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*The EU Community Pharmacy Market:
The Density and its Influencing Factors*

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Selina Schwaabe

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Institut für Gesundheit & Soziales
der FOM Hochschule
für Oekonomie & Management

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The EU Community Pharmacy Market: The Density and its Influencing Factors

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The EU Community Pharmacy Market:

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Preface

Community pharmacies deliver high-quality health care and are responsible for medication safety. The goal of the government is to ensure nationwide, accessible, and affordable medical health-care services provided by pharmacies. Therefore, the per capita density of community pharmacies matters. Overall, the density of community pharmacies fluctuates, with slightly decreasing tendencies in some countries. So far, studies have shown that changes in the system affect prices and density. However, an overview of the development of the density of European community pharmacies and its causes is still missing. This research is important to counteract decreasing density resulting in a lack of professional health care delivered through pharmacies. I focus on liberal versus regulated market structures and the regulation of mail-order of prescription drugs.

The density of community pharmacies is increasingly becoming the focus of health-care policies. The supply of nationwide health-care services, especially with regard to recent pandemics, is important. Community pharmacies are not just a counter for prescription drugs. They deliver high-quality health advice and, in some cases, can replace a doctor's visit. Hence, a decline in the density of community pharmacies can affect people's health (care).

During my research, I collected data on the number of community pharmacies per 100,000 inhabitants from 27 EU countries from 2000 to 2021. The motivation for this research comes from both a health-care policy and a personal perspective. I grew up in a pharmacist's household and worked at the family's pharmacy. During this time, I learned about the differences in pharmacy market regulations throughout the EU, which led me to question what influences pharmacy density.

I am indebted to my supervisors, Prof. Dr. Tim Bütke and Prof. Dr. Christian Adam, for their continuous help and advice. Thank you. Further, I would like to thank Prof. Dr. Ellen Schaffheutle for her spontaneous, important input on the EU community pharmacy market. In addition, I appreciate the information and advice given by the research group members of the international relations chair at the TUM/HfP. Further, I would like to thank Dr. Isabel Gödl-Hanisch, Julius Schmidt, Charlotte Hummel and David Schweitzer for their feedback on this paper. I would also like to extend my gratitude to the respective European pharmacy associations for providing me with the data on pharmacy density. My gratitude also goes to the ifgs publication series for offering me the opportunity to publish. I am particularly grateful to Prof. Dr. David Matusiewicz and Sarah Berndsen.

Munich, January 2025

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List of Abbreviations

ABDA	Bundesvereinigung Deutscher Apothekerverbände e. V.
AMPreisV	Arzneimittelpreisverordnung
DKMA	Danish Medicines Agency
e-prescription	electronic Prescription
EU	European Union
FIP	International Pharmaceutical Federation
GDP per capita on PPP	Gross Domestic Product per capita based on purchasing power parity
H	Hypothesis
INHS	Italian National Health Service
NNF	Nacht- und Notdienstfond
OTC	over-the-counter
POM	prescription only medicines
Rx	prescription
WHO	World Health Organisation

1 Introduction

The liberalization of markets has been of considerable interest in various industries, as it aims to promote competition, innovation, and consumer choice (Enthoven, 1993; Sidak & Spulber, 1998). In the context of the pharmacy sector, ownership structure has historically been subject to stringent regulations, limiting the number of community pharmacies¹ per capita and their ownership arrangements (World Health Organization, 2019). Recent discussions have emerged regarding the potential benefits of liberalizing pharmacy ownership and mail-order² pharmacy services for prescription medications (Rx)³ (Carballada & Lois-González, 2022; Garattini et al., 2012; Grabein et al., 2008; Greß, 2016; May et al., 2017; Oleszkiewicz et al., 2021; Policarpo et al., 2019; Vogler, 2014; Vogler et al., 2012; Weißenfeldt, 2019; Wisell et al., 2016).

Existing literature explores how the pharmacy market may affect pharmacy density⁴ and as a consequence the distribution of medication through pharmacies with professional advice (Anell et al., 2012; Carballada & Lois-González, 2022; Karttunen, 2020; Purcell, 2004; Rants, 2014; Vogler, 2014; Wisell, 2019; Wiśniewski et al., 2020). The most commonly studied properties of markets are regulatory models of ownership structures and the rules regarding Rx mail-order (Gallone et al., 2020; Greß, 2016; Gross & Volmer, 2016; May et al., 2017; Meyer, 2020; Wisell et al., 2016). The main distinction is between regulated and liberal markets. This paper refers to market systems regarding the ownership regulations of a pharmacy. A regulated market is defined by relatively restricted criteria for opening a pharmacy, i.e., high entry barriers. Only licensed pharmacists are allowed to open and manage a retail pharmacy.⁵ This license depends on national professional requirements (World Health Organization, 2019). In contrast, in liberal markets, there are lower entry barriers as ownership

¹ “A community pharmacy is defined as a pharmacy providing access to medicines for a specific community (often retail premises)” (Bates et al., 2016). Further, this research defines a community pharmacy as a point of service for prescription drugs.

² Rx mail-order defines mail-order of Rx from (online) pharmacies abroad.

³ Prescription drugs are, for example, antibiotics, antihypertensives, or narcotics. The classification as Rx varies throughout EU countries based on different drug regulations.

⁴ Pharmacy density refers to the concentration of pharmacies within a specific geographical area, often measured as the number of pharmacies per capita.

⁵ Besides the ownership restrictions, there are further limitations concerning where and how to open a pharmacy, which are not taken into account for the definition of regulated and liberal. Further, in order to open a pharmacy, one must obtain a permit from the respective licensing authority (Ministry of Health/Health Agency).

of a pharmacy is legally available to nearly anyone.⁶ However, exceptions exist, for example, no physicians or insurance companies can own a pharmacy (World Health Organization, 2019). In addition, there is a continuing debate as to whether the density of pharmacies is affected by the online distribution of Rx (Greß, 2016; May et al., 2017; Weißenfeldt, 2019). The EU⁷ pharmacy market is very heterogeneous due to individual state regulations. Hence, the density differs. For example, the density of pharmacies per 100,000 inhabitants in Greece is three times as high as in Portugal (see Table 6 in Appendix 1). Further, their regulatory markets differ. The density in Austria, with no Rx mail-order, is smaller than in Germany, where Rx mail-order is permitted (see Table 6 in Appendix 1). To get a clearer sense of the causes of market dynamics, it will be valuable to understand better whether market regulations on ownership and Rx mail-order affect the density of community pharmacies in Europe. The research question is: Do market regulations on ownership structure and Rx mail-order affect pharmacy density in the EU?

It is commonly assumed that regulations drive density but there are examples which prove that this relationship is not straightforward and, therefore, demands more detailed investigation. There is disagreement in the existing literature as to whether the liberalization of the pharmacy market, i.e., the liberalization of ownership and Rx mail-order permits, leads to positive effects in pharmacy density (Carballada & Lois-González, 2022; Eades et al., 2011; Rants, 2014; Vogler, 2014; Wisell, 2019; Wiśniewski et al., 2020). This analysis delves into the theory of managed competition, i.e., with regulations, and its implications for the liberalization of the pharmacy market. Evidence from a number of EU countries shows that liberalization within the pharmacy market does not automatically increase market⁸ density (for more information see Appendix 3) (Carballada & Lois-González, 2022; Garattini et al., 2012; Oleszkiewicz et al., 2021; Vogler et al., 2014). As demonstrated in Sweden, the introduction of ownership liberalization did not expand accessibility (Vogler et al., 2006; Vogler et al., 2014; Wisell, 2019; World Health Organization, 2019). Additionally, in Germany, the permission for Rx mail-order increases competition. Following a debate by May et al. (2017) the permission for Rx led to a decrease in pharmacy density in

⁶ One must obtain a permit from the respective licensing authority (Ministry of Health/Health Agency).

⁷ European Union (EU) member states, which consequently fall under EU regulations excluding the United Kingdom (UK), Switzerland, Norway, and Liechtenstein.

⁸ All pharmacy markets within the EU differ concerning regulations on drugs, permissions of different active ingredients, health systems, prices of medicines, health insurance, the service provided at the pharmacy, etc.

Germany.⁹ Further, the liberalization of ownership structure, for example, in Portugal,¹⁰ showed an increase in density (Policarpo et al., 2019; Ribeiro et al., 2020).

The main weakness of existing literature includes a restricted scope, conceptual heterogeneity, and analytical gaps, specifically regarding density. In addition, the existing literature has not addressed the question of which ownership structure (liberal/regulated) or Rx mail-order regulation positively or negatively affects density. Hence, my contribution is to extend current research.

Based on this analysis, the results indicate that market regulations on ownership and Rx mail-order do not significantly impact pharmacy density within the EU. Instead, the number of pharmacists per 100,000 inhabitants is a significant determinant of pharmacy density. Additionally, economic factors such as GDP per capita and demographic factors, particularly the percentage of the population over 65, also play crucial roles in influencing pharmacy density. To answer the research question, this paper is structured as follows: First, to understand how regulatory changes in health-care policies affect the density of community pharmacies,¹¹ “managed competition” is used as the theoretical framework to shed light on the ideas of the liberalization process. A description of the different pharmacy markets (regulated and liberal)¹² in study focusing on EU countries helps to understand the various opportunities to expand the pharmaceutical service and ownership structures at the community pharmacy and the Rx mail-order¹³ markets (see more in Appendix 3). Two hypotheses will follow. Further,

⁹ Details on that specific case are summarized in Appendix 3.

¹⁰ Portugal declares itself as regulated. However, following this paper's definition of regulated and liberal ownership, the pharmacy market in Portugal is defined as liberal.

¹¹ Due to high complexity within the pharmacy business, this paper focuses only on community (retail) pharmacies, not hospital pharmacies, university pharmacies or Parapharmacies (pharmacies without the right for Rx).

¹² Ownership is not restricted to pharmacists in liberal markets. Non-pharmacists can own (parts of) a pharmacy. However, limitations on horizontal (chains) and vertical (wholesalers, the pharmaceutical industry, or private persons/companies) integration exists. Furthermore, to prevent conflicts of interests, some business groups cannot own a pharmacy. This rule differs between EU countries.

¹³ This paper addresses only the importance of the community pharmacy for handing out Rx, not for over-the-counter (OTC) sale. Meanwhile, OTC is available at supermarkets. This research shows that community pharmacies are the important seller of Rx because of sensibility of pharmacists towards customers and professional advice on risks and side effects of drugs. The Rx mail-order permit refers to the sale of prescription drugs by mail order. The Rx mail-order ban prohibits pharmacies from shipping Rx medications to consumers. Only dispensing at an on-site pharmacy is permitted. The Rx mail-order permit, however, allows prescription drugs to be offered

this study employs two statistical modeling approaches to examine the determinants of pharmacy density across European countries: cross-sectional analyses and fixed-effects panel analyses. The cross-sectional analysis provides a snapshot of the relationship between various factors and pharmacy density across different countries at a single point in time, while the fixed effects analysis examines the influence of these factors within countries over time, accounting for country-specific characteristics and unobserved heterogeneity. By comparing the results, this study enhances the understanding of the factors influencing pharmacy density. To the best of my knowledge, this paper is the first attempt in pharmacy research to examine the effects of the ownership structure and the Rx mail-order regulation on pharmacy density within the EU pharmacy market and can be seen as a starting point for further research.

through mail order. However, a distinction must be made as to whether this shipment may only occur within the country (Sweden, Finland, and Netherlands) or may also be imported from other EU countries (as in Germany, for example). There are strict EU regulations to fight against counterfeit drugs and to ensure certified providers.

2 Theoretical Framework

Governments liberalize the pharmacy market under the expectation to achieve cheaper prices and better accessibility for customers. But the empirical effects are far from straightforward (Carballada & Lois-González, 2022; Clara, 2011; Gallone et al., 2020; Rants, 2014; Vogler, 2014; Wisell, 2019; Wisell et al., 2016). The literature investigates the assumption that due to liberalization of ownership, the density increases (Gallone et al., 2020; Vogler et al., 2014; Wisell et al., 2016). The more people have the right to open a pharmacy, the higher the pharmacy density should become (Wisell et al., 2016). Some researchers have tested this hypothesis on the effects of the liberalization process, for example, in Sweden, Portugal, and Poland (Ribeiro et al., 2020; Sowada et al., 2019; Vogler et al., 2014; Wisell et al., 2016; Wiśniewski et al., 2020). The results of these studies are that the density of pharmacies in these countries has increased, but several pharmacies have not been able to withstand the pressure due to increased competition. Thus, the liberalization of ownership in these countries has increased the number of pharmacy chains, which are not distributed evenly but are concentrated where the demand is highest, i.e., in urban areas (Anell et al., 2012; Balgård, 2012; Crisand, 1996; Enste et al., 2020; Vogler et al., 2012; Vogler et al., 2014). Rants (2014, p. 36) explains this phenomenon as “urban clustering”. She further cites an argument by Lluch (2009, pp. 26-27), who highlights the problem of liberalizing the pharmacy market:

The rationale behind deregulation in the pharmacy sector is the expectation that liberalisation will increase competition and thus succeed in lowering, or at least containing (public) expenditure, while access to quality pharmacy services will remain stable, if not improved, by the opening of new outlets. In sum, deregulation claims to make the market more efficient whilst key areas like equity and access are not compromised.

To counteract the risk of an oversupply of pharmacies in highly populated areas, there are geographical and/or demographic criteria for the optimal location of a pharmacy.¹⁴ Hence, each pharmacy has either a particular radius in which no other pharmacy is located or a specific number of inhabitants it has to serve.¹⁵ For example, the minimum distance between pharmacies in Austria, Poland, and Latvia is 500 meters (m). In Spain and Hungary, the minimum distance is 250 m.

¹⁴ Which is a form of regulation and can exist in liberal and regulated pharmacy ownership markets.

¹⁵ See Tables 3, 4 and 5 in Appendix 1.

Further, in Austria, one pharmacy must serve at least 5,500 inhabitants. A pharmacy in Hungary has to serve 4,000 inhabitants in cities with 50,000 inhabitants and 4,500 for fewer inhabitants. In Portugal, the minimum number of inhabitants a pharmacy has to serve is 3,500. Several further restrictions exist for operating pharmacies, for instance in relation to the size of the city it is located in, the general regional structure, and if nearby medical centers exist (World Health Organization, 2019).

This regulation process within a liberalized market can be linked to the core ideas of managed competition. The concept of managed competition has gained significant attention in the realm of market liberalization. This theory encompasses an economic approach that aims to introduce market mechanisms into regulated industries, fostering competition and efficiency (Enthoven, 1993; Sidak & Spulber, 1998; Vogel, 2007). By opening markets previously dominated by state monopolies or stringent regulations, managed competition seeks to strike a balance between liberalization and regulatory oversight, aiming to achieve improved outcomes for consumers and other market participants (Enthoven, 1993).

Enthoven defined the economic concept by presenting the need for regulated competition. He writes:

Managed competition in health care is an idea that has evolved over two decades of research and refinement. It is defined as a purchasing strategy to obtain maximum value for consumers and employers, using rules for competition derived from microeconomic principles. A sponsor (either an employer, a governmental entity, or a purchasing cooperative), acting on behalf of a large group of subscribers, structures and adjusts the market to overcome attempts by insurers to avoid price competition. (Enthoven, 1993, p. 25)

Brandeis, another proponent of managed competition, discussed ideas of “setting standards of fair competition and effective cost accounting” (Berk, 2009, p. 148). Hence, regulation (within liberal markets) is defined as a market coordination mechanism “in the public interest” (Paul, 2020, p. 401). In addition, it is about managing “the competitive transition to determine the outcome of competition” (Sidak & Spulber, 1998, p. 118). Moreover, Sidak and Spulber (1998) rely on the term *fairness*. They argue that “markets are known for their efficiency properties, rather than the equity of their outcomes” (Sidak & Spulber, 1998, p. 118). Further, they mention that “(...) regulators need an operational definition of fairness that

does not attempt to specify outcomes, a set of objectives that does not perpetuate regulation, but, rather, lets it recede as competition progresses” (Sidak & Spulber, 1998, p. 118). However, it is necessary that “regulators should establish basic rules for an orderly transition to competition that rely on competitive innovation and cost cutting as the sources of consumer benefits” (Sidak & Spulber, 1998, p. 119). Overall, managed competition is “a combination of liberalization with re-regulation” more specific: “true deregulation (freer markets and fewer rules)” (Vogel, 2007, p. 33). The assumption of re-regulation by Vogel (2007, p. 34) is as follows:

The logic by which liberalization drives re-regulation varies according to the nature of the preexisting regime and the character of the transition toward greater competition. A shift from monopoly to competition typically requires pro-competitive regulation to jump-start competition (...). A transition from public to private provision of services often requires new regulation to mandate public service requirements such as universal access or interoperability) that were previously met directly by the public corporation. An increase in the number and diversity of market players generally demands a more codified regulatory regime (“more rules” in the literal sense). And an intensification of competition may spur companies to behave worse (to produce greater externalities), therefore requiring more social, environmental, or other types of protective regulation.

The application of managed competition with regulations has been particularly relevant in sectors undergoing liberalization, such as telecommunications, energy, transportation, and financial services. In these cases, the gradual dismantling of state monopolies or regulatory barriers has been accompanied by the implementation of regulatory frameworks to ensure fair competition and protect public interests (Vogel, 2007). It is also important to know what managed competition is not. For example, Enthoven (1993, pp. 44-45) explains that it is not deregulation, it is not a free market, and “it is new rules, not no rules”.

Managed competition controls the entry into a liberalized market, ensures fair conduct by all market players thus acting in the (end) consumer’s best interest. Entry barriers to the pharmacy market are ownership licenses, geographic and demographic rules, minimum and maximum Rx drug prices, retail concepts (workforce requirements), and provided services (vaccinations, diabetes counseling, expanded assortments such as cosmetics, and more)¹⁶. One specific

¹⁶ Which are not considered in this analysis.

market that has recently witnessed the application of managed competition through regulations is the pharmacy market.

The Swedish pharmacy market has changed from a regulated market to a market with managed competition. Sweden's pharmacy market went from a state monopoly to a more liberally regulated market where a broader service, new selling places for fair competition, and an improvement of service exist (Wisell, 2019; Wisell et al., 2016). As governments explore avenues to liberalize this traditionally regulated sector, striking the right balance between competition and regulatory oversight becomes crucial. The implementation of managed competition principles, combined with targeted regulations, presents a promising approach to fostering competition while safeguarding patient safety, maintaining access to quality health care, and ensuring the sustainability of the pharmacy sector. The next section briefly presents which regulations and liberalizations exist within several EU countries.

3 Empirical Developments

Sweden's state-monopoly based pharmacy market was liberalized in 2009 to introduce more competition. Parts of the pharmacy market in Portugal were liberalized by removing some regulations regarding the ownership structure in 2007. In Austria, so-called private partnerships can invest in a pharmacy since 2008. However, the pharmacist in charge has to hold more than 50 percent of the business (Österreichische Apothekerkammer, 2020b). Nevertheless, the market has structures of re-regulation (liberalization with more regulation) in the sense of fair competition. Regulation examples include geographic and demographic rules for establishing a new pharmacy to create accessibility and fairness. Further, in 2004, the German government liberalized Rx mail-order without changing existing price regulations within the country (liberalization without new rules for competition) (May et al., 2017). Due to the unchanged restrictions for German pharmacies regarding Rx fixed pricing rules,¹⁷ pharmacies could not withstand the price competition because pharmacies from abroad are allowed to discount the additional payment on Rx (usually between 5 and 10 €) of the insured in the amount of 10 percent of the pharmacy dispensing price (Bundesministerium für Gesundheit, 2023). A study by May et al. (2017) concluded that this resulted in a decline in the density of pharmacies in Germany.

Due to the international trend of liberalizing regulated markets, the former government of Italy under Prime Minister Mario Monti also discussed liberalizing the Italian pharmacy market. A report by Garattini et al. (2012) highlighted that the liberalization plan of the Italian pharmacies would not change the policy goals of better accessibility, lower prices, and more competition.¹⁸ The researchers write:

The new law in Italy aims to enhance competition in the pharmacy sector by reducing the historical restrictions through liberalization. However, after careful evaluation, the new regulations do not seem to radically change this tightly regulated distribution channel. One of the major hurdles to a free market (i.e. ownership restrictions) will remain and new shopping forms (e.g. internet pharmacies) will not

¹⁷ Every Rx medicine has a fixed price in Germany to ensure that the customer gets the same price in every pharmacy. This price is not discountable at German local pharmacies.

¹⁸ Nevertheless, in 2017, the pharmacy market was liberalized by allowing non-pharmacists to own a pharmacy through partnerships or companies (Gallone et al., 2020).

be introduced. Other limits, such as the demographic and geographic rules for opening a new pharmacy, have not been cancelled, just relaxed. An expected consequence is that many more pharmacies could open, resulting in redistribution of INHS remuneration for approved drugs.

In theory, increased supply with equal demand could result in enhanced competition. (Garattini et al., 2012, p. 25)

They further agree with other researchers that liberalizing the geographical rules will not expand density (Garattini et al., 2012). It will increase density in the urban areas, but the density in rural areas will remain low (urban clustering) (Garattini et al., 2012). In addition, current literature expresses that liberalizing the pharmacy market has different outcomes: pharmacy chains will have a more significant influence while smaller retail pharmacies have to close (Carballada & Lois-González, 2022).

Competition promises positive impacts on the freedom of choice for the public and an increase in the number of community pharmacies (Gallone et al., 2020; Vogler, 2014; Wisell et al., 2016). These positive expectations have not been confirmed in all liberalized pharmacy markets. From the literature one gathers that the liberalization of the pharmacy market is associated with false expectations of more competition due to more players within the market – for example, in Sweden. (Vogler et al., 2006; Wisell, 2019). Wisell (2019, p. 36) argues that the liberalization reform was made “without the necessary research on the possible consequences”. Further, she explains that liberalizing the market

was not based on rational arguments but mainly on an ideology. (...) privatization per se seemed to be an important rationale in the abolishment of the monopoly. The idea of how it ought to be was prioritized over what was probably going to be, based on the evidence at hand. (Wisell, 2019, p. 36)

While liberalizing parts of the market, other regulations remain strong, such as geographic and demographic rules (Carballada & Lois-González, 2022; Rants, 2014).

Using the core ideas of the managed-competition approach, this analysis explains how liberalization of the pharmacy market in the field of ownership and Rx mail-order impacts density. The next part of this paper describes the hypotheses according to the theoretical approach.

4 Theoretical Expectations

Higher pharmacy density has been associated with improved¹⁹ accessibility to health-care services, enhanced medication availability,²⁰ and increased competition, which may result in lower prices and higher quality of care (Vogler, 2014; Wisell et al., 2016; Wiśniewski et al., 2020). The expectations derived from the discussion above posit that the number of pharmacies within a market will rise by relaxing ownership restrictions and allowing a more diverse range of owners, such as independent pharmacists or non-pharmacist investors. Proponents of this hypothesis argue that liberalization stimulates entrepreneurial activity, attracts investments, and fosters a competitive environment, ultimately leading to an expansion of pharmacy services and increased accessibility for patients (Clara, 2011; Vogler, 2014; Wisell, 2019; Wisell et al., 2016).

The tougher the restrictions on opening a pharmacy are, the fewer pharmacies exist. Following the ideas of managed competition, liberal markets (liberal pharmacy ownership)²¹ can further increase competition. In addition, researchers discuss a higher density when changing from a regulated to a liberal market, with more competition (BWB, 2018; Eilard, 2015; Gallone et al., 2020; Vogler et al., 2006; Vogler et al., 2012; Wiśniewski et al., 2020). Differences between liberal and regulated markets are sometimes hard to spot. The pharmacy market is liberal if the ownership is not restricted to pharmacists. Hence, the pharmacy market is regulated if the ownership is 100 percent restricted to pharmacists. This distinction between liberal and regulated was chosen based on the existing work of the two regulatory markets within pharmacy research (Purcell, 2004; Vogler et al., 2014; Wiśniewski et al., 2020; World Health Organization, 2019).

Theoretically, following the debate in previous literature, this analysis expects a correlation between pharmacy density and pharmacy ownership regulations (liberal vs. regulated). Accordingly, following the core ideas of managed competition, a liberal pharmacy market, meaning liberal ownership, is expected to increase pharmacy density. Therefore, the first hypothesis is as follows:

¹⁹ By improvement, this analysis means more services available at the pharmacy, a broader choice of products, longer opening hours, digitalization, larger stock of drugs, etc.

²⁰ Licensed pharmacists are also a highly sought-after profession in the pharmaceutical industry. Due to the economic size of the pharmaceutical industry, these pharmacists can be paid better, and the working hours are more flexible than in the retail sector of the pharmacy.

²¹ In every liberal ownership market, regulations on further market regulations exists.

H1: Liberalizing the ownership structure increases pharmacy density.

Pharmacy density refers to the concentration of community pharmacies within a specific geographical area. Density has long been viewed as a measure of health-care accessibility and the availability of prescription medications (World Health Organization, 2019). With the advent of technology, Rx mail-order services have emerged as an alternative means for patients to obtain their prescription medications conveniently through mail delivery.

The next hypothesis suggests that by liberalizing Rx mail-order services, patients may increasingly opt for this convenient option, leading to reduced demand for traditional pharmacies. May et al. (2017) argue that there is a decline in German pharmacy density due to foreign competition advantages regarding Rx mail-order.²² In most EU countries, Rx mail-order is prohibited, regulated with pricing rules, or limited to community pharmacies (not online pharmacies, i.e., pharmacies without an on-site store). The density is more or less stable (for example, in Denmark).

It can be assumed that liberalization of Rx mail-order (without new rules) will increase the likelihood that patients buy their drugs where they are cheapest (May et al., 2017; Rohrer, 2021). In Germany, because of competitive disadvantages, Rx drugs at foreign pharmacies are not bound to German Rx pricing rules (May et al., 2017). However, this is a particular case for Germany. Nevertheless, the customer buys the medication where it is cheapest and easiest to buy: in drugstores, supermarkets, gas stations, or abroad. Prescriptions can secure the primary income of a pharmacy. The fewer sales generated by Rx on-site, the lower the gross profit (Deutsche Apotheker Zeitung, 2022). Because of missing rules for competition, the density will decline. Hence, the underlying presumption is a decreasing density of pharmacies due to the mail-order permission for Rx. Thus:

H2: Liberalizing Rx mail-order reduces pharmacy density.

²² Rx mail-order only exists in the following EU countries: Sweden, Germany, Denmark, the Netherlands, Malta, Finland, Estonia. I only mention Germany as an example because of the competitive advantages on prices for Rx, which is unique.

Besides the regulation of ownership and Rx mail-order, several regulations could impact pharmacy density. The current literature on community pharmacy research discusses the influence on pharmacy density by the Gross Domestic Product per capita based on purchasing power parity (constant 2017 international \$, GDP per capita on PPP), the number of pharmacists per 100,000 inhabitants, the proportion of the number of the population aged 65 and over (+), if there are regulations on geographic and demographic rules, and the number of medical doctors per 100,000 inhabitants (International Pharmaceutical Federation - FIP, 2017; World Health Organization, 2019). A positive correlation in density is expected due to the number of pharmacists because every pharmacy needs a pharmacist who is available during opening hours (Gallone et al., 2020; World Health Organization, 2019; Zelnio et al., 1984). Therefore, the more pharmacists there are, the more pharmacies can exist. This holds true, for example, if the maximum number of pharmacies within a specific area or for a specific number of inhabitants is not fulfilled. Pharmacies are established where doctors or medical centers are in proximity, so patients can be referred to a pharmacy and easily access the pharmacy for prescriptions (World Health Organization, 2019). Hence, more pharmacies are needed if the number of medical doctors increases. Another reason for higher density could be the number of the population aged 65+ because the elderly need more medication (World Health Organization, 2019).²³ Finally, geographic and demographic²⁴ rules are discussed to secure competition and regulate density (International Pharmaceutical Federation - FIP, 2017; Vogler et al., 2014; World Health Organization, 2019). The next part presents the data and methods used and analyzes the output.

²³ Such as cardiovascular disease, diabetes, Alzheimer's disease, joint pain, and cancer.

²⁴ This analysis only captures if geographic and demographic rules exists or not. Further definitions are not included due to complexity of the rules regarding each country and each city.

5 Data

This study employs a comprehensive analysis to investigate the factors influencing pharmacy density across 27 EU countries during the period spanning from 2000 to 2021. The objective is to explore the determinants of pharmacy density and evaluate the influence of specific ownership characteristics, prescription drug distribution methods, and various socio-economic factors (see more details on sources of data in Appendix 2 Table 7). The data on pharmacy density²⁵ primarily comes from the provided dataset by the Federal Union of German Associations of Pharmacists (“Bundesvereinigung Deutscher Apothekerverbände e. V.”, short: ABDA), which is used for their annual report “Figures Data Facts”. This dataset was supplemented and completed with the help of annual reports on pharmacies from respective pharmacy associations (Apteekkariliitto, 2023; Österreichische Apothekerkammer, 2023; Statistics Poland, 2023). Direct email inquiries were made to the relevant health ministries of all 27 EU countries to obtain additional data on pharmacy density. Due to the lack of data on pharmacy density from 2000 to 2010, there are more observation gaps in the dataset. Information regarding the permission for prescription drug mail-order services was obtained from the annual reports of the ABDA (ABDA, 2020a, 2020b, 2021) and a report by the World Health Organization (WHO) (World Health Organization, 2019). The data on GDP per capita on PPP (constant 2017 international \$) is sourced from the World Development Indicators database 2022 (The World Bank, 2023). Furthermore, the number of pharmacists per 100,000 inhabitants was obtained from the WHO European Data Warehouse (2023) and Eurostat (2023), and the number of doctors per 100,000 inhabitants was also taken from Eurostat (2023). The presence of geographical and demographic factors was filtered from the literature (ABDA, 2020a, 2021; Carballada & Lois-González, 2022; International Pharmaceutical Federation - FIP, 2017; Vogler et al., 2014; World Health Organization, 2019). Data on the proportion of the population aged 65 and over was taken from Eurostat (2022) and International Pharmaceutical Federation - FIP (2017).

Data on pharmacy density has been collected from all EU countries from 2000 until 2021.²⁶ The key variables of interest are the density of pharmacies for each

²⁵ See Table 6 in Appendix 1 for an overview of the number of community pharmacies per 100,000 inhabitants of 27 EU countries from 2000-2021.

²⁶ I choose the timeframe to cover important changes within the pharmacy market, which could have influenced density like the permission of Rx mail-order, the online sale of drugs, and several market regulation changes. Further, there is no other study, which covers the last 21 years.

EU country over time, the ownership market model, and the Rx mail-order. This paper explains the variation in pharmacy density, using the pharmacy density per 100,000 inhabitants²⁷ in each EU country as the dependent variable. Further, the main two binary independent variables are the pharmacy market model (0 = regulated/1 = liberal), and the Rx mail-order (no = 0/yes = 1). Control variables are introduced for socio-economic factors, including the GDP per capita on PPP (adjusted for purchasing power parity), geographical characteristics (if geographic and demographic rules exist; change from 0, no, to 1, yes), population demographics (specifically the proportion of the population aged 65 and over), and the number of pharmacists and medical doctors per 100,000 inhabitants.²⁸

²⁷ In pharmacy research, it is a standard to analyze the accessibility and coverage of pharmacies through the density per 100,000 inhabitants.

²⁸ Assuming the population is getting older, the need for pharmacies, predominantly medication, is increasing. Further, managed competition will rule the market if demographic and geographic rules exist. An increasing number of medical doctors and pharmacists could positively affect pharmacy density as well.

6 Method

This study employs two statistical modeling approaches to examine the determinants of pharmacy density across EU countries: cross-sectional analyses and fixed-effects panel analyses. These methods were chosen to capture both the differences between countries and the changes within countries over time. Together, they provide comprehensive insights into the factors influencing pharmacy density.

Four models were developed for the cross-sectional analyses. Model 1 includes a broad range of regulatory and demographic variables, such as third-party ownership allowance, Rx mail-order allowance, and geographic and demographic restrictions. It serves as a baseline analysis to explore general associations between these variables and pharmacy density. Model 2 incorporates GDP per capita and the number of pharmacists per 100,000 inhabitants in addition to the variables in Model 1. Countries with missing data for specific variables were excluded to increase the accuracy of the analysis. This model aims to assess the importance of economic and labor market factors in influencing pharmacy density. Model 3 focuses on variables that were at least weakly significant in Model 2. By reducing the number of variables, the analysis becomes more efficient, examining whether the previously observed relationships are robust. Model 3' was developed to verify the robustness of the results by excluding Greece due to its specific characteristics. This model helps identify potential outliers and ensure the stability of the findings. The cross-sectional analyses provide an overview of country-specific differences and allow for the identification of general trends and relationships between the variables and pharmacy density.

In addition to the cross-sectional analyses, fixed-effects panel analyses were conducted to examine changes within countries over time. This method accounts for unobserved country-specific characteristics that remain constant over time, isolating the effect of the variables of interest. Two fixed-effects models were created. Fixed-Effects Model 1 includes variables such as GDP per capita, third-party ownership allowance, Rx mail-order allowance, geographic and demographic restrictions, the percentage of the population over 65, the number of pharmacists per 100,000 inhabitants, and the number of doctors per 100,000 inhabitants. It investigates the impact of these variables on pharmacy density within countries over time. The fixed-effects Model 2 excludes non-significant variables (third-party ownership allowed and doctors per 100,000 inhabitants) to increase the efficiency of the analysis. This model checks the robustness of the significant variables from Model 1 and focuses on the main influencing factors.

The fixed-effects panel analyses capture the dynamics within countries and provide a more precise determination of the causal effects of the variables of interest. By combining these two approaches, a comprehensive picture of the factors influencing pharmacy density is drawn. These methods help to understand both the static and dynamic aspects of pharmacy distribution and offer valuable insights for policymakers aiming to optimize pharmacy services and address healthcare accessibility challenges in different national contexts.

7 Results

So far, a rough overview of the two pharmacy markets and their regulations has been provided. This part illustrates the output²⁹ of the analytical approaches explained above to answer the research question of which market regulations explain the variance in the density of community pharmacies.

Table 1: Cross-Section Analysis

Pharmacy Density	Model 1	Model 2	Model 3	Model 3'
Third-party ownership	-2,847 (0.734)	-6,568 (0.259)		
Rx mail-order	-17.530* (0.065)	-11.066* (0.076)	-15.253** (0.044)	-12.577** (0.023)
Geographic and/or demographic restrictions	-6.478 (0.482)	-10.357* (0.085)	-12.956* (0.092)	-10.939* (0.050)*
GDP per capita in PPP (constant 2017 \$)		-0.417*** (0.003)	-3.949** (0.016)	-0.346** (0.004)
Percentage of population over 65		-1.672 (0.169)		
Number of pharmacists per 100,000 inhabitants		2.985*** (0.006)	0.348*** (0.007)	0.276** (0.004)
Number of doctors per 100,000 inhabitants		3.696 (0.436)		
R-Squared	0.1413	0.6101	0.4717	0.5470
N	27	25	27	26

Notes: Years covered: 2000-2021 (all models), * p < 0.1; ** p < 0.05; *** p < 0.01

The results in Table 1 reveal several significant associations. Model 1 captures the regulatory environment by including the two independent variables, third-party ownership and Rx mail-order, and geographic and demographic restrictions as the main control variable for all 27 EU countries. However, no variables show statistical significance in this model.

Model 2 refines the analysis by including all control variables for 25 EU countries, omitting Greece and Portugal due to missing data on the number of doctors per

²⁹ Since changes in regulation are potentially driven by trends, the results should not be interpreted as causality.

100,000 inhabitants. This model shows a significant negative association with GDP per capita and a significant positive association with the number of pharmacists per 100,000 inhabitants. The high R-squared value of 0.6140 indicates a strong explanatory power of the model.

Model 3 focuses on the four variables that were at least weakly significant in Model 2. In this model, Rx mail-order allowed (negative), GDP per capita (negative), and the number of pharmacists per 100,000 inhabitants (positive) are significant, suggesting that their significance in Model 2 is not merely an artifact. The R-squared value of 0.4717 is an improvement over Model 1 but not as high as Model 2.

Model 3', which excludes Greece, shows improved significance of variables, suggesting that the inclusion of certain outliers or country-specific effects can impact the model's performance.³⁰ The R-squared value of 0.5470 indicates a better fit than Model 3 and is close to Model 2.

Overall, the analysis highlights the importance of economic capacity (GDP per capita) and workforce availability (number of pharmacists per 100,000 inhabitants) as significant predictors of pharmacy density. The allowance of Rx mail-order shows a potential negative impact on pharmacy density, though the evidence is mixed. Excluding Greece enhances the robustness and significance of the findings, underscoring the need to consider country-specific effects in cross-national analyses.

Table 2: Analysis over time (within-effects)

Pharmacy Density	Model 1	Model 2
Third-party ownership	-0.330 (0.541)	
Rx mail-order	-2,529* (0.099)	-2.380 (0.107)
Geographic and/or demographic restrictions	-1.427 (0.276)	-1.340 (0.292)
GDP per capita in PPP (constant 2017 \$)	0.299*** (0.000)	0.320*** (0.000)

³⁰ The number of pharmacists per 100,000 inhabitants is relatively high in Greece compared to other EU countries with a low GDP per capita. Additionally, Greece lacks Rx mail-order and geographic or demographic regulations.

Percentage of population over 65	-0.533*** (0.002)	-0.391*** (0.001)
Number of pharmacists per 100.000 inhabitants	0.098*** (0.000)	0.106*** (0.000)
Number of doctors per 100.000 inhabitants	0.011 (0.233)	
N	25	27

Notes: Years covered: 2000-2021 (all models), * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Table 2 investigates the factors influencing pharmacy density across countries, focusing on economic, regulatory, and demographic variables. Using fixed-effects regression models, I assess the impact of these variables within countries over time while accounting for country-specific characteristics. Two fixed-effects regression models were employed: Model 1, a comprehensive model including all relevant variables, and Model 2, an adjusted model excluding third-party ownership allowed and the number of doctors per 100,000 inhabitants due to their lack of significance in cross-national analysis and data limitations for certain countries.

In Model 1, the coefficient for third-party ownership allowed is not significant ($p = 0.541$), suggesting that allowing third-party ownership does not significantly impact pharmacy density; hence, this variable was excluded in Model 2 for efficiency. The negative coefficient for Rx mail-order allowed is marginally significant ($p = 0.099$), suggesting that allowing Rx mail-order might decrease pharmacy density, although the evidence is not strong. Geodemographic restrictions have a non-significant coefficient ($p = 0.276$), indicating that these restrictions do not significantly influence pharmacy density. The positive and highly significant coefficient of GDP per capita ($p < 0.000$) indicates that higher GDP per capita is associated with increased pharmacy density. This finding is robust and consistent across models, underscoring the role of economic prosperity in supporting pharmacy infrastructure. The negative and significant coefficient for the percentage of the population over 65 ($p = 0.002$) suggests that a higher proportion of elderly in the population is associated with lower pharmacy density, possibly reflecting higher healthcare needs that are not met by increasing the number of pharmacies alone. The positive and highly significant coefficient for pharmacists per 100,000 inhabitants ($p < 0.000$) shows that more pharmacists per capita correlate with higher pharmacy density, highlighting the importance of workforce availability in the pharmacy sector, as before. The coefficient for doctors per 100,000 inhabitants is not significant ($p = 0.233$), and this variable

was excluded in Model 2 due to non-significance and missing data for certain countries.

Model 2, which excludes the non-significant variables third-party ownership allowed and the number of doctors per 100,000 inhabitants to improve efficiency, shows that GDP per capita remains positive and highly significant ($p < 0.000$), confirming its robust influence on pharmacy density. The negative coefficient for Rx mail-order allowed is less significant ($p = 0.107$), suggesting a weaker but still notable potential impact on reducing pharmacy density. Geodemographic restrictions remain not significant ($p = 0.292$), consistent with Model 1. The percentage of the population over 65 is negative and significant ($p = 0.001$), consistent with the findings from Model 1. The number of pharmacists per 100,000 inhabitants remains positive and highly significant ($p < 0.000$), reinforcing the importance of pharmacists' availability in increasing pharmacy density.

The analysis highlights several key determinants of pharmacy density across countries. GDP per capita and the number of pharmacists per capita are consistently significant positive predictors, emphasizing the roles of economic capacity and workforce availability. The percentage of the elderly population is a significant negative predictor, indicating potential gaps in meeting healthcare needs despite higher pharmacy densities. The allowance of mail-order pharmacies shows a potential negative impact, though not strongly significant.

The exclusion of non-significant variables (third-party ownership allowed and the number of doctors per 100,000 inhabitants) in Model 2 enhances model efficiency without compromising the robustness of significant predictors. This approach aligns with the need for efficient models in cross-national analyses, especially when dealing with incomplete data.

8 Discussion

Managed competition stands out as one of the leading paradigms guiding political reforms in pharmacy market regulations. This study employs data on pharmacy density and several independent variables, including ownership market regulations, Rx mail-order policies, GDP per capita on PPP, geographic and demographic factors, the proportion of the population over 65, the number of pharmacists, and the number of doctors per 100,000 inhabitants. This study aims to explore the factors influencing pharmacy density across 27 EU countries from 2000 to 2021. Using two distinct analytical approaches: cross-sectional and fixed-effects within analyses, I provide valuable insights, yet they emphasize different aspects of the data, enhancing the understanding of the factors influencing pharmacy density.

The cross-sectional analysis includes four models, each refining the set of variables to identify those that significantly impact pharmacy density. Model 1 captures the regulatory environment and includes variables such as third-party ownership, Rx mail-order, and geographic and demographic restrictions. However, none of these variables show statistical significance. This model suggests that, when considered in isolation, these regulatory factors do not have a substantial impact on pharmacy density across the 27 EU countries included in the study. Model 2 expands the analysis by incorporating additional control variables (excluding GDP per capita) for 25 EU countries, excluding Greece and Portugal due to missing data on the number of doctors per 100,000 inhabitants. This model identifies a significant negative association with GDP per capita and a positive association with the number of pharmacists per 100,000 inhabitants. The high R-squared value of 0.6140 indicates a strong explanatory power, highlighting the importance of economic capacity and workforce availability in determining pharmacy density. Model 3 narrows down to the variables that were at least weakly significant in Model 2. This model shows that GDP per capita (negative), Rx mail-order allowed (negative), and the number of pharmacists per 100,000 inhabitants (positive) are significant predictors. The R-squared value of 0.4717 is lower than Model 2 but still indicates substantial explanatory power. This model suggests that the significance of these variables in Model 2 is not an artifact, emphasizing their consistent impact on pharmacy density. Model 3' excludes Greece to assess the influence of potential outliers. This model improves the significance of variables, suggesting that country-specific effects can significantly impact the model's performance. The R-squared value of 0.5470 is higher than Model 3, close to Model 2, indicating a better fit and reinforcing the importance of considering country-specific contexts in cross-national analyses.

The fixed-effects within analysis provide a different perspective by focusing on the changes within countries over time, accounting for unobserved country-specific characteristics. Model 1 (Fixed-Effects) includes GDP per capita, third-party ownership allowed, Rx mail-order allowed, geographic and demographic restrictions, the percentage of the population over 65, the number of pharmacists per 100,000 inhabitants, and the number of doctors per 100,000 inhabitants. This model reveals that GDP per capita and the number of pharmacists per 100,000 inhabitants are significant positive predictors of pharmacy density, while the percentage of the population over 65 is a significant negative predictor. The fixed-effects model highlights the importance of economic and workforce factors while controlling for time-invariant characteristics within countries. Model 2 (Fixed-Effects) refines the analysis by excluding the non-significant variables (third-party ownership allowed and doctors per 100,000 inhabitants). This model confirms the robust influence of GDP per capita and the number of pharmacists per 100,000 inhabitants, with both variables remaining significant. The percentage of the population over 65 continues to show a significant negative association. This refined model, with a higher within R-squared value of 0.3833, demonstrates improved explanatory power and efficiency.

Comparing the results of the cross-sectional and fixed-effects within analyses provides a comprehensive understanding of the factors influencing pharmacy density. Both analytical approaches consistently show that GDP per capita is a significant predictor of pharmacy density, underscoring the importance of economic prosperity in supporting pharmacy infrastructure, as wealthier countries are better equipped to maintain a higher density of pharmacies. The number of pharmacists per capita is another consistent positive predictor across both methods, highlighting the critical role of workforce availability in ensuring adequate pharmacy services.

The percentage of the elderly population is a significant negative predictor in the fixed-effects analysis, indicating that higher healthcare needs among the elderly are not met by merely increasing the number of pharmacies. The allowance of Rx mail-order shows a potential negative impact on pharmacy density in the cross-sectional models, though the evidence is mixed. This suggests that policies facilitating mail-order prescriptions might reduce the need for physical pharmacies.

The exclusion of Greece in the cross-sectional analysis (Model 3') and the control for country-specific characteristics in the fixed-effects analysis both highlight the importance of accounting for unique national contexts in cross-national studies. These adjustments improve the robustness and significance of the findings.

Summarizing the results shows that market regulations do not play a role in pharmacy density. This analysis rejects H1. Furthermore, this analysis does not accept H2. Rx mail-order does not have a statistically significant influence on pharmacy density. An important result of this analysis is that economic capacity and workforce availability are crucial factors, while demographic and regulatory variables also play significant roles. Combining the liberalization process with the core ideas of managed competition, it becomes clear that without establishing new rules in a liberalized market, goals of more competition, broader service, and higher density are harder to achieve. In conclusion, the combined insights from both analytical approaches emphasize the multifaceted determinants of pharmacy density. Policymakers should consider these determinants to optimize pharmacy services and address healthcare accessibility challenges in different national contexts. Further research should shed more light on new rules after liberalization and how new rules can affect density behavior – for each country individually; especially, how more pharmacists can lead to higher pharmacy density.

9 Limitations

The data is limited due to gaps in research data.³¹ A difference-in-difference design was not possible due to the short observation time before a policy changed and due to gaps in research data. Furthermore, this study is limited to the EU pharmacy market. Additional research might include Switzerland, the United Kingdom, Iceland, Liechtenstein, and Norway. Additionally, only Rx mail-order is analyzed in this study – not OTC mail-order. Further, external delivery services are not included.³² As mentioned above, this paper does not measure the quality of pharmacies or the services they provide. Due to the uniform mandate of all pharmacies to supply the population with medication throughout the country and the fact that there is no competition due to fixed prices, a study of the pharmacies' health-care quality cannot be carried out within this analysis and should be considered for further research. The range of services offered cannot measure the quality of a pharmacy, as this is determined by various economic factors (location, specialist pharmacy, staff, size, family business, etc.), which are not quantified. This study is limited to the service of community pharmacies to deliver Rx. This study does not consider changes in regulations within the drug market. Likewise, it does not investigate the possible effects of the COVID-19 pandemic (for example an extended online market, influence of vaccination at the pharmacy, distribution of masks and gloves, etc.).

³¹ After contacting several ministries of health and different lobby groups of community pharmacies in every single EU country, this dataset includes all available data on pharmacy density per 100,000 inhabitants.

³² Rules regarding the delivery service of (OTC/Rx) drugs differ significantly throughout the EU.

10 Conclusion

In sum, market regulations like ownership and a ban on Rx mail-order do not significantly support the increase in pharmacy density in this specific study. Policymakers and health-care providers should consider implementing strategies to enhance the availability of pharmacists to meet the growing demand for pharmacy services. This would help to better manage the allocation of pharmacists across pharmacies, thereby enhancing pharmacy density and improving healthcare accessibility.

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Appendix 1: Visualization of pharmacy market regulations**Table 3:** Overview of the definition of general regulations within liberal and regulated EU pharmacy markets with examples

Regulation	Liberal	Regulated	Exceptions on regulated market	For example
Regulated ownership: only pharmacists	no	yes	no	France, Germany
Rx Mail-Order	yes	no	yes	Germany: RX Mail order but regulated system, Austria: no RX mail-order but liberal system
OTC Mail-Order	yes	yes	yes	Exception in Switzerland: OTC mail-order only with prescription
Prohibition of third party ownership	no	yes	no	Czech Republic: no regulation on how many pharmacies one pharmacist can have
OTC Sale outside Pharmacy	yes	yes	no	Only for some special licensed products
Regulated distance between pharmacies	yes	yes	yes	Germany: no regulation on distance but regulated system, Portugal: regulation on distance, Austria: so-called Gebietsschutz
Regulation on interior	yes	yes	no	Germany: regulation on interior of a so-called Labor and minimum size of pharmacy, Sweden: free parking spots in front of the pharmacy
Pick-up station	yes	no	yes	Sweden, Finland and Denmark

Source: based on Gross & Volmer, 2016; Vogler, 2014; Vogler et al., 2006; Vogler et al., 2012; World Health Organization, 2019.

Table 4: General overview of regulations within the EU pharmacy market, including all 27 EU countries³³

Country	Pharmacy System	Digitalization: e-prescription	Vaccination against influenza	Rx-Mail-Order	Prohibition of third-party ownership	OTC Sale outside Pharmacy	Geographic and demographic rules
Austria	liberal	yes	no	no	no	yes	yes
Belgium	liberal	yes	no	no	no	no	yes
Bulgaria	liberal	yes	no	no	no	yes	no
Croatia	liberal	yes	yes	no	no	no	yes
Cyprus	regulated	yes	yes	no	yes	no	no
Czech Republic	liberal	yes	no	no	no	yes	no
Denmark	regulated	yes	yes	yes	yes	yes	no, only for branches
Estonia	regulated	yes	no	yes	yes	yes	yes
Finland	regulated	yes	no	yes	yes	yes	no
France	regulated	no	yes	no	yes	yes	yes
Germany	regulated	yes	Pilot Project	yes	yes	yes	no
Greece	regulated	yes	yes	no	yes	yes	yes
Hungary	regulated	yes	no	no	yes	yes	yes
Ireland	liberal	yes	yes	no	no	yes	no
Italy	liberal	yes	no	no	no	yes	yes
Latvia	regulated	yes	no	no	yes	yes	yes
Lithuania	regulated	yes	no	no	yes	yes	yes

³³ No data = research gaps because of missing data.

Luxem- bourg	regulated	yes	no	no	yes	no	yes
Malta	regulated	yes	no	yes	yes	yes	yes
Nether- lands	liberal	yes	no	yes	no	yes	no
Poland	regulated	yes	no	no	yes	yes	yes
Portugal	liberal	yes	yes	no	no	yes	yes
Romania	regulated	yes	no	no	yes	yes	yes
Slovakia	liberal	yes	no data	no	no	no	yes
Slovenia	liberal	yes	no	no	no	yes	yes
Spain	regulated	yes	no	no	yes	yes	yes
Sweden	liberal	yes	no	yes	no	yes	yes

Source: based on ABDA, 2020a, 2020b, 2021; PGEU, 2020; World Health Organization, 2019.

Table 5: Overview of regulations and their changes in seven selected countries

EU Country (Case Study)	Pharmacy System	Regulation change	Rx mail-order	Regulation change	3rd party ownership	Regulation change	Regulation on distance	Reason why country selected
Austria	liberal	yes, 2004	no	no	yes	in 2008 (so-called Personenengesellschaften can invest)	yes, so-called Gebietschutz, minimum distance of 500m	Regulated pharmacy system including regulation on distance and no RX mail-order. The density is consistently rising
Denmark	regulated	no	yes	no data	no	no	yes, for branches	Regulated pharmacy system including new rule on expanding branches
Finland	regulated	no	yes	no data	no	no	no, without minimum distance	Regulated pharmacy system but without regulation on distance: Country with highest e-prescription usage in EU
Germany	regulated	no	yes	in 2004	no	no	no, so-called Niederlassungsfreiheit	Regulated pharmacy system including freedom of establishment and RX mail-order
Poland	regulated	yes, in 2002 and 2017	no	no data	yes, from 2002 2017	yes, in 2002 and in 2017	yes, 3,000 inhabitants to serve and 500m or 1 km distance	Regulated pharmacy system with two changes in the system since 2002
Portugal	liberal	yes, in 2007	no	no	yes	in 2007 (no wholesalers are allowed to run and own a pharmacy)	yes, 35,000 inhabitants to serve, minimum distance of 250m	Liberal pharmacy's system with change in the system since 2007 but without RX mail-order
Sweden	liberal	yes, in 2009	yes	in 2001	yes	in 2009 (including wholesalers)	no	Liberal pharmacy's system with absolutely no regulations on RX mail-order, 3rd party ownership and distance

Source: data based on ABDA, 2020a, 2021; Balgård, 2012; BWB, 2018; Karttunen, 2020; Mossialos & Srivastava, 2008; Ribeiro et al., 2020; Vogler, 2014; Vogler et al., 2006; Vogler et al., 2012; Wiśniewski et al., 2020; World Health Organization, 2019.

Table 6: Total number of community pharmacies in the EU from 2000-2021³⁴

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Austria	14	14	14	14	14	14	15	15	15	15	15
Belgium							49		48		47
Bulgaria											57
Croatia											25
Cyprus						42	40	40	40	40	40
Czech Republic	19	20	21	21	22	23	23	23	22	23	23
Denmark	6				6		6		6		6
Estonia	30	30	32	35	35	35	40	39	38	37	36
Finland	15	15	15	15	15	15	15	15	15	15	15
France		38				37	37	36	36	36	35
Germany	26	26	26	26	26	26	26	26	26	26	26
Greece											99
Hungary									24		25
Ireland	31	31	31	31	32	32			37		38
Italy	29					30					30
Latvia											42
Lithuania											48
Luxembourg							18				18
Malta											51
Netherlands	10	10	10	10	11	11	11	12	12	12	12
Poland				25	26	26	27	28	28	28	30
Portugal	24				26		26		26		27
Romania											34
Slovakia	19				25		29		36		36
Slovenia	12	12	13	13	13	14	14	14	14	15	15
Spain	48	48	48	48	47	47		46	46	46	46
Sweden	9	9	9	9	9	9	10	9	10	10	12

Country	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Austria	15	15	15	15	16	16	16	16	16	16	16
Belgium		45	45	44	45	44	44	44	43	42	42
Bulgaria			56	51	50	51	51	51	46	46	46
Croatia			24	26	26	26	26	26	28	28	28
Cyprus	55	55	54	57	60	60	62	62	61	61	63
Czech Republic	23	24	25	25	25	24	24	24	24	24	24
Denmark		6	6	6	6	6	7	8	8	8	9
Estonia	36	35	36	36	35	38	38	37	38	37	38
Finland	15	15	15	15	15	15	15	15	15	15	15
France	35	35	35	34	35	33	33	32	32	31	32
Germany	26	26	26	25	25	25	24	24	23	23	23
Greece		99	99	87	99	87	87	87	88	88	88
Hungary			25	24	24	24	23	23	23	23	23
Ireland		38	40		40	39	39	39	39	38	38
Italy			30		30	30	30	31	31	32	32
Latvia	42	43	37	43	37	37	44	44	44	43	43
Lithuania	47	47	45	47	45	45	47	47	47	47	47
Luxembourg			15		18	17	16	16	16	15	15
Malta			51		51	51	51	51	49	49	49
Netherlands	12	12	12	12	12	12	12	12	12	12	12
Poland	31	32	30	33	30	30	38	38	36	36	36
Portugal		28	28	28	28	28	28	28	28	28	28
Romania			32	43	40	40	43	43	44	44	44
Slovakia			36	28	36	36	28	28	37	37	37
Slovenia	15	15	15	16	16	16	16	16	16	16	16
Spain	46	46	46	47	46	47	47	47	47	47	47
Sweden	13	13	13	14	14	14	14	14	14	14	14

³⁴ Including research gaps due to missing data. Illustration based on my research results; numbers are rounded up.

Country	Source of the numbers
Austria	Vogler et al. (2012); ABDA (2021b); Österreichische Apothekenkammer (2021)
Belgium	Belgian Pharmaceutical Association (2021); ABDA (2021b)
Bulgaria	ABDA (2021b); Ministry of Health Republic of Bulgaria (2021)
Croatia	ABDA (2021b); Ministry of Health of the Republic of Croatia (2021)
Cyprus	ABDA (2021b); Ministry of Health of Cyprus (2021)
Czech Republic	ABDA (2021b)
Denmark	ABDA (2021b); Vogler et al. (2012); Denmark Chamber of Commerce (2021)
Estonia	ABDA (2021b)
Finland	ABDA (2021b); Vogler et al. (2012)
France	ABDA (2021b); Ordre National de Pharmaciens (2021)
Germany	ABDA (2021b)
Greece	ABDA (2021b); Ministry of Health Greece (2021)
Hungary	ABDA (2021b); Ministry of National Resources of Hungary (2021)
Ireland	ABDA (2021b), Vogler et al. (2012); Pharmaceutical Society of Ireland (2021)
Italy	ABDA (2021b); Federfarma.it (2023); Federfarma.it (2025)
Latvia	ABDA (2021b); State Agency of Medicines Republic of Latvia (2025)
Lithuania	ABDA (2021b), State Agency of Medicines Republic of Latvia (2025)
Luxembourg	ABDA (2021b); pharmacie.lu (2025)
Malta	ABDA (2021b); The Ministry for Health and Active Ageing in Malta (2021)
Netherlands	ABDA (2021b); Statista (2025); Stichting Farmaceutische Kengetallen (2021)
Poland	ABDA (2021b); Statistics Poland (2023)
Portugal	ABDA (2021b); Infarmed (2021)
Romania	ABDA (2021b); Press centre of the Ministry of Health in Romania (2021)
Slovakia	ABDA (2021b); Public Health Authority of the Slovak Republic (2021)
Slovenia	ABDA (2021b); Ministry of Health of Slovenia (2021)
Spain	ABDA (2021b); Spanish Ministry of Health (2021)
Sweden	Apoteksföreningen (2021); Apoteksföreningen (2025); Pharmaceutical Pricing and Reimbursement Information (2007); Apoteket (2025); Vogler et al. (2012)

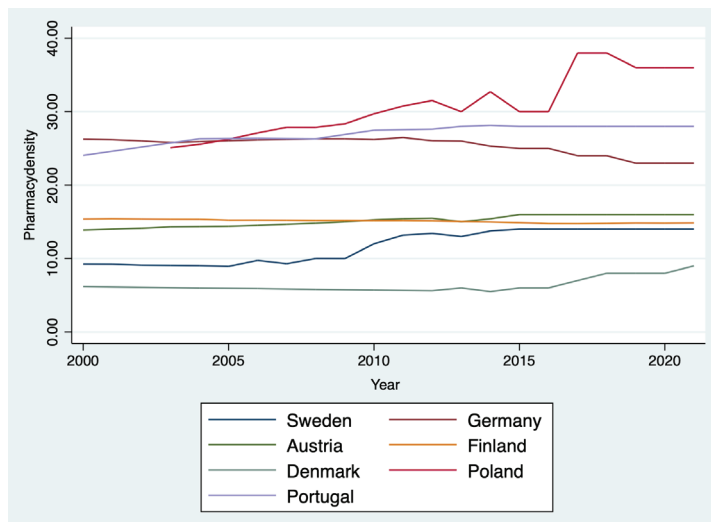
Appendix 2: Sources of Data**Table 7: Sources of Data collection**

Data on	Observation period	Source
Pharmacy density per 100,000 inhabitants	2000-2021	ABDA (2020); ABDA (2021); Vogler et al. (2006); Vogler et al. (2012); Vogler et al. (2014); PGEU (2020); Apotheket AB (2023)
System (regulated/liberal)	2000-2021	ABDA (2020); ABDA (2021); Vogler et al. (2006); Vogler et al. (2012); Vogler et al. (2014); World Health Organization (2019); International Pharmaceutical Federation - FIP (2019)
RX mail-order regulation	2000-2021	ABDA (2020), ABDA (2021); World Health Organization (2019); International Pharmaceutical Federation - FIP (2019)
Ownership structure	2000-2021	ABDA (2020); ABDA (2021); Vogler et al. (2006); Vogler et al. (2012), Vogler et al. (2014); World Health Organization (2019); International Pharmaceutical Federation - FIP (2019)
Number of pharmacies in total	2000-2021	ABDA (2020); ABDA (2021); Apotheket AB (2023); Statistics Poland (2023); World Health Organization (2019); International Pharmaceutical Federation - FIP (2019)
GDP per capita in PPP (constant 2017 international \$)	2000-2021	World Development Indicators (2022)
Number of pharmacists per 100,000 inhabitants	2000-2021	WHO European Data Warehouse (2022)
Proportion of population aged 65 and over	2000-2021	Eurostat (2022); WHO European Data Warehouse (2022); International Pharmaceutical Federation - FIP (2019)
Geographic and demographic rules	2000-2021	Vogler et al. (2006); Vogler et al. (2012); Vogler et al. (2014); WHO (2019); World Health Organization (2019); International Pharmaceutical Federation - FIP (2019)
Number of medical doctors per 100,000 inhabitants	2000-2021	Eurostat (2022)

Appendix 3: Contributory facts and detailed description of the pharmacy market of case study countries

The seven EU countries below have been chosen in order to understand the differences in pharmacy markets and their regulations depending on their density. This part aims to demonstrate the idea behind the hypotheses developed above. As already discussed, the density of the chosen countries increased over time; some even stagnated or did not consistently increase (see Figure 1). Is this due to a market change regarding the ownership structure or Rx mail-order? The case study below clarifies possible differences in density behavior concerning different market regulations.

Figure 1: Evolution of pharmacy density³⁵



Sweden

From 1971 on, Swedish pharmacies “were expropriated by law and amalgamated into one national pharmacy corporation owned by the state” (Balgård, 2012, p. 23). “Apoteket AB” had a monopoly on drugs until 2009. The market opened for more competition, and the state monopoly was ended (Westerlund & Marklund, 2020). The intention was to get better availability of the pharmacies and lower prices for OTC products (Balgård, 2012). The idea was driven by the right-wing

³⁵ This figure only illustrates the seven selected case countries. Due to missing data, the observation period for Poland starts in 2003.

party, which replaced the social democratic party after the election in 2006. The liberalization of the pharmacy market included three main changes: recreating hospital pharmacies, open market structures, and the sale of OTC outside the pharmacy. The idea behind the liberalization policy was to get better accessibility, better use of drugs, more diversity, and better prices and efficiency (Vogler et al., 2014; Wisell, 2019). No rules were set on ownership. Instead, one pharmacist must be present at all times during office hours. This person has to own a Bachelor's degree (three years, prescriptionist) or a Master's degree (five years) in Pharmacy (Westerlund & Marklund, 2020).

Before the liberalization, "Apoteket AB" owned over 880 community pharmacies. After the deregulation, almost all existing pharmacies were sold to new chains, and over 200 new pharmacies opened (Balgård, 2012). In 2020, Sweden had around 1,433 community pharmacies, with 14 pharmacies per 100,000 inhabitants (Westerlund & Marklund, 2020).

As already discussed, the liberalization of the pharmacy market involved many expectations of improvements such as better accessibility, lower prices, and better service (Vogler et al., 2012). Indeed, better prices of OTC were available, but not at the pharmacy. The pharmacies could not keep up with the prices at gas stations or drugstores because of higher purchase costs from the wholesaler. Furthermore, pharmacies could request the stock in other branches through a networked storage system. Now that each chain has its own system, this access is no longer possible (Balgård, 2012). The liberalization also removed the dependency on "Apoteket AB's" regulations. Pharmacies became freer to operate without the restriction of the large state-owned group. Now, 97 percent of the community pharmacies belong to chains, 45 independent pharmacies, and "three unmitigated e-commerce pharmacy companies, that are taking medicine orders online only" (Westerlund & Marklund, 2020, p. 3). Further, OTC sale is possible outside the pharmacy. The pick-up of dispensed prescriptions at pharmacy representatives, so-called "Apoteksombuds", are further opportunities to get medicine, especially in rural areas (Vogler et al., 2012; Westerlund & Marklund, 2020).

The medical services provided in Swedish community pharmacies are extensive: medication reviews, blood measure treatments, skincare analysis, allergy tests, smoking cessation programs, vaccination services with the help of nurses, and much more. Westerlund and Marklund (2020) explain that chains focus more on selling medicines, whereas private pharmacies concentrate more on extended services like medication plans. In their view, the reason is that chains have to compete more in the sale of medicines than private pharmacies. Thus private

pharmacies can better maintain their position in the market by offering more services (Westerlund & Marklund, 2020).

Sweden was one of the first EU countries that implemented digital prescribing. Almost all prescriptions are digital, and patients can access their data with their personal identification (ID) card (Kierkegaard, 2013; Vogler et al., 2012). Online sales of OTC started in 2002, and Rx mail-order in 2006.³⁶ Since 2009, the online sale of medicines by internet pharmacies other than “Apoteket AB” has been allowed as well (Vogler et al., 2012). OTC prices, compared to prescription only medicines (POM), are not regulated; therefore, pharmacies sell more OTC products. Further, community pharmacies cannot produce medicine, for example, in Germany or Austria. They do not have a laboratory³⁷ to do so (Vogler et al., 2012).

Following Westerlund and Marklund (2020), the reimbursement³⁸ system is mixed. It “is based on a Pharmacy Margin, with a combination of fixed fee and percentage” (Westerlund & Marklund, 2020, p. 4). Discounts on generic drugs are allowed but not on “primary care services” (Westerlund & Marklund, 2020, p. 4). However, generic substitutions are reimbursed “with an increased margin added to all generic drugs” (Westerlund & Marklund, 2020, p. 4).

The liberalization process increased the number of community pharmacies across Sweden. Of course, the density is much higher in urban areas. Therefore so-called “Apoteksombuds” exist to cover rural areas. Further, with a high digitalization standard and extended services within the pharmacy, the density remains stable – even with Rx mail-order. However, the main goal of better accessibility throughout the country could not be achieved (Garattini et al., 2012; Vogler et al., 2014; Wisell, 2019).

³⁶ Only within the country, not from abroad.

³⁷ A laboratory at the pharmacy is used by pharmaceutical staff, for example, to test existing anesthetics for any impurities and to prepare ointments or capsules specially prescribed by a doctor. Furthermore, pharmaceutical staff can mix unique prescribed tea flavors and produce disinfectants.

³⁸ By definition: “Pharmacy reimbursement means the amount paid to a pharmacy by a pharmacy benefit manager for a dispensed prescription drug or prescription device” (Law Insider Inc., 2022).

Denmark

The Danish pharmacy market is a regulated one. Only licensed pharmacists, accepted by the Danish Medicines Agency (DKMA), can run and own a pharmacy. The DKMA further limits the number of pharmacies and gives an evaluation of applicants to the Ministry of Health. They then decide who will get the license for a pharmacy (Vogler et al., 2012).

Pharmacies, branch pharmacies, and supplementary units are the institutions with the right to sell Rx and some specific OTC products (Vogler et al., 2012). In addition to the 227 pharmacies (1 January 2021), “80 branch pharmacies, 209 voluntarily established branches, 24 pharmacy outlets, about 350 OTC outlets and about 400 medicine delivery facilities – all of which are connected to one of the pharmacies” (Danish Medicines Agency, 2021) exists. OTC outlets are stores approved to sell OTC products outside the pharmacy, for example, supermarkets. They are further allowed to “deliver prescription-only medicinal products that have been dispatched by a pharmacy to the outlet” (Danish Medicines Agency, 2021). In addition, buying POM online is partly prohibited. The only exception is the platform called “Apoteket.dk”. Since 2004, it has been the only online pharmacy with the right to sell POM online. It is an online platform for all pharmacies in Denmark initiated by the Danish pharmacy representative (Kierkegaard, 2013).

The density of Danish pharmacies varies over time. Noteworthy is that in 2015, the density increased because Denmark allowed every owner of community pharmacies to open up to seven branches within a radius of 75 kilometers (Danish Medicines Agency, 2021). The change in the Danish Pharmacy Act should increase the accessibility of community pharmacies for the patient – with success.

To make the ownership of pharmacies in rural areas more attractive, there are so-called equalization schemes: “Pharmacies with large turnover are obliged to pay a sales tax, which is used to subsidise small scale pharmacies in rural areas” (Vogler et al., 2012, p. 101).³⁹ The Danish pharmacies have to pay special fees to the DKMA (Danish Medicines Agency, 2021).

There is no obligation for a 24-hour service – but there is a system specially organized by authorities. Some pharmacies must stay open throughout the night; others have on-call duty services. There are three different categories:

³⁹ Likewise in Germany with the “Nacht-und Notdienstfond” (NNF).

- Category one: on-call duty plus opening hours up to 22 hours from Monday to Friday and Saturday up to 2 pm and between 6 pm and 10 pm.
- Category two: on-call duty hours plus one hour more than usual during the week. On Saturdays, there are two hours on top and three on Sundays or legal holidays.
- Category three: only on-call duty hours (Vogler et al., 2012).

The overall margin of OTC products is limited, so there is no motivation to sell more OTC. Further, only two pharmacies in Denmark can produce certain prescribed drugs within their laboratory (Vogler et al., 2012). The services provided in Danish pharmacies are of a broad variety. Medication plans, smoking cessation programs, cholesterol and blood sugar measurements, etc. For assisting at the pharmacy, they get compensated (Danish Medicines Agency, 2021).

The status of digitalization in Denmark is very high. E-prescribing exists since the end of the 1990s. The patient can check everything about the prescriptions and medicine online under “Apoteket.dk”. Further, the patient can redeem the medication online, too (Kierkegaard, 2013). In addition, the prescribed doctor gets informed if and when the patient hands in the prescription, and the patient receives a text message on when to take the medication. The e-prescription started with 4,000 prescriptions in 1994 and reached up to 89 percent of all prescriptions twenty years later (Kierkegaard, 2013).

The number of Danish community pharmacies increased over the last years, although the market is regulated. The possibilities to redeem a prescription are more manageable due to the high level of digitalization. The local pharmacies are supported by “Apoteket.dk” and are not in competition for Rx mail-order. In addition, the liberalization of the branches increased the density significantly.

Finland

Finish pharmacies are run by pharmacy staff only (a Master’s degree in pharmacy is needed) (Mossialos & Srivastava, 2008). Each branch (limited to three pharmacies) requires a new license from the Finish Medicine Agency (FIMEA). This license is only valid until the pharmacist themselves is 68 years old. Further, no horizontal integration is possible – the pharmacy market in Finland is regulated. Chains are not allowed (Vogler et al., 2012). However, the pharmacies that belong to the Universities are allowed to have branches (Karttunen, 2020).

The FIMEA regulates the pharmacy market. In addition to private community pharmacies and the branch pharmacies of the University (which are also limited to 16), there are pharmacy service points: owned by local pharmacists, authorized by the FIMEA, and only serving OTC products. They are established “in sparsely populated areas or a village centre, which does not provide an operating basis for a branch pharmacy” (Vogler et al., 2012, p. 115) or exceptional within the catchment area of the connected pharmacy. Pharmacies can provide their service online as well. They need a website and information about the FIMEA.

POMs are limited to community pharmacies. Online POM (only with e-prescription) and OTC products have been allowed since 2011 (Vogler et al., 2012). Further, no POM or OTC can be sold in drugstores except for nicotine replacements. Compared to Sweden, Finish pharmacies can produce pharmaceuticals within their laboratory (Vogler et al., 2012). Finish pharmacies provide vaccinations, blood pressure, glucose, cholesterol, and asthma measurement, night services, and more. According to Vogler et al. (2012, p. 126):

the average margin for medicines in Finland amounted to 23 percent of the pharmacy retail price net referring to the total pharmacy market.

In theory, there are incentives for pharmacists, in the way how pharmacy remuneration is organized to sell more medicines, but not to sell more expensive medicine. However, pharmacies cannot influence the content of prescriptions, and promoting unnecessary medicine use is prohibited by law, also with self-care medicines.

In 2009, e-prescribing started, and 15 months later, almost 85 percent of the prescriptions were digital (Gross & Volmer, 2016; Kierkegaard, 2013). Now, 100 percent of the prescriptions are digitalized. Paper prescriptions are only allowed in some exceptional cases. As an extension, an e-prescription from Estonia, Croatia, or Portugal can be redeemed at Finish community pharmacies (Kanta Services, 2021). This follows after the European Directive 2012/52/EU of December 20th in 2012, which resulted from the agreement that the European member states work together “through the eHealth Network established under Article 14 of Directive 2011/24/EU, on the interoperability of ePrescriptions in order to facilitate the implementation of Article 11 of Directive 2011/24/EU” (European Union, 2014, p. 3).

In sum, the density of community pharmacies across Finland varies in increasing direction over time – despite the regulated market. Service points outside the pharmacy expand the accessibility of OTC products, Rx, and OTC mail-order.

Poland

The pharmacy market in Poland was liberal until 2017. After the new regulation, “Pharmacies for the pharmacists”, the market became regulated (Zaprutko et al., 2020, p. 1). Only licensed pharmacists can own and run a pharmacy. Therefore, “a minimum of five years of experience in the community pharmacy or three years and specialization obtained during postgraduate education” (Świeczkowski et al., 2017, p. 2) is needed. Before, after the pharmaceutical law in 2001, this was also the case: one pharmacy per pharmacist. This means that up to 2002, the market was regulated, then liberal, and since 2017 regulated again. In 2002, the regulation changed, and the market opened for anyone, chain pharmacies existed, and not only pharmacists had the right to run a pharmacy. Two years later, in 2004, geographical rules were established: “(...) the anti-concentration limit was changed from 10 % pharmacies in the country up to 1 % pharmacies in the province” (Wiśniewski et al., 2020, p. 2). In 2017, Poland started to regulate its pharmacy market again: pharmacy chains were prohibited, and new pharmacies were run by pharmacists only and limited up to four branches. Further, geographical and demographic limits were set (Sowada et al., 2019; Świeczkowski et al., 2017; Wiśniewski et al., 2020; Zaprutko et al., 2020). Existing pharmacies could be sold to pharmacists. The new Act cut the density of the pharmacies in Poland from “13,300 community pharmacies and 1300 thousand pharmacy outlets” to “12,900 thousand at the end of 2018” (Wiśniewski et al., 2020, p. 3). In between, the density increased “due to the implementation of applications for authorization submitted before the act entered” (Wiśniewski et al., 2020, p. 3).

A pharmacy owner has to be authorized by the Voivodeship Pharmaceutical Inspector and can only open a pharmacy,

if the number of inhabitants per one outpatient pharmacy is at least 3 000 and the distance from the planned location of the pharmacy to the nearest pharmacy is at least 500 metres (these rules can be waived in individual cases by the Minister of Health). (Sowada et al., 2019, p. 43)

Further, only one pharmacist can own one pharmacy. There has to be another pharmacist set as a director for the four branches. However, the opening hours depend on “the needs of the population – they are determined by the county councils in consultations with the territorial self-government units and the professional self-government of pharmacists” (Sowada et al., 2019, p. 43). This includes that pharmacies should be open at night, on legal holidays, and on weekends. Online shopping of OTC products is allowed through pharmacies and pharmacy outlets – Rx mail-order is prohibited (Sowada et al., 2019).

To Wiśniewski et al. (2020, p. 5), the “profitability of a pharmacy depends on three parameters: the number of patients per pharmacy, the number of expenditures on drugs per patient, as well as the pharmacy’s margins” and the “location, factual and friendly staff, epidemiology, etc.”. The authors explain that the average turnover of a pharmacy in Poland is very low due to the low prices of medicine and the small number of inhabitants to be served (Wiśniewski et al., 2020). Germany, Sweden, Austria, and Denmark have a five times higher turnover than Poland (Wiśniewski et al., 2020). Sowada et al. (2019, p. 44) explain that after 2012 pharmaceutical pricing changed in the direction that

the first generic equivalent applying for reimbursement must be 25 % cheaper than the branded product on the reimbursement list and any products subsequently added to the reimbursement list cannot be more expensive than the current reimbursement limit.

Overall, a liberal market should “improve access to medicines and pharmacies and reduce pharmaceutical prices” (Zaprutko et al., 2020, p. 7). Further, a regulated pharmacy market suggests that “more regulation contributes, e.g., to a better quality of pharmacy services and to ensuring access to pharmacies in rural areas” (Zaprutko et al., 2020, p. 7). According to a study by Zaprutko et al. (2020, p. 7), the regulation of the pharmacy market in Poland “did not cause any market disturbances, which is consistent with other analyses concerning the consequences of pharmaceutical market regulations”. Nevertheless, they concluded that the “controlled market model may be associated with good access to pharmacies” (Zaprutko et al., 2020, p. 7). However, at the end of 2018, 458 pharmacies had to close, and therefore, the market regulation “resulted in a decrease in the number of pharmacies” (Zaprutko et al., 2020, p. 7). The market relaxation could explain the increase in pharmacy density after the regulation or the rise in demand for medicines due to the COVID-19 pandemic.⁴⁰

⁴⁰ Not yet empirically proven.

Portugal

The pharmacy market in Portugal is liberal. Portuguese pharmacies are “privately owned, and each has a technical director with a degree in pharmaceutical sciences” (Policarpo et al., 2019, p. 2). Since 2007, the regulations to own a pharmacy changed, and non-pharmacists⁴¹ could own a pharmacy. In addition, it is regulated because of geographical rules. To open a new pharmacy,

there must be a minimum of 3,500 inhabitants in the location, unless the pharmacy is opened at a distance of more than 2 km from the closest pharmacy or, within residential areas, 350 meters between pharmacies in a direct line; 100 meters between the pharmacy and the health care unit, except in places with less than 4,000 inhabitants. (Ribeiro et al., 2020, p. 3)

Compared to other European countries, the density of Portuguese pharmacies in rural areas is relatively high (Ribeiro et al., 2020). Further, as in Sweden, they offer extended office hours (Policarpo et al., 2019).

Prices for non-prescription drugs and other products like cosmetics are not fixed; every pharmacy can set their prices – usually a 28 percent markup. In addition, prescription drugs are regulated by the government with “a percentage of the medicine ex-factory price (from 18.4 to 27.9 %) and a progressive dispensing fee per package (from 0.63 EUR to 8.28 EUR)” (Ribeiro et al., 2020, p. 3). Overall, there is a ban on Rx mail-order in Portugal (ABDA, 2021a).

Pharmacies in Portugal take care of more health services and are highly accepted (Policarpo et al., 2019). They are allowed to offer

home care support, first aid, medicines administration, immunisation (vaccines not included in the National Vaccination Plan), lab tests, diagnostic and therapeutic services, disease management programmes, health campaigns and collaboration in national health education programmes. (Policarpo et al., 2019, p. 2)

The Portuguese credit the pharmacies for their work. For example, Cavaco et al. (2005, p. 56) mentioned that the Portuguese “ascribe to the pharmacist a social role, as part of a supportive network, solving among other things economic limitations to medicine access”.

⁴¹ Exception: no physicians, wholesalers, or persons within the pharmaceutical industry can run a pharmacy.

In sum, despite the liberalization of the ownership of the pharmacies, regulations increase density. First of all, their social attractiveness is helpful in customer loyalty. Second, their additional services within the pharmacy increase their remit and thus extends its legitimacy. Last, geographical rules prevent competition among pharmacies themselves (Policarpo et al., 2019; Ribeiro et al., 2020).

Austria

The Austrian pharmacy market is liberal. Not only pharmacists can own a pharmacy,⁴² and the authority regulates the number of pharmacies – generally, the location. In addition to the community pharmacies, there are dispensing doctors as well – especially in rural areas (BWB, 2018). Pharmacies are privately owned and commercial enterprises as in Germany. To own a pharmacy, a person must be a licensed pharmacist with different language skills, practical skills, business knowledge, and financial solvency (Österreichische Apothekerkammer, 2020a). To open a pharmacy, the store has to be at least 500 meters away from another pharmacy (so-called “Gebietsschutz”, 5,500 inhabitants to be served, with some exceptions), there has to be a prescribing doctor within the area, and the federal government must approve the pharmacy – so-called “Konzession” (Österreichische Apothekerkammer, 2020a). Despite geographical regulations, the density of community pharmacies has risen over time.

Austrian pharmacies can also produce medication. Almost 44 percent of dermatologists’ prescriptions are generally made in pharmacies laboratory – so-called “Magistrale Zubereitung” (Österreichische Apothekerkammer, 2020a).

The digitalization process expanded over time. Austrians have an electronic patient card and e-prescription. A digital database where all vaccinations are stored is available as well. A specially developed application (“Apo-App”) helps Austrians understand their prescriptions and further health data. Furthermore, there is a 24/7 pharmacy hotline for pharmaceutical questions.

Mail-order of OTC has been available since 2015 – but not for prescription drugs (ABDA, 2021a; BWB, 2018). Further, OTC sale is possible outside the pharmacy in drugstores or supermarkets, but with particular restrictions.

⁴² At least over 50 percent. The rest can be owned by investors or wholesalers (Riedl, 2016).

Pharmacies in Austria have to adapt their opening hours to the local shops. The pharmacies provide emergency and night services, not financed by a special fund as in Germany (NNF), but by the pharmacies themselves.

The wholesalers set prices for drugs. Following BWB (2018), reimbursable medicines⁴³ cannot be discounted, whereas a discount can be guaranteed on non-reimbursable medications.

Further, pharmacies can set their price on non-refundable drugs, so the competition starts. Pharmacies in Austria deliver medicines, give health advice, and check on notable side effects. The staff can vaccinate against several pathogens and provide health-care support about smoking, blood sugar, cholesterol, and many more (Langer et al., 2018).

Despite the regulated market, the density of Austria's community pharmacies has risen. Due to the so-called "Gebietsschutz", there is no direct local competition. Without Rx mail-order within the country but dispensing doctors having the right to sell medicine in rural areas, the accessibility to POM and OTC is ensured (Österreichische Apothekerkammer, 2022).

Germany

After many years of growth, the density of community pharmacies in Germany has declined since 2008. The German case might be challenging because of the hybrid pharmacy market, foreign mail-order disadvantages for community pharmacies, and many bureaucratic hurdles within the business (Schwaabe, 2020). In recent years, the effects or regulatory implementations for the German community pharmacies have led to the so-called "Apothekensterben" – a decline in the number or density of community pharmacies. Due to the German reunification, the number of pharmacies increased significantly. Positive effects were also recorded after the ban on multiple and third-party ownership. However, these were deceptive, as pharmacies were bought up. Since 2008, the total number of pharmacies in Germany has decreased continuously from 21,602 pharmacies to 18,461 pharmacies in 2021 and 18,256 in mid-2022 (Tagesschau, 2022).

Some articles repeatedly refer to the competitive advantages of foreign mail-order pharmacies ("ausländische Versandhandelsapotheken") (Coenen et al., 2011; May et al., 2017; Meyer, 2020). The granting of discounts on prescription drugs

⁴³ Reimbursable medicines are covered by health insurance.

by foreign mail-order pharmacies, the resulting competitive advantage over German pharmacies, the “Mehr- und Fremdbesitzverbot” and the e-prescription could be possible causes of a decline in pharmacy density. Nevertheless, the German pharmacies are at a disadvantage due to the German price regulation for prescription drugs (“AMPreisV”), which binds pharmacies to fixed prices when selling Rx. Thus, no discounts will be applicable. This means that the pharmaceutical industry sets a price with the insurance on one active substance. Publicly insured people have to pay a so-called “Eigenanteil”. This is obligated. Online pharmacies from abroad can give a discount on this “Eigenanteil”.

The fixed drug prices in Germany are intended to ensure that local German pharmacies can provide comprehensive medical care for the same price. In 2016, this approach was criticized by the European Court of Justice (ECJ) as it could not be adequately justified. The ECJ noted that binding consignors from abroad to the German “AMPreisV” violates European law. Price-fixing constitutes an unjustified restriction on the free movement of goods in the sense of a quantitative import restriction. Therefore, the fixed prices in Germany are for German pharmacies but not foreign (mail-order) pharmacies. The “DocMorris”⁴⁴ decision in 2003 opened the mail-order market for non-POM and OTC products (Jorge, 2016). Germany went one way further and opened the mail-order market for POM with their “Modernisierungsgesetz” in 2004. In 2021, the pharmacists’ lobby abolished discounts for Rx abroad after lengthy legal battles between several German community pharmacies and “DocMorris”. However, this applies to patients with statutory insurance only. Privately insured patients continue to receive a discount (Rohrer, 2021).

In addition, OTC sale is permitted outside the pharmacy within drugstores or supermarkets. Only licensed pharmacists with a so-called “Approbation” can run and own a pharmacy in Germany. No chains are allowed, only so-called “Einkaufsgenossenschaften”⁴⁵ (“Guten Tag Apotheken”, “mea Apotheken”, and many more).

Another remark is that German pharmacists are registered traders. This means that the pharmacy owner is liable for their assets. The average net turnover of a pharmacy in Germany is about 2.78 million euros per year. However, there is a

⁴⁴ “DocMorris”, an online pharmacy located in the Netherlands, is a Swiss “ZurRoseAG” subsidiary. It is the most prominent online pharmacy provider in Europe.

⁴⁵ Smaller pharmacies unite to form a cooperative to buy as a more significant customer from the wholesalers or the companies themselves and thus get better discounts on the purchase price.

vast spread. Around 60 percent of pharmacies do not achieve the average turnover, while individual large pharmacies are far above the average.

In the end, pharmacies need traffic. They should be located next to a prescribing doctor, within shopping centers, or on shopping streets (Elabed et al., 2016; Österreichische Apothekerkammer, 2022). In other EU countries, it is mandatory to have a dispensing doctor close to the pharmacy (Österreichische Apothekerkammer, 2022). Although the German pharmacy market is regulated, freedom of establishment prevails. Therefore, the competition is increasing, having pharmacies close to each other. The pharmacy with the best offers and further services survives. Pharmacies in Germany offer the same services as in Austria except for the vaccination service. Since 2022, German pharmacists have been allowed to vaccinate against Covid-19 but not against influenza (ABDA, 2022).

In sum, the density of pharmacies in Germany decreased because of the freedom of establishment, the Rx mail-order, its discounts, and the missing digitalization. Due to new laws that allow pharmacies to vaccinate (only) against COVID-19 since February 2022 and the ban on discounts on Rx abroad, stability of the density could be expected. Nevertheless, the digitalization process, which is much more developed in other EU countries and has become an essential part of everyday pharmacy life, lacks behind.

Appendix 4: Outlook on pharmacy density in Germany

Germany has seen a decline in its pharmacy density, decreasing from 21,592 community pharmacies to 17,571 within the last 23 years. In 2023, there were 599 closures compared to 62 new openings, leading to approximately 21 pharmacies per 100,000 inhabitants – a figure that has been gradually declining (ABDA, 2024).

According to the ABDA (2024) “Zahlen, Daten, Fakten” report, this trend is influenced by various factors, including economic pressures, demographic shifts, and regulatory challenges. The report notes the financial strain on pharmacies, particularly independent ones, due to rising operational costs and lower reimbursement rates for medications. Additionally, the growing presence of mail-order pharmacies is changing consumer behavior, with more patients opting for online services, which has impacted the foot traffic in traditional pharmacies.

This trend is consistent with broader developments observed in other European countries. For instance, from 2004 to 2023, Belgium’s pharmacy density decreased from 50 to 40 pharmacies per 100,000 inhabitants, while Austria experienced a slight increase from 14 to 16 per 100,000 inhabitants. These changes reflect ongoing shifts within the European pharmacy sector (ABDA, 2024).

The findings of this study suggest that market regulations, such as ownership restrictions and bans on Rx mail-order services, do not significantly contribute to an increase in pharmacy density in Germany. Instead, the focus may need to shift towards improving the availability and effective placement of pharmacists. The ABDA (2024) report emphasizes the importance of retaining and recruiting pharmacists, particularly in rural areas, where pharmacy closures can have a more pronounced impact on healthcare accessibility, too.

Policymakers may consider interventions such as financial incentives for pharmacists in underserved areas, support for small and independent pharmacies, and potential adjustments to the regulatory framework to better support pharmacy operations. These measures could help stabilize pharmacy density in Germany and ensure continued access to professional healthcare services for all citizens.

In the coming years, both policymakers and pharmacies in Germany will need to consider how many pharmacies per 100,000 inhabitants are necessary for the country. It will be important to evaluate whether approximately 22 pharmacies per 100,000 inhabitants were excessive and if this level of competition was

sustainable. Additionally, there may be a need to assess whether Germany requires demographic or geographic regulations for pharmacies, potentially moving away from the current system of free establishment. Furthermore, the issue of recruiting new licensed pharmacists should be addressed in political discussions. Financial incentives could be considered to encourage more individuals to pursue careers in pharmacies. However, this study highlights that changes in the pharmacy market should not be automatically adopted from other countries. Policies that have been effective in other EU nations may not necessarily produce the same outcomes in the German pharmacy market.

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