

# Price and Non-price Effects of Cross-market Mergers in Regulated Markets \*

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## Abstract

We study how cross-market mergers affect price and non-price outcomes in the pharmaceutical markets of two Nordic countries, Finland and Sweden, that have differing regulatory environments. Cross-market mergers entail the merging of two firms that compete in different active ingredient markets, that are used to treat the same illnesses. The customers can therefore be seen as common, even though the markets are separate. We use product-level price and quantity data from the two countries and analyze the effects of the mergers on expenditure, prices, sales and assortment, analyzing the differences in net, target firm and rival firm effects using differences-in-differences. In both countries, we find no economically significant adverse effects of the studied mergers on pharmaceutical short term expenditure or prices. Second, we find no adverse effects on the pharmaceutical assortment or on market size. Third, we find merger effects vary markedly between target firms and rival firms, underscoring the importance of research designs in which control units are not directly exposed to the merger. Finally, we demonstrate the importance of defining the merger event correctly in time: the use of the announcement or deal date as the event may generate differing results. The paper offers novel insights into the joint effects of market regulation and mergers, a topic previously understudied in drug markets.

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## 1 Introduction

Mergers and acquisitions (M&A) are a defining feature of the global pharmaceutical industry (Pang, Folwell, Osborne, Tung, Vasiliou, Boliter, Murphy and Szücs 2020). They are often motivated by economies of scale, expanded or restructured product portfolios, and synergies in research and development, but they also raise concerns about reduced competition, increased concentration of market power, and risks of pharmaceutical shortages. These concerns can be particularly salient in regulated pharmaceutical markets, where prices, market entry, and reimbursement schemes are shaped primarily by public policy rather than by market forces alone (Lakdawalla 2018). Yet relatively little is known about the joint effects of price regulation and mergers, and about how M&A activity in such settings affects both price and non-price outcomes.

This paper studies how cross-market mergers—transactions between firms active in different but related therapeutic markets—affect outcomes in regulated pharmaceutical markets. While merger analysis traditionally focuses on consolidation within narrowly defined product markets, many pharmaceutical mergers instead take a cross-market form: firms combine product lines that treat the same conditions using different active ingredients. Such mergers can create overlaps in customer bases without direct product substitution, thereby altering competitive dynamics through portfolio effects. Despite their prevalence, the effects of cross-market mergers in regulated pharmaceutical markets remain understudied. We examine both price and non-price outcomes, including pharmaceutical expenditure, product assortment, and measure of market size.

We analyze the impact of mergers using product-level data from two Nordic countries, Finland and Sweden, which share similar Beveridge-style healthcare systems but differ markedly in the design and strictness of pharmaceutical price regulation. In Sweden, stronger consumer-choice reforms provide, in the form of reference pricing, sharper incent-

ives for patients, and the pharmaceutical reimbursement system is also more generous than in Finland. This institutional contrast provides a natural setting to study how the regulatory environment shapes merger outcomes, because the difference in consumer choice policy strictness can lead to different merger effects.

Empirical analyses of mergers in industrial organization typically fall into two broad methodological categories. The first consists of structural analyses, in which hypothetical or actual mergers are evaluated using estimated demand and supply systems and counterfactual simulations (Björnerstedt and Verboven 2016; Asker and Nocke 2021; Miller and Weinberg 2017). Structural methods have been used to study both price and non-price outcomes of mergers in a range of industries. The second category consists of reduced-form studies that exploit pre- and post-merger data and compare outcomes for merged and non-merged firms or markets, usually within a difference-in-differences framework (Ashenfelter, Hosken and Weinberg 2013). When mergers influence many products and markets, full structural analyses can become cumbersome and computation-intensive, so papers that study multiple merger events typically rely on reduced-form methods instead. In our empirical analysis, we follow this reduced-form research tradition.

In our empirical analysis, we focus on large global pharmaceutical mergers that involve firms with products in the Nordic markets but are driven primarily by global pharmaceutical demand rather than by the profitability of the Nordic markets. We build our identification strategy on this notion and treat the global merger events as plausibly exogenous ownership structure shocks in our difference-in-differences (DiD) design. Because the mergers occur at different points in time, we use modern DiD methods for staggered treatment adoption Callaway and Sant'Anna (2021). We treat each active ingredient as the relevant market in both countries, and all outcomes are measured at the market level. Using product- or firm-level outcomes would require a SUTVA assumption that is un-

realistic given substitution and strategic interaction across products and firms within a market. Our SUTVA assumption instead allows for arbitrary strategic interaction among firms within a market but, as in standard DiD identification strategies, rules out spillovers across markets (Minton and Mulligan [2024](#)).

Our analysis yields three main findings. First, we show that the timing of mergers is central for empirical difference-in-differences (DiD) designs: some outcomes respond already at the merger-announcement stage, which implies that using the legal completion or deal date to define pre- and post-merger periods can be misleading. We show that in our context the use of completion date leads to results that are hard to rationalize. Second, over a two-year follow-up period, we find no economically meaningful adverse effects of these mergers on pharmaceutical expenditure or prices in either Finland or Sweden. Third, we detect no evidence of a reduction in product assortment or market size, suggesting that the mergers did not reduce pharmaceutical availability or materially restrict consumer choice. Together, these findings provide new evidence on how regulatory design interacts with corporate consolidation in pharmaceutical markets. The results have implications for competition policy, particularly when assessing mergers in which direct overlap is limited but customers are shared and therapeutic effects create indirect links between markets.

Economic research on mergers in healthcare markets has a long tradition. Previous work has focused on hospitals, primary and specialty care, and other healthcare providers in a variety of institutional contexts, documenting the potential adverse implications of increased provider concentration and market power Lyu and Zhang ([2025](#)), Brot, Cooper, Craig and Klarnet ([2024](#)), Buri and Heinonen ([2025](#)), Wollmann ([2020](#)) and Eliason, Heebsh, McDevitt and Roberts ([2020](#)).

Previous research has also documented several ways in which mergers affect pharmaceutical markets. Empirical work has examined the impact of consolidation on innovation

(Cunningham, Ederer and Ma 2021; Higgins and Rodriguez 2006; Haucap, Rasch and Stiebale 2019), on prices and non-price outcomes (Bonaime and Wang 2024; Hammoudeh and Nain 2024; Schutz 2023), on advertising (Dubois and Majewska 2022), on mergers under price regulation (Gugler and Szücs 2023), and on stealth consolidation (Feng, Hwang, Liu and Maini 2024). Most of this literature focuses on mergers that generate substantial within-market overlap among directly competing products. By contrast, we study cross-market mergers that link related therapeutic markets through shared customers and limited therapeutic substitutability in a setting with explicit price regulation and rich data on both prices and availability. For our purposes, the strands on regulation and on price and non-price outcomes are the most relevant.

We contribute to three distinct economics literatures related to mergers. First and foremost, this paper is about mergers and particularly cross-market mergers in pharmaceutical markets (Schutz 2023; Feng, Hwang, Liu and Maini 2023). Our setting differs from these papers in two important ways. We study mergers in price-regulated environments, whereas the existing cross-market studies focus on the US pharmaceutical market. Moreover, because the US market is highly profitable relative to the Nordic markets, it is likely to be one of the primary drivers of global merger activity. This raises endogeneity concerns when studying merger outcomes in the US. By contrast, the Nordic markets are too small to drive global merger decisions, so the mergers we study are plausibly exogenous to local market conditions. Our setting also allows us to follow the same cross-market mergers in two different countries, rather than in a single market, providing a comparative perspective on how institutions mediate merger effects. This offers a new insight into the impact of consolidation in regulated pharmaceutical markets.

Second, we contribute to the study of price and non-price outcomes in price-regulated pharmaceutical markets (Gugler and Szücs 2023). A major benefit of studying mergers in

Finland and Sweden is the institutional setup and the availability of detailed price data. The two countries are similar in many respects, yet they differ in key dimensions of pharmaceutical regulation, and, importantly, the actual prices that pharmaceutical producers set are observable to researchers. In comparison to papers studying the US pharmaceutical market, we do not need to rely on measures that proxy for the prices firms set in the markets. Studying mergers in two geographic markets also increases the external validity of our results.

Third, our analysis contributes to how reduced-form ex post evaluations of mergers can be improved in difference-in-differences setups (Bonaime and Wang 2024; Hammoudeh and Nain 2024; Minton and Mulligan 2024). Our analysis departs from the usual product-level approaches because we want to understand the market-level implications of the studied mergers and, at the same time, impose a realistic SUTVA assumption for our analysis. Aggregating to the active-ingredient (market) level allows for rich substitution and strategic interaction within markets while ruling out cross-market spillovers in line with standard DiD identification assumptions. We also show that, at least in our application, merger timing decisions are important: the outcomes we study react to merger announcements, and this in turn can affect evaluation. We demonstrate that one could arrive at qualitatively different conclusions if merger deal dates, rather than announcement dates, were used to define treatment timing.

The remainder of the article is structured as follows. In Section 2, we present the relevant institutions and regulations. Then in the Section 3 we discuss how regulation can influence merger outcomes and in Section ?? we present our data and empirical sample. We present our empirical stragy in Section 5. We present our results in Section 6 and we conclude in Section 7.

## 2 Background

In this Section, we review the relevant institutional setup in the Finnish and Swedish markets during our sample period of 2009–2017 in Subsection 2.1. The Nordic pharmaceutical market contains more price and consumer choice regulation than the US market, where the majority of existing studies of cross-market mergers come. We also discuss the institutions related merger control at the EU and at the national level in Subsection 2.2.

### 2.1 Nordic pharmaceutical markets

As a brief overview, in 2009, the Nordic countries combined relatively small populations with high per-capita economic output, shaping the conditions of their pharmaceutical markets. Taken together, the region accounted for roughly 25.4 million inhabitants. Sweden was the largest country, with about 9.34 million people, followed by Denmark (5.54 million), Finland (5.34 million), Norway (4.86 million), and Iceland (0.32 million).<sup>1</sup> Despite their modest demographic size, all five countries exhibited comparatively high GDP per capita in euro terms. Norway stood out with approximately €55,000–60,000 per person, placing it among the wealthiest nations in Europe, while Sweden, Denmark, Finland, and Iceland also reported strong income levels. Consistent with their status as welfare states, the Nordic countries maintain universal, tax-financed healthcare systems and extensive public involvement in the provision and financing of health services.

Regulation of the pharmaceutical markets in Finland and Sweden are characterized by several institutional features: (i) extensive reimbursement systems with maximum expenditure caps, (ii) price regulation across different stages of the vertical market structure, and (iii) regulatory frameworks imposed by the European Union. In addition to these,

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1. The EU-27 population was around 500 million people in 2009, so Nordics correspond to a 5% of the EU-27 population.

there are national rules governing the safe dispensing of pharmaceuticals as well as the operation of community pharmacies.

Finland and Sweden include pharmaceuticals within their public health insurance systems, with reimbursement rates typically ranging from 40 to 100 percent. In many instances price regulation is a prerequisite for public reimbursements. It is important to note that not all products are regulated and pharmaceutical products included to the reimbursement scheme can vary across the two studied countries. In Sweden reimbursement is determined at the patient level, where co-payment rates follow a decreasing piecewise function of annual expenditure. In contrast, Finland applies reimbursement rules at the product level. Both countries impose annual caps on out-of-pocket payments, which range from approximately €200 in Sweden to €600 in Finland.

The use of price regulation policies is a central policy tool for managing the fiscal impact of pharmaceutical reimbursement. Finland and Sweden employ three main forms of price regulation. First, wholesale and consumer prices in competitive markets (i.e. generic markets) are set uniformly in both countries. Pharmaceutical producers compete at the wholesale level and wholesale prices are converted to retail prices using regulated markup formulas. Second, both countries impose price ceilings, which serve as the primary regulatory instrument during periods of patent protection. Although these ceilings formally remain in place after patent expiry, competitive market pressures typically render them non-binding especially for generic products. Third, both countries implement consumer choice policies in generic markets through different variants of reference pricing, which aim to reallocate demand from higher-priced to lower-priced alternatives.

The study period 2009-2017 is selected so that the overall structure of these consumer choice policies is stable. They operate primarily through the reimbursement system: consumers are reimbursed for the cheapest (or nearly cheapest) available product, while the

out-of-pocket payment increases if a consumer opts for a more expensive alternative. This mechanism incentivizes firms to set prices so that consumer demand is reallocated towards the cheap products. In Sweden, patients who don't choose a reference priced product may be required to pay the full price out of pocket. In Finland, patients instead cover the full price difference between the reference product and their chosen alternative out of pocket.

Finally, EU-level regulation also shapes pharmaceutical markets through its rules on market entry and parallel trade. All pharmaceuticals sold within the European Union must obtain marketing authorization, either from a national medicines agency—such as the Finnish Medicines Agency (Fimea)—or from the European Medicines Agency (EMA). In addition, EU legislation guarantees the legality of parallel trade in pharmaceuticals between member states. Through parallel trade, firms are able to purchase medicines in lower-cost countries and resell them in higher-cost countries, thereby profiting from cross-country price differentials.

## 2.2 Mergers of pharmaceutical firms

The pharmaceutical markets and the biopharma industry are homes for fervent M&A activity (Pang, Folwell, Osborne, Tung, Vasiliou, Boliter, Murphy and Szücs 2020). The sectors are also screened and scrutinized by competition authorities on both the European and national level. This is because of their importance for public health, the role of innovation in the industry and the regulatory frameworks that govern both access and competition in the markets. To provide an understanding of pharmaceutical mergers in Europe, we review the broader institutional setting and some sector-specific features that distinguish it from other markets.

Merger control in pharmaceuticals is characterized by very narrow market definitions and the joint effects of competition and regulation. As described in Section 2.1, both market

access and competition in further stages is regulated by several governing bodies. While they do not directly intervene in merger control, their decisions shape the competitive landscape of the markets by determining which products may enter, for how long they are protected by patents and what prices they are able to or should post. Especially in markets with little competition, mergers may have significant implications on concentration of market power.

Both of the studied countries, Finland and Sweden, belong to the European Union and are thus subject to European level merger regulation. At this level, merger control is primarily governed by the European Commission's Directorate-General for Competition (DG COMP). This entity reviews large transactions that are notable on the EU-level. Between 2009–2017 DG COMP screened biotech deals worth of at least 200 billion euros. DG COMP is governed by the EU Merger Regulation (EUMR), which establishes thresholds for merger control. These thresholds are created so that merger activity with cross-border significance is assessed centrally at the EU-level. There are two alternative ways to reach turnover thresholds for the deal to be of so-called EU-dimension. The first alternative includes (i) a combined worldwide turnover of over 5 000 million euros and (ii) an EU-wide turnover for each of at least two firms over 250 million euros. The second alternative includes (i) a worldwide turnover of all the merging firms of 2 500 million euros, (ii) a combined turnover of all the merging firms over 100 million euros in each of at least three EU member states, (iii) a turnover of over 25 million euros for in each of the three member states under (ii), and (iv) an EU-wide turnover of more than 100 million euros (European Commission 2013). The EUMR also provides a referral mechanism, which allows for cases to be shifted between DG COMP and national competition authorities if need be. In this paper, most of the mergers assessed are large, internationally significant mergers, that have been reviewed by DG COMP.

In addition to the EU-level merger control, Finland and Sweden also have their own national competition authorities. In Finland, merger control is overseen by the Finnish Competition and Consumer Authority (FCCA). Mergers must be notified to the FCCA if the combined turnover of the merging parties exceeds 100 million euros globally and at least two of the parties each generate more than 10 million euros Finland (FCCA [2025a](#)). Once the FCCA is notified of a possible transaction, they conduct a two-phase review, which is closely aligned with the review process of DG COMP. In Finland, pharmaceutical manufacturing is a small sector. The competition authority may have interests to pay particular attention to transactions that may reduce generic competition or affect hospital pharmacy procurements that are heavily centralized.

In Sweden, merger control is handled by the Swedish Competition Authority (SCA). Notification thresholds are met when the combined turnover of the parties exceeds approximately 91 million euros and at least two of the parties have turnovers of more than 18 million euros in Swedish markets. The SCA may also review deals smaller than this if they have concerns over possible markets effects. The Swedish review process is also two-tiered. The SCA lists pharmaceutical markets as one of the most important markets to observe from the viewpoint of merger control (SCA [2025a](#)).

The operations of the national competition authorities are much smaller scale than at the EU-level. Between 2020–2024, the FCCA reviewed 186 deals in the first stage, of which only 17 proceeded to the second stage review (FCCA [2025b](#)). The SCA reports 507 completed inspections of merger notifications between 2020–2024 (SCA [2025b](#)).

### 3 Theoretical framework for understanding mergers in regulated markets

The mergers we study in this paper are cross-market mergers. Transactions in which the merging parties are active in different product markets and therefore merger does not eliminate a direct rival within a market. Before discussing the mechanisms through which such mergers can affect prices and welfare, it is useful to briefly review the standard logic for horizontal mergers and use it as a benchmark when thinking about cross-market consolidation in regulated pharmaceutical markets.

The theoretical framework for understanding the price effects of horizontal mergers is well established (Asker and Nocke 2021). When two close rivals merge within the same market, the reduction in competitive pressure can increase market power and raise prices, thereby reducing consumer welfare. These effects can be offset—or in some cases amplified—by efficiency gains (Williamson 1968), quality improvements (Federico, Langus and Valletti 2018), or by entry of new firms (Caradonna, Miller and Sheu 2025). Efficiencies may arise through lower marginal costs, reduced fixed costs, or improved organization of production and distribution, and competitive forces can pass through some of these gains to consumers. Mergers may also generate benefits by expanding access to higher-quality products or improving service dimensions, although consolidation can simultaneously weaken innovation incentives. Finally, entry can discipline post-merger market power when potential entrants can respond quickly and at scale.

Cross-market mergers differ in that the merging firms operate in distinct product (or geographic) markets and therefore do not reduce competition through the standard unilateral-effects channel of removing a close substitute (Dafny, Ho and Lee 2019). Instead, the relevant concern is that consolidation can increase market power through mechanisms

that rely on linkages across markets—for example, common customers or intermediaries, portfolio interactions, or repeated strategic interaction across multiple markets. A canonical illustration comes from the U.S. hospital sector: hospitals located in separate local markets may not compete for the same patients, but they can become jointly valuable to the same insurers, and a merger can increase bargaining leverage in negotiations over network inclusion and reimbursement (Dafny, Ho and Lee 2019). The implication is that the effects of cross-market mergers depend less on substitution patterns within a market and more on how consolidation changes the terms of trade with buyers, intermediaries, or regulators.

In regulated markets, price caps can dampen the direct price effects of consolidation by constraining the ability of firms to raise prices above administratively determined price caps. In such settings, the empirically relevant effect of a merger may be less about discrete post-merger price increases and more about changes in the intensity of price competition and product assortment.

In the context of the generic outpatient market in the Nordic pharmaceutical market, where prices and demand are heavily shaped by reimbursement and substitution rules, cross-market mergers could in principle increase market power through three broad mechanisms: (i) portfolio effects, (ii) bargaining effects, and (iii) multimarket conduct. Portfolio effects arise when a merger expands the number of products a firm supplies across distinct substitution groups. If pharmacies face procurement or inventory frictions, or if delivery reliability and availability matter, a broader portfolio can improve the merged firm's ability to secure favorable purchasing terms or to become a more attractive supplier relative to more narrower rivals. Bargaining effects arise when prices or reimbursement conditions are determined through administrative procedures or negotiations; consolidation could strengthen the firm's position by increasing the economic importance of reaching agreement with the

merged entity or by reducing the regulator's alternatives. Finally, multimarket contact may soften competition if firms interact repeatedly across many product markets: aggressive pricing in one market can be deterred by the threat of retaliation in others, reducing competitive intensity even absent direct product overlap.

At the same time, several institutional features of Nordic generic markets make it less likely that these cross-market mechanisms translate systematically into higher prices. Consumer choice policies and price caps have the ability to mute the adverse price effects of cross-market mergers at least partially. First, demand in generic markets is affected by consumer choice policies that reallocate demand towards cheap products. This decreases the gains firm can achieve from price increases. Choice policies and price caps can downplay the effects of these theories atleast partially, because choice policies reallocate demand towards the cheapest products.

## 4 Data and sample

In this section, we describe the data, the mergers used in the empirical analysis, and the construction of the estimation sample. Subsection 4.1 presents the sample, outcome variables, and descriptive statistics. Subsection 4.2 provides descriptive information on the mergers included in our analysis.

### 4.1 Pharmaceuticals

We use data from two different data providers on monthly revenues and quantities of drugs purchased by community pharmacies. The major benefit of using data from the Nordic countries is that available prices correspond to the prices pharmacies pay for the pharmaceuticals. Our data set covers Finland and Sweden. Finnish data is obtained from the Finnish Medicines Agency (FIMEA) and Swedish data is obtained from IQVIA. Both

dataset cover 2009–2017.

The data sets consist of information on the sales value and volume of each pharmaceutical package sold in the respective country. The sales values are defined in pharmacy purchase prices and volumes in Defined Daily Dosages (DDD)<sup>2</sup> for each respective active ingredient according to the ATC5. We use wholesales prices or so-called pharmacy purchase prices. In principle, all regulation is targeted on the wholesale prices, and retail prices are determined with a mechanical formula of the wholesale price, making them the natural choice. Furthermore, we use nominal prices of local currencies, the euro and the Swedish Krona, as all regulation is imposed on the national nominal values.

The country-specific data sets provide information on product characteristics and the regulatory environment imposed on the products. We observe, for example, the Nordic Article Number (VNR), drug format, package size, strength, brand status, marketing license holder and manufacturer as well as regulation-related variables such as the substitution group, price caps and reference prices.

In our main analyses we aggregate our data to the active ingredient × month level, constructing an aggregated data for products with an appropriate DDD. It should be noted there is a slight discrepancy between the use of an ATC5 as the market definition and how regulation is imposed on the products. As explained earlier, regulatory measures, such as reference pricing policies, are imposed on the substitution group level. In this paper, we do not attempt to directly study the regulatory environments, but rather the joint effects of observing a merger in a given regulatory environment. Our estimations are not on the product-level, but the market level. We discuss the implications and alternatives of using this market definition in Section 4.3.

Table 1 depicts descriptive statistics on key variables in our sample. There are level

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2. DDDs are defined by the World Health Organization.

differences of some of the outcomes between different markets and we therefore use log transformed outcomes in the analysis. The main outcomes are logarithms of average expenditure, average wholesale price per DDD, sales in DDDs and the product count. Average expenditure is measured by multiplying the price of a given package by its sales quantity in each period and dividing this expression by the total of DDDs sold in the market in the given period. The expenditure thus reflects changes in both prices and quantities sold.

Table 1: Descriptive statistics for main outcomes, averages on ATC5-level

	Finland		Sweden	
	Treated	Control	Treated	Control
Expenditure	5.990	1.243	107.425	7.993
DDD price	7.637	1.392	184.846	10.981
DDD sales	69 218	37 509	80 378	74 281
Package count	23	19	34	29

The average wholesale price per DDD is measured by dividing the package prices by the DDDs in the given package. It is aggregated onto the ATC5-level unweighted. Total sales in DDDs correspond to the packages sold multiplied by the doses in given package. This is aggregated to the ATC5-level. Separately estimating these two measures allows us to further investigate the components of the expenditure measure described above.

The product count is simply the number of package level variants in each active ingredients (ATC5). Although we refer to this measure with availability, it should not be confused with what is actually being offered in each pharmacy. It measures the number of articles on the market, but does not take into account for example pharmacy offering or shortages.<sup>3</sup>

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3. Information on shortages is gathered in Finland and Sweden by the respective authorities. The information is gathered from notifications from firms, and can therefore be patchy.

## 4.2 Merger Events

During our sample period 2009–2017, global pharmaceutical markets experienced a myriad of mergers and acquisitions. Between 2009–2017 the Directorate-General for Competition has screened biotech deals worth of at least 200 billion euros. Estimates of total value for mergers and acquisitions exceed this greatly.

Our data on ownership changes are combined from different data sources. Firstly, we use the listings of the Directorate-General for Competition for large deals exceeding screening thresholds within the EU. The deals included in this list are within the economic activity category of manufacturing of basic pharmaceutical products and pharmaceutical preparations, where the target and/or the acquirer are classified as pharmaceutical firms. The list excludes joint ventures and animal drugs. We also exclude deals between firms manufacturing medical devices, as our analysis is focused on orally dispersible pharmaceuticals.

Secondly, we use the Refinitiv Eikon database. The Nordic markets are home to many national pharmaceutical companies and to make sure we account for mergers that are small in value, but possibly significant in the given markets, we search for any deals below the competition authority screening thresholds both in the Nordic countries and the rest of Europe. The deals in question may be either full acquisitions or mergers, or partial acquisitions. In the partial acquisitions, a firm usually acquires some particular therapeutic business or a particular drug, or increases its stake in the company. These cases represent the minority in our data.

Table 2: Mergers in sample by calendar year

Year	Deals	Total sales in DDDs*	Products in treated markets		Average market share of targets in ATC5**	
			Targets	Rivals	Finland	Sweden
2010	1	14.7	80	313	0.25	0.24
2013	1	0.2	3	3	0.80	0.85
2015	2	5.6	26	81	0.52	0.21
2016	1	2.6	26	85	0.77	0.49
2017	1	2.5	19	42	0.58	0.53
Total	6	25,6	154	542		

\* Measured in millions of DDDs \*\* Measured in sold DDDs in year of deal

Table 2 describes the mergers in the sample. Due to data usage limitations, we are unable to provide the names of the merging entities or products. As seen in the table, total sales measured in DDDs differs between deals and the deals are of different size. This indicates mergers may have heterogeneous effects. The share of target firms' products is relatively similar in all mergers. Average market shares of targets are similar in most deals in Sweden and Finland, making cross-country comparison between country specific results feasible.

### 4.3 Merger Sample

We identify in total 272 mergers and acquisitions from the Directorate-General and Refinitiv Eikon lists. Of these deals, 28 match to our data in the sense that both the acquirer and target are present in the Finnish and Swedish markets at at least some point in time with at least one pharmaceutical product. Low match rate can be explained by the fact that merger lists cover large mergers that occurred at the EU-level, so it possible that not both parties of the merger are not present in Finland and Sweden.

We also need to select the data period so that the underlying market institutions don't

change, because we are interested in understanding how cross-market mergers influence the pharmaceutical market and not on the joint impact of regulation changes and merger shocks. Because of this requirement we can only use years 2009-2017, because in this period there are no major (price) regulation changes. Both countries have imposed heavy regulation on pharmaceuticals, and we have chosen our sample period to be such that there are no major regulatory changes during it (Kortelainen, Markkanen, Siikanen and Toivanen 2023). More information on the changes can be found in Appendix ??.

Our pharmaceuticals sales data does not sufficiently indicate ownership changes, so the list of 28 deals is matched to the sales data described in Section 4.1 based on the firm names. Firms names have been inspected manually to correspond to those in the list of mergers. Of the list of 28 merger deals, we observe 6 that take place both in Finland and Sweden and these are the mergers we use in our analysis since the idea is to compare the effects of mergers across two different countries.

We make the following sample selection restrictions that decrease the number of available mergers i) Merging firms need to operate in both countries before the merger announcement ii) We only consider generic markets iii) Sample is limited to orally dispersible tablets and capsules iv) We exclude over-the-counter drugs v) We exclude hospital sector.

The first sample restriction is made to ensure that both merger parties are present at the studied countries. Secondly, We focus on markets where market exclusivity has ended, because in these market there are room for merger effects to happen given the regulation. Furthermore, we require a competitive period of 18 months prior to the deal date to classify the market as competitive. This is done to avoid effects of generic entry to be combined with possible merger effects. During exclusivity periods products are commonly priced to the price caps and this obviously limits the analysis of merger price effects. Thirdly, we limit analysis to orally dispersible tablest and capsules. This restriction is made, because

quantity can be measured for these products in DDD and this makes quantity measurement easy. Finally, we omit over-the-counter drugs and hospital pharmaceutical market. The reason for these omissions are data issues. For Sweden, we don't have transaction prices for OTC drugs and we don't have transaction prices for hospital sector products in either of the countries.

Our final sample consists of six mergers affecting 76 ATC5 markets in Finland and 38 ATC5 markets in Sweden. The active ingredient ATC5 is used as our market definition. We The treated markets where deals occur account on average for 13–15 percent of all prescription drug sales in Finland and 3–6 percent of all prescription drug sales in Sweden, with the share varying slightly depending on the year.

Table 3: Summary statistics of treated and control ATC5s by calendar time

Year	Average market share per product in ATC5				Average number of products in ATC5			
	Finland		Sweden		Finland		Sweden	
	Treated	Control	Treated	Control	Treated	Control	Treated	Control
2009	.062	.149	.056	.089	24	12	36	19
2010	.062	.156	.051	.083	25	13	39	23
2011	.066	.151	.046	.076	24	13	38	25
2012	.074	.135	.085	.081	22	13	30	24
2013	.072	.138	.062	.076	25	13	32	26
2014	.054	.145	.054	.067	24	12	36	25
2015	.051	.156	.051	.065	23	11	39	29
2016	.064	.172	.066	.066	25	10	33	26
2017	.071	.189	.085	.066	23	10	32	23

Due to data restrictions, we are not able to report the list of deals or their specifics, but the average reported value of deals in our sample is approximately 10.6 billion euros. To highlight the nature of the companies, on average the total sales of targets and acquirers

in all prescription markets account for 30 percent of sales in Finland and 45 percent of sales in Sweden. That is to say, the firms participating in merger activity are often large, multinational companies that can be classified as big pharma. This also gives rise to the fact that the mergers we analyze can be thought of as exogenous. The Nordic markets are small in value compared to many other European markets, still less global markets.

Control groups are sought from within the same ATC3, which corresponds to the therapeutic subgroup. However, controls cannot be within the same pharmacological subgroup ATC4 as the treated markets to ensure there are no spillover effects of the mergers into the control groups. Table 3 describes the treatment and control groups in the sample over calendar time in Finland and Sweden. What we observe is that product-level average market shares as well as product counts within ATC5s stay relatively constant over time in all groups, although the levels differ.

## 5 Empirical Strategy

We estimate the causal effect of cross-market mergers using a differences-in-differences strategy on market-level outcomes. Our main outcomes are average expenditure, average prices, quantity and package count, all in logs. Our empirical strategy exploits the fact that the studied mergers are likely to be exogenous with respect to the Nordic pharmaceutical market. The exogeneity stems from the observation that pharmaceutical demand and demand shocks in the studied markets are not the driving force behind global M&A activity.

In our analyses, we focus on market-level outcomes instead of firm or product outcomes, because we want to impose a plausible SUTVA assumption that matches the regulatory setup in the Nordic pharmaceutical markets. The imposed SUTVA assumption allows strategic firm behavior with respect to studied outcomes within markets (active ingredients), but assumes that there are no spillovers between markets. This is in contrast with the pre-

vious reduced form papers on this topic (e.g, Feng, Hwang, Liu and Maini (2023), Schutz (2023) and Bonaime and Wang (2024)), but this approach allows to study the impact of mergers in a setting that is compatible with basic theories of firm conduct.

We use the DID estimator proposed by Callaway and Sant'Anna (2021) to address potential biases in the traditional two-way fixed effects (TWFE) estimator in a staggered DID design with heterogeneous dynamic treatment effects (Baker, Larcker and Wang 2022). Equation 1 presents the estimation equation for Callaway and Sant'Anna (2021) estimator with covariates:

$$ATT(g, t) = E \left( \left[ \frac{G_g}{E(G_g)} - \frac{\frac{p_{gij}(X_{ijs})C_i}{1-p_{gij}(X_{ijs})}}{E \left( \frac{p_{gij}(X_{ijs})C_i}{1-p_{gij}(X_{ijs})} \right)} \right] (Y_{tij} - Y_{ijs(g-1)}) - m_{gti}(X_{ijs}) \right) \quad (1)$$

where  $t \geq g$  is the time period and  $g$  is the group, defined by the time period when market  $i$  becomes treated.  $G_g$  is the time period when market  $i$  becomes treated and it is equal to  $g$ .  $C_i$  is an indicator variable for whether market  $i$  is in a never-treated control group.  $Y_{it}$  is the outcome market  $i$  in period  $t$ . Variable  $p_{gi}(X_i)$  denotes the propensity score, which is a conditional probability that a market  $i$  is first treated in period  $g$  given market specific control variables  $X_i$ . Term  $m_{gti}(X_i) = E[Y_{ti} - Y_{i(g-1)} | X_i, C_i = 1]$  represents the population outcome regression, which is the estimated conditional expectation of the outcome in the absence of treatment, based on controls  $X_i$ .

Estimation proceeds following: First propensity scores  $p_g(X_i)$  are estimated using logit regressions and outcome regressions ( $m_{gti}$ ) are estimated using linear regressions. Then atts for each  $g, t$  pair can be calculated by inserting predicted probabilities and linear predictions to Equation (1). These atts can then be aggregated to event studies using Equation 2.

The average effect of participating in the treatment for units in group  $g$  is identified by taking the path of outcomes (that is, the change in outcomes between the most recent period before they were affected by the treatment and the current period) actually experienced by that group and adjusting it by the path of outcomes experienced by the control group. Under the maintained parallel trends assumption, discussed in detail in De Chaisemartin and D'Haultfœuille (2023), this latter path is the path of outcomes that units in group  $g$  would have experienced had they not participated in the treatment conditional on control variables  $X_i$ .

Treatment timing is set to the merger announcement date. The actual deal date is not used as the treatment date, because between announcement and deal dates there could be anticipation. Target firm or the rivals can anticipate the merger and that has the potential to introduce bias to results. Our approach is conservative and guarantees that anticipatory behavior has minimal impact on results.

To test parallel trends and study the dynamic effects of entry, we follow Callaway and Sant'Anna (2021) and use the event study aggregate of att at a specific event time that is  $e = t - g$  periods since the market became treated:

$$\theta_{es}(e) = \sum_{g \in \mathcal{G}} \mathbf{1}\{g + e \leq \mathcal{T}\} P(G = g | G + e \leq \mathcal{T}) \widehat{ATT}(g, g + e). \quad (2)$$

We perform three types of analyses. First, we estimate event studies for each outcome. The pre-period is 10 months long and the post period is 18 months long. We interpret systematical statistically significant event study coefficients before the merger as a sign of pre-trends. As a second analysis type, we convert event study results as average treatment effects. Finally we also calculate average treatment effects for the target and rival firms. These analyses help to assess whether the studied cross-market merger responses come from the outcomes of the merged firm or from its competitors. Causal interpretation of

these results relies SUTVA that might not be fully valid, but this helps to highlight whose behaviour is driving the results.

In all analyses standard errors are clustered at the market level. The number of markets is sufficiently large so that there is no need to use wild bootstrapped standard errors.

## 6 Results and discussion

We have three main results. First, we find no short term economically significant adverse effects of the studied mergers on pharmaceutical short term expenditure or prices. Second, we find no adverse effects on the pharmaceutical assortment or on market size. Third, merger effects vary markedly between target firms and rival firms, underscoring the importance of research designs in which control units are not directly exposed to the merger.

We begin by discussing event study results presented in Figures 1 and 2, which reports outcomes by country. After these analyses we discuss the ATTs induced by the mergers and the effects of mergers on markets with Target and Rival firms.

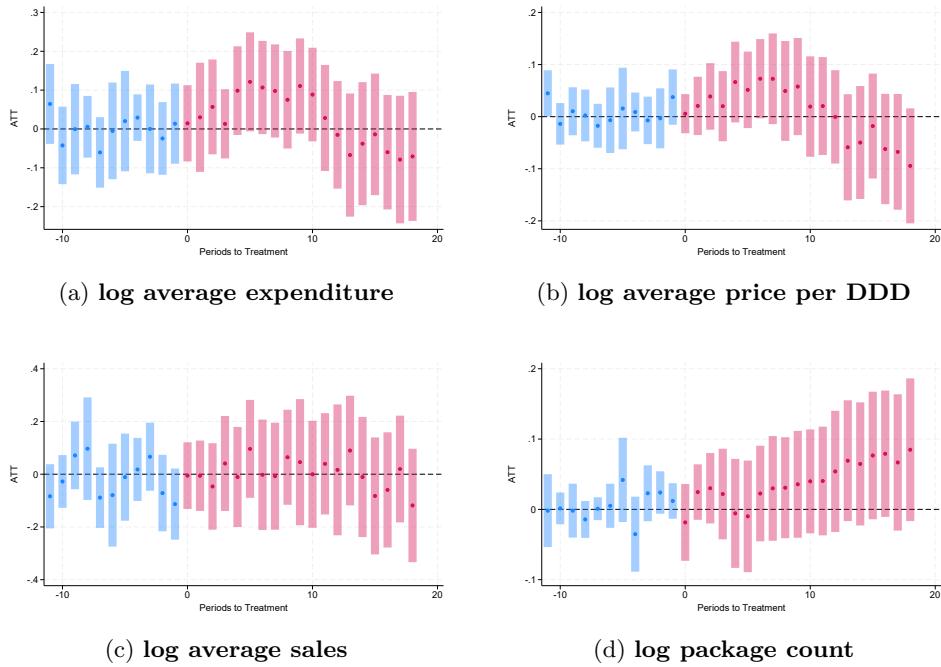


Figure 1: Net aggregated announcement date event ATTs for targets and rivals in Sweden

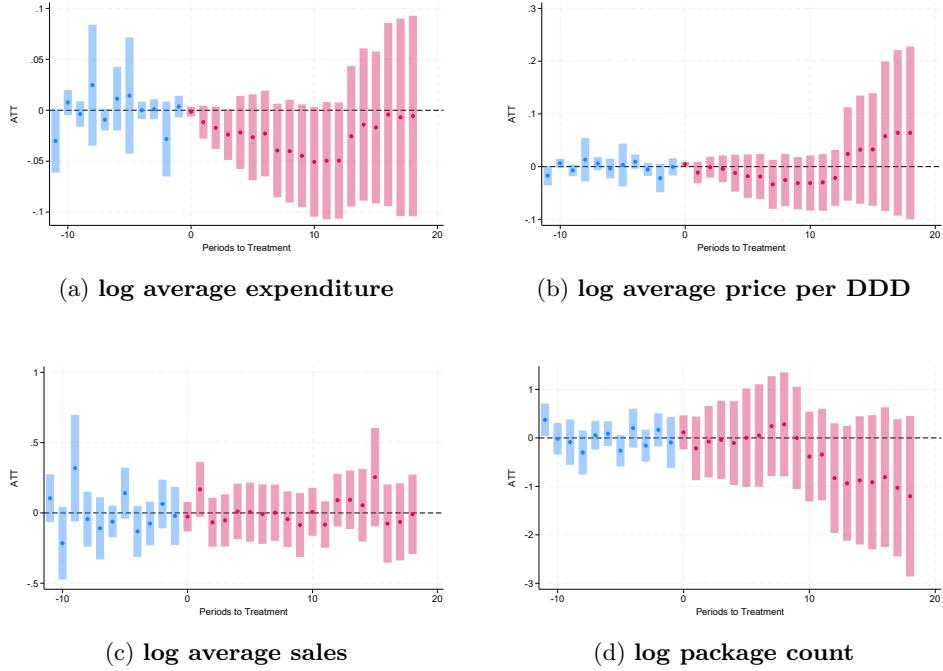


Figure 2: Net aggregated announcement date event ATTs for targets and rivals in Finland

Figures 1 and 2 show how the aggregate outcomes evolve before and after the merger event. We find no systematic evidence of differential pre-trends in either country prior the studied merger events: point estimates hover around zero for most outcomes, and most lead coefficients are statistically insignificant.

The event study results indicate the effects of dynamic treatment on average expenditure, average price per DDD, and package count in both countries. In Finland, average expenditure and the average price per DDD initially decline following the merger but reverse after about 8 periods. In Sweden, the same outcomes fall almost immediately, with effects stabilizing after roughly 10–12 periods. Market size is the only outcome that does not respond dynamically to the mergers in either country. This lack of response is unsurprising, as aggregate market size need not change even when prices and expenditures

adjust.

Table 4: ATTs by announcement date

	Finland			Sweden		
	Net (1)	Target (2)	Rival (3)	Net (4)	Target (5)	Rival (6)
Log expenditure	-.025 (.023)	-.030 (.030)	-.023 (.024)	.027 (.058)	.089 (.093)	.027 (.062)
Log price	.002 (.026)	-.026 (.029)	.012 (.031)	.008 (.039)	.111 (.125)	.007 (.043)
Log DDD sales	.009 (.092)	.029 (.077)	.016 (.091)	.004 (.077)	-.028 (.362)	-.003 (.109)
Package count	-.011 (.032)	.007 (.022)	-.028 (.036)	.038 (.034)	.074 (.037)	.003 (.040)
Obs.	4 768	4 701	4 675	4 478	4 334	4 363

Columns 1 and 4 present our main results in ATT form; columns 2–3 and 5–6 decompose effects for target and rival firms. In Finland, the average effect of mergers on average expenditure is negative and non-significant with small effect size. However, while interpreting our results it is important to acknowledge that our results are based on analysis of market based outcomes instead of firm or product level outcomes usually used in earlier work. Understanding this distinction helps to reconcile the differences between our results and earlier work.

Comparing the net effect with rivals and targets shows that target firms experience also a similar decrease in average expenditure. These expenditure patterns are consistent with changes in both prices and quantities while taking the statistical uncertainty into account.

By contrast, in Sweden, mergers have a positive and statistically non-significant effect on average expenditure through increased prices. Interestingly the expenditure increase seems to be driving by price increases of the Target firms.

It is important to observe that we find no short-term effects of mergers on the product variety in the studied markets. In principle, mergers could have price effects through strategic product portfolio management. The merged firm entity could systematically drop cheap products from the selection and, through this, increase the average prices of its products.

## 7 Conclusion

This paper examines how cross-market mergers shape outcomes in two regulated pharmaceutical markets. Using detailed product-level data from Finland and Sweden and exploiting the effective exogeneity of global M&A activity to the Nordic markets, we estimate the causal effects of these mergers on expenditure, prices, market size, and product variety. Despite the theoretical possibility of upward pricing pressure and portfolio-driven adjustments, our results point to limited short-run consequences for consumers or payers. Across both countries, we find no economically meaningful increases in average expenditure or prices and no evidence that mergers reduce product assortment or shrink markets.

The comparison between Finland and Sweden also highlights the importance of regulatory design. Although the two systems impose similar forms of price regulation, their institutional differences do not translate into markedly different merger effects. This suggests that the price caps and reimbursement rules in both countries may be sufficiently constraining to dampen potential anti-competitive pricing responses, even when merging firms share therapeutic portfolios rather than direct substitutes. At the same time, our findings that target and rival firms adjust differently underscore the value of empirical

strategies that allow for heterogeneous effects and avoid contamination of control units.

More broadly, the results inform ongoing policy debates about how to evaluate mergers in pharmaceutical markets where direct overlaps are limited but firms may nonetheless serve common patients. Cross-market consolidation is prevalent in the industry, yet its implications are often assessed using tools suited to narrow horizontal mergers. Our evidence suggests that, at least in tightly regulated environments, these mergers may not systematically harm short-term market outcomes. Still, the possibility of anticipatory behavior and the longer-run strategic consequences of portfolio reconfiguration remain important areas for further research. Future work could study how mergers interact with innovation incentives, entry dynamics, and regulatory reforms that alter how binding price caps are over time.

Overall, the findings provide novel empirical evidence on how regulation and market structure jointly shape the effects of corporate consolidation. They underscore that merger assessments in pharmaceuticals must take the institutional context seriously and that the consequences of cross-market mergers cannot be inferred solely from models developed for unregulated settings.

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## A Appendix

### A.1 Regulatory changes

#### A.1.1 Finland

#### A.1.2 Sweden

### A.1 Additional results

#### A.1.1 Deal date as event

Table 5: ATTs by deal date

	Finland			Sweden		
	Net (1)	Target (2)	Rival (3)	Net (4)	Target (5)	Rival (6)
Log expenditure	-.007 (.028)	-.101 (.061)	.006 (.032)	-.120 (.031)	-.253 (.070)	-.107 (.035)
Log price	.023 (.044)	-.089 (.061)	.039 (.056)	-.099 (.024)	-.350 (.114)	-.063 (.029)
Log DDD sales	.011 (0.069)	.180 (.109)	-.024 (.085)	.020 (.058)	-.110 (.418)	.060 (.112)
Log package count	-.011 (.040)	.076 (.049)	-.034 (.049)	.040 (.022)	.109 (.039)	.019 (.031)
Obs.	5 142	5 108	5 049	4 423	4 399	4 345

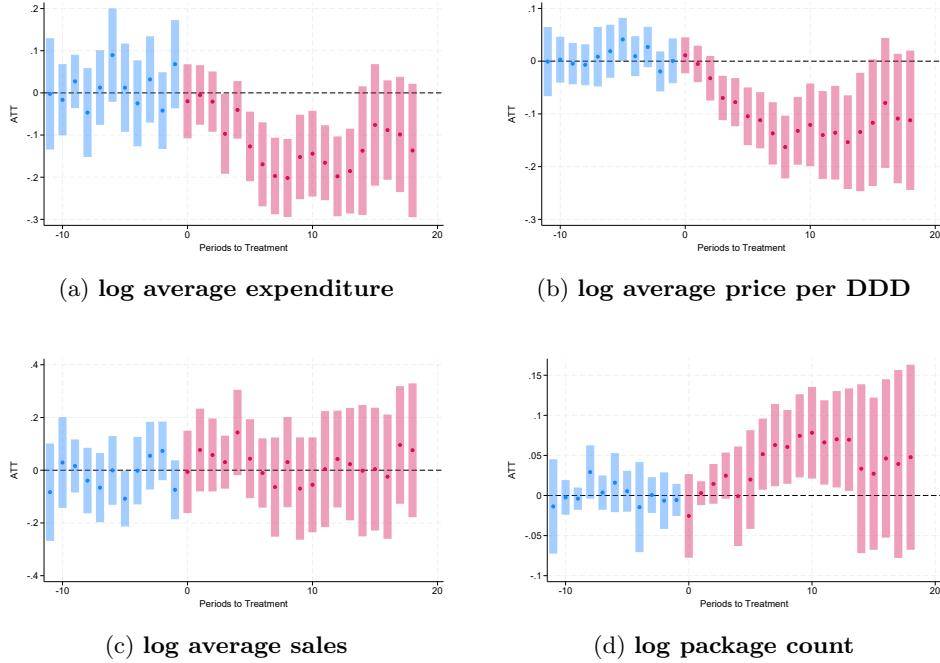


Figure 3: Net aggregated event ATTs for targets and rivals in Sweden

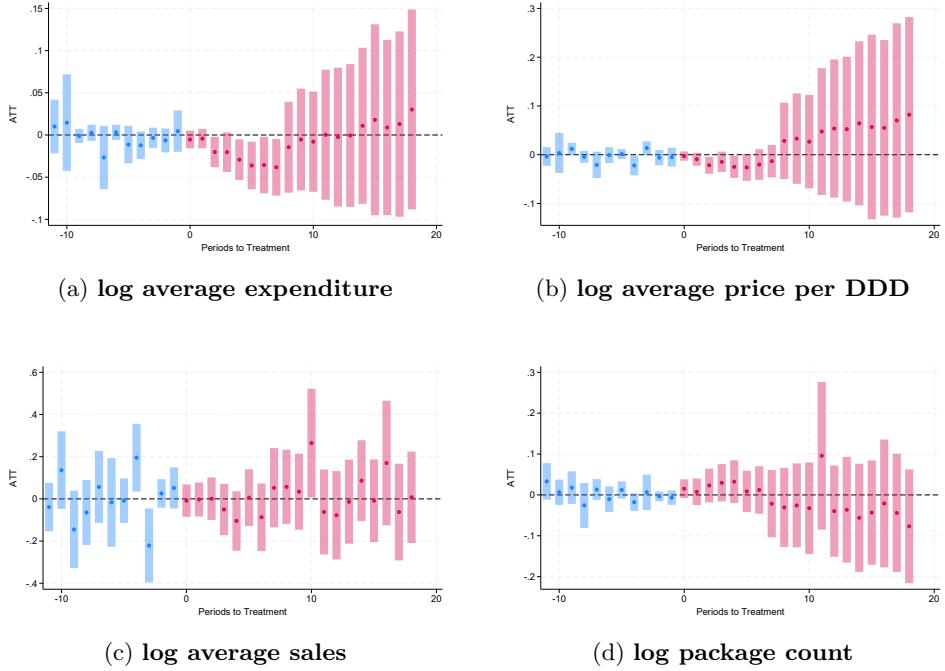


Figure 4: Net aggregated event ATTs for targets and rivals in Finland