Online Appendix
Price Dynamics of Swedish Pharmaceuticals

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A Proof of Lemma 1

A monopolist sets $p^t = R$ in each time t independent of the history $\mathscr{H}_t$. The valuation for the monopolist is $V = \frac{R(1+l+\theta)}{1-\delta}$. By definition the equilibrium is Markov perfect as well as a Subgame perfect.

A monopolist faces a demand of $1+\theta+l$, which is price inelastic. The continuation value of a monopolist is solely the same payoff discounted by δ such that one may write the maximization problem for the monopolist can be described as:

$$\begin{aligned} \max_{p} \quad & \frac{p(1+\theta+l)}{1-\delta} \\ \text{subject to} \quad & p \in [0,R] \end{aligned}$$

Given $\theta \geq 0$ and $l > 0$, the optimal price for a monopolist is equal to the price ceiling $p^* = R$. The valuation of the monopolist is therefore equal to $V = \frac{R(1+l+\theta)}{1-\delta}$. Price setting forms an equilibrium as each period the monopolist is maximizing its profits.

B Proof of Lemma 2

The game $\mathscr{G}(x^1)$ with $N = \{1,2\}$ has no Markov perfect equilibrium in pure strategies.

I divide the proof into two parts. Firstly, I consider the situation with $\theta = 0$, i.e., no habit persistent patients. Secondly, I show that the claim is true for $\theta > 0$. In both cases I consider firms $i, j \in N$ where $i \neq j$. Note that the base of patients with a brand preference can be either the same such that $l_i = l_j = l$ or different, i.e., $l_i \neq l_j$.

Case with $\theta = 0$:

Firstly I show that same prices $p_j = p_i$ cannot form an equilibrium. Given that $\theta = 0$ it is sufficient to evaluate stage payoffs. Consider that firm j sets a price equal to $p_j \in P$. It is never optimal for a firm i to set the competitor's price as there (1) either exists a $\varepsilon > 0$ such that the payoff from undercutting is higher than the payoff from charging the same price, $(p_j - \varepsilon)(1+l_i) > p_j(1/2 + l_i)$ or (2) charging the upper bound price gives a higher price than marginally undercutting and therefore also changing the same price, $Rl_i > (p_j - \varepsilon)(1+l_i) > p_j(1/2+l_i)$

Secondly, I show that different prices cannot form an equilibrium. Given a price of an opponent $p_j \in P$ firm i either undercuts if $(p_j - \varepsilon)(1+l_i) > Rl_i$ or sets a price equal to the price ceiling if $(p_j - \varepsilon)(1+l_i) < Rl_i$. Consider first the case that $(p_j - \varepsilon)(1+l_i) > Rl_i$. The best reply for player i to price p_j is to set $p_i = p_j - \varepsilon$. These prices cannot form an equilibrium. *Proof by contradiction:*

The equilibrium requires that firm j's profit from playing p_j is greater than undercutting $p_i = p_j - \varepsilon$ marginally. In terms of profits it requires that $p_j l_j \geq (p_j - 2\varepsilon)(1 + l_j)$. Rewriting this condition gives $\varepsilon \geq \frac{p_j}{2(2+l_j)}$. As $\varepsilon \to 0$ I showed a contradiction. Secondly, suppose that $(p_j - \varepsilon)(1 + l_i) < Rl_i$ such that the best reply from firm i is to charge $p_i = R$. These prices cannot form an equilibrium. *Proof by contradiction:* The equilibrium requires that firm j's profit from playing p_j is greater than undercutting $p_i = R$ marginally. In terms of profits it requires that $p_j(1 + l_j) \geq (R - \varepsilon)(1 + l_j)$. Rewriting this condition gives $p_j \geq R - \varepsilon$. As $\varepsilon \to 0$ and same price setting is not possible (see first part of the proof) I showed a contradiction.

Case with $\theta > 0$:
Next I consider pure strategy equilibria when with $\theta > 0$. In these cases one also considers continuation payoffs. Let V_1 and V_0 be the valuation function of a firm with and without habit persistent patients respectively. Note that the firm with habit persistent patients never undercuts as it receives the same payoff by charging the identical price as an opponent.

Firstly I show that the same prices $p_j = p_i$ cannot form an equilibrium. The reasoning is identical to the case without habit persistent patients. In detail, the firm without state dependent patients has an incentive to undercut the opponent. Consider firm j has a mass of habit persistent patients and sets a price p_j. Given that $V_1 > V_0$ firm i undercuts as there exists a ε for which undercutting gives a higher profit than setting $p_i = p_j$, i.e. $(p_j - \varepsilon)(1 + l_i) + \delta V_1 > p_j l_i + \delta V_0$.

Secondly, I show that different prices cannot form an equilibrium. Again, consider that firm j has habit persistent patients ans sets a price p_j such that firm i without habit persistent patients undercuts marginally and sets $p_i = p_j - \varepsilon$. The prices cannot form an equilibrium. *Proof by contradiction:* Suppose the prices form an equilirbium. Firm j, the firm with habit persistent patients, has no incentive to deviate only if charging the same price as firm i as well as charging the maxmimum price would give a lower output. Formally, it is required that $p_j(l_j + \theta) + \delta V_0 \geq (p_j - \varepsilon)(1 + l_j + \theta) + \delta V_1$ and that $p_j(l_j + \theta) + \delta V_0 \geq R(l_j + \theta) + \delta V_0$. The first condition can be rewritten as $\varepsilon > \frac{p_j + \delta(V_1 - V_0)}{1 + l_j + \theta}$, the second as $p_j \geq R$. If $p_j \neq R$ the second condition is never fulfilled and therefore firm j has always an incentive to set a price R. If $p_j = R$, firm i undercuts marginally and the first condition is not satisfied as $\varepsilon \to 0$. I have showed a contradiction. Equal as well as different prices cannot form a pure strategy equilibrium.

C Proof of Proposition 1

The game $\mathscr{G}(x^1)$ with $N = \{1, 2\}$, $l_1 = l_2 = l$, $\delta \in (0, 1)$ and given any initial state $x^1 \in \mathscr{L}$ has a unique Markov perfect equilibrium in mixed strategies which is defined by the following conditions:

1. *Strategies $\mathscr{S}_j$ for $j \in N$:*

$$S_j = \begin{cases} p_j \sim F(p) & = \frac{p(1+l+\theta)-V(\cdot|x=j)(1-\delta)}{p+\delta(V(\cdot|x=j)-V(\cdot|x\neq j))} \quad for \quad p \in [\underline{p}, R] \quad if\, x \neq j \\ p_j \sim F(p) & = \frac{p(1+l)+\delta V(\cdot|x=j)-V(\cdot|x\neq j)}{p+\delta(V(\cdot|x=j)-V(\cdot|x\neq j))} \quad for \quad p \in [\underline{p}, R] \quad if\, x = j \end{cases}$$

2. *Valuation functions:*

$$\begin{aligned} V(\underline{p},|x \neq j) &= \frac{\underline{p}(1+l+\delta\theta)}{1-\delta} \\ V(\underline{p},|x = j) &= \frac{\underline{p}(1+l+\theta)}{1-\delta} \end{aligned} \quad where\ \underline{p} = \frac{R(\theta+l)}{1+l+\theta+\delta\theta}$$

Note first given that one may rewrite the continuation payoffs $V_j(\cdot|x \neq j)$ and $V_j(\cdot|x = j)$. Let $F_i(p_j|x = j)$ be the CDF of i's price given the price of firm j and $x = j$ for $i \in N$ $i \neq j$. Further, $F_i(p_j|x \neq j)$ is the CDF of an i's price if $x \neq j$ Therefore the continuation functions can be represent as:

$$V_j(p_j|x = j) = p_j(1 - F_i(p_j|x = j) + \theta + l_j) + \delta[(1 - F_i(p_j|x = j))V_j(\cdot|x = j) + F_i(p_j|x = j)V_j(\cdot|x \neq j)]$$
$$V_j(p_j|x \neq j) = p_j(1 - F_i(p_j|x \neq j) + l_j) + \delta[(1 - F_i(p_j|x \neq j))V_j(\cdot|x = j) + F_i(p_j|x \neq j)V_j(\cdot|x \neq j)]$$

The equations can be rewritten as:

$$\begin{aligned} F_i(p_j|x = j) &= \frac{p_j(1+\theta+l_j) - V_j(\cdot|x = j)(1-\delta)}{p_j + \delta(V_j(\cdot|x = j) - V_j(\cdot|x \neq j))} \\ F_i(p_j|x \neq j) &= \frac{p_j(1+l_j) - \delta V_j(\cdot|x = j) - V_j(\cdot|x \neq j)}{p_j + \delta(V_j(\cdot|x = j) - V_j(\cdot|x \neq j))} \end{aligned}$$

Considering only symmetric equilibria the distribution functions for a firm $j \in N$ given a opponents price p are equal to

$$p_j \sim F(p) = \frac{p(1+l+\theta) - V(\cdot|x = j)(1-\delta)}{p + \delta(V(\cdot|x = j) - V(\cdot|x \neq j))} \quad \text{for} \quad p \in [\underline{p}, R] \quad \text{if } x \neq j$$
$$p_j \sim F(p) = \frac{p(1+l) + \delta V(\cdot|x = j) - V(\cdot|x \neq j)}{p + \delta(V(\cdot|x = j) - V(\cdot|x \neq j))} \quad \text{for} \quad p \in [\underline{p}, R] \quad \text{if } x = j$$

I divide the proof into several steps. Firstly, I show that under some assumptions, the support of the mixing substitutions has certain characteristics. Secondly, I show that the presented strategy satisfies previous assumptions and forms a Markov Perfect Equilibrium. My approach is closely related to Padilla (1995) and Anderson (1995)

Consider $\text{supp}(F(p)) = [\underline{p}, \bar{p}]$, for $x = j$ and $x \neq j$. (1) Assume that the upper support is defined as $\bar{p} = R$. (2) Further $\underline{p}$ as well as $\bar{p}$ are assigned with zero probability. (3) $V(\cdot|x = j) > V(\cdot|x \neq j)$.

First note that for each state x, no price in the interior of the support of F, $p \in$int(supp(F)), is assigned with a positive probability. Proof by contradiction: Suppose there exists a $p \in$int(supp(F)) for $x \neq j$ which is played with positive probability. Given $\varepsilon > 0$ there is an p', $p' \in (p - \varepsilon, p + \varepsilon)$, $p' \neq p$, that is not assigned a positive probability. The reasoning stems hat masspoints are not infinite. The firm with habit persistent patients ($x = j$) has the same masspoint in p. There exists a μ for which the firm with habit persistent patients ($x = j$) shifts density from the interval $(p, p + \mu)$ to p as $p(1 + l + \theta) + \delta V(\cdot|x = j) > (p + \mu)(l + \theta) + \delta V(\cdot|x \neq j)$. For the firm, without habit persistent patients, it cannot be optimal to have a masspoint at p, as it can increase its profit by shifting its mass point from p to $p + \mu$. Therefore the firm in state $x \neq j$ has not a masspoint in p. The same reasoning holds for the firm with habit persistent patients ($x = j$). In detail the firm in $x \neq j$ would reply by undercutting and the firm with habit persistent patients could increase its profit by shifting its mass point.

Secondly, we note that for each state $x \in 1, 2$ the interiors of the support, int(supp(F)) is connected. The reasoning for this statement is equivalent to the proof before. The interior of the support is solely connected if and only if it is an interval. If one firm has a gap in its interval, the opponent profits from shifting its density.

Thirdly, we challenge the assumption that $\underline{p}$ has a probability of being assigned equal to zero. The same reasoning as before applies. Consider a masspoint of the firm with no mass of habit persistent patients ($x \neq j$). The opponent has the incentive to shift density to the masspoint of the opponent. For the firm with habit persistent patients, it is optimal to shift the masspoint such that it cannot be an equilibrium. The same holds for the firm with habit persistent patients.

Finally note that under assumptions (1), (2) and (3) the valuation for the firm with habit persistent patients, $V(\cdot|x \neq j) = \bar{p}(1 - F(\bar{p}) + l_j) + \delta[(1 - F(\bar{p}))V(\cdot|x = j) + F(\bar{p})V(\cdot|x \neq j)]$ is increasing in $\bar{p} \leq R$ such that the maximum is attained for $p = R$ which implies the upper bound of the support that is equal to R[1].

$F(\underline{p}) = 0$ gives us the following equations:

$$\frac{\underline{p}(1 + l + \theta) - V(\cdot|x = j)(1 - \delta)}{\underline{p} + \delta(V(\cdot|x = j) - V(\cdot|x \neq j))} = 0$$

$$\frac{\underline{p}(1 + l) + \delta V(\cdot|x = j) - V(\cdot|x \neq j)}{\underline{p} + \delta(V(\cdot|x = j) - V(\cdot|x \neq j))} = 0$$

[1]Note that this statement refers to strategies defined by the conditional distribution function and not pure strategies.

Solving the equations simultaneously results in:

$$V(\cdot|x \neq j) = \frac{\underline{p}(1+l+\delta\theta)}{1-\delta}$$
$$V(\cdot|x = j) = \frac{\underline{p}(1+l+\theta)}{1-\delta}$$

The firm with habit persistent patients prefers to set a price equal to R if $R(l+\theta) + \delta V(\cdot|x \neq j) \geq p(1+l+\theta) + \delta V(\cdot|x = j)$. With the valuation functions it shows that all $p \leq \frac{R(\theta+l)}{1+l+\theta+\delta\theta}$ are dominated by $p = R$. The firm without habit persistent patients will therefore never set a price lower and we get the lower bound equal to $\underline{p} = \frac{R(\theta+l)}{1+l+\theta+\delta\theta}$.

We see that $V(\cdot|x = j) > V(\cdot|x \neq j)$ which satisfies assumption (3). Furthermore, the probability distributions F for $x = j$ and $x \neq j$ are proper probability measures that satisfy assumptions (1) and (2). We have constructed an equilibrium whereby construction the strategies satisfies indifference of both players among prices in the equilibrium support. The equilibrium is stationary and Markov Perfect.

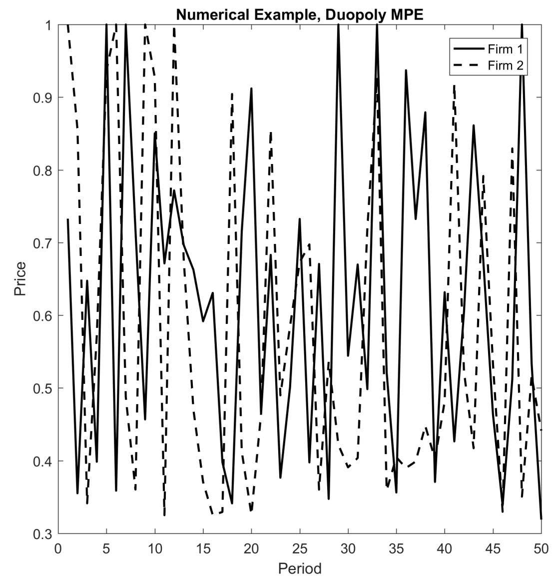
By definition it is also Subgame Perfect. Each period the probability distributions and support constitutes a Nash equilibrium. Furthermore, the equilibrium in unique as the lower bound of the equilibrium support describes the entire equilibrium strategy, which is described by the distributions $F(p)$.

Numerical Example:

In the following, I present a brief numerical example of the final price development. I start by assigning numerical values for the parameters of the model. In detail let $l = .5$, $\theta = .2$, $\delta = .95$ and $R = 1$. Given these parameter the minimum support of prices is equal to $\underline{p} = 0.3704$ and the continuation functions for the states $x \neq j$ and $x = j$ are $V = 12.5185$ and $V = 12.5926$.

To estimate the pricing behavior, I use the inverse transform sampling method. Given the cumulative distribution functions, I am generating sample numbers at random. In detail, given a continuous variable $u \sim [0,1]$ and the invertible functions $F(p)$ for both states, I generate random prices p, as $p = F^{-1}(u)$ has a distribution of F. In short, for the price of a firm without habit persistent patients, I generate a random number u from the uniform distribution and then compute p such that $F(p) = u$. Figure 1 shows a simulation of prices for 50 periods for two firms that play the mixed Markov perfect equilibrium as presented before.

Figure 1: Example MPE



Example of Markov Perfect equilibrium with $l = .5$, $\theta = .2$, $\delta = .95$ *and* $R = 1$.

D MPE, Heterogenous Mass of Patients with Brand Preferences

The game $\mathscr{G}(x^1)$ *with* $N = \{1,2\}$, $l_1 = l^H > l^L = l_2$, $\delta \in (0,1)$ *and given any initial state* $x^1 \in \mathscr{L}$ *has a unique Markov perfect equilibrium in mixed strategies which is defined by the following conditions:*

1. *Strategies* $\mathscr{S}_j$ *for* $j \in N$*:*

$$S_1 = \begin{cases} p_1 \sim F(p) & = \frac{p(1+l^H+\theta)-V_1(\cdot|x=j)(1-\delta)}{p+\delta(V_1(\cdot|x=j)-V_1(\cdot|x\neq j))} \quad for \quad p \in [\underline{p}_2, R] \quad if\, x \neq j \\ p_1 \sim F(p) & = \frac{p(1+l^H)+\delta V_1(\cdot|x=j)-V_1(\cdot|x\neq j)}{p+\delta(V_1(\cdot|x=j)-V_1(\cdot|x\neq j))} \quad for \quad p \in [\underline{p}_1, R] \quad if\, x = j \end{cases}$$

$$S_2 = \begin{cases} p_2 \sim F(p) & = \frac{p(1+l^L+\theta)-V_2(\cdot|x=j)(1-\delta)}{p+\delta(V_2(\cdot|x=j)-V_2(\cdot|x\neq j))} \quad for \quad p \in [\underline{p}_1, R] \quad if\, x \neq j \\ p_2 \sim F(p) & = \frac{p(1+l^L)+\delta V_2(\cdot|x=j)-V_2(\cdot|x\neq j)}{p+\delta(V_2(\cdot|x=j)-V_2(\cdot|x\neq j))} \quad for \quad p \in [\underline{p}_2, R] \quad if\, x = j \end{cases}$$

2. *Valuation functions:*

$$V_1(\underline{p}_2|x=j) = \frac{\underline{p}_2(1+l^H+\theta)}{1-\delta}$$

$$V_1(\underline{p}_1,\underline{p}_2|x\neq j) = \underline{p}_1(1+l^H) + \frac{\delta\underline{p}_2(1+l^H+\theta)}{1-\delta}$$

$$V_2(\underline{p}_1|x=j) = \frac{\underline{p}_1(1+l^L+\theta)}{1-\delta}$$

$$V_2(\underline{p}_1|x\neq j) = \underline{p}_2(1+l^L) + \frac{\delta\underline{p}_1(1+l^L+\theta)}{1-\delta}$$

3. *A minimum support of the strategies:*

$$\underline{p}_1 = \frac{R(l^L+\theta) + \frac{\delta R(l^H+\theta)(1+l^L)}{(1+\delta)(1+\theta+l^H)}}{[1-\frac{\delta^2(\delta-1)^2(l^H+1)(l^L+1)}{(\delta^2-1)^2(1+\theta+l^H)(1+\theta+l^L)}](1+\delta)(1+\theta+l^L)}$$

$$\underline{p}_2 = \frac{R(l^H+\theta) + \frac{\delta R(l^L+\theta)(1+l^H)}{(1+\delta)(1+\theta+l^L)}}{[1-\frac{\delta^2(\delta-1)^2(l^H+1)(l^L+1)}{(\delta^2-1)^2(1+\theta+l^H)(1+\theta+l^L)}](1+\delta)(1+\theta+l^H)}$$

Note first that one can rewrite the continuation payoffs as in Proposition 1:

$$\begin{aligned}
V_j(p_j|x=j) = {} & p_j(1-F_{-j}(p_j|x=j)+\theta+l_j)+ \\
& \delta[(1-F_{-j}(p_j|x=j))V_j(\cdot|x=j)+F_{-j}(p_j|x=j)V_j(\cdot|x\neq j)] \\
V_j(p_j|x\neq j) = {} & p_j(1-F_{-j}(p_j|x\neq j)+l_j)+ \\
& \delta[(1-F_{-j}(p_j|x\neq j))V_j(\cdot|x=j)+F_{-j}(p_j|x\neq j)V_j(\cdot|x\neq j)]
\end{aligned}$$

One the one hand the difference to the situation of symmetric patients with brand preferences is that the distribution according to which the firms mix their prices may differ dependent if firm $j=1$ or $j=2$ is in the state with habit persistent patients. However, given that one firm is in a state with habit persistent patients ($x=j$) both firms have the same lower bound. A firm without habit persistent patients ($x\neq j$) do not sets a lower price than the minimum support of the distribution according to which the with habit persistent patients ($x=j$) is mixing. Therefore the strategies can be written as:

$$S_1 = \begin{cases} p_1 \sim F(p) & = \frac{p(1+l^H+\theta)-V_1(\cdot|x=j)(1-\delta)}{p+\delta(V_1(\cdot|x=j)-V_1(\cdot|x\neq j))} \quad \text{for} \quad p \in [\underline{p}_2, R] \quad \text{if } x \neq j \\ p_1 \sim F(p) & = \frac{p(1+l^H)+\delta V_1(\cdot|x=j)-V_1(\cdot|x\neq j)}{p+\delta(V_1(\cdot|x=j)-V_1(\cdot|x\neq j))} \quad \text{for} \quad p \in [\underline{p}_1, R] \quad \text{if } x = j \end{cases}$$

$$S_2 = \begin{cases} p_2 \sim F(p) & = \frac{p(1+l^L+\theta)-V_2(\cdot|x=j)(1-\delta)}{p+\delta(V_2(\cdot|x=j)-V_2(\cdot|x\neq j))} \quad \text{for} \quad p \in [\underline{p}_1, R] \quad \text{if } x \neq j \\ p_2 \sim F(p) & = \frac{p(1+l^L)+\delta V_2(\cdot|x=j)-V_2(\cdot|x\neq j)}{p+\delta(V_2(\cdot|x=j)-V_2(\cdot|x\neq j))} \quad \text{for} \quad p \in [\underline{p}_2, R] \quad \text{if } x = j \end{cases}$$

Given a minimum support $\underline{p}_1$ and $\underline{p}_2$, F equals zero such that the valuation functions are:

$$\begin{aligned} V_1(\underline{p}_2|x=j) &= \frac{\underline{p}_2(1+l^H+\theta)}{1-\delta} \\ V_1(\underline{p}_1|x\neq j) &= \underline{p}_1(1+l^H) + \frac{\delta \underline{p}_2(1+l^H+\theta)}{1-\delta} \\ V_2(\underline{p}_1|x=j) &= \frac{\underline{p}_1(1+l^L+\theta)}{1-\delta} \\ V_2(\underline{p}_1|x\neq j) &= \underline{p}_2(1+l^L) + \frac{\delta \underline{p}_1(1+l^L+\theta)}{1-\delta} \end{aligned}$$

Solving the four equations gives us the lower supports of the distributions.

The proof is identical to the one presented in Proposition 1.

E Same Price Setting Subgame Perfect Equilibrium

As long as $\theta > 0$ the game $\mathscr{G}(x^1)$ with $N = \{1,2\}$ and $l_1 = l_2 = l$ has no Subgame Game equilibrium of the following strategies:

$$\mathscr{S}_{jt} = \begin{cases} p_j^t = R & \text{if } x^1 = j \quad \text{if } t = 1 \\ p_j^t = R & \text{if } x^1 \neq j \quad \text{if } t = 1 \\ p_j^t = R & \text{if } p_j^{t-1} = p_{-j}^{t-1} = R \quad \forall t > 1 \\ \text{Reversion to MPE} & \text{if } p_j^{t-1} \neq R \text{ or } p_{-j}^{t-1} \neq R \quad \forall t > 1 \end{cases}$$

However, such a SPE exists if $\theta = 0$.

Suppose the presented strategy is a Subgame Perfect Equilirbium and $\theta > 0$. The firm without habit persistent patients has a valuation function of $V(\cdot|x \neq j)^{SPE} = \frac{Rl}{1-\delta}$. Deviation would give the firm a one period profit of $\pi_0 = (R-\varepsilon)(1+l)$ with $\varepsilon > 0$. Given the continuation value by the

Markov Perfect Equilibrium which we have described in Proposition 1 the valuation of deviation is $V(\cdot|x \neq j)^{DEV} = (R-\varepsilon)(1+l) + \delta VV(\cdot|x=j)^{MPE}$, where $V(\cdot|x=j)^{MPE}$ is the valuation of the Markov Perfect Equilibrium described in Proposition 1. There exists a sufficiently small $\varepsilon > 0$ such that it is always optimal for the firm with habit persistent patients to deviate, $V(\cdot|x \neq j)^{DEV} > V(\cdot|x \neq j)^{SPE}$. In detail, given our results from the Markov Perfect Equilibrium in Proposition 1 one may substitute valuation functions in $V(\cdot|x \neq j)^{DEV} > V(\cdot|x \neq j)^{SPE}$ and get a condition of $\varepsilon < \frac{R(1-\delta+\theta+\delta\theta(1-\delta)+l(1-\delta)+\delta\theta l(1-\delta)+\delta\theta^2)}{(1+l+\theta+\delta\theta)(1+l)(1-\delta)}$. This condition is always satisfied for a sufficient small ε as $\delta \in (0,1)$. The reason stems from the fact that the firm with habit persistent patients does not only serves the mass of habit persistent patients but also the new arriving patients. The presented Subgame Perfect Equilibrium does not exist.

Secondly, suppose that $\theta = 0$. Note that without the unit mass of habit persistent patients. New patients are randomly assigned to one of the firms if both firms play $p = R$. The valuation for one firm is therefore $V^{SPE} = \frac{R(1/2+l)}{1-\delta}$. In comparison deviation gives a firm $V^{DEV} = (R-\varepsilon)(1+l) + \delta V_1^{MPE}$ where V_1^{MPE} is the valuation of the Markov Perfect Equilibrium in Proposition 1. Given our results from the Markov perfect equilibrium $V^{SPE} \geq V^{DEV}$ if and only if $\delta \geq \frac{R(1/2(1+l))-\varepsilon(1+l)^2}{R(1+l)-\varepsilon(1+l)^2}$. So for sufficiently patient firms and sufficient small $\varepsilon > 0$ the presented Subgame Perfect Equilibrium is sustainable.

F Proof of Proposition 2

The game $\mathscr{G}^{SP}(x^1)$ with $N = \{1,2\}$, $l_1 = l_2 = l$ and $\delta \in (0,1)$ has a Subgame Perfect Game equilibrium with the following strategies:

$$\mathscr{S}_j^t : \begin{cases} p_j^t = \underline{p} & \text{if } x^1 \neq j \quad \text{if } t = 1 \\ p_j^t = R & \text{if } x^1 = j \quad \text{if } t = 1 \\ p_j^t = \underline{p} & \text{if } p_j^{t-1} = R \text{ and } p_{-j}^{t-1} = \underline{p} \quad \text{for all } t > 1 \\ p_j^t = R & \text{if } p_j^{t-1} = \underline{p} \text{ and } p_{-j}^{t-1} \quad \text{for all } t > 1 \\ \text{Reversion to MPE} & \text{otherwise} \end{cases}$$

Where in each equilibria $\underline{p}$ satisfies:

$$\underline{p} \in \left(R(1 - \frac{\delta^2(1+\delta\theta)}{1+l+\theta+\delta\theta}, R \right)$$

Secondly consider the firm in state $x = j$, in the state with habit persistent patients. Continuation

payoff given the described strategy is $V(\cdot|x=j) = \frac{R(l+\theta)+\underline{p}(1+l)}{1-\delta^2}$. The payoffs in the MPE which describe the punishment are as presented before. The optimal deviation in state $s=1$ is to undercut the opponent marginally, i.e. to set a price equal to $p-\varepsilon$ where $\varepsilon \to 0$. This price allows the firm in $x=j$ to serve the new incoming patients for the highest possible price and further continuing with the better continuation payoff in state $x=j$. Correspondingly the payoff from deviating in state $x=j$ can be written as $V(\cdot|x=j)^{DEV} = (\underline{p}-\varepsilon)(1+l+\theta)+\delta V(\cdot|x=j)^{MPE}$. In order to prevent deviation the following condition needs to be satisfied: $V(\cdot|x=j) \geq V(\cdot|x=j)^{DEV}$ which can be rewritten as $\underline{p} \geq \frac{R(l+\theta)}{1+l+\theta+\delta\theta} + \varepsilon(1+\frac{\delta(1+l)}{1+l+\theta-\delta(1+l)-\delta^2(1+l+\theta)}$. Given that $\varepsilon \to 0$ one may rewrite the condition as $\underline{p} > \frac{R(l+\theta)}{1+l+\theta+\delta\theta})$.
Note that both conditions, for state one as well as state two, need to be satisfied to have a subgame perfect equilibrium. The parameter values of l and θ determine which condition is more restrictive. Therefore the lower and upper bound of $\underline{p}$ are defined as:

$$\underline{p} \in \left(\max\left\{\frac{R(l+\theta)}{1+l+\theta+\delta\theta}, R(1-\frac{\delta^2(1+\delta\theta)}{1+l+\theta+\delta\theta})\right\}, R\right)$$

As it holds that

$$R\left(1-\frac{\delta^2(1+\delta\theta)}{1+l+\theta+\delta\theta}\right)-\left(\frac{R(l+\theta)}{1+l+\theta+\delta\theta}\right) = \frac{R(1-\delta^2)(\theta\delta+1)}{l+\theta+\theta\delta+1} > 0,$$

one may write the lower bound as:

$$\underline{p} \in \left(R(1-\frac{\delta^2(1+\delta\theta)}{1+l+\theta+\delta\theta}, R\right)$$

G Proof of Proposition 3

The game $\mathscr{G}(x^1)$ with $N=\{1,2,3\}$, $l_1=l_2=l_3=l^L=l$, $\delta \in (0,1)$ given any initial state $x^1 \in \mathscr{L}$ has a Markov perfect equilibrium which is defined by the following conditions:

1. *Strategies $\mathscr{S}_j$ for all $j \in N$:*

$$S_j : \begin{cases} p_j = R & \text{if } x = j \\ p_j \sim F(p) = \frac{p(1+l)+\delta V(\cdot|x=j)-V(\cdot|x\neq j)}{p+\delta(V(\cdot|x=j)-V(\cdot|x\neq j))} \quad \text{for } p \in [\underline{p}, R] & \text{if } x \neq j \end{cases}$$

2. *Valuation functions:*

$$V(\underline{p}|x \neq j) = \frac{\underline{p}(1+l) + \delta R(\theta + l)}{1-\delta^2} \quad \textit{where } \underline{p} = \frac{R(l-\delta\theta)}{1+l}$$
$$V(\underline{p}|x = j) = \frac{R(\theta + l) + \delta \underline{p}(1+l)}{1-\delta^2}$$

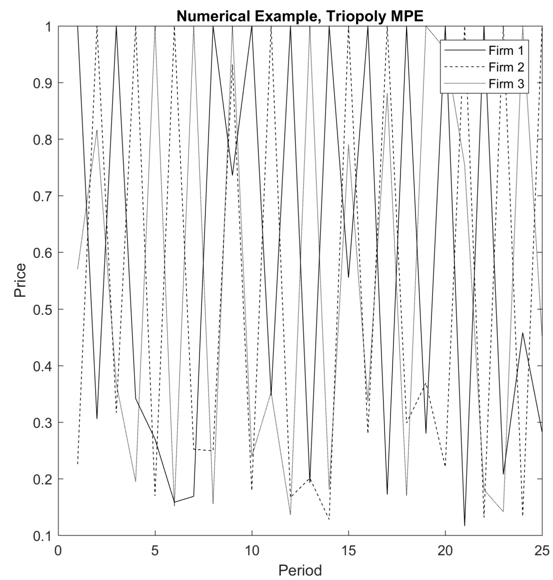
The proof for the mixed strategy equilibrium of those firms in state $x \neq j$ is analogous to the presented proof in Proposition 1 and is therefore omitted. The major difference is that two firms in state $x \neq j$ have no habit persistent patients. Therefore their valuation function given p and the probability distribution of the opponent in a state without habit persistent patients, donated by $F(p)$ can be written as $V(\cdot|x \neq j) = p[(1-F(p))+l] + \delta[(1-F(p))V(\cdot|x = j) + F(p)V(\cdot|x \neq j)]$. This equation equals $F(p) = \frac{p(1+l)+\delta V(\cdot|x=j)-V(\cdot|x\neq j)}{p+\delta(V(\cdot|x=j)-V(\cdot|x\neq j))}$. For $p = \underline{p}$ we get $F(\underline{p}) = 0$ and therefore $V(\cdot|x \neq j) = \underline{p}(1+l) + \delta V(\cdot|x = j)$. On the other side the firm with habit persistent patients (in state $x = j$) has a valuation of $V(\cdot|x = j) = R(\theta + l) + \delta V(\cdot|x \neq j)$ as she plays a pure strategy by setting the price equal to the price ceiling with certainty. Substitution gives $V(\cdot|x \neq j) = \frac{\underline{p}(1+l)+\delta R(\theta+l)}{1-\delta^2}$ and $V(\cdot|x = j) = \frac{R(\theta+l)+\delta\underline{p}(1+l)}{1-\delta^2}$. The firms without habit persistent patients are indifferent to setting a price equal to R and to $\underline{p}$ if $Rl + \delta V(\cdot|x \neq j) = \underline{p}(1+l) + \delta V(\cdot|x = j)$ which can be rearranged to $\underline{p} = \frac{R(l-\delta\theta)}{1+l}$. One concludes that the firm without habit persistent patients will never set a price lower than this lower bound.
Finally, the Markov Perfect Equilibrium requires that the firm with habit persistent patients (state $x = j$) does not deviate from his pure strategy of setting a price equal to R. Deviating would give a continuation payoff of $V(\cdot|x = j)^{DEV} = \underline{p}(1+l+\theta) + \delta V(\cdot|x = j)$. The firm in state $x = j$ does not deviate if $V(\cdot|x = j) \geq V(\cdot|x = j)^{DEV}$. The condition is satisfied if $\underline{p} \leq \frac{R(\theta(1-\delta)+l)}{1+\theta+l}$. As the minimum support of the strategies from the firms without habit persistent patients is represented by $\underline{p} = \frac{R(l-\delta\theta)}{1+l}$, the condition is always satisfied.

Numerical Example: As before, I present a numerical example of the Markov perfect equilibrium. Again, I simulate the prices of the presented strategy with the following parameter values which are the same as before: $l = \frac{1}{3}$, $\theta = .2$, $\delta = .95$ and $R = 1$. Figure 2 shows the price simulation for 50 periods.

H Proof of Proposition 4

The game $\mathscr{G}(x^1)$ with $N = \{1,2,3\}$, $l_1 = l^H > l^L = l_2 = l_3$, $\delta \in (0,1)$ given any initial state $x^1 \in \mathscr{L}$ has a Markov perfect equilibrium which is defined by the following conditions:

Figure 2: Example MPE



Example of Markov Perfect equilibrium with $l = \frac{1}{3}$, $\theta = .2$, $\delta = .95$ *and* $R = 1$.

1. Strategies $\mathscr{S}_j$ for $j \in N$:

$$S_1 : p_1 = R$$

$$S_j : \begin{cases} p_j \sim F(p) = \frac{p(1+l^L+\theta)-V(\cdot|x=j)(1-\delta)}{p+\delta(V(\cdot|x=j)-V(\cdot|x\neq j))} & \text{for } p \in [\underline{p}, R] \quad \text{if } x \neq j \quad \text{for all } j \in \{2,3\} \\ p_j \sim F_1^j(p) = \frac{p(1+l^L)+\delta V(\cdot|x=j)-V(\cdot|x\neq j)}{p+\delta(V(\cdot|x=j)-V(\cdot|x\neq j))} & \text{for } p \in [\underline{p}, R] \quad \text{if } x = j \quad \text{for all } j \in \{2,3\} \end{cases}$$

2. Valuation functions:

$$V_j = \frac{Rl^H}{1-\delta} \qquad \text{for } j = 1$$

$$V_j(\underline{p}|x \neq j) = \frac{\underline{p}(1+l^L+\theta\delta)}{1-\delta} \qquad \text{for all } j \in \{2,3\}$$

$$V_j(\underline{p}|x = j) = \frac{\underline{p}(1+l^L+\theta)}{1-\delta} \qquad \text{for all } j \in \{2,3\}$$

3. Where $\underline{p}$ satisfies:

$$\underline{p} = \frac{(\theta+l^L)}{1+l^L+\theta+\delta\theta} \leq \frac{R(l^H-\delta\theta)}{1+l^H}2 \tag{1}$$

The proof for firms $j=2$ and $j=3$ which are playing mixed strategies is identical to those strategies of the firms in a duopoly presented in Proposition 1. Therefore I omit the repetition. It remains to show that the pure strategy of firm $j=1$ is sustainable in the equilibrium. Firm A sets a price of R independent of the state which gives a valuation function of $V_1 = \frac{Rl^H}{1-\delta}$. A one shot deviation would give $V_1^{DEV} = \underline{p}(l^H+1) + \delta R(l^H+\theta) + \frac{\delta^2 Rl^H}{1-\delta}$. Firm $j=1$ does not deviate if $V_1 \geq V_1^{DEV}$. This condition can be rewritten as $\underline{p} \leq \frac{R(l^H-\delta\theta)}{1+l^H}$. Given the minimum support and this upper bound of $\underline{p}$ the we get the condition for $\underline{p}$, namely: $\underline{p} = \frac{R(\theta+l^L)}{1+l^L+\theta+\delta\theta} \leq \frac{R(l^H-\delta\theta)}{1+l^H}$.

I Proof of Proposition 5

The game $\mathscr{G}^{SP}(x^1)$ with $N=\{1,2,3\}$, $l_1 = l^H > l^L = l_2 = l_3$, $\delta \in (0,1)$ given any initial state $x^1 \in \mathscr{L}$ has Subgame Game Perfect equilibria of the following strategies:

$$\mathscr{S}_j^t : p_j^t = R \quad \text{for } j=1$$

$$\mathscr{S}_j^t : \begin{cases} p_j^t = R & \text{if } x^t = j \text{and } t=1 \quad \text{for all } j \in \{2,3\} \\ p_j^t = \underline{p} & \text{if } x^t \neq j \text{and } t=1 \quad \text{for all } j \in \{2,3\} \\ p_j^t = R & \text{if } p_j^{t-1} = \underline{p} \text{ and } p_{-j}^{t-1} = R \quad \text{for all } t>1 \quad \text{and } j \in \{2,3\} \\ p_j^t = \underline{p} & \text{if } p_j^{t-1} = R \text{ and } p_{-j}^{t-1} = \underline{p} \quad \text{for all } t>1 \quad \text{and } j \in \{2,3\} \\ \text{Reversion to MPE} & \text{otherwise} \quad \text{for all } j \in \{2,3\} \end{cases}$$

Where in each equilibria $\underline{p}$ satisfies:

$$\underline{p} \in \left(R(1 - \frac{\delta^2(1+\delta\theta)}{1+l^L+\theta+\delta\theta}, R \right)$$

Firstly, notice that the punishment strategy is the reversion to the MPE in Proposition 4. Therefore the equilibrium is based on the assumption that $\frac{R(\theta+l^L)}{1+l^L+\theta+\delta\theta} \leq \frac{R(l^H-\delta\theta)}{1+l^H}$ as presented before. We will see that this assumption is also incorporated by the condition on $\underline{p}$.
The proof for the existence of the presented SPE for firm $j=2$ and $j=3$ is the same as the one presented in Proposition 2. Correspondingly the lower bound of the price for which the equilibria are possible is $\underline{p} > \max(\frac{R(l^L+\theta)}{1+l^L+\theta+\delta\theta}, R(1 - \frac{\delta^2(1+\delta\theta)}{1+l^L+\theta+\delta\theta}))$. It remains to show that firm $j=1$ has

[2] If all parameters are positive this expression reduces to $l^H - l^L \geq (1+\delta)\theta$.

no incentive to deviate. The profit of firm $j=1$ from sticking to the pure strategy of playing R is the same as in the MPE presented in Proposition 4, namely $V_1 = \frac{Rl^H}{1-\delta}$. Deviating from his strategy would give $j=1$ an initial profit of $(\underline{p}-\varepsilon)(1+l^H)$ with $\varepsilon \rightarrow 0$ as she would undercut marginally. In the following periods all players play the MPE of Proposition 4. Therefore firm $j=1$ plays the pure strategy of playing A. Note that firm $j=1$ has a profit from habit persistent patients in the initial period after deviation such that the overall continuation function from deviation can be described as $V_1^{DEV} = (\underline{p}-\varepsilon)(1+l^H) + \delta R(l^H+\theta) + \delta^2 \frac{R(1+l^H)}{1-\delta}$. The condition that firm $j=1$ does not deviate is expressed by $V_1 \geq V_1^{DEV}$ which is equivalent to $\underline{p} \leq \varepsilon + \frac{R(l^H-\delta\theta)}{1+l^H}$. As $\varepsilon \rightarrow 0$ we can rewrite the condition as $\underline{p} \in \left(\max\left\{\frac{R(l^L+\theta)}{1+l^L+\theta+\delta\theta}, R(1-\frac{\delta^2(1+\delta\theta)}{1+l^L+\theta+\delta\theta})\right\}, \frac{R(l^H-\delta\theta)}{1+l^H}\right)$ equilibria are sustainable. As it holds that

$$R\left(1-\frac{\delta^2(1+\delta\theta)}{1+l^L+\theta+\delta\theta}\right) - \left(\frac{R(l^L+\theta)}{1+l^L+\theta+\delta\theta}\right) = \frac{R(1-\delta^2)(\theta\delta+1)}{l^L+\theta+\theta\delta+1} > 0,$$

one may write the lower bound as:

$$\underline{p} \in \left(R(1-\frac{\delta^2(1+\delta\theta)}{1+l^L+\theta+\delta\theta}, R\right)$$

J Summary Statistics

In the following, I provide additional summary statistics that allow comparing key statistics of the demand and supply-side data source. The demand, as well as supply data, is on the product level. The demand data is a subset of the supply data as I observe pharmaceutical products of the therapeutic subgroups of painkillers, anti-epileptics, antibiotics, and beta-blockers. Note that each of the subgroups contains different substances which are again ordered in observable substitution groups. Table 1 compares prices and competition between the substitution groups and products of the three therapeutic groups and the entire supply side. Note first that the demand subsets do not cover most of the supply side as we see that only a few of all substances are included. Further, the three therapeutic subgroups are not entirely representable, but they capture some heterogeneity, for example, in terms of competition and prices.

K Robustness Check: Functional Form

In the first robustness check I explore the role of the functional form assumption of the provided regression framework. I have focused on Linear Probability Models where the number of competi-

Table 1: Summary Statistics, Demand and Supply

	Painkillers	Antiepileptics	Antibiotics	Beta-Blocker	Supply
Number of Substances	10	4	24	6	301
Number of SubGrp	158	36	147	54	2251
Number of Products	566	72	438	234	8544
Average Number of Prod. in SubGrp	1.95	1.38	1.38	2.22	2.79
	(1.13)	(0.39)	(0.39)	(1.69)	(2.58)
Average Price	290.34	392.09	228.53	171.95	378.57
	(345.28)	(387.85)	(295.62)	(253.73)	(1356.91)
Average Price Originals	362.68		331.36	256.12	655.78
	(429.11)		(312.03)	(378.19)	(2275)
Average Price Generics	267.39	376.7	195.91	150.97	285.27
	(314.93)	(397.04)	(274.64)	(207.48)	(860.17)
Average Price Parallelimports	421.46	468.65	325.31	246.12	677.97
	(328.92)	(328.29)	(366.2)	(66.66)	(2234.85)

Notes: The first four column (Therapeutic subgroups: Painkiller, Antiepileptics, Antibiotics and Beta-Blocker) describe the demand side. The Supply column describes the data sources used in the supply side analysis. Number of substances corresponds to the number of pharmaceutical substances (ATC codes) available. The number of substitution groups and number of products shows the sum of each number respectively. The average number of products corresponds to the average number of competitors within a substitution group over the sample period of 6 years. Average prices, as well as prices of originals, generics or parallelimports are averages in SEK (10 SEK are approx. 1 USD) over substitution groups and time. Note that there are no originals in the substitution group of antiepileptics. Standard deviations in parentheses.

tors is treated as a factor variable. The intention is to explore the nonlinear relation of the number of competitors with the probability of observing a price cycle.

In the following I deviate from two this analysis. I show regression evidence by using a logit model and do not treat the number of competitors as discrete but as a continuous variable. Given the restriction that price cycles by definition are not possible for monopolists I exclude the monopoly markets from the analysis.

Hypothesis S2. *Tacit collusion schemes exist in the form of price cycles for markets with two competitors. Price cycles also exist in a triopoly. In detail, two generics form a price cycle when one original is present. However, in substitution groups with more than three competitors, price cycles between two competitors are less common.*

As in the main specification the probability of price cycle (SPC and APC) is estimated by the (continuous) number of competitors including substitution as well as time fixed effects:

$$P(S_{it} = 1|C_{it}) = \alpha_i + \gamma_t + \beta C_{it}$$

Table 2 shows regression results for 4 different models where the outcome variable is equal to one if a substitution group at time t is in a symmetric price cycle (SPC). The first model is a Linear Probability model without fixed effects. Model 2 shows the same evidence in a logit regression. The third and fourth are results from a linear probability as well as logit model with time and subgroup fixed effects.

Table 3 shows the same analysis for the asymmetric price cycle (APC). The major result, that higher competition leads to less price cycles is valid. Therefore the *Hypothesis* is still validated.

In order to evaluate the last part of *Hypothesis S2* with a continuous competition variable I use the number of competitors as well as an interaction between the number of competitors and a dummy which takes the value one if an original is present as regressors. As before time and substitution group fixed effects are included:

$$P(S_{it} = 1|C_{it}) = \alpha_i + \gamma_t + \beta_1 C_{it} + \beta_2 C_{it} \times O_{it},$$

where O_{it} is a dummy that takes the value one if one competitor in substitution group i at time period t is an branded product. As before, table 4 shows regression results for the probability of being in a SPC in 4 different models. Two linear probability models without and with time and substitution group fixed effects (Model 1 and 3) as well as two logit models without and with substitution group fixed effects (Model 2 and 4).

The regressions without fixed effects show insignificant coefficients for the interaction of the

Table 2: Logit Regression, SPCs

	(1) SPC, OLS	(2) SPC,Logit	(3) SPC, OLS	(4) SPC,Logit
NoComp	-0.00311***	-0.522***	-0.00388***	-0.888***
	(0.000423)	(0.0667)	(0.00100)	(0.0963)
Constant	0.0273***	-2.589***	0.0162***	
	(0.00325)	(0.234)	(0.00425)	
Time & Subgroup FE	No	No	Yes	Yes
N	64959	64959	64959	10199
R^2	0.005		0.199	
pseudo R^2		0.056		0.194

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

Notes: Robustness check using non-linear models. Sub-sample without Monopolists. One observation corresponds to a substitution group at time t. The dependent Variable is a Dummy which takes the value one in case that a substitution group at time t is in a Symmetric Price Cycle (SPC). NoComp are the number of competitors in a substitution group at t. Model (1) is a pooled least square regression. Model (2) is a logistic regression without controls. Model (3) is a OLS regression, controlling for time and substitution group fixed effects. Model (4) is a logistic regression with both fixed effects. The R^2 corresponds to the the full model, including the fixed effects. Standard Errors in parentheses.

Table 3: Logit Regression, APCs

	(1) APC, OLS	(2) APC, Logit	(3) APC, OLS	(4) APC, Logit
NoComp	-0.00325***	-0.328***	-0.00392***	-0.600***
	(0.000446)	(0.0401)	(0.00108)	(0.0702)
_cons	0.0319***	-2.864***	0.0153**	
	(0.00345)	(0.182)	(0.00473)	
Time & Subgroup FE	No	No	Yes	Yes
N	64959	64959	64959	16917
R^2	0.004		0.182	
pseudo R^2		0.034		0.165

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

Notes: Robustness check using non-linear models. Sub-sample without Monopolists. One observation corresponds to a substitution group at time t. The dependent Variable is a Dummy which takes the value one in case that a substitution group at time t is in a Asymmetric Price Cycle (APC). NoComp are the number of competitors in a substitution group at t. Model (1) is a pooled least square regression. Model (2) is a logistic regression without controls. Model (3) is a OLS regression, controlling for time and substitution group fixed effects. Model (4) is a logistic regression with both fixed effects. The R^2 corresponds to the the full model, including the fixed effects. Standard Errors in parentheses.

Table 4: Logit Regression, SPCs, Generics and Originals

	(1) SPC, OLS	(2) SPC,Logit	(3) SPC, OLS	(4) SPC,Logit
NoComp	-0.00284***	-0.451***	-0.00518***	-1.065***
	(0.000428)	(0.0630)	(0.00118)	(0.113)
NoComp Orig.	-0.000289	-0.110	0.00137**	0.220***
	(0.000251)	(0.0582)	(0.000438)	(0.0626)
Constant	0.0270***	-2.617***	0.0173***	
	(0.00321)	(0.231)	(0.00426)	
Time & Subgroup FE	No	No	Yes	Yes
N	64959	64959	64959	10199
R^2	0.005		0.200	
pseudo R^2		0.059		0.196

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

Notes: Robustness check using non-linear models. Sub-sample without Monopolists. One observation corresponds to a substitution group at time t. The dependent Variable is a Dummy which takes the value one in case that a substitution group at time t is in a Symmetric Price Cycle (SPC). NoComp are the number of competitors in a substitution group at t. NoComp Orig are the number of competitors interacted with a dummy that takes the value one if an original product is present. Model (1) is a pooled least square regression. Model (2) is a logistic regression without controls. Model (3) is a OLS regression, controlling for time and substitution group fixed effects. Model (4) is a logistic regression with both fixed effects. The R^2 corresponds to the the full model, including the fixed effects. Standard Errors in parentheses.

number of competitors with an original. Including fixed effects change the results such that the interaction has a positive effect. As in the regressions in Table 2 higher competition is associated with a lower probability of price cycles. However, the presence of an original increases the possibility of a SPC.

Table 5 shows the identical analysis where the outcome variable is a dummy that takes the value one if a substitution group is in a APC. The results are similar. One can conclude that an original branded product in substitution groups facilitates competition, in line with *Hypothesis S2*.

Table 5: Logit Regression, APCs, Generics and Originals

	(1) APC, OLS	(2) APC,Logit	(3) APC, OLS	(4) APC,Logit
NoComp	-0.00310***	-0.295***	-0.00549***	-0.714***
	(0.000486)	(0.0409)	(0.00128)	(0.0777)
NoComp Orig.	-0.000163	-0.0440	0.00165***	0.161***
	(0.000300)	(0.0397)	(0.000477)	(0.0442)
Constant	0.0318***	-2.881***	0.0166***	
	(0.00343)	(0.180)	(0.00475)	
Time & Subgroup FE	No	No	Yes	Yes
N	64959	64959	64959	16917
R^2	0.004		0.183	
pseudo R^2		0.035		0.167

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

Notes: Robustness check using non-linear models. Sub-sample without Monopolists. One observation corresponds to a substitution group at time t. The dependent Variable is a Dummy which takes the value one in case that a substitution group at time t is in a Asymmetric Price Cycle (APC). NoComp are the number of competitors in a substitution group at t. NoComp Orig are the number of competitors interacted with a dummy that takes the value one if an original product is present. Model (1) is a pooled least square regression. Model (2) is a logistic regression without controls. Model (3) is a OLS regression, controlling for time and substitution group fixed effects. Model (4) is a logistic regression with both fixed effects. The R^2 corresponds to the the full model, including the fixed effects. Standard Errors in parentheses.

Finally, I provide a robustness check for the evaluation of *Hypotheses 5*:

Hypothesis S5. *If firms do not collude in a duopoly, the firm with the cheapest product of the month does not increase its price in the subsequent period with certainty. However, if firms do not collude in a market with $|N| \geq 3$, the firm with the cheapest product of the month increases its price* *in the subsequent period with certainty. Further, the firm raises its price to the price ceiling.*

In the main specification I evaluated the probability that a product of the month increase its price in a preceding period as well as the probability that a product of the month increases its price to the maximum price given the number of competitors in a substitution group by linear probability model, treating the number of competitors as discretely. In the following I provide a robustness check by a linear probability as well as Compared to the previous specification I do not restrict the samples (and exclude monopolists) as I am not investigating price cycles.

Table 6 shows regression evidence where the outcome variable takes the value one if a product of a month of substitution group i in time t increases its price in the future period. Model 1 is a linear probability model, model 2 is a logistic specification. Both models do not include fixed effects. Model 3 and 4 are a linear probability model as well as a logit model including time and subgroup fixed effects. As in the main specification in section 5.4 higher competition is associated with a higher probability of an increasing price of the product of the month. For example in model 3, an additional competitor increases the probability that a product of the month increases its price by 1.9%.

Table 7 shows very similar regression evidence for the outcome which takes the value one if a product of the month increases its price in the forthcoming period such that it is the (weak) maximum price in a substitution group. The order of the models one to four is equivalent to Table 6 (including the implemented fixed effects). Results deviate as the number of competitors is not significantly related to the probability that a product of the month increasing its price to the maximum. Considering the specification with fixed effects, the coefficient for the number of competitors is negative, in the logit model even significant. One reason for this effect is observable in the main specification of section 5.4. The number of competitors increases the probability of a price increase to the maximum for two and three competitors, however the relationship is negative for higher competition. To explore the non-linearity I include a second and third order polynomial of the Number of competitors in model 5 and perform the same least square regression. The results suggest that initially increasing the number of competitors increases the marginal probability of increasing the price up to the maximum. For more than three competitors the probability is however decreasing. Although for high competition environments ($|N| > 3$) the product of the month increases its price, it is not increasing up to the upper bound.

The main hypothesis that the product of the month increases its price more often in the case of three compared to the case of two competitors is confirmed. Furthermore, also the theoretical prediction that the increase up to the maximum is more probable in triopolies than in duopolies. However, competitive environments with more than three competitors do not show an increase of the price of the product of the month to the maximum but an increase.

Table 6: Logit Regression, Behavior Prod of the Month

	(1) Inrease, OLS	(2) Increase, Logit	(3) Increase, OLS	(4) Increase, Logit
NoComp	0.0667***	0.345***	0.0190***	0.130***
	(0.00226)	(0.0136)	(0.00444)	(0.0116)
Constant	0.0456***	-2.283***	0.125***	
	(0.00771)	(0.0586)	(0.0191)	
Time & Subgroup FE	No	No	Yes	Yes
N	89407	89407	89407	82947
R^2	0.173		0.448	
pseudo R^2		0.142		0.180

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

Notes: Robustness check using non-linear models. One observation corresponds to a product of the month in a substitution group at time t. The data exclude substitution groups in a price cycle and a same price setting scheme (three period of subsequent same prices) at time t. The dependent variable is a dummy which takes the value one if a product of a month increase its price in the forthcoming period. NoComp are the number of competitors in a substitution group at t. Model (1) is a pooled least square regression. Model (2) is a logistic regression without controls. Model (3) is a OLS regression, controlling for time and substitution group fixed effects. Model (4) is a logistic regression with both fixed effects. The R^2 corresponds to the the full model, including the fixed effects. Standard Errors in parentheses. Standard Errors in parentheses.

Table 7: Logit Regression, Behavior Prod of the Month

	(1) IncMax, OLS	(2) IncMax, Logit	(3) IncMax, OLS	(4) IncMax, Logit	(5) IncMax, OLS
main					
NoComp	0.000943	0.0130	-0.00481	-0.168***	0.0550***
	(0.000653)	(0.00894)	(0.00302)	(0.0220)	(0.0136)
$NoComp^2$					-0.00990***
					(0.00180)
$NoComp^3$					0.000424***
					(0.0000733)
Constant	0.0733***	-2.535***	0.0420***		-0.0321
	(0.00434)	(0.0624)	(0.0120)		(0.0239)
Time & Subgroup FE	No	No	Yes	Yes	Yes
N	89407	89407	89407	70731	89407
R^2	0.000		0.290		0.292
pseudo R^2		0.000		0.162	

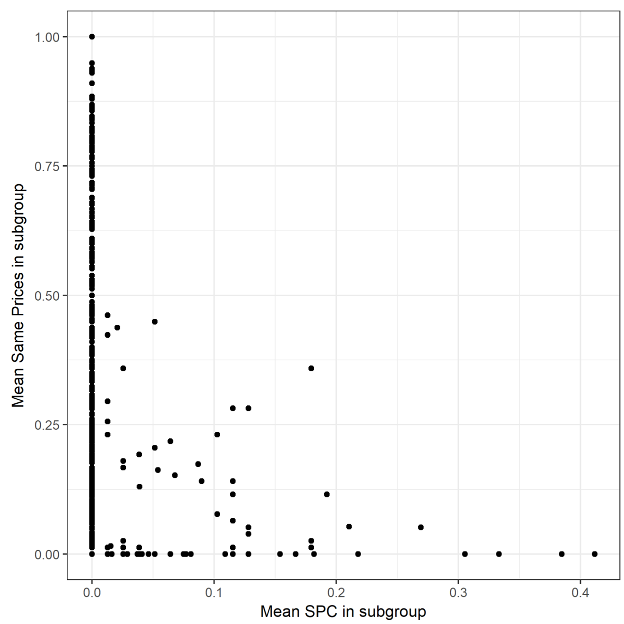
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes: Robustness check using non-linear models. One observation corresponds to a product of the month in a substitution group at time t. The data exclude substitution groups in a price cycle and a same price setting scheme (three period of subsequent same prices) at time t. The dependent variable for the models 4 to 6 is a dummy which takes the value one if a product of a month increase its price in the forthcoming period to the maximum within the substitution group. NoComp are the number of competitors in a substitution group at t. Model (1) is a pooled least square regression. Model (2) is a logistic regression without controls. Model (3) is a OLS regression, controlling for time and substitution group fixed effects. Model (4) is a logistic regression with both fixed effects. Model (5) Includes a second and third order polynomial in a least square regression ($NoComp^2$ for the second order and $NoComp^3$ for the third order polynomial. The R^2 corresponds to the the full model, including the fixed effects. Standard Errors in parentheses.

L Robustness Check: Identical Prices

Within this robustness check, I first evaluate the difference between identical price and price cycle schemes. I highlight several empirical phenomena about setting the same prices. Most important, substation groups in which we see market sharing schemes are different from those subgroups where competitors participate in price cycles. Figure 3 presents the relationship of substitution groups with equal price-setting strategies and those where one observes SPCs. The graph shows the correlation between the share of observations in a substitution group in an SPC and the share of observations where prices are equal over three periods in a substitution group. In the majority of subgroups where I observe same price-setting behavior, firms do not participate in price cycles.

Figure 3: SPCs and Identical Prices



Share of observations in a substitution group in an SPC over time against the share of observations where at least two periods have the same prices for three subsequent periods.

Furthermore, the behavior of the same price setting is happening at different points in time compared to the price cycle behavior. We observe the strategies of the same prices equally over the years, whereas strategies of price cycles occur more often in later years. However, no paradigm change is observable. Figure 4 shows a histogram of pricing schemes over time.

Additionally, the data indicate that collusion schemes in the form of price cycles have higher stability in terms of renegotiation. After the breakdown of a price cycle, we observe that firms can form new price cycles based on new prices. Table 8 highlights these observations for the case of substitution groups with two competitors.

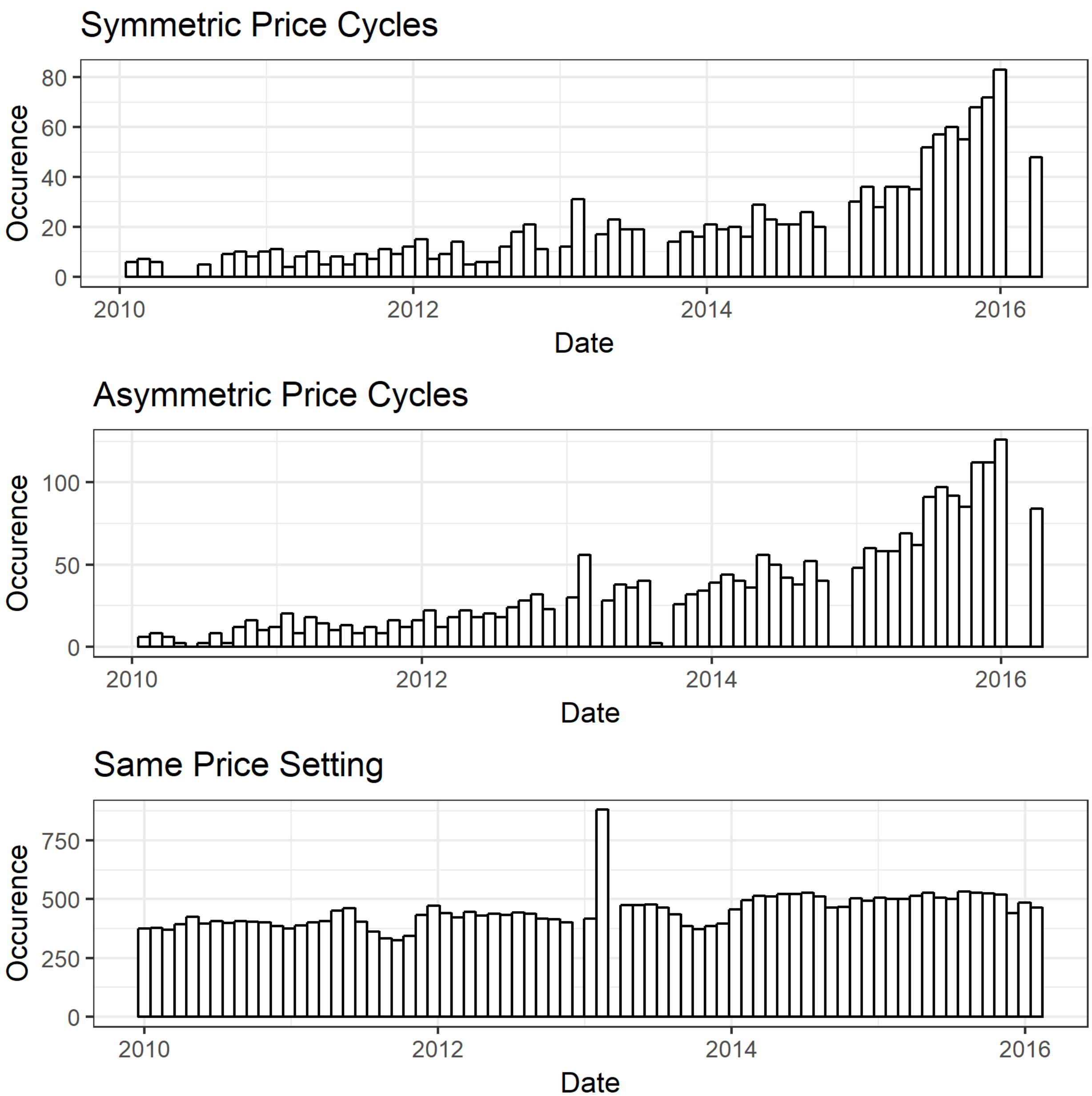


Figure 4: *Histogram of prices in SPC, APC, and same prices over three subsequent periods.*

Table 8: Differences in Pricing Schemes

	No. of Subgroups	Mean Price Difference	Mean Share Original	Mean Numb. of Rearrangements
SPC	77	0.0087	0.17	1
		(0.0135)	(0.34)	
APC	86	0.0345	0.49	1.198
		(0.03)	(0.58)	
SamePrice	299	0	0.24	0.988
		(0)	(0.46)	

Notes: Description of pricing schemes for substitution groups with two competitors. The price difference corresponds to the absolute difference between two products divided by the price of the more expensive products. A rearrangement takes place (is equal to one) if two products are able to re-coordinate in a pricing scheme within six month. Standard deviation are reported in parentheses.

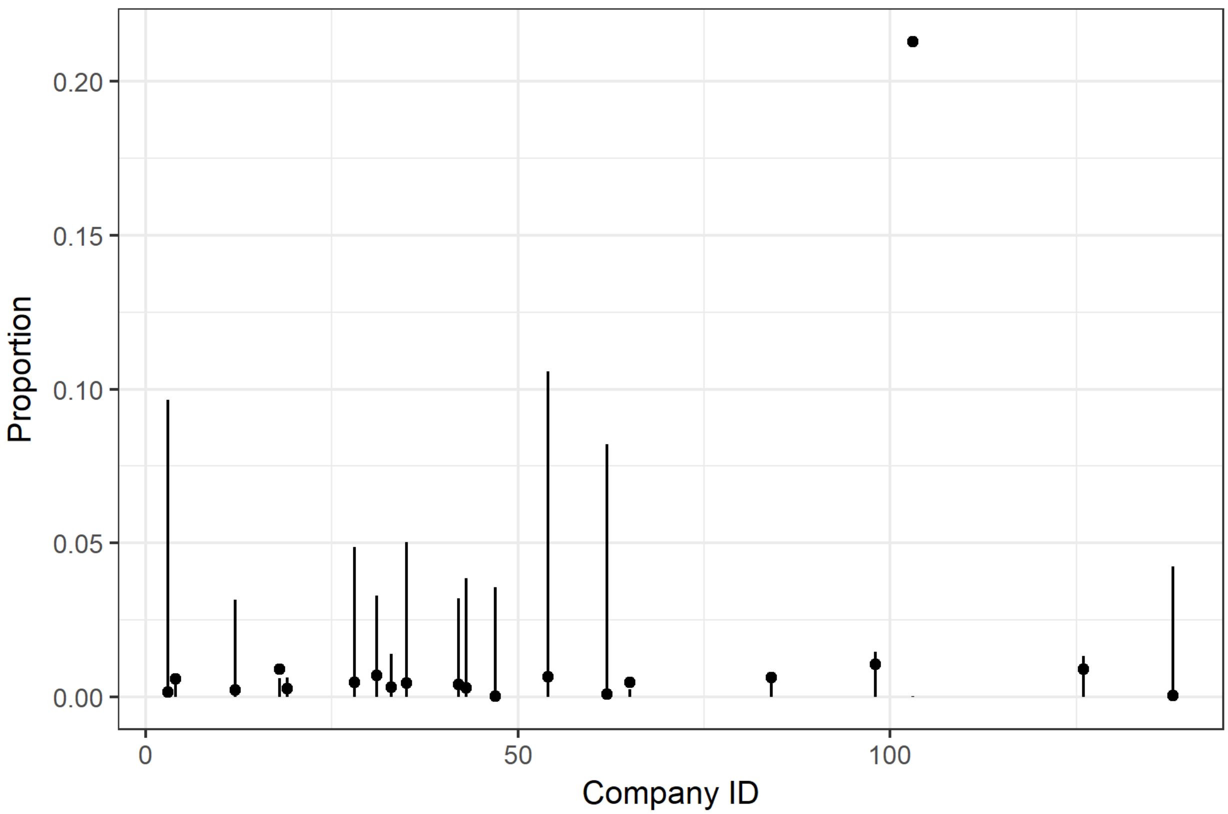
M Robustness Check: Multi-product Firms and Multi-Market Contacts

In this robustness check, I explore the role of multi-product firms and multi-market contacts. Within the 2251 substitution groups, some producers offer products in several groups. Furthermore, it is possible that several manufacturers compete with identical competitors in multiple markets. Those contact across markets may affect pricing incentives. For example, firms could condition tacit collusion schemes on the outcome in multiple markets. Such schemes would make collusion more sustainable as the deviation is connected to a higher loss, the breakdown of collusion in markets. In the following, I summarize how important multi-product firms and multi-product contact is in general as well as in the subset of price cycles.

First of all, note that the number of firms that are involved in price cycles is relatively high even though price cycles are not common. Within the sample, I observe 142 firms. Of these 142 firms, 33 participate at least once in an APC, and 22 participate at least once in an SPC. As I observe 2,389 of 350,057 observations with APC (0.6% see Table 2) and 23% of participating firms, one does not find a concentration of price cycles with specific firms. This result is confirmed by the graphical investigation in Figure 5. The graph shows for all firms the share of bids in the sample as well as of the share of price cycles across the own presence. Less than 1 to 2% of all prices from all large firms are suspected SPCs. Nevertheless, the share is always greater than zero. At the same time, all but one firm have shares of less than 2.5% of its own prices in SPCs. One outlier has a high share of prices that are in price cycles. However, the firm has a small market share, only having been in the Swedish market and one substitution group over a year. Overall, this descriptive

Figure shows that one does not observe a concentration of price cycles. Further, a lot of large firms are partly involved in SPCs.

Figure 5: Individual Firms: Price and SPC Fraction



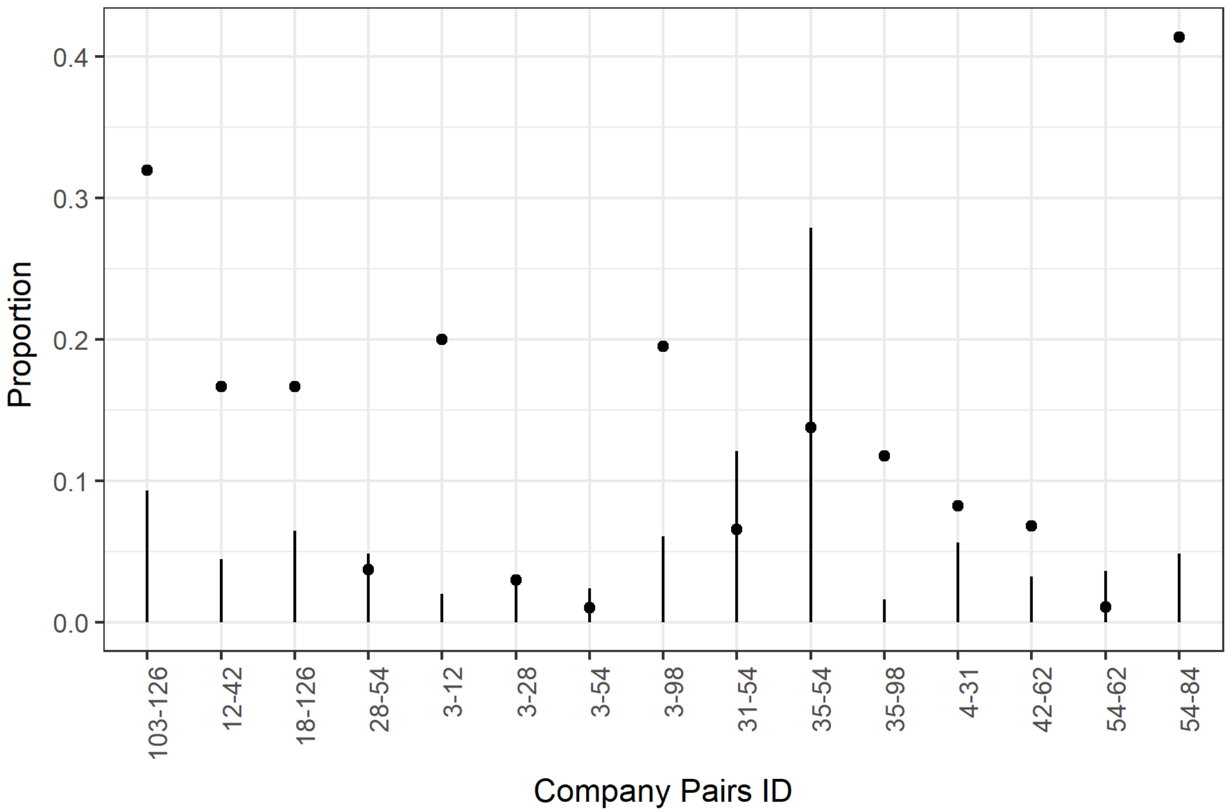
Note: Each individual firm is ordered according to their company IDs. The vertical lines represent the share of prices in the sample that are due to a firm. The circles show the share of SPCs of the prices of a firm has submitted across substitution groups and over months.

Next, I turn to the analysis of multi-market contact. An average firm within an SPC in a given month is involved in 5.52 (SD: 4.763) SPCs while beeing present in 280.1 (SD: 171.79) substitution groups. Multi-market SPCs are observable but present just a small part of the overall multi-market prices/contacts. I further investigate if potentially the same combination of firms in price cycles are observable. Figure 6 visualizes two main statistics of possible multi-market contacts. Its shows all two firm combinations which at least four times had contacts classified as a SPC.[3] I show the share of own contacts that are classified as SPCs and the share of these SPCs of all observable SPCs. Similar to the individual firms, a lot of pair of manufacturers are participating in SPCs, the distribution of contacts is not concentrated. Further, for a few firm combinations, a large share (30

[3]Note that a lot of firm combination (approx. 20) had SPC classified contacts over one to three months.

to 40 %) of contacts is characterized by SPCs. However, their share of all SPCs in the markets is small. At the same time, some firm combinations account for around 10% of all SPCs, but they often have market contacts that look different to SPCs. Overall, SPCs are neither closely connected to specific firms nor to certain firm combinations.

Figure 6: Company Pairs: SPCs



Notes: Each pair of a firm is ordered according to their IDs. The sample is restricted to those firm combination who had at least four times a contact that is classified as an SPC. The filled circles present the share of contacts between the two firms that are classified as an SPC. The vertical lines present the share of these SPCs of the aggregated SPCs across all markets and month.

Last, I try to identify possible signs of multi-market collusion. If firms do collude in multiple markets and the punishment phase includes a reversion to a Markov Perfect equilibrium in every single market, it may be possible to see multiple breakdowns as well as the start of SPCs of the same firm combinations across markets. I define a breakdown of a SPC if a pair of firms have been involved in a SPC for the past two periods ($t-1$ and $t-2$) and the price cycles is not observable for two following periods (t and $t+1$). The two period horizon avoids identification of a break down that is indeed solely due to a shift of a price ceiling of the regulator. In detail, it may be possible that a regulator changes the price ceiling R and therefore firms need one period to readjust their prices. Consequently also the start of a SPC is defined by two periods without preceding two periods with SPCs. Multi-market tacit collusion schemes would be characterized by breakdowns that take place by the same pair of firms, at the same time in different substitution groups.

According to the definition I observe 54 break-downs and 58 start of SPCs. The two events over time are connected to 35 firm combinations. In Figure 7 I show frequencies of break downs as well as starts for firm combinations with at least one breakdown or one start observation. Again, breakdown and starts are not highly concentrated. However, some firm combinations have a higher fraction of break downs and starts. Indeed, a single firm is present in multiple of these multi-market break downs. However, the firm is (1) present in a large share of observable markets and (2) break downs as well as starts seem not be coordinated over time. Exploring the relation in the time horizon, one observes that breakdowns, as well as starts, are not coordinated (The highest sum of break downs as well as starts in a month is two). Rather, it seems that for some firms, price cycles seem to break down and readjust after a period of 3 to 5 months. Overall, the short data exploration shows that multi-market contacts are observable. However, they seem not to drive tacit collusion schemes.

N Robustness Check: Producer Fixed Effects

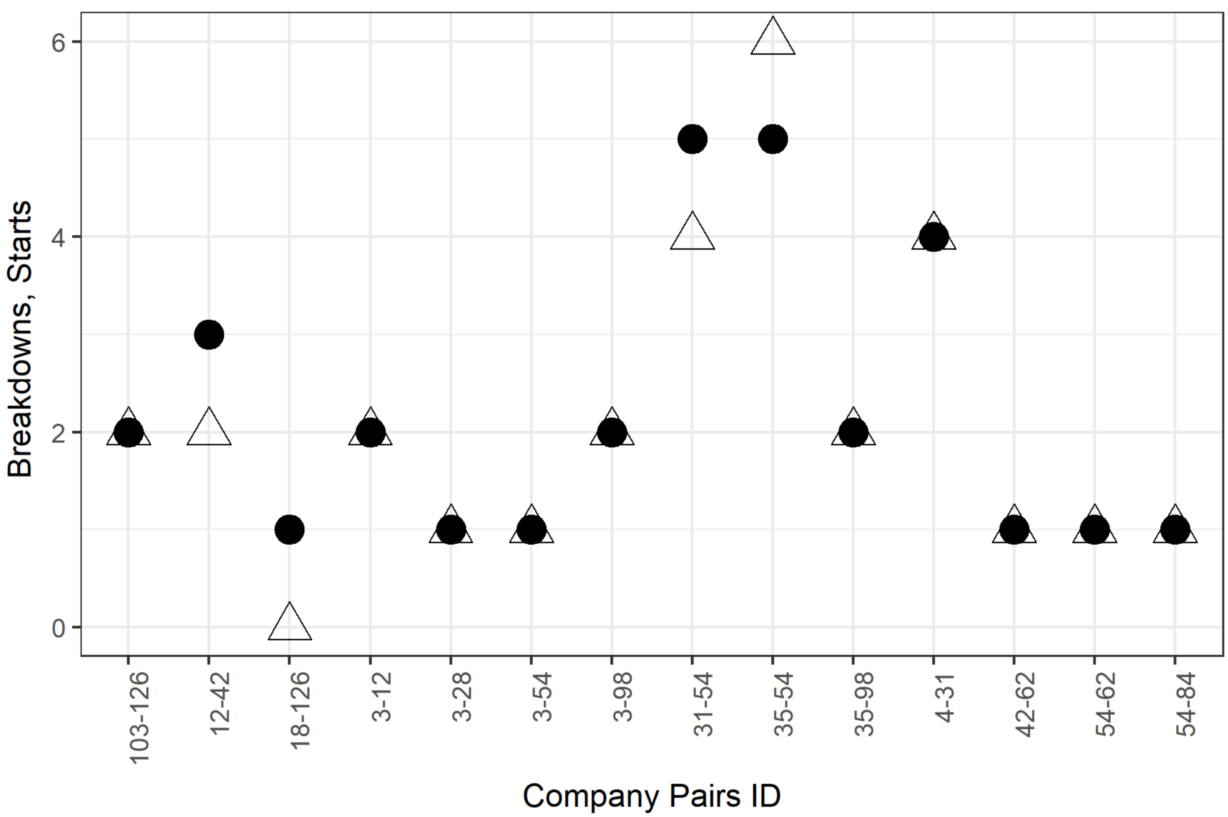
Within this robustness check, I turn to investigate if not the primarily the number of competitors but the identity of specific companies drive price cycles. First, note that I show in Figure 5 that SPCs are not concentrated among a few firms. I extend the observation by providing regression evidence using panel data methods with producer as well as individual fixed effects. Focusing on the effect of competition on SPCs, I show that specific firms do not drive the result.

Note first, that I do not collapse the data on the substitution group level to explore the role of specific firms. Therefore substitution groups with more competition are overrepresented. I explore the impact of competition on the possibility of an individual firm in a price cycle using firm, product, and time fixed effects. The linear probability model takes the following form.

$$P(S_{jFit} = 1|C_{it}) = \rho_F + \alpha_j + \gamma_t + \beta C_{it} + \varepsilon_{jit},$$

where product j is produced by producer F in substitution group i in month t. The outcome S_{jFit} now takes the value one if the firm is part of an SPCs. Partly I include producer fixed effect ρ_F. I, therefore, control for the effect that specific firms are causing SPCs. The variation that is exploited with producer fixed effects is one of competition for a specific producer. A producer may

Figure 7: Breakdowns and Starts of SPCs



Notes: Each pair of firm is ordered according to their IDs. Sample where at least one start or one break down is observed. Circles present number of breakdowns of SPCs. Triangles present starts of circles.

be present in several substitution groups. Furthermore, I partly use product fixed effects $alpha_j$. Here I do not only cover the identity for a producer but for a specific product that is only present in one substitution group. I also use added time fixed effects for the producer as well as product fixed effects.

The results are presented in Table 9. The major conclusion is that producer, as well as product fixed effects, do not change the interpretation of the main analysis. Specifically, the situation with two competitors is associated with a higher probability of price cycles, even after controlling for product fixed effects. I conclude that producer specific characteristics cannot explain the price cycles. Further, these results are in line with the predictions from theory.

O Robustness Check: Serialcorrelation and Price Cycle Definition

The analysis of the supply side is based on monthly data across substitution groups. I evaluate if firms participate in price cycles or substitution groups are characterized in price cycles at a given point in time. Observations over time are correlated, and the autocorrelation may be a threat for inference. I use a 'cluster' estimator proposed by Arellano (1987) for the specific case of fixed effects models. Standard errors are adjusted for heteroscedasticity.[4] Another threat may arise through the definition of price cycles. Some price cycles are characterized by short breaks. In detail, the regulator sets a new price ceiling, which affects prices and over one month. However, after a one-time adjustment of prices, the cycle continues. Within my definition, I do not define the transition period as a price cycle.

Within this robustness check, I evaluate the robustness to serial correlation as well as a different definition of price cycles. First, I allow a substitution group in a price cycle in case prices are adjusting from one price cycle to the next. Furthermore, I collapse the data on the substitution group level. In detail, I calculate the average value of the number of competitors as well as the share of price cycles over time. One observation now corresponds to a substitution group. The following Linear Probability Model is a static one not using panel data methods.

$$P(S_i = 1|C_i) = \alpha + \beta C_i + \varepsilon_i.$$

The outcome variable S_i is now the share of observable price cycles in a substitution group i

[4] Wooldridge (2003) describes the estimator the following way: '*Arellano (1987) proposed a fully robust variance matrix estimator for the fixed effects estimator, and it is consistent (as G increases with the Mg fixed) with cluster samples or panel data; see also Wooldridge (2010)* [Cited version from 2002]. *For panel data, the idiosyncratic errors can always have serial correlation or heteroskedasticity, and it is easy to guard against these problems in inference.*'.

Table 9: Producer Fixed Effects

	Symmetric Price Cycle			
	(1)	(2)	(3)	(4)
C=2	0.017***	0.017***	0.012***	0.012***
	(0.002)	(0.002)	(0.003)	(0.003)
C=3	0.009***	0.008***	−0.003	−0.004
	(0.001)	(0.001)	(0.003)	(0.003)
C=4	0.003***	0.002**	−0.009***	−0.009***
	(0.001)	(0.001)	(0.003)	(0.003)
C=5	−0.001	−0.001***	−0.012***	−0.013***
	(0.0005)	(0.001)	(0.004)	(0.004)
C=6	−0.001	−0.001***	−0.012***	−0.013***
	(0.001)	(0.001)	(0.004)	(0.004)
C=7	−0.001**	−0.002***	−0.013***	−0.013***
	(0.001)	(0.001)	(0.004)	(0.004)
C=8	−0.001**	−0.001***	−0.012***	−0.012***
	(0.001)	(0.001)	(0.004)	(0.003)
C=9	−0.001**	−0.001**	−0.012***	−0.011***
	(0.001)	(0.001)	(0.004)	(0.003)
C=10	−0.001**	−0.001**	−0.013***	−0.010***
	(0.001)	(0.001)	(0.004)	(0.003)
C=11	−0.001	−0.001*	−0.013***	−0.010***
	(0.001)	(0.001)	(0.004)	(0.003)
C=12	−0.001*	−0.001	−0.013***	−0.009***
	(0.001)	(0.001)	(0.004)	(0.003)
C=13	−0.001	−0.001	−0.013***	−0.009**
	(0.001)	(0.001)	(0.004)	(0.003)
C=14	−0.001	−0.002***	−0.012***	−0.009**
	(0.001)	(0.001)	(0.004)	(0.003)
C=15	−0.001	−0.001**	−0.012***	−0.008**
	(0.001)	(0.001)	(0.004)	(0.003)
C=16	−0.001	−0.001	−0.012***	−0.007*
	(0.001)	(0.001)	(0.004)	(0.003)
C=17	−0.001*	−0.00001	−0.012***	−0.004
	(0.001)	(0.001)	(0.004)	(0.003)
C=18	−0.001	0.00001	−0.012***	−0.002
	(0.001)	(0.001)	(0.004)	(0.004)
Constant	−0.007***			
	(0.001)			
Fixed effects	No	Time	Product	Product and Time
Producer FE	Yes	Yes	No	No
R-Squared	0.018	0.021	0.171	0.174
N	349,778	349,778	349,899	349,899

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Notes: One observation corresponds to a product at time t. Dependent Variable is a dummy that takes the value one if a product at time t is in a Symmetric Price Cycle (SPC). C are the number of competitors in a substitution group at t. Model (1) is a pooled regression controlling for producer fixed effects , Model (2) includes time fixed effects (and time fixed effects), Model (3) uses product group fixed effects and producer controls are dropped as they are perfectly correlated with the product fixed effects, Model (4) includes product- as well as time fixed effects. Standard errors are clustered on the product group level and adjusted for auto-correlation as well as heteroskedasticity. The R^2 corresponds to the the full model, including the fixed effects. Standard errors are reported in parentheses.

according to the old definition as well as the new one, SPCs, and APCs, respectively. I still evaluate the effect of competition. C_i is the average number of competitors in the substitution group i. I allow for nonlinear effects and create 5 dummies, that take the value one if the average number of competitors of i lies between predefined values ($C_i \leq 1.5, 1.5 < C_i \leq 2.5, 2.5 < C_i \leq 3.5, 3.5 < C_i \leq 4.5$, and $C_i > 4.5$). The results of the regression are presented in Table 10. The coefficients of C are relative to those substitution groups with 1 competitor over the entire time horizon $C_i = 1$. Overall, the results are in line with the main analysis. Having excluded the possibility of serial correlation, the main take away is the same. Symmetric- as well as asymmetric (SPCs, APCs) are observable in those substitution groups with two and three competitors. Increasing the number of competitors, the probability (and also the significance of coefficients) decreases. The lighter definition of price cycles increases the absolute number of price cycles as I now also consider adjustment periods. Consequently, the coefficients in size increase. Overall, the results are robust to a more lenient way of price cycle definition.

Table 10: New Price Cycle Definition

	SPC	SPC new definition	APC	APC new definition
	(1)	(2)	(3)	(4)
$C \leq 1.5$	0.002	0.004	0.002	0.004
	(0.004)	(0.008)	(0.004)	(0.009)
$1.5 < C \leq 2.5$	0.019***	0.043***	0.020***	0.047***
	(0.002)	(0.005)	(0.002)	(0.005)
$2.5 < C \leq 3.5$	0.020***	0.052***	0.028***	0.082***
	(0.003)	(0.006)	(0.003)	(0.007)
$3.5 < C \leq 4.5$	0.014***	0.036***	0.018***	0.053***
	(0.004)	(0.008)	(0.004)	(0.009)
$C > 4.5$	0.003	0.011**	0.005**	0.026***
	(0.002)	(0.005)	(0.002)	(0.005)
Constant	0.000	0.000	0.000	0.000
	(0.001)	(0.003)	(0.001)	(0.003)
N	2,251	2,251	2,251	2,251
Adjusted R^2	0.051	0.057	0.064	0.083

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Notes: One observation corresponds to a substitution group. Dependent Variable is a shows the average times of a substiution group in a Symmetric Price Cycle (SPC) or a Asymmetric Price Cycles (APC). C are the average number of competitors in a substitution group, ordered in brackets. Model (1) is a using the standard SPC definition, Model (2) the new SPC definition, Model (3) uses the old APC definition, Model (4) the new APC definition. Standard errors are clustered on the substitution group level and adjusted for auto-correlation as well as heteroskedasticity. Standard errors are reported in parentheses.

P Robustness Check: Heterogeneity in Habit Persistence

Within this section, I extend the analysis of exploring habit persistence. First, I show heterogeneity across the three different therapeutic subgroups (Painkillers, Antibiotics, Antiepileptics, and Beta-Blocker). Second, I show the role of generics and originals when it comes to habit persistence. In Table 11 I use the same regression model as described in Section 8 of the main article. I show regression evidence for each subgroup separately and display results using product and time fixed effects. Results are comparable to the overall results. In the therapeutic subgroups of painkillers, antibiotics, and beta-blocker patients are habit persistent as the coefficient ρ_1 of $PoMn_{it-1}$ (product of the month in $t-1$ but not in t) are positive and significantly different from zero. However, for antiepileptics, the habit persistence is not visible. Note that for painkillers the coefficients of $PoMn_{it-2}$ (product of the month in $t-2$ but not in t and $t-1$) are positive and significant. However, the size of coefficients is much smaller than for $PoMn_{it-1}$ (for painkillers: $PoMn_{it-2}$ has a coefficient of 0.015 and $PoMn_{it-1}$ one of 0.039; for antibiotics: 0.031 and 0.056). Habit persistence is still much higher if a product has been a product of the month in the preceding month. Overall the results confirm the pooled regressions with interaction terms for the therapeutic subgroups as well as the study in Janssen (2019).

In a second regression, I evaluate the role of originals in terms of habit persistence. In theory, I assume that original and generic products have the same possibility to attract habit-persistent patients. In the following, I present a regression model that is similar to the one presented in Section 8 of the main article.

$$\begin{aligned} Share_{it} =& \beta_0 Original_i + \theta Add.Expenses_{it} + \rho_0 Original_i \times PoM_{it} + \\ & \rho_1 Original_i \times PoMn_{it-1} + \rho_2 Original_i \times PoMn_{it-2} + \\ & \rho_3 Original_i \times PoMn_{it-3} + \alpha_i + \gamma_t + \zeta NoComp_{it} + \varepsilon_{it}, \end{aligned} \tag{2}$$

I investigate the impact of a dummy $Original_{it}$ that takes the value one if product i is an original. I interact the indicator for an original product with the variables of indicating a past or current product of the month (i.e., $PoMn_{it-1}$ is one if i has been a product of the month in $t-1$ but not in t). If originals would have the same possibility of attaining habit patients, the coefficients of the interaction terms should be insignificantly different from zero. I show results for the three therapeutic subgroups of painkillers, antibiotics, and beta-blocker. Note that originals are not present in the subgroups of antiepileptics. Table 12 shows regression evidence for the models, including product and time fixed effects. Note first that originals still have general brand premia. However, this brand premium diminishes if they are the product of the month. In detail, they have the same market share associated with being the product of the month as generics. Importantly, the interac-

Table 11: Regression, Habit Persistence, Individual Substances

	Painkiller	Antiepileptics	Antibiotics	Beta-Blocker
	(1)	(2)	(3)	(4)
Add. Expenses (SEK)	-0.0001^{***}	0.00004	-0.0001	-0.0005^{***}
	(0.00003)	(0.0001)	(0.0001)	(0.0001)
POM	0.383^{***}	0.365^{***}	0.443^{***}	0.398^{***}
	(0.011)	(0.062)	(0.015)	(0.017)
POMn(t-1)	0.039^{***}	-0.122^{*}	0.056^{***}	0.042^{***}
	(0.006)	(0.062)	(0.011)	(0.010)
POMn(t-2)	0.015^{***}	-0.055	0.031^{***}	0.010
	(0.005)	(0.059)	(0.009)	(0.009)
POMn(t-2)	0.008^{*}	-0.093^{**}	0.013	0.013^{*}
	(0.005)	(0.041)	(0.008)	(0.007)
Product and Time FE	yes	Yes	Yes	Yes
Competition Controls	Yes	Yes	Yes	Yes
R-Squared	0.84	0.825	0.816	0.822
N	19,927	1,761	15,540	8,817

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Notes: One observation corresponds to a product i in a substitution groups of painkiller, antibiotics, antiepilepics, or beta blocker within a month t. The outcome variable is the monthly market share. $Add.Expense$ are the out of pocket expenses for product i, the difference between the price of product i and the product of the month. $POM$is a dummy that takes the value one if product i is the cheapest available product of the month in t. $POMn(t-1)$, $POMn(t-2)$, $POMn(t-2)$ is a dummy that takes the value one if product i is the cheapest available product of the month in $t-1$, $t-2$ or $t-3$ but not subsequent month up to t. Models are considering four different therapeutic subgroups. Standard errors are reported in parentheses, they are clustered on the product group level, adjusted for serial correlation or heteroskedasticity.

tion terms with the original dummy $PoMn_{it-1}$ are insignificant for the subgroups of painkillers and antibiotics but positive and significant for the beta-blockers. Even though heterogeneity is observable, for most observable cases, habit persistence is not higher for original products. Taking into account that generics are more often a product of the month, purchases that are caused by habit persistence are higher for generics.

Q Robustness Check: Habit Persistence and Competition

Within the supply estimation, I show that lower competition is associated with price cycles as predicted by the model. One concern is that habit-persistence itself is a function of the number of competitors. Therefore habit persistence is itself induced by a competitive situation. The model does not incorporate this possibility. Within this section, I explore the possibility of correlated habit-persistence and the number of competitors. I show that habit persistence is the same for all competitive situations and not induced through competition.

Consider the following regression model that is closely related to the demand side analysis of Section 8 in the main article. The outcome variable is the market share of product i in a month t.

$$\begin{aligned} Share_{it} =& \zeta NoComp_{it} + \theta Add.Expenses_{it} + \rho_0 NoComp_{it} \times PoM_{it} + \\ & \rho_1 NoComp_{it} \times PoMn_{it-1} + \rho_2 NoComp_{it} \times PoMn_{it-2} + \\ & \rho_3 NoComp_{it} \times PoMn_{it-3} + \alpha_i + \gamma_t + \varepsilon_{it}, \end{aligned} \tag{3}$$

I evaluate again if habit-persistent is present, now interacting the variable of interest with the number of competitors of i at time t. I treat the number of competitors as factor variables and allow for nonlinear effects. If habit persistence is not correlated with the number of competitors, I expect that the coefficients of the interactions between a number of competitors higher than 3 are insignificant. To exclude the possibility that habit persistence arises when two and three products are in a choice set the coefficients of the interactions with two or three competitors with $PoMn_{it-1}$ (product of the month in $t-1$ but not in t) should not be significantly higher compared to other interactions. I present results for the entire sample of the four therapeutic subgroups. I exclude monopolies. Consider the situation with product and time fixed effects. The baseline coefficient of two competitors ($NoComp_{it} = 2$) interacted with $PoMn_{it-1}$ is 0.034 (p-value<0.001). I show the coefficients of ρ_1 graphically in 8. The coefficients for each number of competitors except for ten competitors are not significantly different from the one with two competitors. Further most coefficients (except for five competitors where the coefficients are negative but insignificant). There is no evidence for higher habit persistence for two or three competitors.

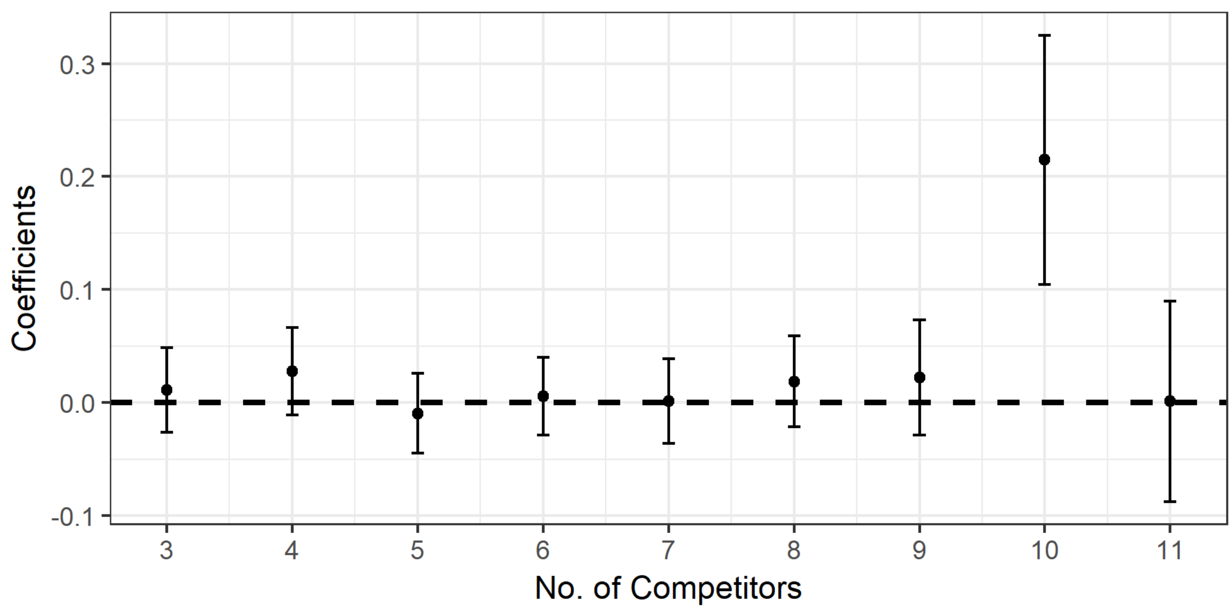
Table 12: Regression, Habit Persistence, Individual Substances, Originals

	Painkiller	Antibiotics	Beta-Blocker
	(1)	(2)	(3)
Add. Expenses (SEK)	-0.0002^{***}	-0.0003^{***}	-0.0004^{***}
	(0.00003)	(0.0001)	(0.0001)
Original	0.200^{***}	0.102^{***}	0.136^{***}
	(0.028)	(0.027)	(0.021)
POM	0.339^{***}	0.407^{***}	0.416^{***}
	(0.016)	(0.016)	(0.018)
POM(t-1)	0.030^{***}	0.068^{***}	0.069^{***}
	(0.010)	(0.012)	(0.010)
POM(t-2)	0.014^{*}	0.035^{***}	0.027^{***}
	(0.008)	(0.011)	(0.008)
POM(t-2)	0.009	0.007	0.025^{***}
	(0.008)	(0.009)	(0.009)
POM x Original	-0.219^{***}	-0.165^{***}	-0.155^{***}
	(0.036)	(0.035)	(0.037)
POM(t-1) x Original	0.004	0.033	0.114^{***}
	(0.040)	(0.029)	(0.040)
POM(t-2) x Original	0.022	0.034	0.109^{***}
	(0.041)	(0.026)	(0.033)
POM(t-3) x Original	0.019	0.032	0.117^{***}
	(0.043)	(0.027)	(0.036)
Constant	0.697^{***}	0.604^{***}	0.605^{***}
	(0.026)	(0.024)	(0.020)
Product and Time FE	yes	Yes	Yes
Competition Controls	Yes	Yes	Yes
R-Squared	0.646	0.682	0.715
N	19,927	15,540	8,817

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Notes: One observation corresponds to a product i in a substitution groups of painkiller, antibiotics, antiepilepics, or beta blocker within a month t. The outcome variable is the monthly market share. $Add.Expense$ are the out of pocket expenses for product i, the difference between the price of product i and the product of the month. $POM$is a dummy variable that takes the value one if product i is the cheapest available product of the month in t. $POMn(t-1)$, $POMn(t-2)$, $POMn(t-2)$ is a dummy variable that takes the value one if product i is the cheapest available product of the month in $t-1$, $t-2$ or $t-3$ but not subsequent month up to t. Original is a dummy variable that takes the value one if the product is an original. Models are considering three different therapeutic subgroups. Note that the subgroup of antiepileptics is excluded as originals are not present. Standard errors are reported in parentheses, they are clustered on the product group level, adjusted for serial correlation or heteroskedasticity.

Figure 8: Regression Coefficients, Habit Persistence, Competition



Notes: Figure shows the coefficients of ρ_1 *for each possible number of competitors NoComp. Coefficients from regression in model 3. One observation corresponds to a product i in a substitution groups of painkiller, antibiotics, antiepilepics, or beta blocker within a month* t*. The outcome variable is the monthly market share. Error bars show the 95% confidence interval.*

R Robustness Check: Same Prices

In the following, I present a robustness check of the pharmacy behavior if two firms offer the same price. The model is closely related to the regression evidence in Section 8 of the main article when I regress market shares on past market shares. Within this robustness check, I show regression evidence for substituting the lagged market share with PoM_{it-1} (a dummy that takes the value one if a product has been the product of the month in $t-1$). Other variable definitions are the same as in the main article.

$$\begin{aligned} Share_{it} =& \theta Add.Expenses_{it} + \rho_0 PoM_{it} + \rho_1 TPoM_{it} + \kappa_0 PoM_{it-1} + \\ & \beta_0 Original_{it} + \kappa_1 TPoM_{it} \times PoM_{it-1} + \beta_1 TPoM_{it} \times Original_{it} + \\ & \alpha_i + \gamma_t + \zeta NoComp_{it} + \varepsilon_{it}, \end{aligned}$$

Table 13 presents the results. Controlling for product and time fixed effects, being the product of the month is associated with a 44.8 percentage points higher market share, while the interaction of both has a significant negative coefficient. Also, being a product in the last period leads to a higher share, while the interaction of POM_{t-1} and POM_t is negative and significant. In case two firms are a product of the month ($POM\ and\ SP = 1$), the share decreases by 26.8 percentage points. Importantly, if two firms are a product of the month and have the same price, the firm that has been the product of the month in the previous month increases its market share by 18.8 percentage points. Therefore, a firm that has been the product of the month in the previous period gets a large share of the market if two firms set the same price. For originals, we do not observe any effect. This result confirms the results of the main regression model in Section 8.

S Test of Additional Hypotheses, Supply Side

Price dispersion in price cycles

Focusing on the substitution groups in price cycles, the model predicted that different price bounds depended on the number of firms in a substitution group. I expect that price cycles in substitution groups with two competitors have smaller differences between the products than a substitution group with three competitors (*Hypothesis S3*).

I start by restricting the sample to observations in a price cycle. Figure 9 shows the average relative price differences between the products in a price cycle conditional on the absolute number of firms competing. The price differences between the two products in a price cycle increase for a higher number of competitors. This descriptive evidence is in line with *Hypothesis S3*.

However, substitution groups may differ depending on the number of competitors. To account

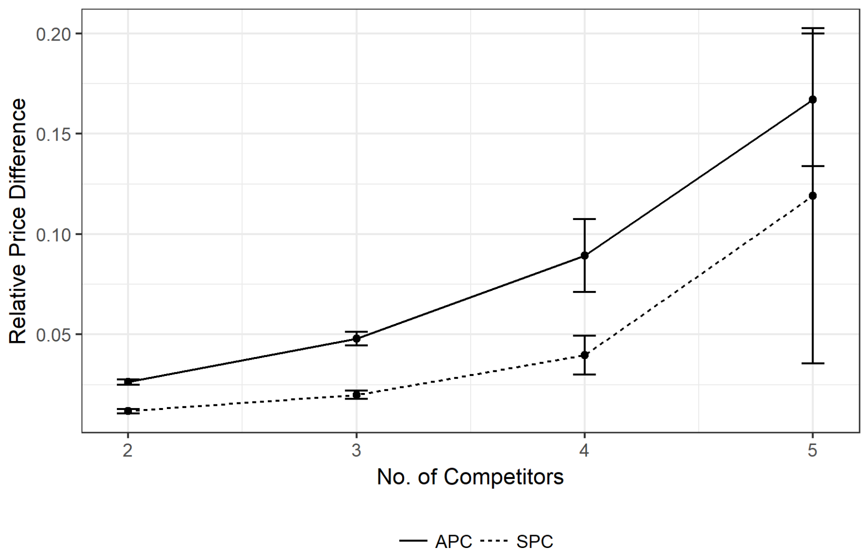
Table 13: Regression, Robustness Check, Identical Prices and Market Shares

	Share	Share	Share
	(1)	(2)	(3)
Add. Expenses (SEK)	-0.0001^{***}	-0.0001^{***}	-0.0001^{***}
	(0.00003)	(0.00003)	(0.00003)
POM	0.449^{***}	0.448^{***}	0.448^{***}
	(0.007)	(0.007)	(0.007)
POM(t-1)	0.019^{***}	0.019^{***}	0.019^{***}
	(0.004)	(0.004)	(0.004)
POM and SP	-0.266^{***}	-0.268^{***}	-0.268^{***}
	(0.011)	(0.011)	(0.011)
Original	-0.172^{***}		
	(0.008)		
POM x POM(t-1)	-0.144^{***}	-0.144^{***}	-0.144^{***}
	(0.008)	(0.008)	(0.008)
POM SP x POM(t-1)	0.190^{***}	0.188^{***}	0.188^{***}
	(0.014)	(0.014)	(0.014)
POM SP x Original	-0.028		
	(0.027)		
Fixed effects	No	Product	Product and Time
Competition Controls	Yes	Yes	Yes
R-Squared	0.825	0.825	0.825
N	46,141	46,141	46,141

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Notes: One observation corresponds to a product i in a substitution groups of painkiller, antibiotics, antiepilepics of beta blocker within a month t. The outcome variable is the monthly market share. $Add.Expense$ are the out of pocket expenses for product i, the difference between the price of product i and the product of the month. $POM$is a dummy that takes the value one if product i is the cheapest available product of the month in t. $POM(t-1)$ is a dummy that takes the value one if product i is the cheapest available product of the month in $t-1$. POM and SP is a dummy that takes the value one if i and at least one different product have been product of the month in t. Original is a dummy that takes the value one if product i is an original. All models include the $Number\ of\ Competitors$ as controls, where each competitor is taken as a own variable to allow for nonlinear effects. Model (1) is a pooled regression, Model (2) includes product fixed effects and Model (3) includes product as well as time fixed effects. Standard errors are reported in parentheses, they are clustered on the product group level, adjusted for serial correlation or heteroskedasticity. The R^2 corresponds to the the full model, including the fixed effects.

Figure 9: Price Differences in Price Cycles



Price differences of products in price cycles conditional on the number of competitors. One observation corresponds to a substitution group at time t where two firms form a price cycle. Relative price differences are defined by the absolute difference between both products in a price cycle divided by the larger price. Conditional on the number of competitors, the graph shows the average relative price difference. I restrict the sample to the case of two to five competitors. Error bars correspond to the 95% confidence interval.

for differences between subgroups, we get descriptive evidence by performing a fixed-effects regression of the relative price differences on the number of competitors. Table 14 presents regression evidence from a pooled regression, a regression including subgroup fixed effects, and a regression including time and subgroup fixed effects for APC and SPC price cycles on the substitution group level. The reference level of the regression evidence is the case of two competitors. For the SPC, the relative price difference is significantly higher for three competitors compared to the case of two competitors in the first and second specification (both .9 percentage points). Including subgroup and time fixed effects, the difference is not significantly different from zero but positive (.6 percentage points). For the broader defined price cycle, the APC, the relative price difference is significantly higher for substitution groups with three competitors in all specifications (2.2 percentage points pooled, 1.5 percentage points with substitution group and 1.3 percentage points with substitution group and time fixed effects.).

Table 14: Regression, Relative Price Differences

	Price Difference between Prod in PC					
	SPC	SPC	SPC	APC	APC	APC
	(1)	(2)	(3)	(4)	(5)	(6)
C=3	0.015**	−0.001	−0.003	0.016**	0.015*	0.015
	(0.006)	(0.001)	(0.003)	(0.006)	(0.006)	(0.008)
C=4	0.039*	0.003	−0.008	0.057**	0.030**	0.032*
	(0.020)	(0.003)	(0.008)	(0.018)	(0.009)	(0.014)
C≥5	0.329***	0.068***	0.036	0.233***	0.030**	0.033
	(0.027)	(0.003)	(0.023)	(0.029)	(0.009)	(0.019)
Constant	0.012			0.018		
	(0.010)			(0.014)		
Fixed effects	No	Subgroup	Subgroup and Time	No	Subgroup	Subgroup and Time
R-Squared	0.01	0.162	0.166	0.021	0.169	0.177
N	435	435	435	1,192	1,192	1,192

* $p < 0.05$, ** $p < 0.02$, *** $p < 0.001$

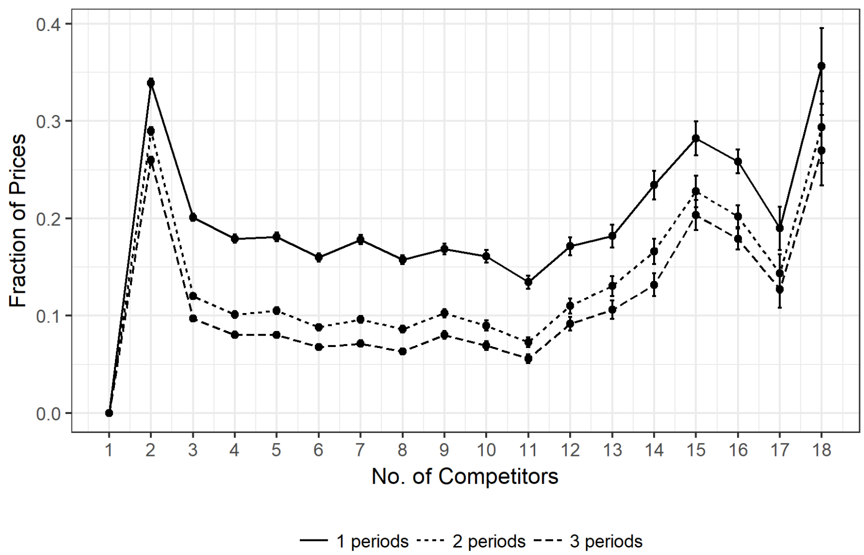
Notes: One observation corresponds to a substitution group at time t in a SPC (Models 1 to 3) and in an APC (Models 4 to 6). Given the definition of price cycles two firms form a price cycle. The dependent variable is the relative price difference, defined as the absolute difference between both products in a price cycle divided by the larger price. C are the number of competitors in a substitution group at t, including those product not part of a price cycle. More than five competitors are merged. In the Online Appendix I present a Table with all competitors used individually. Models (1) and (4) are pooled regressions controlling for the ATC code, Models (2) and (5) use substitution group fixed effects and ATC controls are dropped as they are perfectly correlated with the substitution group, Models (3) and (6) include substitution- as well as time fixed effects. Note that subgroup fixed effects reduce the number of coefficients. Standard errors are clustered on the substitution group level and adjusted for auto-correlation as well as heteroskedasticity. The R^2 corresponds to the the full model, including the fixed effects.

I can conclude that the relative price differences between the two products in a price cycle are on average higher when $|N| = 3$ compared to substitution groups with $|N| = 2$. The empirical analysis is in line with *Hypothesis S3*).

Identical Prices

The model predicts collusion schemes where several firms charge identical prices over time only in substitution groups where consumers are not habit persistent (*Hypothesis S4*). The reasoning is that habit persistence may increase the profits of only one firm if both set the same price. I assume that pharmacies adjust their procurement and supply only one product. One firm therefore has an incentive to deviate.[5] Figure 10 shows the share of prices as conditional on the number of competitors, where at least two firms set their prices equally for one, two, and three subsequent periods.[6] In substitution groups with two competitors, around 25% of the observable prices are equal for three subsequent periods. Lower competition is correlated with a larger share of firms setting the same price.

Figure 10: Same Prices



Share of observations where prices are equal in one, two, and three subsequent periods. Conditional on the number of competitors, I show the fraction of prices where at least two products set the same price for one, two, or three time periods, forward looking. Error bars correspond to the 95% confidence interval.

Following the model, identical prices do not necessary are a result of tacit collusion as also competitive equilibria may have same characteristics of dynamic prices. However, such dynamics are not observable if patients are habit persistent or have heterogeneous brand preferences across products. Assuming that patients preferences and behavioral frictions are stable within a substi-

[5] See Section for a empirical assessment of this assumption.

[6] I have to differentiate same price setting to rotation where, for example, an original brand set the maximum price and a product of the month increases its price up to the maximum for one period. Therefore, I continue with considering the share when at least two identical firms set the same prices for at least three subsequent periods.

tution group over time the substitution groups should be different from those where one observes price cycles (which are only observable with habit persistence or heterogeneous brand preferences). I investigate detailed differences in Appendix L. I show that identical pricing is happening in different substitution groups and differ in several key dimensions (timing, frequency, break downs) to price cycle schemes. I conclude that pricing schemes where several firms are setting the same prices are frequently observable. Substitution groups with such pricing schemes differ from substitution groups with price cycles. The observations back up *Hypothesis S4*.

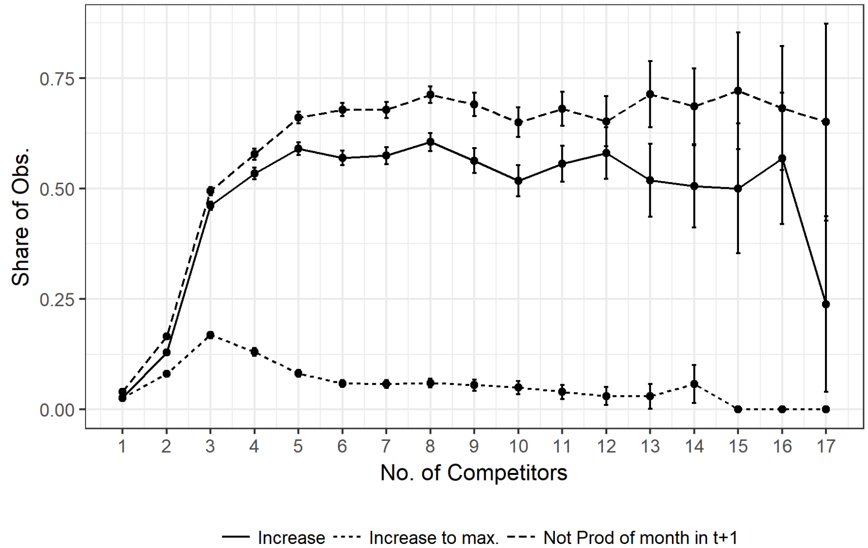
Product of the month

Finally, I consider the products that are not taking part in tacit collusion. I predict a difference in the behavior of firms in periods after being awarded the product-of-the-month status. In substitution groups with two competitors, the unique MPE implied that each competitor randomizes over a price distribution such that I expect an increase in price not with certainty (*Hypothesis S5*). In substitution groups with higher competition, I expect that the product of the month raises its price in the forthcoming period with certainty to harvest habit-persistent patients (*Hypothesis S5*).

In Figure 11, I show three proportions of products of the month for the restricted sample of products not in a price cycle or same pricing scheme conditional on the number of competitors in a subgroup: (1) the share of products of the month that are not products of the month in the subsequent period, (2) the share of products of the month that increase their price in the subsequent period, and (3) the share of products of the month that increase their prices such that they are the most expensive product in the forthcoming period. The basic plot shows that, in substitution groups with two competitors, the product of the month is more often the product of the month in the future period and increases its price less frequently in the future period compared to substitution groups with more competing firms. For the proportion of the products of the month that raise their price up to the maximal price in a substitution group, the graph shows evidence that is more ambiguous. Compared to substitution groups with three competitors, products of the month in substitution groups with two competitors are increasing their prices less often up to the maximum price in a substitution group in the future period. However, the share of products of the month that increase their price up to the maximal price decreases with the number of competitors in substitution groups with a higher number of firms ($|N| > 3$).

Finally, I challenge the graphical evidence by using the previously used fixed effects estimation to control for different demand patterns between substitution groups. As in the previous regression exercises, I collapse the data on the substitution group level. In the first subset of models, the dependent variable takes the value 1 if the product of the month of a substitution group in a period increases its price and 0 otherwise. In the second subset of models, the dependent variable takes the value 1 if the product of the month of a substitution group in a period increases its price up to

Figure 11: Behavior of Prod. of the Month



Share of products of the month that (1) increase their price, (2) increase their price to the maximum in a substitution group, and (3) are not product of the month in the future month. The sample is restricted to substitution groups that are not part of a price cycle and not setting same prices over three subsequent periods at time t. Error bars correspond to the 95% confidence interval.

the maximum price of the subsequent period and 0 otherwise. I explore the effect of the number of competitors in three model specifications for both independent variables: (a) a pooled regression, (b) subgroup fixed effects, and (c) subgroup and time fixed effects. The reasoning for using fixed effects is equivalent to the argument in previous parts. Table 15 shows the regression evidence. Note that I treat the number of competitors as a factor and take two competitors as a base value.

The fixed effects regression shows similar evidence as the graphical interpretation. The product of the month in substitution groups with two competitors is significantly less likely to increase its price compared to substitution groups with more competitors (in case of three competitors it is 18.5 percentage points more likely- including substitution groups and time fixed effects). Considering the rise in prices up to the maximum price in a substitution group, a product of the month in a substitution group with two competitors is less likely to increase its price compared to a substitution group with three competitors (significant in the pooled regression, 6.4 percentage points, and 2.8 percentage points with subgroup fixed effects, but not significantly different with time and subgroup fixed effects, 1.4 percentage points) but not compared to substitution groups with even more competitors. One possible reason could be that the product of the month in high competition groups increases its price but at the same time avoids competition with a high priced original.

Table 15: Regression, Behavior Prod. of the Month

	Increase			Increase to Maximum		
	(1)	(2)	(3)	(4)	(5)	(6)
C=1	−0.096	−0.123	−0.119	−0.070	−0.081	−0.080
C=3	0.304**	0.217	0.184	0.064**	0.027*	0.013
	(0.006)	(0.001)	(0.003)	(0.006)	(0.006)	(0.008)
C=4	0.369*	0.229	0.207	0.028**	−0.032**	−0.041*
	(0.020)	(0.003)	(0.008)	(0.018)	(0.009)	(0.014)
C≥5	0.435***	0.242***	0.208	−0.031***	−0.077**	−0.091
	(0.027)	(0.003)	(0.023)	(0.029)	(0.009)	(0.019)
Constant	0.096			0.095		
	(0.010)			(0.014)		
Fixed effects	No	Subgroup	Subgroup and Time	No	Subgroup	Subgroup and Time
Controls	Yes	No	No	Yes	No	No
R-Squared	0.724	0.927	0.957	0.401	0.927	0.939
N	88,881	89,248	89,248	88,881	89,248	89,248

* $p < 0.05$, ** $p < 0.02$, *** $p < 0.001$

Notes: One observation corresponds to a product of the month in a substitution group at time t. The data exclude substitution groups in a price cycle and a same price setting scheme (three period of subsequent same prices) at time t. The dependent variable for the first three (1 to 3) models is a dummy which takes the value one if a product of a month increase its price in the forthcoming period. The dependent variable for the models 4 to 6 is a dummy which takes the value one if a product of a month increase its price in the forthcoming period to the maximum within the substitution group. C are the number of competitors in a substitution group at t. More than five competitors are merged. In the Online Appendix I present a Table with all competitors used individually. Models (1) and (4) are pooled regressions controlling for the ATC code, Models (2) and (5) use substitution group fixed effects and ATC controls are dropped as they are perfectly correlated with the substitution group, Models (3) and (6) include substitution- as well as time fixed effects. Standard errors are clustered on the substitution group level and adjusted for auto-correlation as well as heteroskedasticity. The R^2 corresponds to the the full model, including the fixed effects.

According to the model, I expect that the absence of from tacit collusion the product of the month in substitution groups with more than three firms increases its price with certainty. The data do not show this exact behavior. However, in comparison to substitution groups with two competitors, a product of the month increases its price significantly more often such that it is not the product of the month in the subsequent period.

Overall, duopolisitic firms with the product of the month do not increase the price in the subsequent period with certainty. I further confirm partly that firms in markets with more than two competitors increase their price more often after being the cheapest product of the month; however, the probability of a price increase is not equal to one.

T Test of Additional Hypotheses, Demand Side

Habit Persistence and Competitive Equilibria

In the following, I use heterogeneity in habit-persistence across the four different therapeutic subgroups to evaluate model predictions of equilibrium pricing patterns. While the four different groups allow showing suggestive evidence by exploiting variation of the number of competitors and variation in habit persistence, I do not have a sufficient sample for sophisticated empirical tests.

Figure 12 summarizes the evaluation of *Hypothesis D4*. First, I show the estimated degree of habit persistence from the regression model in Section 8 of the main article, ρ_1. I show the coefficients for each therapeutic subgroup. *Hypothesis D4* states that higher habit persistence is correlated with a higher lowest price of $\underline{p}$ within a substitution group of two competitors. Allowing for different price levels, it is necessary to normalize with the price ceiling R. I show the lowest price $\underline{p}$ divided by the price ceiling R for the four different therapeutic subgroups across substitution groups with two competitors and across months.[7] Habit persistence is positively correlated with the relative lowest price. We expect the same result in substitution groups with three competitors that include an original product. While I do not observe those substitution groups for antiepileptics, the relative lowest price is again high for the groups with higher habit-persistence (Beta-Blocker, Antibiotics, and Painkiller). Considering substitution groups with three competitors without an original, and substitution groups with four competitors, theory (*Hypothesis D4*) states that higher habit-persistence is associated with a decreased minimum price. The empirical observations confirm the predictions partly. Overall, relative minimum prices lower compared

[7] Note that I do not observe the actual price ceiling and take the maximum price observable over the entire sample within a substitution group. I exclude time periods of price cycles (defined by the APC definition which covers also SPCs), as well as same price setting periods as tacit collusion schemes, as both are not covered by the theoretical predictions.

to the group with three competitors and original or two competitors. Higher estimates of habit persistence are correlated with lower prices for the substitution groups for more or equal to four competitors. However, for the group of three competitors without an original, the relation is not unambiguous. Antiepileptics as the group without originals do not have higher relative minimum prices compared to the other therapeutic subgroups. One explanation is that brand preferences may still play a role. Therefore one firm acts as a branded generic and has higher brand preferences. The equilibrium is similar to the three competitors with one original case. Nevertheless, antibiotics as the group with the highest estimate of habit persistence have much lower relative minimum prices with three competitors without an original than in the case of two competitors. In case four competitors are present, results of relative minimum price and correlation to habit persistence are as expected. Consider the relation between antiepileptics and painkillers: If we observe two competitors, antiepileptics have lower minimum prices as habit persistence leads to higher minimum prices. However, if four firms compete, painkillers have lower minimum prices as now habit-persistence is associated with lower minimum prices. Overall the comparison across the four therapeutic subgroups confirms *Hypothesis D4* except for the ambiguous case of three competitors without an original product.

U Additional Tables

The following two tables describe Figure 12 in the Online Appendix and Figure 7 of the paper in numerical format:

V Copayment Functions

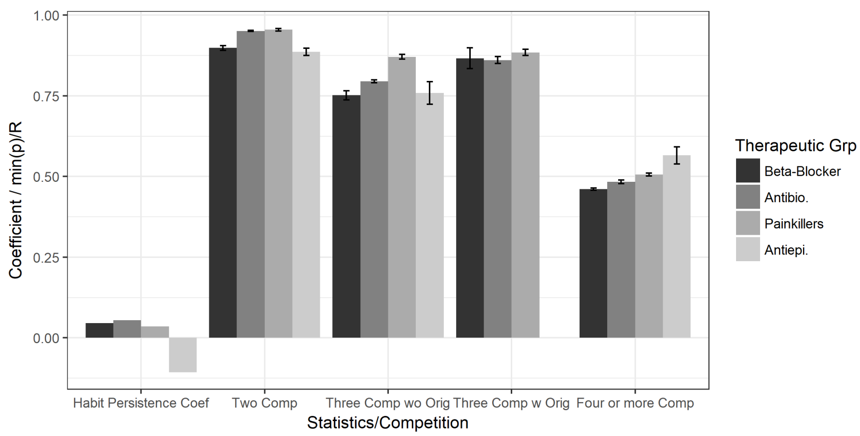
W Trade-margins

X Additional Coefficients

I use dummies for different competitive market structures. In case that markets with more than four competitors are present, I solely use one dummy. Within this section, I show the regression results where I do also treat markets with higher competition individually, i.e., I use a dummy for each competitive situation. Table 21 and 22 refer to Table 4, and Table 23 refers to Table 5 in the paper. Also Table 24 refers to Table 14.

Table 25 shows all coefficients of the Regression evidence of the role of originals and generics on price cycles shown in Table 23.

Figure 12: Habit Persistence and Price Differences



Each colored bar corresponds to one therapeutic subgroup (Beta-Blockers, Antibiotics, Painkillers, Antiepileptics). The coefficients of the habit persistence are from Regression Model in Section 8 of the main article. They are not comparable to the other statistics. The second group shows the average relative minimum price compared to the price ceiling R within a substitution group for those substitution groups with two competitors. I approximate the price ceiling with the highest observable price in a substitution group between 2012 and 2016. The sample includes all observation where I do not observe price cycles or at least three periods of identical price setting. The third group are the average relative minimum values for substitution groups with three competitors without an original. The fourth group is the same statistic for those substitution groups with three competitors where one is an original and the fourth group includes all substitution groups with more or equal to fourth competitors. The error bars correspond to the 95% confidence interval using the standard errors across substitution group averages.

Table 16: Habit Persistence and Relative Price Differences

	Habit	Two	Three wo Orig	Three w Orig	Four more
Beta-blocker	0.045	0.909	0.814	0.926	0.472
		(0.003)	(0.006)	(0.009)	(0.002)
Antibiotics	0.055	0.954	0.802	0.871	0.503
		(0.001)	(0.002)	(0.005)	(0.003)
Painkiller	0.035	0.957	0.881	0.898	0.506
		(0.002)	(0.003)	(0.004)	(0.002)
Antiepileptics	-0.107	0.873	0.759		0.565
		(0.005)	(0.018)		(0.013)

Notes: Description of Figure 12 of the Empirical Online Appendix in numerical format. Each row corresponds to one therapeutic subgroup (Beta-Blockers, Antibiotics, Painkillers, Antiepileptics). The coefficients of the habit persistence are from Regression Model 1. They are not comparable to the other statistics. The second column shows the average relative minimum price compared to the price ceiling R within a substitution group for those substitution groups with two competitors. I approximate the price ceiling with the highest observable price in a substitution group between 2012 and 2016. The sample includes all observation where I do not observe price cycles or at least three periods of identical price setting. The third column is the average relative minimum values for substitution groups with three competitors without an original. The fourth column is the same statistic for those substitution groups with three competitors where one is an original and the fourth group includes all substitution groups with more or equal to fourth competitors. The standard deviations are in parentheses and calculated across substitution group averages.

Table 17: Habit Persistence and Pricing Schemes

	Habit	SPC	Same Prices
Beta-blocker	0.045	0.008	0.046
		(0.035)	(0.115)
Antibiotics	0.055	0.018	0.063
		(0.056)	(0.131)
Painkiller	0.035	0.014	0.105
		(0.062)	(0.227)
Antiepileptics	-0.107	0.004	0.091
		(0.015)	(0.183)

Notes: Description of Figure 7 in the paper in numerical format. I show three different statistics for each therapeutic subgroup (Beta-Blockers, Antibiotics, Painkillers, Antiepileptics). The coefficients of the habit persistence are from Regression Model 1. They are not comparable to the other statistics. Same Prices shows the share of substitution groups where at least two firms had identical prices (and were products of the month) over three consecutive periods over time. SPCs shows the share of substitution groups where firms form a SPC over time. The sample includes all observation more or equal than two competitors as all statistics of interest require at least two competitors. The standard deviations are in parentheses and calculated across substitution group averages.

Price	**Reimbursement**	**Max. sum out-of-pocket payment**
$p \geq 4300$	100%	
$3500 \leq p < 4300$	90%	1800 SEK
$1700 \leq p < 3500$	75%	1700 SEK
$900 \leq p < 1700$	50%	1300 SEK
$p < 900$	0	900 SEK
Price	**Reimbursement**	**Max. sum out-of-pocket payment**
$p \geq 5400$	100%	
$3900 \leq p < 5400$	90%	2200 SEK
$2100 \leq p < 3900$	75%	2050 SEK
$1100 \leq p < 2100$	50%	1600 SEK
$p < 1100$	0	1100 SEK

Table 18: *Co-payment structure for cumulative health care expenditures (including prescription drugs) before (upper table) and after (lower table) 2012. Reimbursement is calculated for expenses during an entire year, beginning with the first expenditure. Prices are in Swedish krona. 10 Swedish Krona are approximately US$1.10.*

Table 19: Trade Margins, since 2016

Purchasing Price (PP)	**Retail Price**
$PP \leq 75$	$PP \times 1.20 + 30.50 + 11.50$
$75 < PP \leq 300$	$PP \times 1.03 + 43.25 + 11.50$
$300 < PP \leq 50,000$	$PP \times 1.02 + 46.25 + 11.50$
$PP > 50,000$	$PP + 1,046.25 + 11.50$

Retail prices of pharmaceuticals under generic competition in dependency to purchasing prices since 04/2016 (TLV, 2016). Trade margins are implicitly defined. Note that the 11.50 KR apply due to the generic competition. Prices in Swedish krona. 10 Swedish krona are approximately 1.1 US Dollar.

Table 20: Trade Margins, before 2016

Purchasing Price (PP)	**Retail Price**
$PP \leq 75$	$PP \times 1.20 + 31.25 + 10.00$
$75 < PP \leq 300$	$PP \times 1.03 + 44.00 + 10.00$
$300 < PP \leq 6,000$	$PP \times 1.02 + 47.00 + 10.00$
$PP > 6,000$	$PP + 167.00 + 10.00$

Retail prices of pharmaceuticals under generic competition in dependency to purchasing prices before 04/2016 (TLV, 2016). Trade margins are implicitly defined. Prices in Swedish krona. 10 Swedish krona are approximately 1.1 US Dollar.

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Table 21: Regression, SPCs

	Symmetric Price Cycle			
	(1)	(2)	(3)	(4)
C=2	0.011***	0.011***	0.007**	0.007***
	(0.002)	(0.002)	(0.003)	(0.003)
C=3	0.011***	0.010***	−0.002	−0.002
	(0.002)	(0.002)	(0.004)	(0.004)
C=4	0.007***	0.007***	−0.008*	−0.008*
	(0.002)	(0.002)	(0.004)	(0.004)
C=5	0.001**	0.0005	−0.012**	−0.012***
	(0.001)	(0.001)	(0.005)	(0.005)
C=6	0.001	−0.0002	−0.011**	−0.011**
	(0.001)	(0.001)	(0.005)	(0.005)
C=7	−0.0001	−0.001**	−0.011**	−0.011***
	(0.0004)	(0.0005)	(0.004)	(0.004)
C=8	0.001*	0.001	−0.010**	−0.010**
	(0.001)	(0.001)	(0.004)	(0.004)
C=9	0.001	0.0002	−0.011**	−0.010**
	(0.0005)	(0.001)	(0.004)	(0.004)
C=10	0.001*	0.001	−0.011**	−0.009**
	(0.001)	(0.001)	(0.004)	(0.004)
C=11	0.001*	0.001	−0.012**	−0.009**
	(0.001)	(0.001)	(0.005)	(0.005)
C=12	0.001	0.001	−0.011**	−0.007*
	(0.001)	(0.001)	(0.005)	(0.004)
C=13	0.001*	0.001	−0.011**	−0.007
	(0.001)	(0.001)	(0.005)	(0.004)
C=14	0.002***	0.0003	−0.011**	−0.007*
	(0.001)	(0.001)	(0.005)	(0.004)
C=15	0.002**	0.001	−0.011**	−0.006
	(0.001)	(0.001)	(0.005)	(0.004)
C=16	0.002**	0.002*	−0.011**	−0.004
	(0.001)	(0.001)	(0.005)	(0.005)
C=17	0.002***	0.003***	−0.011**	−0.002
	(0.001)	(0.001)	(0.005)	(0.005)
C=18	0.002***	0.003***	−0.011**	0.001
	(0.001)	(0.001)	(0.005)	(0.005)
Constant	0.001			
	(0.002)			
Fixed effects	No	Time	Subgroup	Subgroup and Time
Controls	Yes	No	No	No
R-Squared	0.009	0.013	0.161	0.165
N	115,549	115,549	115,869	115,869

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Notes: One observation corresponds to a substitution group at time t. Dependent Variable is a Dummy which takes the value one in case that a substitution group at time t is in a Symmetric Price Cycle (SPC). C are the number of competitors in a substitution group at t. Model (1) is a pooled regression controlling for the ATC code, Model (2) includes ATC controls and time fixed effects, Model (3) uses substitution group fixed effects and ATC controls are dropped as they are perfectly correlated with the substitution group, Model (4) includes substitution- as well as time fixed effects. Standard errors are clustered on the substitution group level and adjusted for auto-correlation as well as heteroskedasticity. The R^2 corresponds to the the full model, including the fixed effects.

Table 22: Regression, APCs

	Asymmetric Price Cycle			
	(1)	(2)	(3)	(4)
C=2	0.026***	0.025***	0.020***	0.021***
	(0.004)	(0.004)	(0.005)	(0.005)
C=3	0.033***	0.031***	0.008	0.008
	(0.004)	(0.004)	(0.006)	(0.006)
C=4	0.015***	0.014***	−0.010	−0.010
	(0.003)	(0.003)	(0.007)	(0.007)
C=5	0.006***	0.005***	−0.017**	−0.017**
	(0.002)	(0.002)	(0.008)	(0.008)
C=6	0.006***	0.003**	−0.016**	−0.018**
	(0.001)	(0.001)	(0.008)	(0.008)
C=7	0.005***	0.002	−0.020***	−0.020***
	(0.001)	(0.001)	(0.008)	(0.008)
C=8	0.006***	0.004***	−0.018**	−0.015*
	(0.002)	(0.002)	(0.008)	(0.008)
C=9	0.004***	0.003**	−0.020**	−0.014*
	(0.001)	(0.001)	(0.008)	(0.008)
C=10	0.002*	0.002	−0.022***	−0.014*
	(0.001)	(0.001)	(0.008)	(0.007)
C=11	0.003*	0.002	−0.022***	−0.012
	(0.002)	(0.002)	(0.008)	(0.008)
C=12	0.005	0.005	−0.023**	−0.009
	(0.004)	(0.004)	(0.009)	(0.009)
C=13	0.008	0.007	−0.018*	−0.004
	(0.005)	(0.006)	(0.010)	(0.010)
C=14	0.007	0.003	−0.018	−0.005
	(0.005)	(0.005)	(0.012)	(0.012)
C=15	0.002	−0.002	−0.025**	−0.010
	(0.001)	(0.002)	(0.010)	(0.010)
C=16	0.002	0.001	−0.026**	−0.008
	(0.001)	(0.002)	(0.011)	(0.011)
C=17	0.003*	0.005**	−0.024**	0.0003
	(0.002)	(0.002)	(0.010)	(0.011)
C=18	0.003*	0.004**	−0.025**	0.005
	(0.002)	(0.002)	(0.010)	(0.011)
Constant	−0.003			
	(0.002)			
Fixed effects	No	Time	Subgroup	Subgroup and Time
Controls	Yes	No	No	No
R-Squared	0.017	0.025	0.168	0.176
N	115,549	115,549	115,869	115,869

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Notes: One observation corresponds to a substitution group at time t. Dependent Variable is a Dummy which takes the value one in case that a substitution group at time t is in a Asymmetric Price Cycle (APC). C are the number of competitors in a substitution group at t. Model (1) is a pooled regression controlling for the ATC code, Model (2) includes ATC controls and time fixed effects, Model (3) uses substitution group fixed effects and ATC controls are dropped as they are perfectly correlated with the substitution group, Model (4) includes substitution- as well as time fixed effects. Standard errors are clustered on the substitution group level and adjusted for auto-correlation as well as heteroskedasticity. The R^2 corresponds to the the full model, including the fixed effects.

Table 23: Regression, Originals and Generics

	SPC			APC		
	(1)	(2)	(3)	(4)	(5)	(6)
C=1,No O	−0.0004	0.010*	0.005	−0.0004	0.010	0.004
	(0.0005)	(0.006)	(0.006)	(0.0005)	(0.006)	(0.006)
C=2,NO O	0.038***	0.045***	0.039***	0.040***	0.047***	0.041***
	(0.006)	(0.009)	(0.009)	(0.006)	(0.010)	(0.009)
C=2,O	0.012***	−0.002	−0.0001	0.013***	−0.003	−0.001
	(0.004)	(0.002)	(0.002)	(0.004)	(0.002)	(0.002)
C=3,No O	0.017***	0.001	−0.006	0.024***	0.006	−0.003
	(0.006)	(0.007)	(0.007)	(0.006)	(0.008)	(0.008)
C=3,O	0.022***	0.004	0.004	0.036***	0.009	0.010
	(0.005)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
C=4,No O	0.010**	−0.009	−0.015	0.013***	−0.006	−0.014
	(0.005)	(0.009)	(0.009)	(0.005)	(0.009)	(0.010)
C=4,O	0.012***	−0.012*	−0.011*	0.016***	−0.012*	−0.011*
	(0.004)	(0.006)	(0.006)	(0.004)	(0.007)	(0.007)
C=5,No O	0.0002	−0.014*	−0.022***	0.004***	−0.011	−0.020**
	(0.001)	(0.007)	(0.008)	(0.002)	(0.008)	(0.008)
C=5,O	0.004**	−0.019**	−0.019**	0.007***	−0.019**	−0.019**
	(0.002)	(0.008)	(0.008)	(0.002)	(0.009)	(0.009)
C=6,No O	0.0004	−0.017**	−0.025***	0.003	−0.016*	−0.027***
	(0.001)	(0.008)	(0.008)	(0.002)	(0.008)	(0.009)
C=6,O	0.003**	−0.018**	−0.019**	0.006***	−0.017*	−0.017**
	(0.001)	(0.008)	(0.008)	(0.002)	(0.009)	(0.009)
C=7,No O	−0.0001	−0.017**	−0.024***	0.004**	−0.018**	−0.026***
	(0.001)	(0.007)	(0.008)	(0.002)	(0.008)	(0.009)
C=7,O	0.002	−0.020***	−0.020***	0.005**	−0.021***	−0.021***
	(0.001)	(0.007)	(0.007)	(0.002)	(0.008)	(0.007)
C=8,No O	0.002	−0.015**	−0.020***	0.007**	−0.012	−0.018**
	(0.001)	(0.007)	(0.007)	(0.003)	(0.008)	(0.008)
C=8,O	0.002*	−0.019***	−0.018**	0.005***	−0.020***	−0.018**
	(0.001)	(0.007)	(0.007)	(0.002)	(0.008)	(0.007)
C=9,No O	0.003	−0.015**	−0.017**	0.005*	−0.019**	−0.021***
	(0.002)	(0.007)	(0.007)	(0.003)	(0.008)	(0.008)
C=9	0.001	−0.019***	−0.017**	0.004**	−0.019**	−0.015**
	(0.001)	(0.007)	(0.007)	(0.002)	(0.008)	(0.007)
C=10,No O	0.001	−0.017**	−0.017**	0.001	−0.023***	−0.022***
	(0.001)	(0.007)	(0.007)	(0.001)	(0.008)	(0.008)
C=10,O	0.001*	−0.019***	−0.015**	0.003	−0.019**	−0.014**
	(0.001)	(0.007)	(0.007)	(0.002)	(0.008)	(0.007)
	[...]	[...]	[...]	[...]	[...]	[...]
Constant	−0.001			−0.003		
	(0.002)			(0.002)		
Fixed effects	No	Subgroup	Subgroup and Time	No	Subgroup	Subgroup and Time
Controls	Yes	No	No	Yes	No	No
R-Squared	0.01	0.162	0.166	0.021	0.17	0.178
N	115,549	115,869	115,869	115,549	115,869	115,869

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Notes: One observation corresponds to a substitution group at time t. The dependent variable for Models (1) to (3) is a Dummy which takes the value one in case that a substitution group at time t is in a Symmetric Price Cycle (SPC). For Model (3) to (6) the dependent Variable is a Dummy which takes the value one in case that a substitution group at time t is in an Asymmetric Price Cycle (APC). C are the number of competitors in a substitution group at t. O stands for the existence of an original product of the substitution group in t whereas NoO means that an original is not existing. Models (1) and (4) are pooled regressions controlling for the ATC code, Models (2) and (5) use substitution group fixed effects and ATC controls are dropped as they are perfectly correlated with the substitution group, Models (3) and (6) include substitution- as well as time fixed effects. he coefficients for more than 9 competitors are omitted. Standard errors are clustered on the substitution group level and adjusted for auto-correlation as well as heteroskedasticity. The R^2 corresponds to the the full model, including the fixed effects. In Table 25 I show coefficients for the cases of over 10 competitors.

Table 24: Regression, Relative Price Differences

	Price Difference between Prod in PC					
	SPC	SPC	SPC	APC	APC	APC
	(1)	(2)	(3)	(4)	(5)	(6)
C=3	0.009***	0.009*	0.006	0.022***	0.015**	0.013**
	(0.003)	(0.005)	(0.004)	(0.006)	(0.006)	(0.007)
C=4	0.024**	0.008	0.007	0.067***	0.030***	0.029***
	(0.012)	(0.006)	(0.007)	(0.019)	(0.009)	(0.011)
C=5	0.068	0.008	0.014	0.141***	0.053***	0.047*
	(0.050)	(0.006)	(0.009)	(0.037)	(0.014)	(0.026)
C=6	0.096*	0.008	−0.004	0.187***	0.019*	0.019
	(0.057)	(0.006)	(0.013)	(0.039)	(0.011)	(0.019)
C=7	−0.008***	0.008	−0.011	0.245***	0.116***	0.099***
	(0.003)	(0.006)	(0.013)	(0.046)	(0.024)	(0.038)
C=8	0.148			0.214***	−0.219***	−0.508***
	(0.124)			(0.077)	(0.024)	(0.037)
C=9	−0.009			0.468***	0.146	−0.134
	(0.006)			(0.101)	(0.216)	(0.213)
C=10				0.760***		
				(0.005)		
C=11	−0.003			0.516***		
	(0.004)			(0.009)		
C=12				0.609***		
				(0.010)		
C=13				0.384**		
				(0.176)		
C=14	−0.003			0.447***		
	(0.004)			(0.008)		
Constant	0.016**			0.012		
	(0.007)			(0.014)		
Fixed effects	No	Subgroup	Subgroup and Time	No	Subgroup	Subgroup and Time
R-Squared	0.212	0.882	0.899	0.505	0.946	0.965
N	929	929	929	1,191	1,191	1,191

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Notes: One observation corresponds to a substitution group at time t in a SPC (Models 1 to 3) and in an APC (Models 4 to 6). Given the definition of price cycles two firms form a price cycle. The dependent variable is the relative price difference, defined as the absolute difference between both products in a price cycle divided by the larger price. C are the number of competitors in a substitution group at t, including those product not part of a price cycle. Models (1) and (4) are pooled regressions controlling for the ATC code, Models (2) and (5) use substitution group fixed effects and ATC controls are dropped as they are perfectly correlated with the substitution group, Models (3) and (6) include substitution- as well as time fixed effects. Note that subgroup fixed effects reduce the number of coefficients. Standard errors are clustered on the substitution group level and adjusted for auto-correlation as well as heteroskedasticity. The R^2 corresponds to the the full model, including the fixed effects.

Table 25: Remaining Coefficients of Table 23

	SPC			APC		
	(1)	(2)	(3)	(4)	(5)	(6)
C=1,No O	−0.0004	0.010*	0.005	−0.0004	0.010	0.004
	(0.0005)	(0.006)	(0.006)	(0.0005)	(0.006)	(0.006)
C=2,NO O	0.038***	0.045***	0.039***	0.040***	0.047***	0.041***
	(0.006)	(0.009)	(0.009)	(0.006)	(0.010)	(0.009)
C=2,O	0.012***	−0.002	−0.0001	0.013***	−0.003	−0.001
	(0.004)	(0.002)	(0.002)	(0.004)	(0.002)	(0.002)
C=3,No O	0.017***	0.001	−0.006	0.024***	0.006	−0.003
	(0.006)	(0.007)	(0.007)	(0.006)	(0.008)	(0.008)
C=3,O	0.022***	0.004	0.004	0.036***	0.009	0.010
	(0.005)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
C=4,No O	0.010**	−0.009	−0.015	0.013***	−0.006	−0.014
	(0.005)	(0.009)	(0.009)	(0.005)	(0.009)	(0.010)
C=4,O	0.012***	−0.012*	−0.011*	0.016***	−0.012*	−0.011*
	(0.004)	(0.006)	(0.006)	(0.004)	(0.007)	(0.007)
C=5,No O	0.0002	−0.014*	−0.022***	0.004***	−0.011	−0.020**
	(0.001)	(0.007)	(0.008)	(0.002)	(0.008)	(0.008)
C=5,O	0.004**	−0.019**	−0.019**	0.007***	−0.019**	−0.019**
	(0.002)	(0.008)	(0.008)	(0.002)	(0.009)	(0.009)
C=6,No O	0.0004	−0.017**	−0.025***	0.003	−0.016*	−0.027***
	(0.001)	(0.008)	(0.008)	(0.002)	(0.008)	(0.009)
C=6,O	0.003**	−0.018**	−0.019**	0.006***	−0.017*	−0.017**
	(0.001)	(0.008)	(0.008)	(0.002)	(0.009)	(0.009)
C=7,No O	−0.0001	−0.017**	−0.024***	0.004**	−0.018**	−0.026***
	(0.001)	(0.007)	(0.008)	(0.002)	(0.008)	(0.009)
C=7,O	0.002	−0.020***	−0.020***	0.005**	−0.021***	−0.021***
	(0.001)	(0.007)	(0.007)	(0.002)	(0.008)	(0.007)
C=8,No O	0.002	−0.015**	−0.020***	0.007**	−0.012	−0.018**
	(0.001)	(0.007)	(0.007)	(0.003)	(0.008)	(0.008)
C=8,O	0.002*	−0.019***	−0.018**	0.005***	−0.020***	−0.018**
	(0.001)	(0.007)	(0.007)	(0.002)	(0.008)	(0.007)
C=9,No O	0.003	−0.015**	−0.017**	0.005*	−0.019**	−0.021***
	(0.002)	(0.007)	(0.007)	(0.003)	(0.008)	(0.008)
C=9	0.001	−0.019***	−0.017**	0.004**	−0.019**	−0.015**
	(0.001)	(0.007)	(0.007)	(0.002)	(0.008)	(0.007)
C=10,No O	0.001	−0.017**	−0.017**	0.001	−0.023***	−0.022***
	(0.001)	(0.007)	(0.007)	(0.001)	(0.008)	(0.008)
C=10,O	0.001*	−0.019***	−0.015**	0.003	−0.019**	−0.014**
	(0.001)	(0.007)	(0.007)	(0.002)	(0.008)	(0.007)
C=11,No O	0.0003	−0.018***	−0.017**	0.005	−0.017*	−0.015
	(0.001)	(0.007)	(0.007)	(0.004)	(0.009)	(0.009)
C=11,O	0.003	−0.019***	−0.014**	0.002	−0.022***	−0.016**
	(0.002)	(0.007)	(0.007)	(0.002)	(0.008)	(0.007)
C=12,No O	0.0004	−0.021***	−0.018**	0.0004	−0.033***	−0.028**
	(0.001)	(0.008)	(0.007)	(0.002)	(0.010)	(0.011)
C=12,O	0.001	−0.020***	−0.012*	0.006	−0.019**	−0.009
	(0.001)	(0.007)	(0.007)	(0.005)	(0.009)	(0.008)
C=13,No O	0.0003	−0.025***	−0.022***	−0.0001	−0.029***	−0.025***
	(0.002)	(0.009)	(0.008)	(0.002)	(0.009)	(0.008)
C=13,O	0.001	−0.019***	−0.011*	0.009	−0.015	−0.004
	(0.001)	(0.007)	(0.007)	(0.006)	(0.010)	(0.010)
C=14,No O	0.002**	−0.017**	−0.015**	0.003***	−0.021***	−0.017*
	(0.001)	(0.007)	(0.008)	(0.001)	(0.008)	(0.010)
C=14,O	0.007	−0.011	−0.003	0.007	−0.016	−0.006
	(0.005)	(0.011)	(0.011)	(0.005)	(0.012)	(0.012)
C=15,O	0.001	−0.016**	−0.006	0.001	−0.024**	−0.012
	(0.001)	(0.008)	(0.008)	(0.001)	(0.010)	(0.010)
C=16,O	0.002*	−0.016*	−0.003	0.002*	−0.024**	−0.009
	(0.001)	(0.008)	(0.008)	(0.001)	(0.010)	(0.011)
C=17,O	0.002*	−0.015*	0.002	0.003**	−0.023**	−0.001
	(0.001)	(0.009)	(0.009)	(0.001)	(0.010)	(0.011)
C=18,O	0.002*	−0.015*	0.007	0.003**	−0.023**	0.004
	(0.001)	(0.008)	(0.009)	(0.001)	(0.010)	(0.011)
Constant	−0.001			−0.003		
	(0.002)			(0.002)		
Fixed effects	No	Subgroup	Subgroup and Time	No	Subgroup	Subgroup and Time
Controls	Yes	No	No	Yes	No	No
R-Squared	0.01	0.162	0.166	0.021	0.17	0.178
N	115,549	115,869	115,869	115,549	115,869	115,869

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Notes: Remaining coefficients not displayed in Table 23.