competition by parallel imports. Therefore, I estimate the effect of the reform on the market share of parallel imports and on the number of importers. Since the reform only affects products that are not subject to a reference price, the empirical strategy is to identify the difference in market dynamics for products that are subject to the reform and those that are not by using a difference-in-difference approach.

I estimate the following fixed effects model

$$y_{it} = \alpha + \beta D_{it} + \rho \mathbf{X}_{it} + \gamma_i + \delta_t + \varepsilon_{it} \tag{21}$$

where y_{it} is the (log) market share of imported products (in packages or in turnover) or the number of importers in a market i in month t. D is a dummy indicating that a market is affected by the reform, $\mathbf{X}_{it}$ contains a set of characteristics that vary over time (the market size measured in number of packages sold and the number of products in the same ATC3 group), γ_i is a product fixed effect, δ_t is a month fixed effect, and ε_{it} is the robust error term.

All markets in the estimations have faced competition by imports prior to the reform. Only

tablets are included for the estimation. Thereby I avoid difficulties arising from potentially limited substitutability between tablet and non-tablet products.

The empirical strategy relies on the assumption that the evolution of treated and untreated markets does not differ systematically before the reform. To test this assumption, a pre-reform test similar to Brekke et al. (2015) is used (see Appendix). The fixed effects regression contains only pre-reform observations. Interaction of monthly dummies with a dummy for markets affected by the reform are included. If these interactions are not statistically significant at usual levels, a similar trend of treated and untreated markets prior to the reform may be assumed. If a dummy indicating affected markets after the reform has a significant effect, this effect may be interpreted as the effect of the reform of treated markets compared to untreated markets.

It turns out that for three years before the reform the interaction term is statistically insignificant in nearly all months (see Appendix). One exception applies for July 2009. Beginning six months prior to the reform, the interaction term starts to be significant at least at the ten percent level. The legislative proposal of the German Federal Parliament dates to four months before the reform. It is not unlikely that hints about reform details were disclosed shortly before the legislative proposal and that this may have affected treated markets prior to the reform.

The development of average market shares of imported drugs for treated markets and untreated markets is shown in Figure 1. The red vertical line indicates the month where the reform came into effect. The green line indicates the month, where the legislative proposal was published by the federal parliament.

Figure 2 shows the development of the average number of importers for treated and untreated markets.

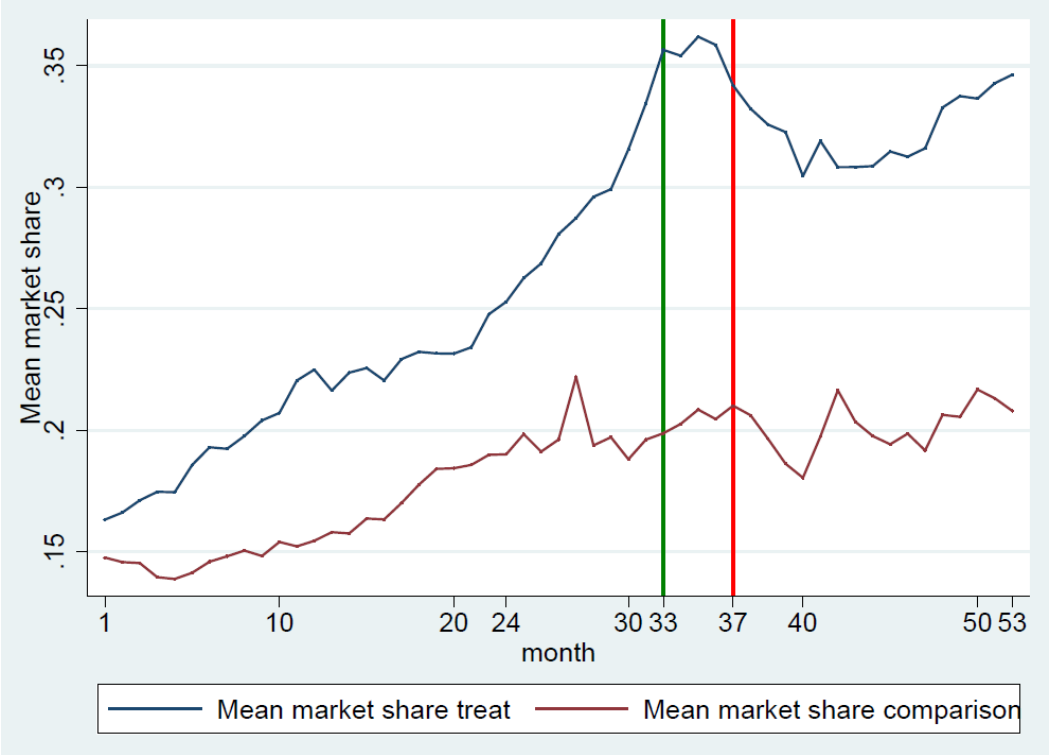

Figure 1: Average market shares for treated and untreated markets

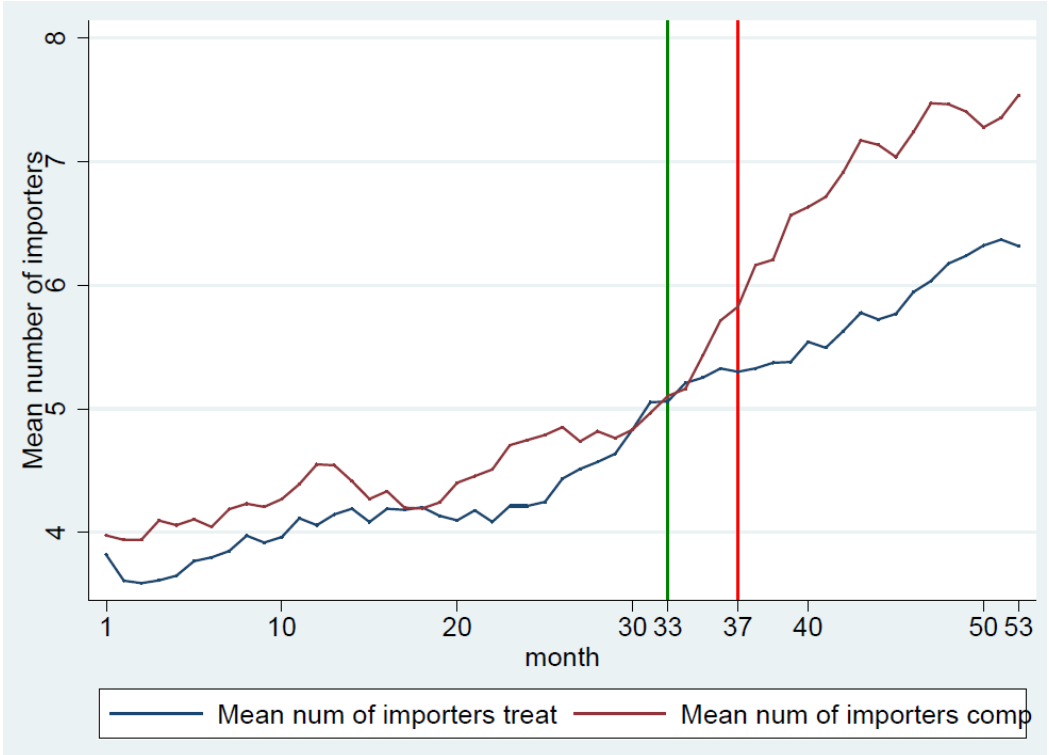

Figure 2: Average number of importers in treatment and comparison group

5.2 Empirical Results

5.2.1 Market Share of Imports

The main empirical results for the market share of imports are shown in Table 2. In this specification, market share is calculated by referring to units.

Table 2: Market Shares

	(1) Market Share Imports	(2) Market Share Imports	(3) Market Share Imports
Reform Dummy	0.325**	0.418***	0.406***
	(0.009)	(0.000)	(0.001)
Market Size		-0.588***	-0.601***
		(0.000)	(0.000)
Number of products in ATC3 group			0.0586***
			(0.000)
Constant	-1.773***	2.340***	-17.26**
	(0.000)	(0.000)	(0.001)
N	23284	21934	21934
R^2	0.145	0.198	0.201

p-values in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Since log values for market shares are used, the coefficients measure (semi) elasticities. The estimations suggest that the reform has increased the market share of imported products by approximately 32% to 41%. So compared to the products not affected by the reform, the market share of imports in affected markets is considerably higher.

Three different sets of controls are applied. Market size is measured by the (log of the) number of packages sold per market in each month. The effect of the market size on the market share of imports is negative with an elasticity of about -0.6. The number of products within the same ATC3 group, which may be considered as therapeutic alternatives has a small but positive effect on the market share of imported products with an elasticity of about 0.05. The treatment dummy and the control variables are significant at the one percent level in all specifications of the estimation.

5.2.2 Number of Importers

The main empirical results for the number of importers in each market are shown in Table 3

Table 3: Number of Importers

	(1)	(2)	(3)
	Num of Importers (log)	Num of Importers (log)	Num of Importers (log)
Reform Dummy	0.194**	0.190*	0.186*
	(0.009)	(0.012)	(0.013)
Market Size		-0.0149	-0.0191
		(0.716)	(0.641)
Number of products in ATC3 group			0.0185*
			(0.010)
Constant	1.595***	1.755***	-4.418
	(0.000)	(0.000)	(0.066)
N	23312	21956	21956
R^2	0.353	0.372	0.373

p-values in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The log of the number of importers in each market is the dependent variable, so the coefficients can be interpreted as (semi) elasticities. The regression indicates that the reform has had a positive impact on the number of importers in affected markets. In markets affected by the reform the reform has increased the number of importers by about 19% compared to non-affected markets. The market size (measured by the log of packages sold) has no significant effect on the number of importers. The number of products in the same ATC3 group has a small positive effect on the number of importers with an elasticity of 0.018.

6 Robustness

In my main regression, market shares refer to units sold. If market shares are measured by weighting units by prices, the results do not change considerably. The magnitude of coefficients remains the same and all coefficients remain statistically significant. Table 4 shows regression results.

Table 4: Market shares weighted by prices

	(1)	(2)	(3)
	Market Share Imports	Market Share Imports	Market Share Imports
Reform Dummy	0.336**	0.429***	0.416***
	(0.007)	(0.000)	(0.000)
Market Size		-0.568***	-0.581***
		(0.000)	(0.000)
Number of products in ATC3 Group			0.0592***
			(0.000)
Constant	-1.827***	2.135***	-17.67***
	(0.000)	(0.000)	(0.001)
N	23284	21934	21934
R^2	0.149	0.197	0.201

p-values in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

In the pre-reform test, the interaction term is significant beginning six months prior to the reform. This might indicate that the anticipation of reform already had an effect on markets. To account for this possibility, I use a specification where the reform is dated six months earlier. The results do not change considerably compared to the original regression (see Table 5).

I test the effect of the reform in another market definition, which refers only to the active ingedient. In this specification, 111 markets are observed, of which for 90 markets the reform applies. Table 6 shows the results of the estimation. While the magnitude of the reform coefficient is similar, the coefficient is not statistically significant anymore. This may be driven by a high level of aggregation of different products in the markets.

Table 5: Market shares reform starting six months earlier

	(1)	(2)	(3)
	Market Share Imports	Market Share Imports	Market Share Imports
Dummy Reform	0.407***	0.502***	0.521***
	(0.000)	(0.000)	(0.000)
Market Size		-0.592***	-0.608***
		(0.000)	(0.000)
Number of Products in ATC3 Group			0.0690***
			(0.000)
Constant	-1.828***	2.316***	-20.78***
	(0.000)	(0.000)	(0.000)
N	23284	21934	21934
R^2	0.148	0.202	0.206

p-values in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 6: Market shares alternative market definition

	(1)	(2)	(3)
	Market Share Imports	Market Share Imports	Market Share Imports
Reform Dummy	0.559	0.608	0.596
	(0.212)	(0.174)	(0.174)
Market Size		-0.217	-0.223
		(0.281)	(0.274)
Number of Products in ATC3 Group			0.0383
			(0.334)
Constant	1.264**	3.070	-7.766
	(0.004)	(0.052)	(0.479)
N	5986	5942	5942
R^2	0.209	0.216	0.217

p-values in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

7 Conclusion

This paper studies the effect of a change in the manufacturer rebate on competition by parallel imports. First, it analyzes the effect of a manufacturer rebate on competition by parallel imports in a two-country model. Second, the paper exploits a policy reform in Germany in 2010, which increased the manufacturer rebate by 10 percentage points. Using a data set with prescription drugs with competition from parallel imports, I estimate the effect of the change in the manufacturer rebate on competition by parallel imports. Empirical results are in line with the theoretical prediction, an increase in the manufacturer rebate increases the market share of parallel imports. Estimation results also indicate that an increase in the manufacturer rebate increases the number of importers. This suggests that stricter wholesale regulation, unlike stricter retail regulation (see Brekke et al., 2015, Birg, 2018a) could enhance competition by parallel imports.

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Appendix

Table 7: Pre-Reform Test

	(1) logmarketshare_i
Interaction 1	-0.136
	(0.361)
Interaction 2	0.0130
	(0.935)
Interaction 3	0.0273
	(0.875)
Interaction 4	-0.119
	(0.467)
Interaction 5	-0.0679
	(0.678)
Interaction 6	0.0162
	(0.925)
Interaction 7	0.133
	(0.485)
Interaction 8	-0.0123
	(0.935)
Interaction 9	0.0218
	(0.864)
Interaction 10	0.201
	(0.223)
Interaction 11	0.0553
	(0.732)
Interaction 12	0.0571
	(0.679)
Interaction 13	-0.101
	(0.382)
Interaction 14	-0.0106
	(0.928)
Interaction 15	-0.0601
	(0.627)
Interaction 16	-0.0505
	(0.733)
Interaction 17	-0.0366
	(0.821)
Interaction 18	-0.106
	(0.463)
1Interaction 19	0.0574
	(0.714)
Interaction 20	-0.0685
	(0.634)
Interaction 21	-0.119
	(0.378)
Interaction 22	-0.0685
	(0.632)
Interaction 23	-0.0731
	(0.591)
Interaction 24	-0.193*
	(0.032)
Interaction 25	-0.0737
	(0.517)
Interaction 26	-0.152
	(0.078)
Interaction 27	-0.137
	(0.107)
Interaction 28	-0.0464
	(0.560)
Interaction 29	-0.0439
	(0.577)
Interaction 30	0.00928
	(0.905)
Interaction 31	0.148*
	(0.035)
Interaction 32	0.150*
	(0.029)
Interaction 33	0.178*
	(0.015)
Interaction 34	0.221**
	(0.002)
Interaction 35	0.137*
	(0.016)
Interaction 36	0.126*
	(0.011)
_cons	-16.23**
	(0.003)
N	15997
r2_w	0.324

p-values in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$