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Entry Regulation and Competition: Evidence from Retail and Labor Markets of Pharmacists

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Entry Regulation and Competition

Evidence from Retail and Labor Markets of Pharmacists*

Davud Rostam-Afschar†, Maximiliane Unsorg‡

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Abstract

We examine a deregulation of German pharmacists to assess its effects on retail and labor markets. From 2004 onward, the reform allowed pharmacists to expand their single-store firms and to open or acquire up to three affiliated stores. This partial deregulation of multi-store prohibition reduced the cost of firm expansion substantially and provides the basis for our analysis. We develop a theoretical model that suggests that the general limitation of the total store number per firm to four is excessively restrictive. Firms with high managerial efficiency will open more stores per firm and have higher labor demand. Our empirical analysis uses very rich information from the administrative panel data on the universe of pharmacies from 2002 to 2009 and their affiliated stores matched with survey data, which provide additional information on the characteristics of expanding firms before and after the reform. We find a sharp immediate increase in entry rates, which continues to be more than five-fold of its pre-reform level after five years for expanding firms. Expanding firms can double revenues but not profits after three years. We show that the increase of the number of employees by 50% after five years and the higher overall employment in the local markets, which increased by 40%, can be attributed to the deregulation.

Keywords: regulation, acquisitions, entry, market concentration, wages, employment, pharmacists

JEL classification: L4, L5, L2, J44, J23

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1 Introduction

Whether entry regulations serve public or private interest is a controversial issue for competition policy with consequences for product and labor markets. Such restrictions, which are very common in different countries and industries, potentially affect entries, exits, economies of scope and scale, prices, and efficiency.[1] A highly prevalent entry regulation restricts markets at the occupational level by imposing costs before specific activities may be legally exercised. These restrictions, particularly frequent among the so-called liberal professions (pharmacists, lawyers, physicians, tax advisors, etc.) and other service providers are mainly justified with reducing quality uncertainty and have been shown to limit labor market competition (Kleiner, 2006). The same line of argument, that is, to prevent undesired effects of competition on quality, is applied to a range of regulations that restrict firm entry in these occupations. However, there is very little evidence on the relationship between occupational regulations and the competitive structure of local markets (Pagliero, 2019).

In this study, we contribute such an analysis by exploiting a deregulation of pharmacists in Germany to understand its effects on retail and labor markets. The reform substantially reduced the cost of firm expansion by allowing a single-store pharmacy to open or acquire up to four stores from 2004 onward. We focus on the easing of the multi-store prohibition in Germany to assess the effects of deregulating entry restrictions. We evaluate the consequences of this reform for entry, exit, survival, and market concentration. Moreover, we show its effects on revenues, costs, and profits as well as labor demand and the occupational choice between self-employment and working as an employee. Our analysis uses very rich information from administrative panel data on the universe of pharmacies from 2002 to 2009 and their affiliated stores matched with survey data, which provide information on the characteristics of expanding firms before and after the reform.

Pharmacists in Germany provide an ideal setting to study these effects since access to the profession, and conduct, remain strictly regulated.[2] In this laboratory-like controlled situation, the multi-store ban was eased in 2004. Opponents of a cap on the number of stores like the German Council of Economic Experts and the German Monopolies Commission argue that multi-store prohibition (and third-party ownership ban) prevent the entry of new stores and restrict pharmacies to have a suboptimal number of stores (German Monopolies Commission, 2008, 2005; German Council of Economic Experts, 2003).

The European Court of Justice, in contrast, cites the notion of a "pharmacy operated by a pharmacist" as a concept to prevent risks to public health (verdicts C-171, 172/07) and views these regulations as being in line with the EU law. It advocates them as extensions to standard occupational licensing practices. Licensing verifies personal experience and diligence by imposing time and cost-intensive educational requirements. Multi-store prohibition (and third-party ownership ban) aim to tie personal investments and the professional existence of pharmacists directly to the operation of the business to make professional misconduct or profit maximization at the cost of

[1] There is a growing set of extensive studies commissioned by the OECD, the European Commission, and national governments devoted to this topic. For instance, see von Rueden and Bambalaite (2020); Koumenta et al. (2019); Paterson et al. (2007); German Monopolies Commission (2005).

[2] For instance, product quality, prices, fees, mark-ups, the internal organization of firms (legal form) and store fixed costs (through ordinances on quality, size, number, and arrangement of rooms, etc.) and wages (through collective bargaining). Moreover, non-pharmacist investors are not allowed to own a pharmacy.

consumers prohibitively costly. Evidence that multi-store prohibition can achieve these goals is hardly available. On the contrary, Janssen and Zhang (2020) show for the US that independent pharmacies illegally divert drugs and after being acquired by a chain, a previously independent pharmacy reduces dispensing of opioids.

The partial lift of these restrictions studied in this paper allows us to provide unconfounded and precise evidence on key questions of firm dynamics. How do entries, exits, and firm survival evolve toward the competitive equilibrium and how quickly is it reached. What is the optimal number of firms in a market, how many stores would they open? Does the liberalization increase overall employment? The reform of the German pharmacy market, therefore, provides a propitious set-up to assess the answers to these questions.

We apply two empirical approaches to answer these questions: first, we quantify the impact of the policy change with the widely used potential outcomes framework. We contrast outcomes to several counterfactuals to quantify the impact of the liberalization. Our main base for comparison are pharmacies that remained single-stores after the reform. We provide evidence that the presence of multi-stores in the market did not affect single-stores, perhaps through more intense competition. Moreover, we show, using difference-in-difference regressions with general practitioners as a control group and pharmacists as a treated group, that the main results are supported.

Second, we estimate the relationship of market concentration and employment following an approach inspired by Bertrand and Kramarz (2002). The basic idea is to describe the association between the number of multi-stores in a local market and concentration measures on the product market as well as, in turn, the effect of market concentration on the labor market. The underlying theoretical mechanism has been described in Blanchard and Giavazzi (2003), where tougher product market regulation, which they model as a higher cost of entry for new firms, increases market power for incumbent firms and lowers equilibrium sales and employment. Therefore, one can expect the liberalization of the pharmacy market to facilitate store foundation and lead to employment growth.

We find that strong immediate increases in entry rates remain more than five-fold after five years for expanding firms. The overall survival of pharmacies and market concentration decreases significantly. Expanding firms double revenues (but not profits after three years), and increase the number of employees by 50% after five years and overall employment by more than 40% per local market. We develop a simple model with market share competition allowing for interlacing and cannibalization effects consistent with this. Without additional welfare gains though banning chains, the optimal store number per firm size suggests that the maximum number of four stores is excessively restrictive. Perhaps surprisingly, firms do not increase personnel after the deregulation proportionally. This is predicted by our model in which firms with higher (relative) managerial and organizational efficiency decide to open more stores per firm and have under-proportionally higher labor demand. The implications of our results are that both labor and product market consequences have to be considered when designing entry regulation.

The article is organized as follows. Section 2 provides a literature review, Section 3 presents the theoretical model, Section 4 provides a brief insight in the institutional background, Section 5 describes the markets of pharmacies (and physicians). Section 6 specifies the econometric entry model, Section 7 discusses the empirical results and the implications for policy reform. Section 8 concludes.

2 Entry Regulation: Securing Quality or Hindering Competition?

Our paper contributes to the literature on entries, exits, and market structure in industrial organization, labor demand and occupational licensing in labor economics, and on the economics of health care markets. We briefly review the theoretical and empirical findings from the extant literature.

Using town-level data, Schaumans and Verboven (2008) find no support for entry regulation on grounds of public interest with entry restrictions reducing the number of pharmacies by more than 50%. Kleiner and Kurdle (2000) show that tougher licensing of practitioners in dentistry does not improve economic outcomes and leads to slower growth in the number of dentists. The findings of Pagliero (2011)'s study on American lawyers supports the capture theory (licensing increases professional salary via a supply reduction) rather than the public interest theory (licensing as the solution to the lemons problem of information asymmetry). Timmons (2017) finds support for broadening the scope of practice in medicare for certain assistant professions as a low-cost alternative since it can decrease the costs of outpatient care.

Focusing on firm and job creation, Branstetter et al. (2013) analyzes the effects of reducing entry costs on the reform in Portugal and find that in the short-term, firm entry and job creation increased.[3] However, similar to the deregulation of 53 crafts professions in Germany studied in Rostam-Afschar (2014), the increased number of new businesses was mainly due to smaller firms. For a further reform in Mexico, Kaplan et al. (2011); Bruhn (2011) find that business start-ups profit from the deregulation of entry costs and processes, even if the effect is only temporary. Bertrand and Kramarz (2002), similar to our study of both product and labor market effects, find that a stronger entry deterrence increases industry concentration in the French retail industry with commercial zoning regulation and reduces the employment growth. Using similar methodology, Sadun (2015) analyzed whether planning regulations affect independent retailers. She finds that the regulation harms independent retailers since large retail chains adjust store sizes and locations such that competition for small local retailers increases.

Dunne et al. (2013) investigate different types of entry costs and the resulting competitive effects on entry as well as on profits for so-called Health Professional Shortage Areas (HPSA). They find that short-run price competition, the magnitude of entry costs (either sunk for potential entrants or fixed for incumbents) are important components for long-run firm values and the market structure. The results of Maican and Orth (2018) are in line with these findings. Long-run profits are affected by entry regulations, as well as market structure and welfare. In their counterfactual policy experiment, they found that in markets for differentiated products competition intensity among firms is affected and, therefore, profits. Further, as a result of increased competition, welfare increases. Implementing licensing fees as entry regulation to protect small stores is counterproductive, however, markets with liberal regulation perform better.

Finally, Aghion et al. (2008) show that the dismantling of the license Raj in India results in industry growth, especially in those states with more pro-employer laws.[4] Yakovlev and Zhuravskaya (2013) show that three consecutive liberalization reforms in Russia had a substantial positive effect

[3] Via a reform that introduced so-called one-stop-shops, which significantly reduced the costs and the time needed to register a new business.

[4] A system that centrally controls entry and output expansion by requiring a license for establishing new factories, expanding capacities, changing locations, or even starting a new product line.

on the performance of firms and reduced the informal sector in regions with stronger governance institutions.

3 A Simple Model of Multi-Store Entry and Market Structure

We develop a simple model of multi-store entry in local markets based on the circular city developed by Salop (1979) to explore the effects of a reform that allows firms to enter as multi-store firms. We also consider asymmetric situations by introducing either an exogenous survival rate or positive effects on consumer utility. However, to keep the model tractable we will derive the outcomes, that is, market structure and optimal store number, in a symmetric equilibrium and determine the key factors influencing the optimal number of stores per firm. To model the competitive effects of multi-store entry on local markets, location models provide a straightforward setting. The location choice on the unit circle (see among others Salop, 1979; Pal and Sarkar, 2006; Janssen et al., 2005) allows us to study the features of competition in markets with localized rivalry.

We explore how the entry of multi-store firms affects the competitive situation in a local market with the equilibrium number of firms M, the number of stores m_i per firm i, the total number of stores N per local market, and the respective market shares of the firms. We assume that consumers of mass α live equally distributed on the unit circle, with α accounting for different market sizes to capture local markets with differences in demand and their influence on the optimal firm number.

Consumers incur transportation costs according to a quadratic function, which increases with a transportation cost parameter t in the distance to the next store. Without loss of generality we normalize the transport cost parameter to one. A representative consumer j's utility when purchasing at a firm i can be described as

$$U_j = \bar{v} - p - (x_j - x_i)^2 + \theta(m_i), \tag{1}$$

where $\bar{v}$ denotes the gross utility from consumption, x_j, x_i the location of the consumer j and a firm i, and $\theta(m_i)$ represents advantages from purchasing from a multi-store, with $\partial\theta(m_i)/\partial m_i > 0$ and $\partial^2\theta(m_i)/\partial m_i^2 < 0$. Procurement/purchase costs are equal for all firms and are captured in the fixed price level p. Firms only incur fixed cost C (per store) and one time entry costs F per firm.

A utility function of this form accounts for additional benefits for consumers from purchasing from multi-store firms in the form of a (non-monetary) additional utility.[5] Therefore, assuming a multi-store firm to be located next to a single-store firm, the indifferent consumer in between these two firms would locate closer to the single-store firm, yielding a higher market share for the multi-store firm at the expense of the single-store firm.

The additional utility leads consumers to be willing to incur higher transportation costs to purchase from the multi-store firm. A utility function of this form, therefore, accounts for market structures with firms preferring interlacing locations instead of a market segmentation (see Janssen et al., 2005), since in the latter case firms would cannibalize the market shares of their stores. It also describes asymmetric situations with multi-store firms obtaining over-proportionally increasing market shares.

[5] The advantages could stem from faster procurement channels, better chain management or higher bargaining power. However, these advantages most likely will increase less strongly the higher the number of stores is.

An asymmetric market situation arises, for instance, due to an exogenous survival rate, that is, one observes in each period, a share of firms e dropping out of the market. In the particular case of pharmacists, a drop-out could occur due to retirement or a better outside option, like being employed as a store manager. As a consequence, a vacancy in the market is created, which can be profitably filled by another firm. Assuming a fixed price level and uniformly distributed consumers, the firms will be located equidistantly to each other. Hence, an external entrant would choose the same position that the closed firm had occupied to maximize its market share. The more interesting question is whether it would be profitable for an incumbent to *open a store* to fill in for a vacancy. For incumbents, incentives to open an affiliated store are higher due to the possibility of dividing the entry cost over both stores, which can account for the successive entrance of affiliated stores in the markets. While single-store firms could open a new single-store firm only as external entrants, multi-store firms may open affiliated stores as incumbents.

To determine the market structure and the equilibrium number of stores per firm, we derive a symmetric equilibrium of multi-store firms. To keep the analysis tractable we assume no additional benefits, that is, $\theta(m_i) = 0$. With uniformly distributed consumers and a fixed price level, we assume that stores locate equidistantly at a distance of $1/N$ to the next rival store, leaving each firm i with a market share m_i/N where the total number of stores equals the sum of stores per firm $N = \sum_{i=1}^{M} m_i$. All firms simultaneously decide on their optimal number of stores. The optimization problem of a firm i with respect to its number of stores is

$$\begin{aligned}\pi_i &= pq_i - wL_i - m_iC - F \\ &= \left(p - \frac{w}{\mu}\right) q_i - m_iC - F \\ &= \bar{p}\frac{\alpha m_i}{N} - m_iC - F \end{aligned} \tag{2}$$

with profit π of firm i determined by the wage rate w, price $\bar{p} = p - w/\mu$ and demand given by the market share and the market size as $q_i = (\alpha m_i)/N$. Assuming a linear relation for the production function with labor as the single input gives $q_i = \mu L_i$, where L_i is labor demand and μ represents the managerial and organizational efficiency. Differentiating the profit function with respect to the number of stores yields the first order condition. Assuming all firms to be symmetric in equilibrium, that is, $m_i = m_{-i}$ and consequently $N = Mm_i$, the number of stores per firm (depending on the number of firms M) follows as

$$m^* = \frac{\bar{p}\alpha(M-1)}{CM^2}. \tag{3}$$

The number of entering firms is determined by the zero profit condition, that is, firms decide to enter the market as long as they obtain non-negative profits $\pi(M) \geq 0$. By substituting m^* (3) into the profit function, the equilibrium number of firms is

$$M^* = \sqrt{\frac{\bar{p}\alpha}{F}}. \tag{4}$$

The equilibrium number of stores per firm is

$$m^0 = \frac{1}{C}\left(\sqrt{\bar{p}\alpha F} - F\right), \tag{5}$$

given the number of firms entering the market and the condition that revenues exceed entry cost, that is, the condition $\bar{p}\alpha > F$. The total number of stores is

$$N^* = M^* m^0 = \frac{1}{C}\left(\bar{p}\alpha - \sqrt{\bar{p}\alpha F}\right). \tag{6}$$

With $N^* = M^* m^0$ the symmetric market share is $\frac{1}{M}$, and with multi-store prohibition, only single-stores may enter and consequently the total number of stores equals the number of firms N^S. Using the zero profit condition $\pi^S = \frac{\bar{p}\alpha}{N} - C - F \geq 0$, the number of firms is

$$N^S = \frac{\bar{p}\alpha}{C + F}. \tag{7}$$

The resulting market share can be calculated as the inverse of the firm/store number N^S. Comparing the single- to a multi-store entry game, for the threshold $C < \sqrt{\bar{p}\alpha F} - F$ the number of independent stores in a multi-store set-up is lower, $M^* < N^S$, however, the overall number of stores is higher, $N^* > N^S$, since firms can divide entry costs over all stores.

In a simultaneous game, firms decide to open stores to increase their market share. If the costs per store C are rather low, the number of stores per firm m increases, leaving the number of firms M unaffected. Higher entry costs F lead to fewer firms in the market, and therefore, higher market shares per firm. Consequently, when allowing for a retail structure with multiple stores, the entry costs can be divided between the stores, leading to a higher number of firms.

The stores will be equally distributed and since all firms are symmetric, we cannot make any statement about market segmentation or interlacing of stores. However, consumers may prefer a multi-store market structure due to the higher total number of stores leading to shorter distances to travel to the next store and, therefore, lower transportation costs.

The optimal number of stores per firm depends on the demand in the local market, that is, in a market with high demand, (α is large) firms would wish to install more stores. Therefore, regulating the number of stores per firm to a fixed amount independently of the characteristics of the local market is not desirable—neither for firms nor for consumers, given that quality is exogenously fixed.

Considering an initial situation with N single-store firms in the market and allowing them to open affiliated stores in the next period, the firms have incentives to open affiliated stores with the entry cost F being already sunk. However, again the number of optimal stores depends on the size of the market α and the cost per store C. This can explain that the number of stores reaches the equilibrium gradually. Substituting the equilibrium store and firm number in the production function and rearranging yields equilibrium labor demand:

$$L^* = \frac{q^*}{\mu} = \frac{\alpha}{\mu M} = \sqrt{\frac{\alpha F}{\mu(\mu p - w)}}. \tag{8}$$

The higher the managerial efficiency, the higher the equilibrium number of stores per firm m^0 and the number of independent firms M^*. Therefore, we expect firms with higher efficiency to open more stores per firm and consequently be characterized by a higher—though under-proportionally higher—labor demand. Labor demand increases in the size of the local market and the fixed entry cost. However, firms demand less labor if they are characterized by higher managerial efficiency. The labor demand in a single-store equilibrium is $L^S = (C + F)/(\mu p - w)$ per firm. Only for markets with very low demand (low α) or very high costs per store (C) the labor demand per firm can be higher in the single-store equilibrium. Therefore, the liberalization leads to higher labor demand.

Finally, we briefly consider the labor choice of a pharmacist. Each pharmacist has to decide whether to be the owner of a pharmacy(-chain) or to be employed as a store manager. The pharmacist will decide to run a pharmacy instead of being employed as long as the expected profits of the pharmacy(-chain) are higher as the (negotiated) salary of being a pharmacy store-manager.

The predictions one can draw from our theoretical model about the entry reform, i.e. the liberalization of the multi-store ban, can be summarized as follows:

(i) lower entry costs, that is, allowing firms to spread entry costs over more stores leads to intensified competition between firms due to a higher overall number of stores and, therefore, decreasing market concentration

(ii) multi-store firms can realize reduced costs per store, that is, experience efficiency gains or are characterized by higher managerial efficiency

(iii) by allowing for a multi-store structure labor demand per firm can increase

To summarize, the firms obtain (in a symmetric equilibrium) higher market shares compared to the single-store equilibrium (extensive margin). However, when the number of stores per firm increases, each firm obtains smaller market shares (intensive margin) reflecting intensified competition. These findings are in line with our results from analyzing the data.

4 Multi-Store Prohibition

The pharmacy landscape is widely regulated with the justification that consumers (patients) require special protection and that pharmaceutical products need to be affordable and available for all patients. This section briefly examines the relevant institutional background, carves out the most important regulatory institutions for pharmacies, and describes the almost laboratory set-up, which characterizes the market. While the reforms of the German health care system focused initially on cost-cutting measures, the government aimed to implement more competition-oriented structural reforms since 1992.[6]

Two central pillars of all reforms are the multi-store prohibition and the third-party ownership ban—both driven by the notion of "the pharmacist in his pharmacy." In 2004, after repeated requests from pharmacists, competition experts, and some politicians (German Council of Economic

[6]The relevant reforms are those in 2003 ("GKV-Modernisierungsgesetz") and 2007 ("GKV-Wettbewerbsstärkungsgesetz"), see e.g. Gerlinger and Schönwälder (2012).

Experts, 2002; Bundestag, 2003), the liberalization of the multi-store prohibition took place. Since this partial liberalization of multiple ownership, pharmacists are allowed to open up to three affiliated stores in addition to their main pharmacy (German Council of Economic Experts, 2003). The prohibition of multi-store pharmacies before 2004 avoided the emergence of retail chains of pharmacies. This prohibition was justified with undesirable competitive situations, that is, chain formation or highly concentrated markets. The fundamental idea was that a single pharmacy chain could gain too much market power and lead to a deterioration of the medical supply.

Hence, the question is why the government reevaluated the regulation and decided to allow multiple ownership (at least insofar that it is allowed to have up to three affiliated stores). The government argued that due to the price (and quality) regulation in combination with the prohibition of multiple ownership, the pharmacy market indeed lacked necessary competition. Therefore, the policy change was aimed to intensify competition via cost reductions through the expansion of pharmacies. Cost-cutting measures can be attained by larger operational units (main pharmacy with affiliated stores) realizing scale effects, that is, the expansion of the pharmacies might lead to higher flexibility in the procurement of drugs and personnel deployment. These are the key driving factors, which we will analyze in our paper with an examination of whether competition has enhanced.

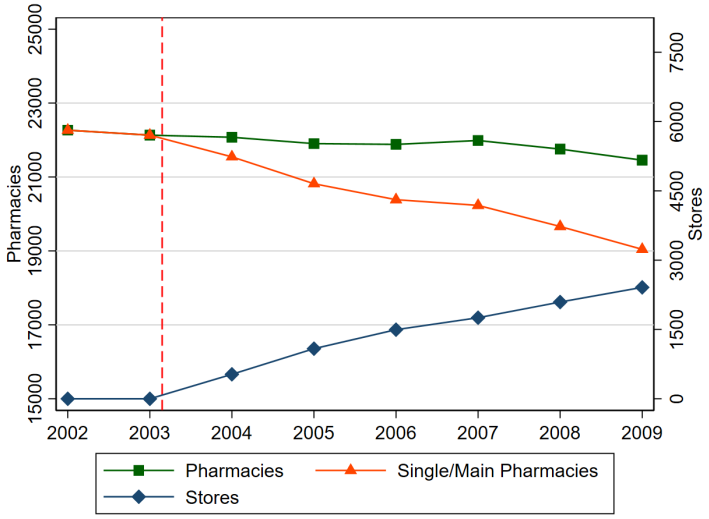
The prohibition of ownership by third parties aims to ensure qualitative standards in the provision of medical supplies and services like the availability of a pharmacist for medical/pharmaceutical advice and expertise. Pharmacists belong to the group of professions requiring occupational licensing, that is, pharmacists are required to have a license to practice to guarantee the quality of service provision in the pharmacy. The regulation prevents third parties (e.g. corporations, financial investors) from owning pharmacies or even chains.

Further regulations make the pharmacy market a laboratory-like controlled environment. For instance, the prices of prescription drugs are fixed to protect consumers from an exhaustive search for the cheapest pharmacy.[7] Since pharmacies underlie strict regulations concerning the quality of drugs and the requirements for premises, they compete mainly in market shares, that is, for consumers. However, compared with other European countries, Germany has a fairly liberal legal situation concerning the freedom of establishment. Since 1958, pharmacists have the freedom to choose the location for their pharmacy, their total number is not limited or in any form dependent on the population. One single exception concerning the geographic location is made concerning the location of the subsidiary stores. Affiliated stores need to be close to the main pharmacy, that is, in the same or neighboring county.

The development of the German pharmacy market in the last decade is characterized by a decline in the total number of pharmacies (see ABDA, 2018). Figure 1 shows how the reform in 2004 led to an increase in the total number of pharmacies in the short run. After relaxing the multi-store ban, pharmacists started to increase the number of stores with new foundations or acquisitions, a development that resulted in somewhat fewer than 5,000 stores in 2018 (ABDA, 2018). We observe a slightly shrinking number of total pharmacies, which often is referred to more colorfully as "pharmacy extinction." More recently, the number of pharmacies started to decrease

[7] See Arzneimittelpreisverordnung (AMPreisV). The selling prices of prescription drugs are derived with a fixed percentage surcharge.

Figure 1: Pharmacy Market in Germany



Notes: Numbers of pharmacies counted at store level.
Datasource: Authors' calculations based on the Business Register (AFiD-Panel URS).

again: in 2017 the numbers fell below the 20,000 mark for the first time since 1990. Breaking the numbers down into the main-/single-store pharmacies and the number of stores, respectively, makes apparent that the former is declining while the number of stores is increasing (ABDA, 2018). It seems that the closures outweigh the openings of new pharmacies each year, which leads to the shrinking number of pharmacies in total.

5 Data and Descriptive Statistics

Our dataset is based on two unique sources that we match to a register and survey panel on firm, store, and local market characteristics. The first one is an administrative data panel, the German business register (AFiD-Panel URS).[8] It is a decentralized register that is maintained by the German Federal Statistical Offices. The register combines data from the German Federal Employment Agency and fiscal authorities. Reporting the data is mandatory for all firms in Germany. Due to the regular annual updating of the register, it is a very detailed data source offering us the possibility to observe the universe of pharmacists and general practitioners in Germany not only on firm but also, further disaggregated, at a store-level. We use the AFiD-Panel URS from the very first year available in 2002. The data include 579,203 observations over the observation period of the years 2002 to 2009.[9]

We extend this rich information by our second data source, which is a survey of firms in the retail trade sector (AFiD-Panel Retail) compatible with the AFiD-Panel register data, despite its high

[8] AFiD-Panel URS is short for Amtlichen Firmendaten für Deutschland Panel, Unternehmensregister.

[9] All observations until 2007 are covered by the industry classifications of the German Federal Statistical Office (Klassifikation der Wirtschaftszweige, Ausgabe 2003, WZ2003), and (Klassifikation der Wirtschaftszweige, Ausgabe 2008, WZ2008). We distinguish between pharmacists and general practitioners via the industry branch classifications. Industry codes for Pharmacies are WZ2003: 52310, WZ2008: 47730, and for general practitioners WZ3003: 85121, WZ2008: 86210.

quality, not officially on the program of the German Federal Statistical Offices. It includes 11,990 observations of pharmacists from 2002 to 2006. The trade survey panel draws its sample from the firms included in the URS. The survey is an unbalanced panel. In each federal state, the industry branches are clustered by their revenues and within these clusters, a random sample is drawn. About 8% of all firms are surveyed and supplemented with sampling weights, which we use in our analysis. In the survey data, we observe pharmacies only at the firm level, however, it provides additional information to the administrative data like costs (wages, rents, commodity-input).

We need to exclude some observations from the dataset since they are already expired or inactive. Hence, they do not undergo the updating process anymore, but are still listed in the register. Further, we exclude head-stores, because these units are listed twice, once as an affiliated store and once as head-store itself. Finally, we exclude firms that were multi-stores before 2004, which can only be possible due to a special permit and is not a result of the deregulation. Some pharmacists alone were allowed to operate as multi-store with this special operating permit before 2004. A temporary permit was granted in exceptional cases when there has been a serious undersupply with pharmaceuticals in a specific region. We drop pharmacies with more than the upper limit of four stores. The sample restrictions are summarized in Table A.2 in the appendix.

We use these rich data with information on firm- and store-level to analyze the short- and medium-run effects of the deregulation of the multiple ownership ban on the entry of new firms and stores, acquisition of stores, exit, and survival rates. We also analyze the effects of this professional regulation on product-market characteristics such as revenues, costs, and profits, as well as on labor market outcomes like hiring or firing decisions and wages costs.

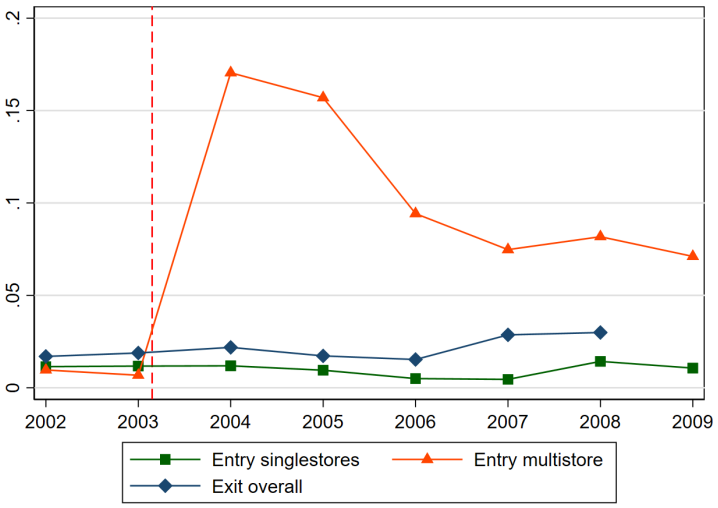
For our analysis, we distinguish between pharmacies that stayed single-store over the whole observation period and pharmacies that either acquired or founded new stores after the deregulation and transformed to multi-stores. With this definition, we can observe those pharmacies that turn into multi-stores even before they could decide to acquire or open new stores. Therefore, we can see whether certain characteristics are influencing the expansion decision.

5.1 German Pharmacy Market

Figure 2 presents the entry and exit rates of pharmacies. An entry (at store level) is recorded whenever a new admission in the register is observed. From this, we calculate the entry rates for single- and multi-store pharmacies. We define an exit whenever we observe a pharmacy store, which is expired. The exit rate (overall) and the entry rate of single-store pharmacies seem unaffected by the reform. Consistent with Figure 1, however, entry rates increase after the 2004 lift of the multi-store prohibition. The entry rate for multi-stores increased to over 15%, which reflects either newly opened stores or acquisitions of existing pharmacies.

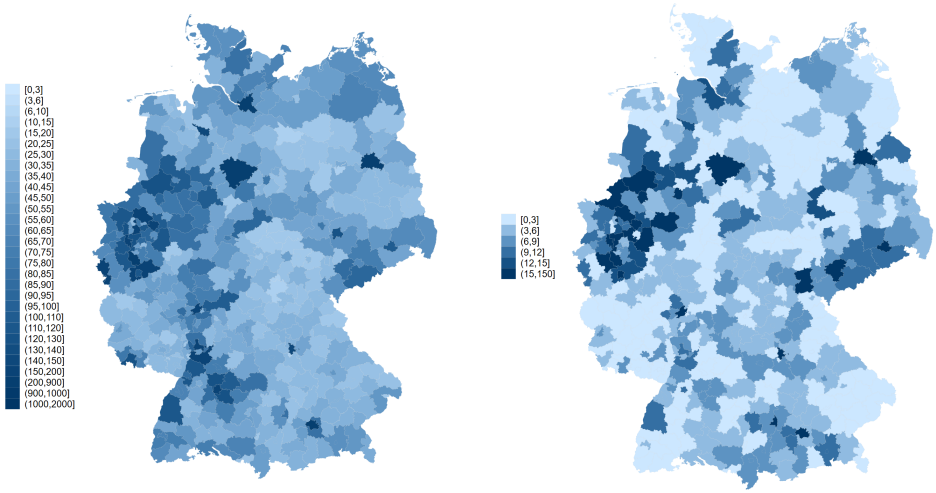
Considering that the total number of pharmacies decreases while we can observe more stores belonging to one pharmacist, we can conclude that competition has intensified due to deregulation. These findings are in accordance with our theoretical model. Since the group of single-store pharmacies is significantly larger than the group of multi-store pharmacies, the overall entry rate is closer to one of the single-store pharmacies. Thus, the overall entry rate lies below the overall exit rate of pharmacists. This fact explains the continuous (in our observation window still rather slow) decrease in overall pharmacy numbers.

Figure 2: Market Entry and Exit Rates



Notes: We report entry rates for pharmacies becoming multi-stores over the observation period and those staying single-store. Exit rates are calculated over all pharmacies independent of store type.
Datasource: Authors' calculations based on the Business Register (AFiD-Panel URS).

Figure 3: Distribution of Pharmacies across German Counties



(a) Pharmacies (2002-2009) (b) Main pharmacies & stores (2009)

Notes: Data on store and county level.
Datasource: Authors' calculations based on the Business Register (AFiD-Panel URS).

The spatial distribution of pharmacies across German counties is characterized by a higher density of pharmacies in the cities, that is, Berlin, Hamburg, or Munich, and urban areas, which are characterized by a higher population density (higher demand). Some federal states appear to have a lower density of pharmacies, like Bavaria, Thuringia, Brandenburg, and Rhineland Palatine. Figure 3 provides an overview of the mean number of pharmacies in Germany by counties over the observation years.

A similar pattern is visible when considering the distribution of multi-store pharmacies. Figure 3b depicts the location of the main pharmacies and their stores over Germany in each county after the reform in 2004. Especially in Northrhine-Westphalia, we observe frequent multi-stores. Figure 3 shows that the prevalence of pharmacies is comparatively low in Bavaria and much of Eastern Germany, where many multi-store pharmacies seem to enter markets. In contrast, for example, in Baden-Wuerttemberg, multi-store pharmacies rather emerge in already densely served regions.

5.2 Firm and Market Characteristics

Table 1 provides summary statistics for (prospective) multi-store and single-store pharmacies before and after the reform. We first discuss firm dynamic outcomes (entries, exits, survival), competition outcomes (market share, revenues, input costs, profits), and finally, labor demand in a difference-in-differences style comparison supplemented with a before-after comparison for concentration measures on the local market level. Comparing the differences before and after 2004 for (ex-post) multi-stores, we see substantial increases in entries and exits in columns I through III. Such effects are virtually absent for single-stores (columns IV through VI).

The impact on competition outcomes seems similarly concentrated almost exclusively among multi-stores. They could further increase their already larger market shares from 2.8% to 3.5%, while single-stores remained almost unchanged below 2.0%. There is also a stronger revenue increase among multi-stores, by more than 50%, whereas they only increase by 20% for single-stores. Input costs rise only by 30% for multi-stores and at the same time for single-stores by 20%.

However, profits grow at the same rate for both types of pharmacies. This might be due to higher personnel costs due to increased labor demand. Each affiliated pharmacy requires a pharmacy manager who is in charge of the respective pharmacy. The number of employees increases by almost five for multi-stores but remains at the pre-reform level of six for single-stores. In terms of revenues and employees, pharmacies that turned multi-stores after the reform were already bigger before the reform, however, the reform has not been conditioned on any of the pre-existing differences in outcomes between pharmacies.

Finally, we observe that concentration outcomes measured (CR[10] and Herfindahl-index) on the local market level increased. Concentration measures CR[1] through CR[5] (not reported) also indicate higher concentration after the reform. We calculate the Herfindal-index as well as the concentration measures with the market shares per firm and aggregate those on county level. In Table A.1 in the Appendix we provide the greater detail on how we construct this measure.

Table 1: Descriptive Statistics

	Multi-Store			Single-Store		
	After	Before	Difference	After	Before	Difference
Firm Dynamics						
Entry rate	0.102	0.008	0.093***	0.009	0.012	-0.002***
	(0.003)	(0.002)	(0.003)	(0.000)	(0.001)	(0.001)
			14,962			160,501
Exit rate	0.016	0.001	0.015***	0.019	0.019	0.000
	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
			14,962			160,501
1-Year survival rate	0.996	0.997	-0.001	0.979	0.979	0.000
	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
			12,342			14,962
Competition Outcomes						
Market share	0.035	0.028	0.007***	0.019	0.018	0.001***
	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)
			11,099			154,577
Log revenues	7.991	7.466	0.525***	7.288	7.093	0.195***
	(0.008)	(0.013)	(0.015)	(0.002)	(0.003)	(0.004)
			9,785			142,535
Log input costs	7.684	7.373	0.311**	6.869	6.679	0.190***
	(0.042)	(0.09)	(0.100)	(0.011)	(0.014)	(0.017)
			623			11,129
Log profits	5.088	5.032	0.055	4.474	4.403	0.072***
	(0.072)	(0.113)	(0.134)	(0.017)	(0.019)	(0.025)
			471			9,300
Labor Market Outcomes						
Number of employees	13.353	8.668	4.685***	6.035	5.952	0.082***
	(0.132)	(0.138)	(0.191)	(0.014)	(0.020)	(0.025)
			10,103			152,186
Concentration Outcomes (Market Level)						
CR(10)	0.516	0.468	0.048***			
	(0.004)	(0.006)	(0.007)			
			3,208			
Herfindahl-index	0.048	0.041	0.008***			
	(0.001)	(0.001)	(0.001)			
			3,208			

Notes: The table evaluates several firm-specific characteristics (firm dynamics, competition outcomes, and labor market outcomes) differentiating between multi- and single-stores and concentration outcomes on the market level in the years before (2002-2003) and after (2004-2009) the deregulation of the multiple-ownership ban. We distinguish pharmacies that remained single-store over the whole observation period and pharmacies that became multi-stores at some point. Firm characteristics are reported at a firm level. The market share is calculated at a firm level per county. Monetary variables measured in Euro are deflated using the drug price index API (Arzneimittelpreisindex). For the detailed description of variables see Table A.1 in the appendix. Robust standard errors are in parentheses and the number of observations (observed over 8 years) is presented below. ***Statistical significance at 0.1%, **significance at 1%, *significance at 5%.

Datasource: Own calculations based on the Business Register (AFiD-Panel URS) 2002-2009 and AFiD Retail Panel 2002-2006.

6 Empirical Strategy

The empirical analysis has two objectives. First, we quantify the impact of the policy change using the potential outcomes framework. Second, we estimate the relationship of market concentration and employment following an approach inspired by Bertrand and Kramarz (2002), which we describe in Section 7.4 in more detail. Our basic empirical approach is to compare outcomes in comparison to several counterfactuals to quantify the impact of the liberalization. Our main basis for comparison are pharmacies that remained single stores after the reform. However, even though the descriptive statistics suggest that their situation did not change at all, the presence of multi-stores in the market could have affected single stores, perhaps through more intense competition, potentially violating the assumption that the observation on one unit should be unaffected by the particular assignment of treatments to the other units. Therefore, we provide additional difference-in-difference regressions at the store level with general practitioners as a control group, since they never have been restricted with respect to the number of stores, and pharmacists as treated group in Section 7.5.

To quantify the impact of the liberalization on pharmacies, we use an event-study style approach on the pharmacy data to account for pharmacies becoming multi-store at different points in time or not expanding at all. For this, we define an indicator variable MULTI, which is equal to one at the year of expansion to a multi-store pharmacy and all subsequent years (and zero otherwise). This specification is similar to the approach used in Branstetter et al. (2013) and identifies the reform impact from the comparison of outcomes within a particular county in years immediately before the introduction of the multi-store to those in the years immediately after since we include county-year fixed effects. Standard errors for this and all subsequent regressions are clustered at the county level.

$$y_{fitc} = \tau \, \text{MULTI}_{it} + \beta X_{fitc} + \theta_t + \theta_c + \theta_{tc} + \theta_i + \epsilon_{fitc},$$

y is an outcome variable varying over store i and year t in firm f and county c. τ is the treatment effect on multi-stores. We include store fixed effects θ_i in addition to year, county, and county-year fixed effects, which are defined with indicator function ϑ as follows:

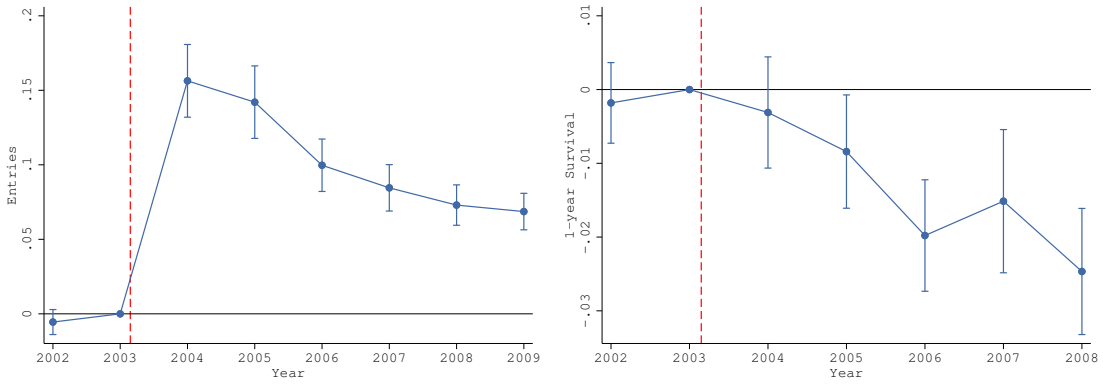
$$\theta_t = \sum_{t=2002}^{2009} \vartheta_t, \qquad \theta_c = \sum_{c=1}^{403} \vartheta_c, \qquad \theta_{tc} = \sum_{t=2002}^{2009} \sum_{c=1}^{403} \vartheta_{tc}.$$

7 Results

7.1 Market Dynamics

Applying an event-study approach provides the advantage of accounting for the pharmacies expanding at different points in time. To assess the effects of expansion on the market outcomes, we show the comparisons of differential trends around the year pharmacists became multi-store. We

Figure 4: Impact on Firm Dynamics



(a) Entries (b) 1-Year Survivals

Notes: Differential time trends for entries around the year of the reform. Data on store-level.
Datasource: Authors' calculations based on the Business Register (AFiD-Panel URS) 2002-2009.

compare expanding pharmacies, that is, those becoming multi-store, to those staying single-store.

In Figure 4a we plot the time trend of entry over the observation period. These results suggest clearly that multi-store pharmacies drive entries. Although we can observe an increase in the entry rate for multi-stores after the liberalization, accounting for the full set of fixed effects, we cannot find higher entry rates in the period before the deregulation. Apparently, expanding pharmacies were not characterized by higher entry rates before the reform. Further, we find one-year survival rates to be decreasing for the pharmacies becoming multi-stores (see Figure 4b). Stores belonging to a multi-store pharmacy are characterized by a slightly lower survival rate. Two years after the liberalization, the one-year survival rate starts to decrease significantly.

The above findings regarding the entries are in line with the predictions of our theoretical model concerning the higher number of entering stores when allowing for multi-store firms. When lifting the multi-store prohibition, entry costs can be divided over multiple stores, and therefore, entry is simplified for multi-store firms in comparison to single-store firms. The increased number of stores intensifies the competition for market shares, and hence, decreases the probability of each store surviving.

7.2 Competition Effects

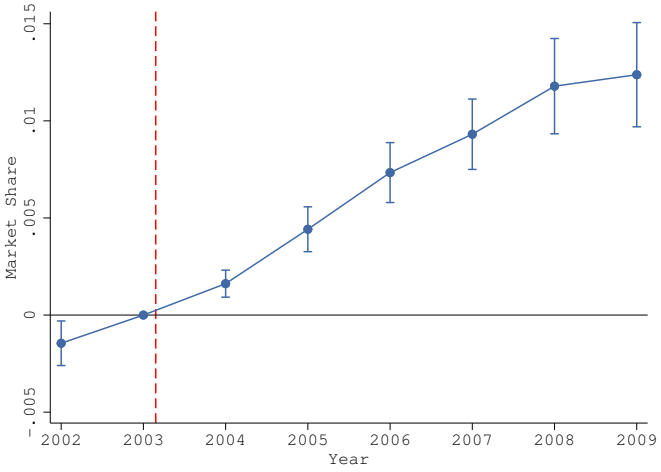
The higher entry rates we found for multi-store pharmacies raise the question of whether they perform differently compared to single-store pharmacies on the product market—in other words, whether we can identify any competitive effects. We find that the market share of multi-store pharmacies increases over time in comparison to single-store pharmacies, see Figure 5.

We statistically reject that the point estimate for 2002 is equal to zero, however, one has to carefully consider the size of the effects shown on the vertical axis, since the difference between those multi-store pharmacies and the single stores is economically minuscule and result from inflation. We apply a rather strict assumption regarding the price index and then calculated real revenues by using the German prescription drug price index API (Arzneimittelpreisindex).[10] We used the

[10]The API is calculated based on prescription drugs that are authorized on the German market and approved by

API instead of the consumer price index (CPI) since the main part of revenues (about 80%) are generated in the prescription drug market.[11]

Figure 5: Impact on Market Competition



Notes: Notes: Differential time trends for market shares around the year of the reform. Data on firm-level.

Datasource: Authors' calculations based on the Business Register (AFiD-Panel URS) and AFiD Retail Panel 2002-2009.

After the deregulation, the market shares increased continuously for multi-store firms. The increase in market share is reflected in a similar increase in revenues, see Figure 6a. Regarding profits, we cannot find increases as we do for revenues. Figure 6b shows that profits rather grow—if at all—much more slowly and to a substantially smaller extent, perhaps due to (proportionally) rising costs (wages, rents, and input costs). Note that the rather large, insignificant point estimate for 2002 is due to substantial revisions in the survey methodology by the Federal Statistical Office between 2002 and 2003 and should therefore be interpreted with caution.

To assess the heterogeneity of the treatment effects and the pre-reform differences in greater detail, we compare the revenue distributions between single- and multi-store pharmacies over the years. These product market effects are described by kernel density plots for each year in Figures 7a and 7b. The figures show, that multi-stores have had already before the reform, higher revenues on average, mainly due to higher probability mass on the right tail.

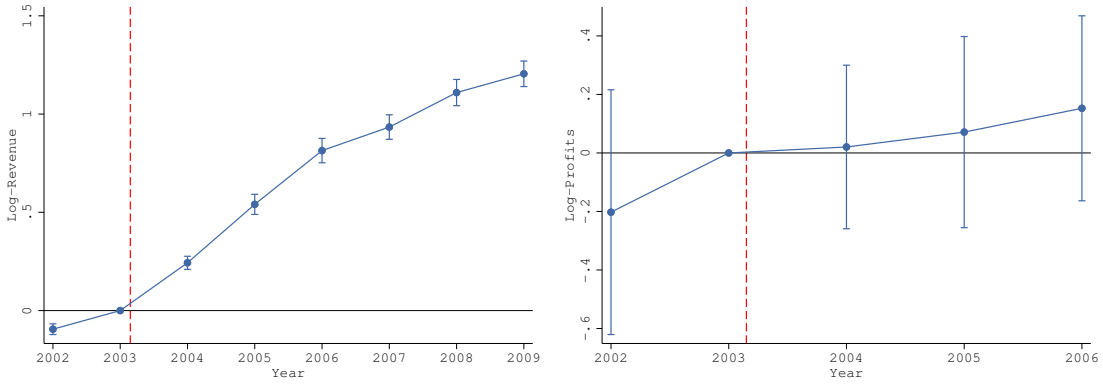
Strikingly, Figure 7b shows an instantaneous shift of the revenue distribution, which can be observed in the years from 2004 to 2005 for multi-stores but not for single stores. The reform not only affected the right tail but also shifted the left tail because all multi-store pharmacies expanded to new locations.

Still, it is remarkable that the dispersion of log revenues has not changed much. Note that we observe small shifts over the years presumably due to inflation. These result from over-the-counter sales for which the CPI applies. In summary, the evidence suggests that i) the reform immediately

the German central organization of the statutory health insurance (GKV, Spitzenverband der Gesetzlichen Krankenversicherung).

[11] This is why we decided not to present the results based on a deflation factor weighted from both the API and the CPI.

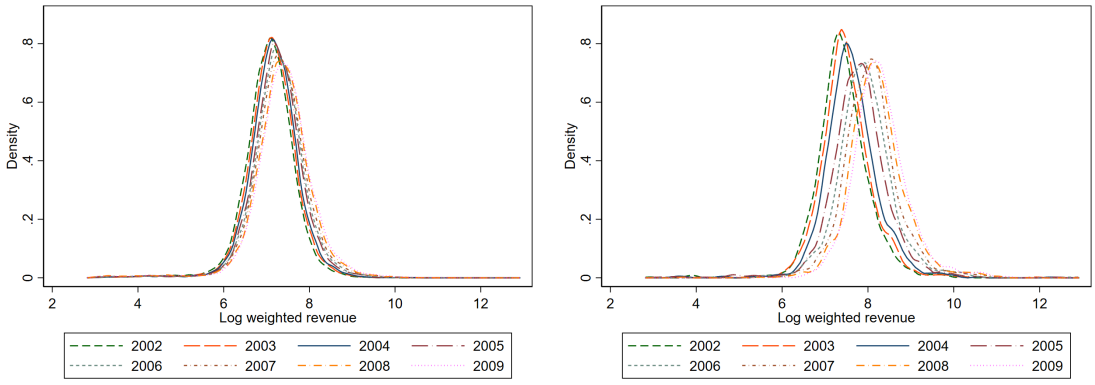
Figure 6: Impact on Competition Outcomes



(a) Log-Revenue (b) Log-Profits

Notes: Differential time trends for log-revenue around the year of the reform. Data on firm-level.
Datasource: Authors' calculations based on the Business Register (AFiD-Panel URS) and AFiD Retail Panel 2002-2009.

Figure 7: Impact across the Distribution of Revenues



(a) Density Revenues Single-Store (b) Density Revenues Multi-Store

Notes: Number of employees and revenues counted on firm level. For the kernel density estimation we used the Epanechnikov kernel.
Datasource: Authors' calculations based on the Business Register (AFiD-Panel URS) 2002-2009.

affected revenues and ii) led to doubling after three years, whereas iii) profits have at best only slightly been affected. This adds to the findings of Maican and Orth (2018), where sales in liberal markets are larger than in restrictive markets.

7.3 Concentration Effects

In this section, we assess one of the key objectives of the liberalization of the multiple-ownership ban, namely to introduce more competition in local pharmacy markets. In order to investigate this, we consider the effects of multi-store pharmacies and entries on concentration indicators as the Herfindahl-index or the concentration ratios, accounting for the market concentration and the market power of the leading pharmacies, respectively.

If the liberalization led to higher competition between the pharmacies we should be able to see the impact reflected in decreasing market concentration. Further, we investigate the effect of

product market liberalization on employment decisions. In Table 2 we report the effects of the liberalization of multiple ownership on the concentration of pharmacies in the local markets, that is, counties.

We estimate the following two panel data regressions, inspired by Bertrand and Kramarz (2002) to measure i) the relationship of the prevalence of multi-store pharmacies on local market concentration measures and ii) to estimate the relationship of concentration measures and the prevalence of multi-stores on the number of employees. We use two measures of prevalence of multi-store pharmacies. First, the number of multi-stores. Second, the share of multi-store firms among all firms in the local market. We estimate the following specificiation:

$$\textsc{Concentration}_{ct} = \alpha \textsc{Multi-Store}_{ct} + \beta \textsc{Entries}_{ct} + \gamma X_{ct} + \theta_t + \theta_c + \epsilon_{ct}, \tag{9}$$

where Concentration is a concentration measure at the local market level (Herfindahl-index or the concentration ratios), Multi-Store and $\textsc{Entries}_{ct}$ denote either the number or the share of multi-store pharmacies and entries varying over county c and year t. α is the estimate of interest, X_{ct} includes the number of general practitioners to proxy for demand, θ_t denotes the year, and θ_c country fixed effects, and ϵ is a residual. The second equation links product market competition to employment in the local market.

$$\textsc{Employees}_{ct} = \delta_1 \textsc{Multi-Store}_{ct-1} + \delta_2 \textsc{Entries}_{ct-1} + \delta_3 \textsc{Concentration}_{ct-1} + \beta X_{ct} + \theta_t + \theta_c + \varepsilon_{ct}, \tag{10}$$

where Employees is the number of employees in a local market, δ_1, δ_2 and δ_3 are the estimates of interest. All regressions of equation (9) presented in Table 2 include year fixed effects and control for the number of general practitioners as a proxy for demand. We explore the effect on markets with multi-store pharmacies alone, hence, excluding markets where no pharmacies expanded during the observation window to assess the intensive margin of higher numbers of multi-store pharmacies.

In Table 2, we correlate the concentration measures either with the number of multi-stores (column 1) and the number of entries (column 2) or with the shares of multi-stores (column 3) and entries (column 4) in the respective county for all outcome values of concentration measures.

We find that all measures of concentration are negatively related to the liberalization: Deregulating the multiple ownership, that is, allowing the number of stores per pharmacy to increase up to four in total, decreases the market concentration. We find this negative effect on the concentration measures to be significant for the number of multi-stores in a county as well as for the share of multi-stores per county. Entry of new pharmacies and a higher entry-share, however, slightly increase the market concentration, while the effects are all not significant.

How do these findings correspond with our findings from the descriptive statistics, where we stated that concentration increased? In general, concentration in the market seems to have increased, however, disentangling the effects showed: in markets with multi-store pharmacies a further increase of the number of stores per firm decreases the market concentration and, therefore, fulfills the intention of the deregulation by introducing a higher competition intensity and meets

the predictions of our theoretical model.

Table 2: Impact of Entry Regulation on Concentration

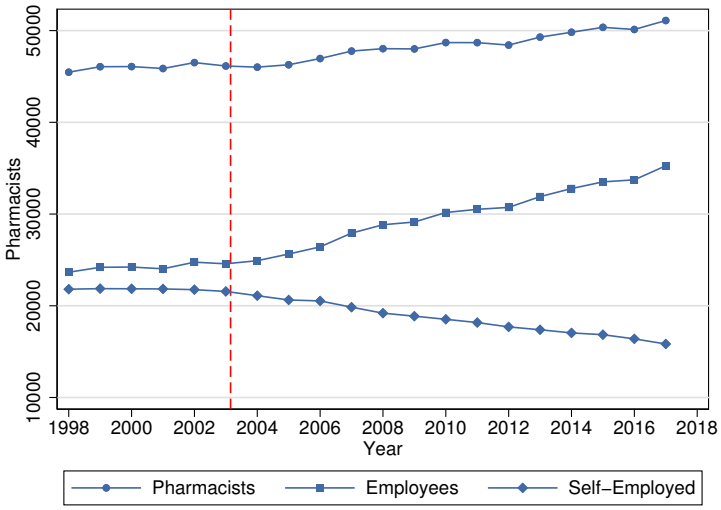
	H	CR[1]	CR[2]	CR[3]	CR[5]	CR[10]
Numbers of firms						
Multi-Stores	-0.045**	-0.088**	-0.103***	-0.111***	-0.101***	-0.069**
	(0.022)	(0.035)	(0.037)	(0.038)	(0.037)	(0.031)
Entries	0.034	0.091	0.082	0.076	0.050	0.011
	(0.041)	(0.075)	(0.079)	(0.083)	(0.082)	(0.074)
Shares of firms						
Multi-	-0.033**	-0.096***	-0.089***	-0.097**	-0.066*	-0.073**
Share	(0.016)	(0.032)	(0.032)	(0.035)	(0.036)	(0.035)
Entry-	0.010	0.050	0.042	0.032	0.016	0.016
Share	(0.019)	(0.038)	(0.045)	(0.046)	(0.044)	(0.036)
No. GP's	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓
Observations	1,865	1,865	1,865	1,865	1,865	1,865

Notes: Multi-Stores and Entries correspond to the numbers of multi-store pharmacies and entries in the market. Multi-Share and Entry-Share correspond to the multi-store or entry shares in the market. The dependent variables are the Herfindahl-index (H) as the sum of the squares of the market shares in each county or the concentration ratios cr[n] with n as the corresponding leading market share(s) per county, where [1] is the largest. All regressions include year fixed effects and control for the number of general practitioners as a proxy for demand. Standard errors clustered at county-level are in parentheses.
***Statistical significance at 1%, **significance at 5%, *significance at 10%.
Source: Authors' calculations based on the Business Register (AFiD-Panel URS) from 2002 to 2009.

We find that the reform had significant effects on the labor market concerning the employment structure. The number of self-employed pharmacists decreased over the years from 1998 till 2017 while the number of employed pharmacists (including those who are employed as a manager of a subsidiary pharmacy) increased (see Figure 8). Expanding a pharmacy still requires a pharmacist in each affiliated store, hence, the "pharmacist in the pharmacy" can be an employed (instead of a self-employed) pharmacist, explaining the increase in the numbers of employed pharmacists after 2004.

Assessing Figure 8 more closely reveals several key aspects on the link between product market regulation and labor market outcomes. Before the deregulation in 2004, we observe that the number of self-employed pharmacists equals the aggregate number of stores as shown in Figure 1. Both groups, self-employed and employed pharmacists follow parallel trends prior to the policy change. When the reform became effective, the number of self-employed pharmacists started to steadily decline by about 3,000—matching precisely the number of new affiliated stores as shown in Figure 1. This can be seen as a potential mechanical impact of the reform on the labor market, suggesting that those single-store pharmacies have been closed perhaps because former self-employed pharmacists retired or because new multi-store pharmacies hired them as pharmacy managers. Therefore, to

Figure 8: Employment Structure of Pharmacists Before and After the Reform



Notes: Authors' calculations. Overall number of pharmacists, employees and self-employed.
Datasource: ABDA 1998-2017.

assess the aggregate employment effects of the reform, it is important to take this substitution effect into account.

In a brief back-of-the-envelope calculation, we assume that all those 3,000 (on average) former self-employed pharmacists appear as employed pharmacists. With this lower bound, the increase in employment from about 22,000 before the reform to roughly 31,000 after the reform implies about 6,000 new jobs or an increase in employment of 18% on average.

To explore the general impact of market concentration on employment, we report the results obtained from estimating specification (10) in Table 3. The dependent variable is the number of employees in pharmacies per county.[12]

In all regressions, we control for the number of multi-stores and entries in the year $t-1$. Employment decisions are likely to be made based on the market situation in the year before, markets with many entries or with a high number of multi-store pharmacies might be in higher need of personnel. As we will see later on, expanding pharmacies increased their number of employees step-wise than instantaneously (see Figure 10b). This suggests that it is important to control for the number of expanding pharmacies and entries in the previous year.

We find that the effect of multi-stores on employment is positive. At the same time, higher market concentration is associated with more employment. These effects are economically relevant. Increasing the market share of the largest pharmacy by ten percentage points leads to six additional employees. The effect of multi-stores is significant for all regressions. A higher number of multi-store pharmacies leads to about three employees more.

[12]Including all employees subject to mandatory social insurance contribution, hence, including besides employed pharmacists also personnel like pharmaceutical-technical assistants.

7.4 Further Labor Market Effects

Disentangling the reform effects on the labor market yields key insights into the dynamics of the hiring behavior of pharmacies. After the reform, we find a significant increase in the number of employees for multi-store pharmacies, which is not surprising since more stores require more personnel. However, in contrast to revenues, the number of employees gradually increases. Quantitatively, the event-study results shown in Figure 9a imply that pharmacists hire about one employee per year on average. The pre-reform estimate is not statistically different from zero.

Table 3: Impact of Concentration on Employment

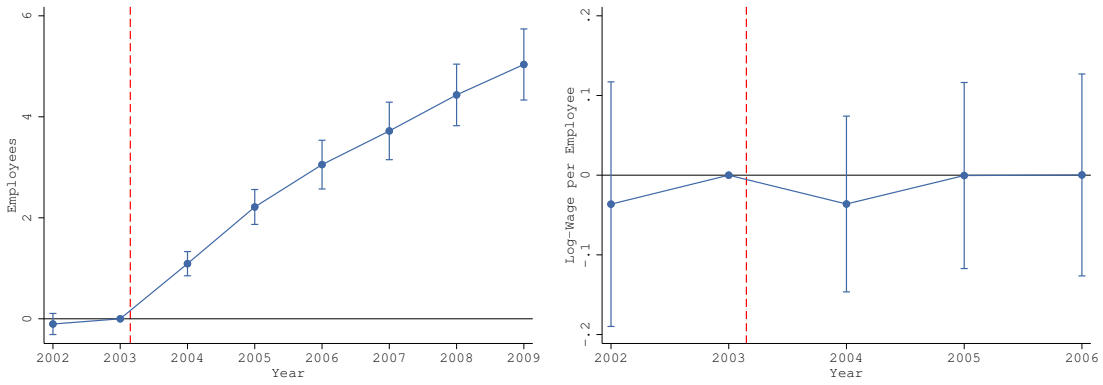
	(I)	(II)	(III)	(IV)	(V)	(VI)
Multi-Stores$_{t-1}$	2.940***	2.935***	2.935***	2.929***	2.916***	2.887***
	(0.485)	(0.486)	(0.488)	(0.491)	(0.496)	(0.504)
Entries$_{t-1}$	-0.607*	-0.578*	-0.593*	-0.591*	-0.570*	-0.531*
	(0.318)	(0.318)	(0.318)	(0.318)	(0.318)	(0.320)
H$_{t-1}$	1.251					
	(0.777)					
CR[1]$_{t-1}$		0.641*				
		(0.341)				
CR[2]$_{t-1}$			0.563*			
			(0.294)			
CR[3]$_{t-1}$				0.545**		
				(0.275)		
CR[5]$_{t-1}$					0.571**	
					(0.281)	
CR[10]$_{t-1}$						0.659**
						(0.319)
Year FE	✓	✓	✓	✓	✓	✓
Observations	2,807	2,807	2,807	2,807	2,807	2,807

Notes: The dependent variable is the numbers of personnel employed as reported in the URS. We control for Herfindahl-index, multi-stores, entries and concentration ratios in year $t-1$. Standard errors clustered at county level are in parentheses. ***Statistical significance at 1%, **significance at 5%, *significance at 10%.
Source: Authors' calculations based on the Business Register (AFiD-Panel URS) from 2002 to 2009.

Presumably, multi-store pharmacies successively increase the number of employees over the years due to increased personnel requirements of two or more stores. However, surprisingly we do not observe a doubling of personnel at the firm level after the deregulation. A reason for this under-proportional increase of personnel might be either some efficiency effects in organizing the staff or the fact that firms enter the market with smaller stores, which perhaps grow in the longer term.

From the survey data, we see that over time pharmacies hire more full-time than part-time employees (not reported), although this evidence is not as clear. Do wage costs increase for pharmacies with more stores? This could be the case perhaps due to local shortage of supply or overtime

Figure 9: Impact on Labor Market Outcomes



(a) Number of Employees

(b) Log-Wages per Employee

Notes: Authors' calculations. Differential time trends for employees around the year of the reform. Data on firm-level.
Datasource: Business Register (AFiD-Panel URS) and AFiD Retail Panel 2002-2009.

pay. In principle, most of the remuneration is based on collective bargaining agreements and the aggregate supply of pharmacists was rather large in our timeframe. Therefore, we expect to see no changes in an event-study regression on log-wages per firm. In fact, Figure 9b shows that wage costs growth remained virtually at zero.[13]

As with revenues, we find significant effect heterogeneity for the group of single-store pharmacies and the group of multi-store pharmacies regarding their number of employees after the deregulation. Figures 10a and 10b depict the density of employees at firm level in single- and multi-store pharmacies, respectively. Multi-store pharmacies have had, except for perhaps some representative pharmacies, on average a similar number of employees before the reform with similar dispersion.

Although the number of employees in single-store pharmacies did not change, we observe a dynamic and step-wise shift of the mean number of employees for multi-store pharmacies. The largest shift can be observed from 2003 to 2004 and from 2004 to 2005. In contrast to the impact on revenues, this shift only affected the right tail of the distribution, increasing the dispersion of pharmacy size.

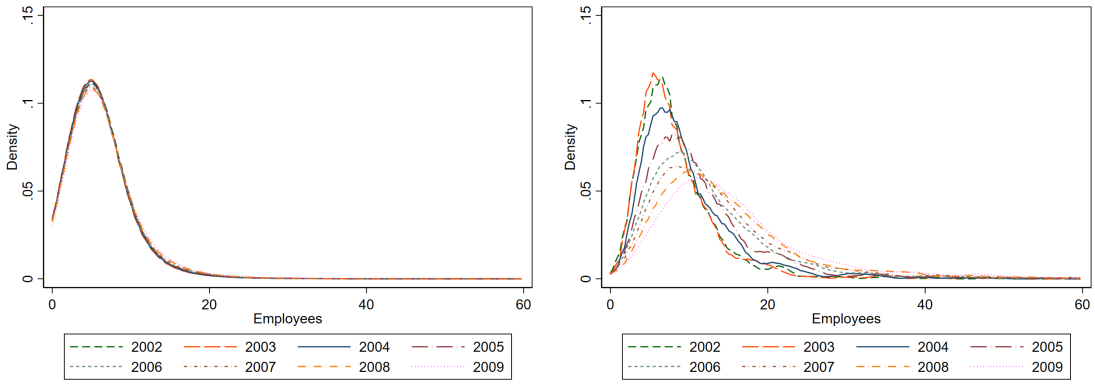
In summary, the evidence suggests that regarding the labor market i) the effect of the reform is rather dynamic and step-wise in contrast to the instantaneous effect in revenues, ii) although employment increases at the firm level, we find no doubling of personnel, and iii) wage-cost were not affected. This leads to the conclusion that employment growth is hindered by entry regulations, which is in line with the findings of Bertrand and Kramarz (2002).

7.5 Robustness

The liberalization of the multiple ownership ban constitutes a large reform for pharmacists, having a major impact on both the labor and product markets of pharmacists. To understand the effects of the entry reform on market dynamics—entry, acquisition, exit, and one-year survival— we apply a difference-in-differences approach. To rule out the possibility that the presence of multi-stores in

[13]Note that the estimate for 2002 in Figure 9b has to be interpreted with caution due to changes in the survey methodology between 2002 and 2003.

Figure 10: Impact across the Distribution of the Number of Employees



(a) Density Employees in Single Store (b) Density Employees in Multi-Store

Notes: Authors' calculations. Number of employees and revenues counted on firm level. For the kernel density estimation we used the Epanechnikov kernel.
Datasource: Business Register (AFiD-Panel URS) 2002-2009.

a local market might have affected single-store pharmacies, we apply the difference-in-differences approach to compare the outcomes for pharmacists to those of general practitioners before and after the reform.

General practitioners have been jointly analyzed with pharmacists in studies such as Schaumans and Verboven (2008) and are a natural comparison group for several reasons. First, trends affecting pharmacists translate directly to general practitioners, since the demand for pharmaceuticals is closely tied to the number of prescriptions dispensed. Second, the stable unit treatment value assumption is likely to hold, since the reform could not affect general practitioners as prices were exogenously fixed and physicians do not have freedom of establishment.[14] Third, the absence of anticipation effects seems also plausible, since the decision whether to become a pharmacist or a general practitioner cannot be adjusted as a reaction to the reform, since the average time of more than four years to be admitted as pharmacists or physician exceeds the time span between announcement and implementation of the reform.

More precisely, we specify

$$y_{fitc} = \tau \, \textsc{Pharmacists}_{it} + \beta X_{fitc} + \theta_t + \theta_c + \theta_{tc} + \theta_i + \epsilon_{fitc},$$

where y is an outcome variable varying over store i and year t in firm f and county c. τ is the average treatment effect (ATE), Pharmacists is a binary indicator equal to one when observing a pharmacist and zero for general practitioners. Year, county and county-year fixed effects are defined as before in Section 6.

Table 4 reports estimated ATE in five specifications for each market outcome. More precisely, we run regressions in which the respective outcome variable is estimated as a function of year effects (all specifications) and county effects (specifications II-V) to control for unobserved local heterogeneity. Specifications (IV) and (V) additionally include store fixed effects to control for

[14] If supply of medical services exceeds 110%, the Association of Statutory Health Insurance blocks the planning region for new general practitioners, regardless of whether they would like to work as self-employed or employee.

differences in specific stores.

We find that entry increases for pharmacists after the liberalization, and also find a positive and somewhat smaller trend for acquisitions. In our preferred specifications (IV and V), the exit rate increases for pharmacists. The one-year survival rate of a store increases as well, however, the survival in the pharmacy market is generally very high. In specification V, we control for first differences instead of fixed effects to address the problem of time-invariant unobserved variables. The results remain virtually unchanged. Overall, they are in line with our main findings of positive effects on entries and small changes in exits.

Table 4: Effects on Market Dynamics: Store-Level

	(I)	(II)	(III)	(IV)	(V)
ATE entries	0.024***	0.025***	0.027***	0.034***	0.024***
	(0.003)	(0.003)	(0.007)	(0.001)	(0.001)
ATE acquisitions	0.008***	0.008***	0.009***	0.007***	0.004***
	(0.000)	(0.000)	(0.001)	(0.000)	(0.001)
ATE exits	-0.006**	-0.006**	-0.016**	0.010***	0.007***
	(0.002)	(0.002)	(0.005)	(0.001)	(0.001)
ATE 1-year survivals	0.005**	0.005***	0.002	0.034***	0.026***
	(0.002)	(0.002)	(0.005)	(0.001)	(0.002)
Year FE	✓	✓	✓	✓	✓
County FE		✓	✓	✓	✓
Store FE				✓	✓
First Differences					✓
No. GP/county			✓		
Observations	412,224	412,224	53,605	412,224	336,058

Notes: We run all specifications for the different dependent variables: entry, acquisitions, exit and one-year survival. All regressions include year fixed effects. In specifications (V) and (VI), we control for the number of general practitioners as a proxy for demand. Standard errors clustered at county level are in parentheses. The number of observations varies with the dependent variable. We report the lowest number of observations. Data on store-level.
***Statistical significance at 0.1%, **significance at 1%, *significance at 5%.
Source: Authors' calculations based on the Business Register (AFiD-Panel URS) from 2002 to 2009.

8 Conclusion

In this study, we use micro-level data on the universe of pharmacies in Germany to investigate the impact of a reform that liberalized market entry for multi-stores. The deregulation of the multi-store ban on the German pharmacy market provides a case in point to assess the effects of deregulating entry. Our results suggest that the reform has increased the acquisition of stores and entry of new stores substantially in the short and long term. We find that competition increased,

resulting in higher exit and lower survival rates, albeit to an economically small extent.

We provide evidence on the characteristics of expanding firms, which have had higher revenues and more employees already prior to the reform, and show that both revenues and labor demand increased, while we cannot find evidence that profits increased. We document that expanding firms double revenues after three years but do not observe a doubling of personnel. This under-proportional increase might reflect efficiency effects in organizing the staff. Finally, we show that competition intensifies in markets where multi-stores exist, but concentration decreases with more multi-stores.

We view the results as consistent with the theoretical considerations set out in our study. With a market share competition model inspired by the local rivalry on the unit circle by Salop (1979), we show that artificially suppressing the number of stores may forgo efficiency gains and reduce consumer welfare. The model predicts that the reduction of entry costs affects competition in a way consistent with our findings in the data. Restricting the maximum number of stores to a fixed number independent of the characteristics of a local market seems excessively restrictive. We further can account for the increased labor demand of multi-store pharmacies and show that a higher (relative) managerial and organizational efficiency leads to an increased number of stores per firm.

On top of this, we show that employment is strongly positively correlated with each concentration measure. This shows that product market competition and labor market outcomes are intimately linked. In fact, although the reform has directly affected the market structure, we demonstrate clear evidence that it had important and sizable effects on the labor market. The policy change increased the number of employees per local market by 40% and led to aggregate job growth for pharmacists of more than 18%.

Our results can be seen as in line with the effects of occupational licensing, which emphasizes the inefficiencies associated with entry regulation in labor markets. More generally, we cannot exclude that entry regulations such as the multi-store prohibition serve the private interests of incumbents. However, these results are from our investigation of competition variables. There was no attempt to assess the quality of services, which may be an ambitious but important avenue for future research.

Evaluating the success of the reform shows that it worked as the intended careful partial liberalization. Nevertheless, even if the maximum number of stores remained restricted to four, the gains were likely quantitatively disproportionally high. This is evident from the characteristics of new firms induced into the market by the reforms, which strengthened already comparatively efficient firms. Even though employment at the local market level increased only slightly in absolute terms, the (unintended) impact on the labor market has been sizable. These results may suggest further liberalization of the multiple ownership, perhaps also including the admission of third-party ownership (German Council of Economic Experts, 2003). However, the higher market concentration would need to be monitored carefully to prevent monopolization, which could lead to undersupply, particularly in rural regions. Moreover, in terms of job creation, the impact of future reforms could be modest—at least initially, as since the 2004 reform, new stores start rather small.

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Appendix

A Definition of Key Variables and Sample Restrictions

Table A.1: Definition of key variables

Variable	Definition
Entry	Indicator for being newly registered on the market.
Acquisitions	Indicator for stores of firm i in t and of firm $j \neq i$ in $t+1$.
Exit	Indicator variable having been deregistered form the market
1-Year Survival	Indicator variable for operating on the market next year.
Market Share	We sum up all revenues r realized in county c and year t by all pharmacies n located in the respective county and divided it by the drug price index (API) we obtain the sales per county Q_{tc}: $$Q_{tc} = \frac{\sum_i^n r_{itc}}{API_t}$$ Then, we calculated the individual market share s_{itc} of each pharmacy (on firm level) in year t and county c by dividing the revenues of pharmacy i by the API and the sales per county: $$s_{itc} = \frac{r_{itc}/API_t}{Q_{tc}} = \frac{r_{itc}}{\sum_i^n r_{itc}}$$
Revenue	Taxable revenue from goods and services in 1,000 Euro deflated with the drug price index (API).
Profits	Profits calculated from revenues and costs in 1,000 Euro deflated with the drug price index (API).
Concentration ratios	$cr(m)$ are calculated using the market share as follows: $$cr(m)_c = \sum_1^m s_i$$ With s_i being the market shares of each of the n pharmacies in the market and m the rank of the leading pharmacies considered in the calculation of the concentration ratios.
Herfindahl-index	$H_c = \sum_1^n s_i^2$.
Employees	Number of employees subject to social insurance contributions.
Wages	(Gross) wages and salaries in Euro deflated with the drug price index (API) reported by the firm.

Table A.2: Sample restrictions

	AFiD-Panel URS		AFiD Retail	
Full Sample:		579,203		11,990
	Eliminated	Remaining	Eliminated	Remaining
Unit is expired	62,851	516,352	-	-
Unit is head-store	6,034	510,318	-	-
Unit is inactve	34,413	475,905	-	-
Multi-store before 2,004	2,829	473,076	114	11,876
More than four stores	181	472,895	57	11,819

Notes: The observations in the AFiD (URS) panel include the industry sectors of pharmacists (WZ2003: 52310, WZ2008: 47730) and general practitioners (WZ3003: 85121, WZ2008: 86210) over the years 2002 until 2009. The AFiD Retail panel is an unbalanced panel of pharmacists (WZ2003: 52310) over the years from 2002 until 2006. If we would observe each pharmacy over all 5 years, we have 23,190 potential observations.
Sources: Authors' calculations.