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The Economics of the Public Option: Evidence from Local Pharmaceutical Markets[†]

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We study the effects of competition by state-owned firms, leveraging the decentralized entry of public pharmacies to local markets in Chile. Public pharmacies sell the same drugs at a third of private pharmacy prices, because of stronger upstream bargaining and market power in the private sector, but are of lower quality. Public pharmacies induced market segmentation and price increases in the private sector, which benefited the switchers to the public option but harmed the stayers. The countrywide entry of public pharmacies would reduce yearly consumer drug expenditure by 1.6 percent. (*JEL* D22, I18, L32, L65, O14)

State-owned firms compete with the private sector in education, health care, insurance, and basic services, among others. Supporters of the public option argue that it helps discipline markets that fail to provide enough incentives for private competition because of either information asymmetries, market power, collusive behavior, or other market failures (Atkinson and Stiglitz 1980). In contrast, critics argue that state-owned firms might be inefficient, provide low quality, or be captured by political interests (Shleifer and Vishny 1994; Shleifer 1998). Estimating the equilibrium effects of the public option has been difficult due to the lack of exogenous variation in the extent of public competition and the scarcity of contexts that allow evaluation of its distributional and political consequences.

In this paper, we study the decentralized and large-scale entry of public retail pharmacies in Chile, where pharmacies managed by local governments entered 146 of the 344 counties between 2015 and 2018. Public pharmacies emerged as nonprofit competition to a fully deregulated and highly concentrated private retail

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market characterized by high prices.[1] Public pharmacies sell drugs at prices that are on average 34 percent of those charged by their private counterparts. These low prices are possible because private pharmacies hold substantial market power and public pharmacies have a cost advantage. However, public pharmacies are of lower quality than their private counterparts: they require consumers to travel more than two times more, carry less product variety, and have more restrictive operating hours and longer waiting times.

To estimate the impacts of public pharmacies, we combine quasi-experimental approaches with a field experiment to study market outcomes and political preferences. The quasi-experiment exploits the staggered entry of public pharmacies across counties. To support the validity of this design, we show that the timing of entry was unrelated to baseline differences or pre-trends in local market attributes. Moreover, anecdotal evidence suggests that the timing of entry of public pharmacies depended partly on unexpected delays in the bureaucratic procedure for obtaining sanitary permits. The field experiment consisted of an informational intervention with consumers, which we conducted during the weeks preceding the 2016 local election in counties with public pharmacies. The treatment covered the existence, location, low prices, and low convenience of public pharmacies. We surveyed consumers before the intervention and two months after, collecting data about drug shopping behavior and political participation.

We begin by estimating how the entry of public pharmacies impacted private sector market outcomes. We exploit the staggered entry of public pharmacies and drug-level data to estimate their impact on private pharmacy prices and sales. Eighteen months after opening, the average public pharmacy had shifted 4 percent of sales away from private pharmacies. The decrease in sales was concentrated among drugs that target chronic conditions. We also find a *positive* and growing effect of public pharmacies on private sector prices: by the end of our sample period, the entry of public pharmacies had induced private pharmacies to increase their prices by 1 percent. We interpret this positive price effect as evidence that this low-price and low-quality public option generated market segmentation. In particular, private pharmacies responded to a shift of relatively price-sensitive consumers toward public pharmacies—and thus a less elastic residual demand—by increasing prices. This result is consistent with theoretical research on the potential for price-increasing competition (Chen and Riordan 2008). A simple model of competition with differentiated firms rationalizes the lack of a stronger demand shift to public pharmacies, despite their low relative prices, as a result of their low relative quality. These results show that public pharmacies generated winners and losers as a consequence of their equilibrium effects.

The reduction in consumer drug expenditure generated by public pharmacies compensates for their costs. We develop a simple accounting framework to implement this comparison. First, we estimate the cost of public pharmacies using detailed data on municipal finances. We find that public pharmacies increase net municipal spending on health services by 4.9 percent and health services revenue by 3.5 percent. Our estimates do not allow us to rule out that this small financial burden came at the cost of forgone increases in net spending on other services. Second, we

[1] Chile has relatively high drug prices and high out-of-pocket spending as a share of health expenditures compared with other OECD countries (OECD 2015).

quantify the benefits public pharmacies provide to consumers. Combining our estimates of economic effects with summary statistics on drug expenditures and prices, we find that introducing public pharmacies in every county would reduce yearly drug expenditure by 1.6 percent or US$61.5 million, which is 8.6 percent higher than the cost of the policy.[2] Equilibrium price responses by private pharmacies are quantitatively relevant, and omitting them would lead to overestimating the reduction in expenditure by 64 percent.

Budget constraints and electoral incentives are crucial drivers of policy decisions (Besley and Case 1995; Lizzeri and Persico 2001; List and Sturm 2006). Although we document that public pharmacies are relatively low cost and descriptive patterns suggest that mayors expected political returns, their small negative impact on a large number of people suggests that this policy might not be politically profitable. Using our field experiment, we provide suggestive evidence showing that the entry of public pharmacies increased political support for incumbent mayors. In particular, we show that awareness of the availability and attributes of a public pharmacy increased the likelihood of supporting the mayor by 6 percentage points in the local election, although point estimates are only marginally significant at conventional levels. We combine these results with our estimates of economic effects, and we cannot rule out that public pharmacies have a political return that is similar to that of cash transfers (Manacorda, Miguel, and Vigorito 2011).

Overall, we show that public pharmacies created winners and losers: consumers who switched to public pharmacies benefited from lower prices, and those who did not, lost from higher prices. The public option did not become a financial burden because of its higher bargaining power in the input market and because private firms hold substantial market power in the wholesale and retail markets. Our paper highlights that state-owned firms could be particularly effective in other contexts in which these two conditions are also met. By doing so, we inform the long-standing question of state versus private ownership of firms and the desirability of introducing a public option into otherwise private markets. Access to a public option exists in a variety of settings, including trash collection, mail delivery, housing finance, and Internet service providers in the United States, and historically in retail gasoline stations in Canada (Petro Canada). Recent calls for the introduction of a public option in the US include noncommercial banking, mortgages, and most notably, health care.[3]

Most previous empirical work has studied public competition in the context of large programs in education (Epple and Romano 1998; Hoxby 2000; Dinerstein and Smith 2021; Dinerstein, Neilson, and Otero 2022) and health insurance (Duggan and Scott Morton 2006; Curto et al. 2019; Saltzman 2023). Recent work has focused on the role of state-owned firms in local markets, either directly managed by the central government, as in the case of milk stores in Mexico (Jiménez-Hernández and Seira 2022) and branches of government-owned banks in Brazil (Fonseca and Matray 2022), or outsourced to the private sector, in the Dominican Republic and

[2] In addition to its economic effects, increased access to drugs could improve prescription adherence and thus health outcomes. Using data on avoidable hospitalizations and deaths, we find no evidence of such effects. This null result justifies our focus on reduced drug expenditure as a measure of benefits from public pharmacies.

[3] See, e.g., "Why America needs a public option for mortgages" by Jeff Spross (Spross 2017) or "There Should Be a Public Option for Everything" by Ganesh Sitaraman and Anne L. Alstott (Sitaraman and Alstott 2019).

Indonesia (Busso and Galiani 2019; Banerjee et al. 2019). Relatedly, Handbury and Moshary (2021) study the price responses of grocery stores following the expansion of the national school program in the United States. This work mostly finds that prices decrease upon increasing public competition. Our paper contributes to this literature by studying the effects of the entry of locally managed state-owned firms into local pharmaceutical markets and by showing that public competition can potentially induce market segmentation and lead to an increase in prices by private firms.

This paper also contributes to a literature that studies how store entry affects local market outcomes (Basker 2007; Hausman 2007; Jia 2008; Matsa 2011; Atkin, Faber, and Gonzalez-Navarro 2018; Arcidiacono et al. 2020; Bergquist and Dinerstein 2020). The extent to which entry can generate segmentation in differentiated product oligopoly markets has been studied theoretically by Chen and Riordan (2008). Empirically, Frank and Salkever (1997) and Ward et al. (2002) provide evidence for price increases by incumbent products upon the entry of generic drugs and private-label consumer packaged goods. We contribute to this literature by studying the consequences of entry by low-price and low-quality firms and providing evidence of market segmentation.

Our analysis of political support for incumbent mayors who opened public pharmacies is related to a large literature that studies whether and how information about politicians and policies can shape political preferences. Previous research has studied the impact of information on the candidates in an election, incumbent policies, and the prevalence of corruption (Ferraz and Finan 2008; Gerber et al. 2011; Chong et al. 2015; Kendall, Nannicini, and Trebbi 2015; Dias and Ferraz 2019). Our experimental analysis differs from previous work by providing information on a specific policy directly to the people most likely to be affected by it and only a few weeks before the election.[4] More generally, we contribute to the literature by providing novel evidence of political returns to the introduction of state-owned firms in local markets.

Finally, this paper contributes to the literature that analyzes policies that aim to increase access to pharmaceuticals. Although access to affordable drugs is a first-order policy concern in low- and middle-income countries, which policies regulators should implement to achieve this goal is up for debate (UN 2010; Pinto et al. 2018). Recent work examines the effects of increased competition in the retail market. Moura and Barros (2020) study the price effects of competition in the market for over-the-counter drugs, while Bennett and Yin (2019) study the price and quality effects of the entry of pharmacy chains in a market dominated by low-quality firms. Other research focuses on the effects of policies to lower drug prices, including price regulation (Dubois and Lasio 2018; Dubois, Gandhi, and Vasserman 2022; Mohapatra and Chatterjee 2020; Maini and Pammolli 2023), quality regulation (Atal, Cuesta, and Sæthre 2022), and public procurement (Brugués 2020; Dubois, Lefouilli, and Straub 2021). We provide novel evidence of how public competition in the retail market affects equilibrium market outcomes.

[4] The focus on health relates our paper to recent work on the effects of the Medicaid Expansion on voter registration and turnout (Haselswerdt 2017; Clinton and Sances 2018; Baicker and Finkelstein 2019).

I. The Public Option in Retail Pharmaceutical Markets

Before the introduction of public pharmacies in Chile, consumers could obtain pharmaceutical drugs by buying from private pharmacies or from public health care providers. According to the 2016–2017 National Health Survey (ENS 2017), almost 40 percent of pharmaceuticals were purchased in the private retail sector, in which there is limited insurance coverage; pharmaceuticals are the most important item of out-of-pocket health expenditures in the country (OECD 2015; Benítez, Hernando, and Velasco 2018).[5] The private sector is highly deregulated, as there are no market structure regulations or price controls. The three largest chains account for around 80 percent of the market share (FNE 2019), and stores are geographically clustered in relatively rich areas (MINECON 2013). Average profit margins in the retail sector reached 40 percent during our period of study (FNE 2019). The wholesale market is also highly concentrated. According to data from the Economic National Prosecutor (*Fiscalía Nacional Económica*, FNE), 72 percent of off-patent medical products—defined as a unique combination of an active ingredient and a dosage—are produced by only one manufacturer, and 99 percent of those markets have an HHI above 2,500. Moreover, profit margins for manufacturers of off-patent products were 52 percent on average (FNE 2019).[6]

The rise of public pharmacies was preceded by a collusion scandal in the pharmaceutical industry in 2008 that involved the three largest pharmacy chains in the country (Alé-Chilet 2018). In a high-profile antitrust case, the pharmacy chains were found guilty. A left-wing mayor of a large county responded to public demands and opened the first public pharmacy in October 2015. Soon after, the popularity of the mayor boomed, and dozens of other mayors from all political parties decided to open public pharmacies in the following months. By the end of 2018, 146 out of the 344 counties in the country were operating a public pharmacy. Figure 1 plots the number of counties with a public pharmacy over time, and online Appendix Figure A.1 displays photos of a private and a public pharmacy.

Public pharmacies offer lower prices because they operate as nonprofit firms by law and have a cost advantage. The latter comes to a large extent from their ability to use a public intermediary that aggregates demand from public providers—most importantly, public hospitals and primary care centers—to negotiate lower prices with manufacturers. As we discuss in detail in Section IIA, around two-thirds of public pharmacies purchase most of their drug supplies through the public intermediary (as opposed to directly from manufacturers). The beneficiaries of public pharmacies are determined by a combination of eligibility requirements, health conditions, and location. Most public pharmacies require that consumers reside in the county, which is determined through a simple enrollment process that entails showing proof of residence. Also, most public pharmacies offer prescription drugs with a focus on drugs that target chronic conditions. Hence, individuals with chronic conditions are more likely to benefit. Finally, public pharmacies enter the market

[5] There is no broad prescription drug insurance market in Chile. Instead, there are a few disjoint programs that mostly cover drugs in the public network or for a limited set of diseases.

[6] Using a broader definition of a market that includes different dosages of the same active ingredient (ATC5), the share of single-firm markets is 54 percent. Still, 89 percent of markets have an HHI above 2,500 under that market definition.

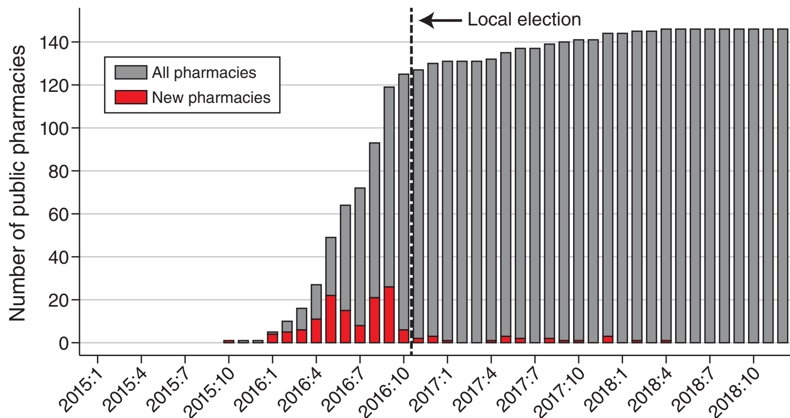

Figure 1. Timing of Entry of Public Pharmacies

Notes: This figure shows the opening dates of public pharmacies (red bars) and the total number of public pharmacies operating (gray bars) in each month between January 2015 and December 2018. The y-axis indicates the total number of public pharmacies opened or the total number of public pharmacies operating each month during this period. The first public pharmacy opened in October 2015. The vertical dashed line in October 2016 indicates the month of the 2016 local election in which most mayors who opened public pharmacies ran for reelection.

with a single location per county, whereas there are multiple private pharmacies in each market; this implies that for most consumers, travel costs to public pharmacies are higher than to private pharmacies.

The increasing popularity of public pharmacies has been accompanied by economic and political controversies. On the economic side, there are two main criticisms. First, public pharmacies may be financially unsustainable and could become a burden for local governments. Second, public pharmacies could be a form of unfair competition, particularly with respect to nonchain private pharmacies—which accounted for around 20 percent of the market, had limited buying power, and were not involved in the collusion scandal. These criticisms motivate part of our analysis, particularly the impact of public pharmacies on private sector outcomes and municipal finances.

II. Research Design

A. *Data*

We collected the opening dates and locations of public pharmacies. Openings span the period between October 2015 and April 2018. Figure 1 shows the number of openings per month and the evolution of the total number of public pharmacies operating over time. Their opening before the local election on October 23, 2016—in which most incumbent mayors were running for reelection—seemed far from a coincidence for many. The abrupt increase in openings during the months before the election is hard to explain without resorting to a political argument.

Regarding the supply of drugs by public pharmacies, we exploit detailed data on drug purchases for the 96 pharmacies that have used the public intermediary

(CENABAST 2017–2019). These data include the name, molecule, dosage, amount, and price of every drug transaction by public pharmacies in 2016–2018. These data provide information on wholesale (as opposed to retail) prices, but public pharmacies charge low or no markups. While these data cover purchases through the public intermediary in detail, we have only limited data on direct purchases by public pharmacies from manufacturers. Therefore, we are unable to measure aggregate sales by public pharmacies, and hence, we cannot estimate the impact of their entry on aggregate sales in the market. Our limited data on direct purchases to manufacturers suggest that public pharmacies that deal with the public intermediary purchase most of their drugs through that channel.[7] Hence, we consider that the data from the public intermediary provides a fairly accurate characterization of public pharmacies. Therefore, we use these data in Section IIIA to describe how prices, quantities, and variety in public pharmacies compare with those in private pharmacies.

To measure outcomes for private pharmacies, we use data from IQVIA, a company that collects pharmaceutical market information worldwide (IQVIA 2014–2018). These data contain monthly local drug prices and sales for 2014–2018 collected from two sources. The four largest pharmacy chains, which account for more than 90 percent of market share, report retail prices and sales directly to IQVIA. Data for other pharmacies are collected from wholesalers.[8] IQVIA aggregates the data at the level of 66 local markets, which cover most of the country.[9] We restrict our attention to prescription drugs, which account for 93 percent of the drugs among the molecules we include in the analysis.

B. *The Entry of Public Pharmacies*

In this section, we describe entry patterns of public pharmacies and discuss how they can be exploited to study their effects. We begin with a characterization of the counties that opened a public pharmacy. We then study the timing of the entry of public pharmacies and their location within the counties in which they opened. Our results show that counties that open public pharmacies differ systematically from those that do not, but the timing of opening among those that open does not seem to be driven by observable county characteristics.

We start by comparing counties with and without public pharmacies. Columns 1–4 in Table 1 show these results. Panels A and B show that public pharmacies opened in dense high-income counties with more penetration of private health insurance; slightly better self-reported health; and a private pharmaceutical market with more pharmacies, more sales, and higher prices. In contrast, panel C shows

[7] With the goal of measuring the relative relevance of the public intermediary as a supplier of public pharmacies, we collected additional data on public pharmacy direct purchases to manufacturers through data requests. Using data from a sample of 14 counties for which we obtained such information, we estimate that the public intermediary accounts for around 70 percent of total purchases by public pharmacies and is hence their main supplier. This finding motivates using the detailed data from the public intermediary in order to describe the attributes of public pharmacies.

[8] We adjust these prices for inflation using the health CPI from the National Institute of Statistics and compute prices per gram of the active ingredient to normalize them across presentations.

[9] Moreover, the data provide price and sales information at the product level for branded drugs, which identifies the laboratory, dosage, and presentation of each drug. However, for unbranded drugs, it only provides price and sales information at the dosage and the presentation level, aggregated across laboratories. This is irrelevant for our analysis since we focus on price indexes and aggregate sales at the molecule level.

Table 1—Descriptive Statistics in Counties with and without Public Pharmacies

	County has public pharmacy		Difference (1) − (2)		Timing of entry	
	Yes (1)	No (2)	Diff. (3)	SE (4)	Estimate (5)	SE (6)
Panel A. Pharmacies and hospitals						
Private pharmacies per 100,000 inhabitants	13.59	7.72	5.87	1.19	−0.001	0.023
Log sales in private pharmacies	15.37	15.15	0.21	0.09	−0.446	0.307
Price index in private pharmacies	931	873	59	23	0.001	0.001
Hospitalizations per 100,000 inhabitants	9,381	8,199	1,182	325	0.000	0.000
Deaths per 100,000 inhabitants	210	186	24	10	−0.004	0.003
Panel B. Socioeconomic characteristics						
Log household income	12.97	12.61	0.36	0.06	−0.601	0.623
Age of inhabitants	44.50	45.67	−1.18	0.23	0.084	0.122
Average unemployment rate	0.10	0.09	0.02	0.00	8.384	4.312
Share with public health insurance	0.83	0.89	−0.06	0.01	1.149	2.399
Self-reported health (1–7)	5.54	5.49	0.05	0.03	0.939	1.041
Number of doctor visits	0.32	0.30	0.02	0.01	0.531	1.557
Population (in 10,000)	9.65	1.88	7.77	0.77	−0.050	0.021
Panel C. Political characteristics						
Number of competitors	3.57	3.20	0.37	0.13	0.186	0.186
Winning margin	0.19	0.17	0.02	0.02	−5.405	2.469
Vote share winner	0.54	0.53	0.01	0.01	6.972	3.929
Incumbent coalition wins	0.62	0.57	0.05	0.05	0.681	0.358
Incumbent coalition: Independent	0.32	0.34	−0.03	0.05	−0.667	0.477
Incumbent coalition: Left-wing	0.47	0.36	0.10	0.05	−0.825	0.429
Incumbent coalition: Right-wing	0.22	0.29	−0.07	0.05	–	–
Number of counties	146	198	344		146	

Notes: This table presents descriptive statistics for counties with and without a public pharmacy in 2018 in columns 1 and 2, respectively. Characteristics in panel A are own construction using data from the Public Health Institute (DEIS 2017) and IQVIA (2014). Socioeconomic characteristics in panel B are own construction using data from the survey National Socioeconomic Characterization (CASEN 2015) conducted in 2015, with the exception of "Population" data, which are publicly available on the website of the National Statistics Bureau (INE 2014). Political characteristics in panel C are own construction using data from the Electoral Service (SERVEL 2017). Column 3 reports the difference between columns 1 and 2, and column 4 the standard error of the difference. Column 5 uses the cross-section of 146 counties with public pharmacies and reports coefficients from an ordered logit using the order in which public pharmacies opened as the dependent variable—the first pharmacy has a value of 1, and the last the value of 146—and all market and political characteristics as explanatory variables, with column 6 reporting the standard error of the coefficient in column 5.

few differences in political variables, as measured by the previous local election of 2012.[10] If anything, counties with a public pharmacy had more candidates and were more likely to have a winner from the left wing. In sum, counties with and without public pharmacies differed significantly in terms of their pharmaceutical market and socioeconomic characteristics but were relatively more similar in their political characteristics.

To examine entry timing systematically, we ranked all public pharmacies by their entry date and estimated an ordered logit model of this ranking on all variables in Table 1. Column 5 in the table presents the results. Pharmacies that opened earlier

[10] In Chile, all mayors are elected simultaneously by a simple majority rule in elections held every four years and without term limits until 2020. To measure local political outcomes, we use county-level information about candidates, parties, coalitions, and votes for each candidate in the 2012 and 2016 local elections from the Electoral Service (SERVEL 2017). The 2012 election allows us to characterize the political equilibrium before the opening of public pharmacies.

entered counties with more population and were more likely to have left-wing mayors, but entry timing is otherwise uncorrelated with the characteristics of the pharmaceutical market, socioeconomic attributes, or electoral competition in the previous election. Instead, anecdotal evidence suggests that unexpected delays in sanitary permits explain why some pharmacies opened after the election. We rely on these results to exploit the timing of entry as exogenous variation.

Finally, we document that mayors opened public pharmacies near existing private pharmacies, which provides a unique opportunity to study the impact of the public option in an existing market. To describe their location choices, we geocoded all private pharmacies in the country and assigned them to geographic cells of 600×600 meters using data from Redfarma (2017). We then estimated cross-sectional cell-level regressions using data from counties with a public pharmacy. The dependent variable is an indicator for a cell that has a public pharmacy, and explanatory variables include the number of private pharmacies, the number of schools as a proxy for population, and county-level fixed effects. Online Appendix Table A.1 displays the results. Estimates reveal that public pharmacies opened in populated areas where private pharmacies were already operating. The maps in Figure 2 provide visual examples of the entry decision in six counties spread across the country.

III. The Economic Effects of Public Pharmacies

A. *Evidence on Prices and Quality of Public Pharmacies*

When public pharmacies opened, consumers gained access to a new alternative in their choice set, which differed from available options along several dimensions. We describe the basic attributes of public pharmacies by using transaction-level data on all purchases by public pharmacies from the public intermediary in 2016–2018. The public intermediary was the main supplier of drugs for the 96 counties that sourced through it, as discussed in Section IIA.

The most salient and advertised difference was related to drug prices. Using a set of exactly matched drugs that are sold in both public and private pharmacies, we study price differences across public and private pharmacies. Figure 3, panel A shows that almost all drugs are sold at lower prices in the former and that the relative price difference is, on average, between 64 and 68 percent depending on the margin public pharmacies charge over purchase costs from the public intermediary. These large price differences suggest that consumers should, in principle, switch to public pharmacies in the local markets in which they open.

Two leading reasons for these price differences are public pharmacies' higher bargaining power in the input market—coupled with a concentrated input market—and the substantial market power of private retailers downstream, both of which we discussed in Section I. In online Appendix A, we formalize these arguments by developing a model of the vertical chain that captures the main features of our setting—namely, that (i) producers and retailers are able to exercise market power, (ii) state-owned firms differ from private firms by having greater bargaining power upstream, and (iii) state-owned firms do not maximize profits but rather total surplus. We show that under mild assumptions regarding the demand

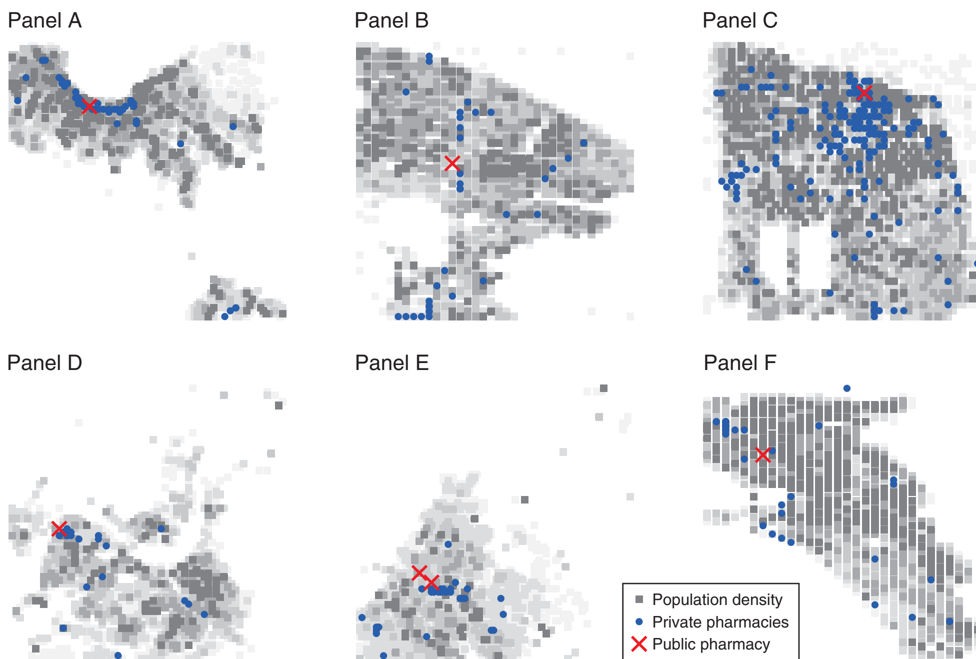

Figure 2. Locations of Public Pharmacies in Local Markets

Notes: Each map represents a local market defined as a county. The maps display the exact locations of private pharmacies (blue dots), public pharmacies (red cross), and population density in cells of 111 × 111 meters (gray scale). White cells correspond to unpopulated (e.g., parks) or commercial areas. We categorize population density in the following 5 bins: $[0,10)$, $[10,50)$, $[50,100)$, $[100,150)$, and more than 150 individuals. We use the home addresses of all individuals in the country as revealed by the official Electoral Registry (SERVEL 2017). The maps correspond to counties in the north, center, and south of the country: panel A: Valparaiso, panel B: Recoleta, panel C: Santiago, panel D: Valdivia, panel E: Talca, and panel F: Iquique.

curve, downstream prices are lower when retailers have more bargaining power upstream and when retailers place a higher weight on consumer welfare relative to profits.

Consumers trade off lower prices with the lower quality of public pharmacies. The fact that public pharmacies enter with a single store in each county implies that most consumers have multiple private pharmacies closer to their homes. Using data on voter home addresses from the Electoral Registry and the locations of public and private pharmacies, we calculate distances between households and every pharmacy in the county. The average (median) individual has 20 (12) private pharmacies located closer than the public pharmacy in their county. Figure 3, panel B shows that the distributions of distance to the closest private pharmacy and public pharmacy differ markedly: the average distance to the closest private pharmacy is 1.1 kilometers—less than one-half of that to the public pharmacy. These facts imply that shopping at public pharmacies entails higher travel costs than shopping at private pharmacies. Moreover, public pharmacies offer less product variety. Figure 3, panel C shows that the average number of products per molecule-county is 2.2 and that 70 percent of molecule-counties offer 3 varieties or fewer, while the average number of varieties in private pharmacies

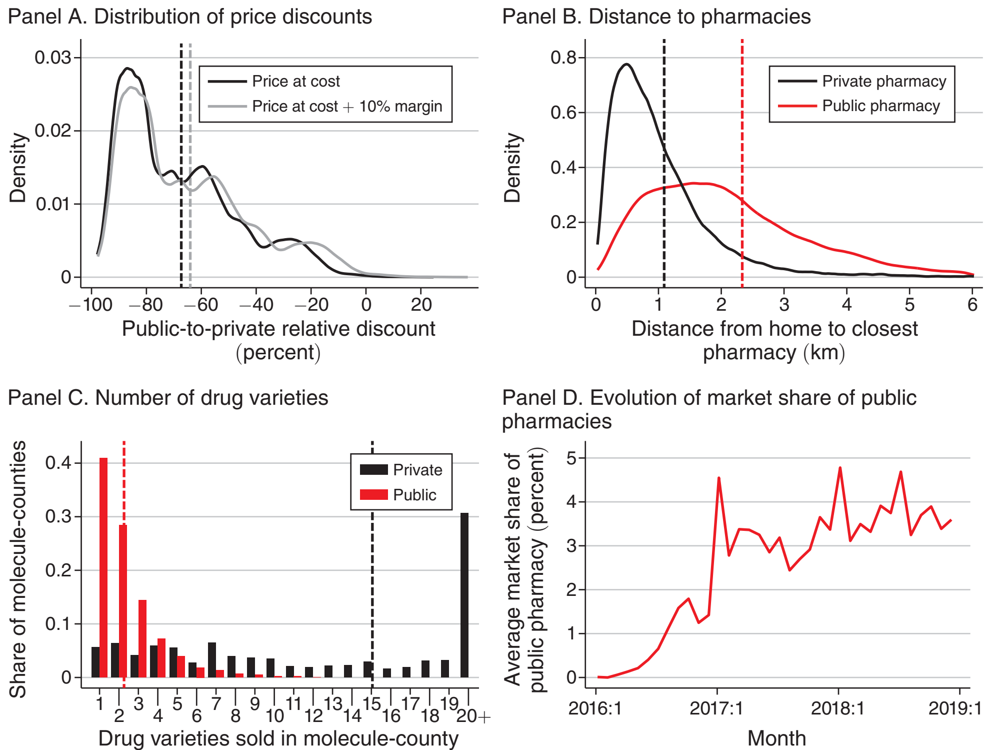

FIGURE 3. RELATIVE PRICES AND ATTRIBUTES BETWEEN PRIVATE AND PUBLIC PHARMACIES

Notes: Panel A displays the distribution of proportional discounts of drugs at public pharmacies relative to private pharmacies. The plot is computed using a matched sample of the exact same drug observed in both the CENABAST (public pharmacies) and IQVIA (private pharmacies) datasets for a given county and month during 2017–2018. Because the CENABAST data only provide the cost to public pharmacies, we compute price discounts for public pharmacies pricing at cost (black) and at a margin of 10 percent over cost (gray). The dashed vertical lines indicate the mean price discount for each scenario. Panel B shows the density of distance from people's homes to the closest private pharmacy (black) and to the public pharmacy (red) in counties with a public pharmacy. The dashed vertical lines indicate the respective means of both distributions. Panel C describes the number of drug presentations of a given molecule sold in a county over 2017–2018 for private (black) and public (red) pharmacies, whenever both private and public pharmacies sell at least one drug of the molecule. Panel D displays the average market share of public pharmacies across molecules and counties in each month during 2016–2018.

is 15.2.[11] To the extent that consumers value product variety, these patterns imply that public pharmacies are less convenient than private pharmacies. The longer waiting times and limited opening hours already described in Section I further exacerbate the relatively low quality of public pharmacies.

The relevance of public pharmacies has grown over time, which demonstrates that at least some consumers value lower drug prices relative to lower convenience enough to switch to public pharmacies. Figure 3, panel D shows that their average market share across molecules and counties reached around 4 percent by the end of 2018. Of course, it is unclear whether sales by public pharmacies have decreased

[11] Relatedly, public pharmacies are more likely to offer only generic drugs or only branded drugs within a molecule: this is the case for 72 percent of molecule-counties at public pharmacies but for only 36 percent at private pharmacies.

sales by private pharmacies or simply expanded market size. To inform this margin, we estimate the effects of public pharmacies on private pharmacy sales.

B. *Equilibrium Effects on Prices and Sales by Private Pharmacies*

Public pharmacies may induce consumers to substitute away from private pharmacies.[12] Moreover, the competitive pressure from public pharmacies may induce private pharmacies to adjust prices. In this section, we estimate the effects of the entry of public pharmacies on prices and sales by private pharmacies.

Theoretically, the effects of entry on incumbent firm prices are ambiguous. Chen and Riordan (2008) study the conditions under which entry leads to increases or decreases in prices. Their analysis shows that these effects depend on the magnitudes of two effects of entry on the incumbent's pricing incentives. First, entry has a *market share effect*, which depends on the extent to which the incumbent loses demand upon entry due to substitution. The more demand the entrant takes away from the incumbent, the stronger the incentives for the incumbent to decrease prices in response to entry. Second, entry has a *price sensitivity effect*, which depends on how the slope of the incumbent's residual demand curve changes after entry. The steeper the demand curve after entry relative to before entry, the lower the extent of substitution away from the incumbent upon entry, and therefore, the stronger its incentive to increase prices upon entry. Overall, the incumbent's price will increase whenever the price sensitivity effect dominates the market share effect and vice versa. Which effect dominates depends on the distribution of consumer preferences and on the attributes of the firms. To further develop intuition for the conditions under which private pharmacy prices may decrease or increase upon the entry of public pharmacies, we develop a model based on Chen and Riordan (2008) in online Appendix C. We then implement illustrative simulations that we employ to discuss our results.

Event Study Evidence: We start by exploiting the staggered entry of public pharmacies in an event study framework. For this analysis, we use IQVIA data on drug prices and sales across local markets. A challenge in combining data on the entry of public pharmacies with data from IQVIA is that the level of geographic aggregation of the latter markets is in some cases larger than counties, which is the level at which public pharmacies operate. To tackle this issue, we estimate a stacked event study regression.[13] Whenever a market has more than one event, we create as many copies of the data as the number of events. We stack the copies in a dataset and use the entry

[12] As part of this research, we designed and implemented an informational field experiment to study the impacts of public pharmacies. In the experiment, we randomly provided information about public pharmacies to individuals buying pharmaceuticals in private pharmacies. In this paper, we use the experiment to estimate the impact of public pharmacies on support for incumbent mayors who opened these. We provide more details in Section V. However, we also collected data on consumer shopping behavior both before and two months after the intervention, to study whether consumers in the pharmaceutical market switched from private to public pharmacies. Overall, consumers learned about the low price and low quality of public pharmacies after the intervention and to some extent reported either having used or planning to use the public pharmacy. We discuss these findings in online Appendix B.

[13] This approach has been adopted in recent work that estimates event study models in settings with multiple events per unit (see, e.g., Lafortune, Rothstein, and Schanzenbach 2018; Cengiz et al. 2019).

of public pharmacies to all counties within a market as events. Online Appendix Figure A.2 shows the distribution of the number of events per market.

The main specification we estimate is given by

$$(1) \qquad y_{mlgt} = \sum_{k=-12}^{18} \beta_k D_{lgt}^k + \lambda_{mt} + \theta_{mlg} + \varepsilon_{mlgt},$$

where g indexes entry events within a market. The dependent variable y_{mlgt} is either the log of drug prices or the log of drug sales for molecule m in local market l in month t.[14] Our interest is in the coefficients β_k on the dummies $D_{lgt}^k = \mathbf{1}\{t = e_{lg} + k\}$, which indicate whether a month t is exactly k months after event time e_{lg} for event g in local market l. We normalize $\beta_{k=-1} = 0$, so we interpret all coefficients β_k as the effect of a public pharmacy's opening on the dependent variable exactly k months after its entry. The specification also includes molecule-month fixed effects λ_{mt} to account for time-varying unobservables at the level of molecules and molecule-market-event fixed effects θ_{mlg} to account for persistent differences in market conditions across markets. Standard errors are clustered at molecule-market level.[15]

The entry of public pharmacies had meaningful effects on private pharmacies. Figure 4, panels A and B present the results for sales and prices, respectively. Drug sales by private pharmacies decrease after a public pharmacy enters a market. Our estimates imply that 18 months after the entry of a public pharmacy, private pharmacies in that market sell around 4 percent less. Furthermore, 18 months after the entry of a public pharmacy, drug prices in private pharmacies increase by 1 percent. Both effects increase over time, which suggests that public pharmacies evolve in terms of enrolling more consumers and possibly improving their product offerings and convenience.[16]

The main threat to the identification of the effect of public pharmacies is reverse causality; unobserved determinants of sales and prices in the private sector may drive the entry of public pharmacies. In that case, β_k would confound the causal effect of public pharmacies on private market outcomes with trends in outcomes that cause the entry of public pharmacies.[17] Reassuringly, the lack of pre-trends in both

[14] We define the market-level price as the share-weighted average of log prices:

$$\hat{P}_{mlt} = \sum_{i \in \mathcal{I}_{ml}} w_{il0} P_{ilt},$$

where $\mathcal{I}_{ml}$ is the set of drugs of molecule m in local market l, P_{ilt} is the log price per gram of product i in period t and market l, and w_{il0} denotes the share of sales of drug i in market l in 2014. Because these weights are constant, changes in the index are driven by changes in prices and not by changes in market shares or market structure. This price index has been used in previous work studying retail drug pricing (e.g., Atal, Cuesta, and Sæthre 2022). For sales, we use the residuals from the projection of the outcome variable on month-of-the-year fixed effects by molecule-market to account for seasonality that is specific to sales in some markets (e.g., due to tourism in the summer).

[15] We use a balanced sample of markets in event time and include never-treated markets to pin down the linear component of pre-trends (Borusyak, Jaravel, and Spiess 2023). Moreover, we fully saturate the model and report results for event dummies 12 months before and 18 months after the event.

[16] An additional margin of response for private pharmacies would be to adjust product variety. We estimate equation (1) using the number of varieties offered as the dependent variable and find no evidence of responses along that margin.

[17] Strategic entry is an identification threat for reduced-form models for the effects of firm entry as equation (1), but it is not a relevant concern in our context. Public pharmacies' business model differs from private pharmacies' since they operate as nonprofit firms.

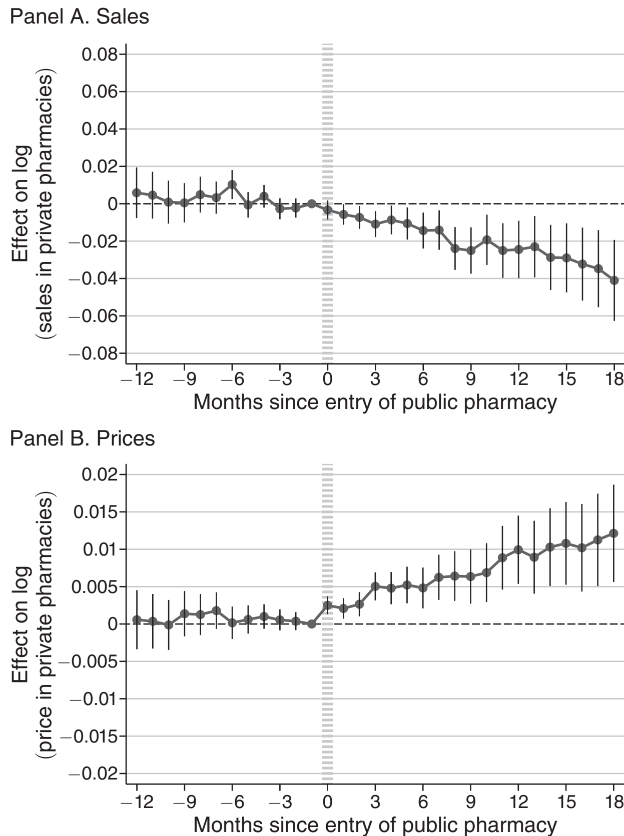

Figure 4. Impact of Public Pharmacies on Sales and Prices in Private Pharmacies

Notes: These figures present the stacked event study estimates of the impact of public pharmacies on private pharmacy sales in panel A and on private pharmacy prices in panel B. The unit of observation is a molecule per market in a given month and entry event. The empirical strategy uses panel data for the period between 2014 and 2018 and exploits the staggered entry of public pharmacies from October 2015 onward in a stacked event study design. In panel A the dependent variable is logged sales, and in panel B the dependent variable is logged prices. The x-axis indicates the month with respect to the opening of the public pharmacy; i.e., 18 means 18 months after the opening, and −12 means 12 months before the opening. Dots indicate estimated coefficients, and vertical lines indicate the corresponding 95 percent confidence interval.

sales and prices leading up to the entry of public pharmacies suggests that reverse causality and strategic considerations do not play a significant role in our setting.[18]

Another concern relates to multiple public pharmacy entries within a market, which could potentially turn the treatment effect of a previous public pharmacy entry into a pre-trend for the subsequent entry. This concern is muted in our context because the majority of markets experience one or two events, and most subsequent entry occurs within one or two months of each other, as shown by online Appendix

[18] As an additional piece of supporting evidence, in column 5 of Table 1, we study the order of entry of public pharmacies using an ordered logit regression of entry on market and political covariates. The results show that the timing of entry is uncorrelated with covariates associated with the supply and demand of drugs.

Figure A.2. To assess the importance of this issue in our setting, we do two robustness checks. First, we redefine the event as the *first* entry of a public pharmacy, in which case this type of pre-trend is absent by definition. The results under that treatment definition are essentially the same as those in our main specification, as shown by online Appendix Figure A.3. Second, we restrict the estimating sample to markets with a single event or multiple events separated by less than one month. The results for this sample track closely those from our main sample, as shown by online Appendix Figure A.4.

Exposure Difference-in-Differences Design: We complement the event study design with a regression analysis that relates market-level outcomes to the share of the population in each market that has access to a public pharmacy at each point in time. The advantage of this design is that it exploits all the variation in the timing of entry of public pharmacies as well as the heterogeneous exposure of markets to public pharmacies. We then employ this design to develop a heterogeneity analysis for the effects of public pharmacies.

We define treatment intensity E_{lt} as the share of the population in market l with access to a public pharmacy at time t and estimate the following specification:

$$y_{mlt} = \lambda_{mt} + \theta_{ml} + \beta^{jump} E_{lt} + \beta^{phaseIn} E_{lt}\big(t - t_e^* + 1\big) + \varepsilon_{mlt}, \tag{2}$$

where $E_{lt} = 0 \forall t < t_e^*$. This functional form is motivated by the patterns of the treatment effects we estimate in our event study analysis in Figure 4. The parameter β^{jump} is a mean shift in outcome y_{mlt} after the adoption of a public pharmacy. Since results from the event study specification imply that the impact on sales and prices evolves over time, we allow for a trend break, $\beta^{phaseIn}$. We include event-time dummies as controls for all periods before $k = -12$ and after $k = 18$ in treated markets, for comparability with the event study results. Our main parameter of interest is the effect of the public pharmacy 18 months after its entry, which we calculate as $\bar{E}_{18} \times \big[\beta^{jump} + \big(18 + 1\big)\beta^{phaseIn}\big]$. The term $\bar{E}_{18}$ is the average exposure to a public pharmacy across markets 18 months after the entry of the first pharmacy in the market.

For ease of exposition, we present the results of the main parameter of interest in Table 2 and report the underlying estimates β^{jump} and $\beta^{phaseIn}$ in online Appendix Table A.2. Columns 1 and 2 in Table 2 present estimates for sales and prices, respectively. Panel A shows that the entry of public pharmacies decreases drug sales by private pharmacies by 3.8 percent and increases drug prices by private pharmacies by 1 percent 18 months after their introduction. Reassuringly, these magnitudes are close to the estimates we obtain at the end of the time window in the event studies in Figure 4. To put the magnitude of this estimate in context, the average coefficient of variation of drug prices across drugs and local markets is 0.08. Hence, our estimates imply that drug prices at private pharmacies increase by around 12.5 percent of a (relative) standard deviation after the entry of a public pharmacy.[19]

[19] The extent of price variation in our data is somewhat higher than roughly comparable measures for within-chain pricing reported by Adams and Williams (2019) and DellaVigna and Gentzkow (2019) for construc-

Table 2—Effects of Public Pharmacies on Drug Sales and Prices in the Private Market

	log(*sales*) (1)	log(*price*) (2)
Panel A. Main estimates		
All sample	−0.038	0.010
	(0.007)	(0.002)
Panel B. Heterogeneity by chronic condition		
Molecules for chronic conditions $(\beta_{chronic})$	−0.045	0.010
	(0.007)	(0.002)
Molecules for nonchronic conditions $(\beta_{nonchronic})$	−0.028	0.011
	(0.008)	(0.002)
p-value: $\beta_{chronic} = \beta_{nonchronic}$	0.006	0.433
Panel C. Heterogeneity by relative product variety		
High public-private variety ratio $(\beta_{highVariety})$	−0.044	0.013
	(0.007)	(0.002)
Low public-private variety ratio $(\beta_{lowVariety})$	−0.033	0.007
	(0.008)	(0.002)
p-value: $\beta_{highVariety} = \beta_{lowVariety}$	0.024	0.000
Panel D. Heterogeneity by distance to private pharmacy		
Private pharmacies are close to public pharmacy (β_{close})	−0.044	0.007
	(0.008)	(0.002)
Private pharmacies are far from public pharmacy (β_{far})	−0.032	0.013
	(0.007)	(0.002)
p-value: $\beta_{close} = \beta_{far}$	0.008	0.000
Observations	691,620	659,986
Molecule-by-month fixed effects	Yes	Yes
Molecule-by-market fixed effects	Yes	Yes

Notes: This table presents the 18-month effect of the impact of public pharmacies on private pharmacies' sales and prices. These estimates are calculated as $\bar{E}_{18} \times \left[\beta^{jump} + (18+1)\beta^{phaseIn}\right]$, where $\bar{E}_{18}$ is the average share of population across markets with access to a public pharmacy 18 months after the first pharmacy in the local market was introduced. We estimate the on-impact effect β^{jump} and the trend break effect $\beta^{phaseIn}$ using an exposure difference-in-differences design that leverages the staggered introduction of public pharmacies in the panel data of molecules observed by market and month in the period 2014–2018. We report estimates of β^{jump} and $\beta^{phaseIn}$ in online Appendix Table A.2. In panel B, exposure to public pharmacies is interacted with an indicator for whether a molecule is targeted toward a chronic condition or not. In panel C, exposure is interacted with an indicator for whether there is a high ratio of variety of products within molecule in public pharmacies relative to private pharmacies defined as above or below the median of the distribution. In panel D, exposure is interacted with an indicator for whether private pharmacies are located "near" or "far" from public pharmacies. We use the average number of public pharmacies operating within 400 meters of private pharmacies and split the sample in two using the median of this cross-sectional market-level variable. Standard errors clustered at the molecule-by-market level are displayed in parentheses.

Heterogeneity Analysis: The remaining panels in Table 2 present a heterogeneity analysis. The characteristics of the context motivated us to focus on three margins. First, public pharmacies specialize in selling drugs for chronic conditions, and thus, we expect a larger impact on these drugs. Column 1 in panel B shows that sales of chronic drugs decrease by 4.5 percent, which is 61 percent more than the 2.8 percent

tion materials and consumer-packaged goods in the United States, respectively. This price variation is consistent with our ability to estimate price effects in this setting. Results are available from the authors.

decrease in nonchronic drugs (p-value < 0.01).[20] In contrast, column 2 in panel B shows similar price increases for both types of molecules. Second, we have emphasized quality differences across public and private pharmacies. We proxy relative quality by the ratio of drug variety within each molecule in public pharmacies relative to private pharmacies in each market.[21] Column 1 in panel C shows that the impact is larger in markets in which the public pharmacy has a richer variety of products within each molecule (p-value 0.024). Column 2 in panel C reveals larger price responses in markets in which public pharmacies offer less variety of products within a molecule (p-value < 0.01). Finally, we consider whether the spatial distribution of private pharmacies matters for the impacts of public pharmacies. We expect that the closer public pharmacies locate to private pharmacies, the larger the decrease in private pharmacy sales. Column 1 in panel D presents heterogeneous effects along this dimension and confirms this intuition (p-value < 0.01).[22]

C. *Discussion*

The entry of public pharmacies had equilibrium effects on private pharmacies. As expected, due to the lower prices offered by public pharmacies, some consumers substituted away from private pharmacies, and drug sales in the latter decreased. While increased competition could have induced private pharmacies to reduce drug prices, we find that private pharmacies instead increased prices. This response is consistent with the price sensitivity effect of entry dominating the market share effect of entry. In particular, while some consumers switched to public pharmacies upon their entry, it must be that they had a relatively low willingness to pay for private pharmacies, which led to the residual demand for private pharmacies to become steeper. The increase in private pharmacy prices we estimate implies that the upward pricing pressure from the latter was larger than the downward pricing pressure from overall substitution toward public pharmacies.[23,24]

The sales response to the entry of public pharmacies may seem small, given the magnitude of the price differences between public and private pharmacies. Our

[20] We observe 102 chronic molecules and 74 nonchronic molecules. This finding is consistent with our experimental evidence showing that households with members with chronic conditions react more strongly to the availability of public pharmacies in terms of shopping behavior. We discuss experimental results in online Appendix B.

[21] We define high (low) variety as observations above (below) the median of the ratio between the number of distinct products within molecule and market offered by the public pharmacy and those by private pharmacies.

[22] To split the sample in two, we use the average number of public pharmacies operating within 400 meters of private pharmacies. For consistency, we only consider private pharmacies that appear in our data for private pharmacy outcomes. These results need to be interpreted with caution, as public pharmacies mostly locate nearby private pharmacies and information about how distance affects pharmacy choice is lacking.

[23] In our model in online Appendix C, we show that a key condition under which private pharmacy prices are more likely to increase is a negative correlation in consumer willingness to pay for public and private pharmacies, such that consumers who have a high valuation for private pharmacies also have a low valuation for public pharmacies. This negative correlation implies that consumers who substitute away from the private pharmacy upon entry are those with low willingness to pay for the private pharmacy—and thus the most price sensitive—which leads to the residual demand curve of the public pharmacy's being steeper after entry. In addition, there must be enough heterogeneity in willingness to pay across consumers, as otherwise, there is no scope for increasing prices substantially. Online Appendix Figure A.5 shows simulation results that demonstrate that the direction of the price effects of entry indeed depends on these parameters of the distribution of consumer preferences.

[24] Caves et al. (1991) and Frank and Salkever (1997) document a similar pattern of market segmentation in pharmaceuticals, in which innovator drugs that become off-patent do not decrease but rather *increase* their prices after generic entry. This fact is known in the literature on competition in pharmaceutical markets as the "generic paradox."

interpretation is that product differentiation plays a role in mediating this response. As documented above, public pharmacies are less convenient than private pharmacies in terms of waiting times, opening hours, product variety, and travel distance. The lack of a stronger response suggests that a sizable share of consumers value those attributes enough to not substitute toward public pharmacies on the basis of lower prices. Higher-quality public pharmacies would have likely led to stronger equilibrium responses.[25] Second, our event study results in Figure 4 show that both quantity and price effects increase over time, which suggests that the full effects may be larger once the market settles into a new equilibrium.

The substitution away from private pharmacies we estimate is consistent with findings in related work by Busso and Galiani (2019) and Jiménez-Hernández and Seira (2022) in different contexts. However, they find a price decrease among private firms as opposed to a price increase. Our results highlight the fact that the price effects of public competition will depend on underlying consumer preferences and firm attributes.

IV. The Benefits and Costs of Public Pharmacies

This section discusses the relative efficiency of state-owned firms. First, we estimate the cost of public pharmacies by exploiting data on municipal finance to study the effects of introducing public pharmacies on spending and revenue on health and nonhealth services. Second, we assess whether public pharmacies have any health effects on consumers as measured by avoidable hospitalizations. Finally, we develop a simple framework that exploits our estimates of the price and quantity effects of public pharmacies to estimate how consumer drug expenditure decreases as a result of public pharmacies and compare it with our cost estimates.

A. *Municipal Finance and the Cost of Public Pharmacies*

Given that public pharmacies were created by local governments that manage multiple other local services, it is important to identify whether they are economically sustainable or represent a financial burden that may crowd out other services. To study this margin, we exploit administrative data from municipal finances to estimate the financial impacts of public pharmacies.[26]

For this analysis, we estimate the following regression:

$$y_{ct} = \theta_c + \lambda_t + \pi^{jump} PP_{ct} + \pi^{phaseIn} PP_{ct}(t - t_e^* + 1) + \varepsilon_{ct}, \tag{3}$$

[25] We illustrate the role of vertical differentiation between private and public pharmacies using our model in online Appendix C. Our model simulations show that vertical differentiation indeed influences the extent to which the entry of public pharmacies affects private pharmacy prices, and market share depends on vertical differentiation. Panel A in online Appendix Figure A.6 shows that the extent of business stealing by an entrant decreases substantially as the quality of the entrant relative to the incumbent decreases. Moreover, panel B in online Appendix Figure A.6 shows that the incumbent in the market is able to sustain higher prices when the quality of the entrant relative to the incumbent is lower.

[26] The data come from the National System of Municipal Information (SINIM 2022). Counties spend resources on transportation, public education, public health, culture, and sports, among others (Law 18695). Approximately 90 percent of their budget comes from county revenues (property and vehicle tax receipts), and other resources correspond to monetary transfers from the central government.

Table 3—Effects of Public Pharmacies on Municipal Finance

	Subcategories of health related to public pharmacies		All health services		Nonhealth services		All services	
	Spending	Revenue	Spending	Revenue	Spending	Revenue	Spending	Revenue
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Public pharmacy 18-month effect	0.266	0.187	0.048	0.034	−0.048	−0.030	0.015	0.010
	(0.071)	(0.082)	(0.016)	(0.016)	(0.035)	(0.034)	(0.015)	(0.015)
Avg. dep. var. in 2014	9.144	6.518	182.60	181.43	513.08	548.73	695.68	730.15
County fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Counties	320	320	321	321	322	322	322	322
Observations	2,200	2,205	2,240	2,240	2,228	2,227	2,243	2,243

Notes: This table presents our estimates for the impact of public pharmacies on municipal finances. We observe a panel of counties every year in the period 2013–2019 and exploit the staggered entry of pharmacies in a parametric event study analysis. The dependent variable is the logarithm of total spending (in US dollars) per capita (2013 population) in odd columns and the logarithm of total revenue per capita in even columns. The 18-month effect is the linear combination of regression coefficients $\pi^{jump} + (1.5 + 1) \times \pi^{phaseIn}$. Online Appendix Table A.3 presents full regression results, i.e., estimates of π^{jump} and $\pi^{phaseIn}$. We focus on 18-month effects to compare the cost of public pharmacies with their impact on sales and prices in private pharmacies (panel A of Table 2). Standard errors clustered at the county level are displayed in parentheses.

where y_{ct} is a financial outcome in county c and year t (e.g., spending on health services), PP_{ct} indicates the share of the year with a public pharmacy in county c, and $t - t_e^*$ measures the number of years since the opening of the public pharmacy. The specification includes county fixed effects θ_c and year fixed effects λ_t. Similar to our specification for private market outcomes in equation (2), the parameter π^{jump} captures a mean shift in the dependent variable after treatment, whereas $\pi^{phaseIn}$ captures a trend break. In terms of data, we observe annual county spending and revenue for 2013–2019. Both spending and revenue have accounts that we aggregate into health and nonhealth categories. Moreover, within the accounts related to health spending and revenue, we construct measures of spending by and revenue from public pharmacies. To ease comparisons across counties, we use the log spending and revenue per capita as dependent variables in this analysis.[27]

Table 3 presents our main results, and online Appendix Table A.3 presents coefficient estimates of equation (3). The main result is the effect of public pharmacies after 18 months of operation (1.5 years), which we compute as $\pi^{jump} + (1.5 + 1) \times \pi^{phaseIn}$. The results deliver four main messages. First, 18 months after the entry of public pharmacies, we observe an increase of 30 percent in health spending related to the public pharmacy, along with a 20.6 percent increase in revenue related to the public pharmacy. Second, these impacts are also statistically significant when looking at health spending and revenue more broadly: we estimate an increase of 4.9 percent in health spending 18 months after the entry of public pharmacies in column 3 of Table 3, which is partially compensated for by an increase in health revenue of 3.5 percent in column 4. Third, the impacts of public pharmacies on nonhealth services in columns 5 and 6 are imprecisely estimated, and we cannot rule out a decrease of a magnitude similar to the increase in health services.

[27] Some counties, which account for 7 percent of the sample, do not report the breakdown of their accounts for health and nonhealth services. To obtain a uniform sample across dependent variables, we drop those observations.

Fourth, in terms of overall municipal finance, our point estimates in columns 7 and 8 imply that spending increases more than revenue, although those coefficients are again not statistically significant. Taken together, the point estimates in the last two columns suggest that public pharmacies induced, if any, only a small and statistically insignificant increase in the overall municipal deficit.[28,29]

These estimates allow us to compute the average cost of introducing a public pharmacy. A public pharmacy's profits depend on the markup it charges on drugs, if any, and any initial investment and operating cost it incurs. The fact that public pharmacies induce a deficit implies that they set prices below average cost. The average spending and revenue per capita are US$695.68 and US$730.15, and the average county in the country has a population of 51,781. Combining these statistics with our point estimates in columns 7 and 8 of Table 3, we calculate that after 18 months of operation, the annual loss for a public pharmacy in the average county is US$164,442.[30] The next sections compare this cost estimate with the estimated benefits of public pharmacies for consumers.

B. *Lack of Health Effects of Public Pharmacies*

Increased access to pharmaceutical drugs could benefit individuals through health improvements. For instance, such effects could operate through improved adherence to prescription drugs for individuals with chronic diseases due to lower prices and increased access (Cutler and Everett 2010). However, in our setting we do not observe individual-level prescriptions and drug purchases. Instead, we focus on avoidable hospitalizations associated with chronic diseases, which would likely not have occurred under appropriate disease management. This variable has been employed previously in the literature (e.g., Layton et al. 2022). The fact that public pharmacies were oriented toward individuals with chronic diseases makes this variable particularly suitable. We would interpret a decrease in avoidable hospitalizations after the entry of a public pharmacy as a signal that the pharmacy increased drug access and, in consequence, adherence by individuals with chronic diseases.

For this analysis, we estimate equation (3) using avoidable hospitalizations as the dependent variable. We exploit data on monthly hospitalizations for 2013–2019 from the Ministry of Health (DEIS 2013–2019), which cover the number of hospitalizations, days of hospitalization, number of surgeries, and number of deaths per diagnosis across all hospitals in the country. The number of hospitalizations captures only the volume of these events, whereas hospitalization days, surgeries, and deaths capture their severity. To focus on the subset of diagnoses for which

[28] Online Appendix Figure A.7 displays corresponding event study estimates and provides reassuring evidence regarding the trends in these outcomes leading up to the entry of public pharmacies.

[29] The data on municipal finance have some zeros, which implies that by taking the log of the dependent variable, we drop some observations. This share is not higher than 2 percent across outcomes, so the impact of this transformation is small. Online Appendix Table A.4 shows results from the same specification for alternative transformations of the dependent variable. The main takeaway from this robustness check is that our results are essentially unchanged across these transformations.

[30] Articles from local newspapers that disclose public pharmacy nondrug costs place the yearly cost of running them at between US$85,000 and US$125,000, which likely provide a lower bound for total operating costs and are in line with our estimates (see, e.g., Araucanía Cuenta 2016; El Austral 2017; Clave9 2017; Diario Concepción 2017; Diario Financiero 2022).

Table 4—Effect on Avoidable Hospitalizations Associated with Chronic Diseases

	Avoidable hospitalizations per 100,000 inhabitants							
	Number of hospitalizations		Days of hospitalizations		Number of surgeries		Number of deaths	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Public pharmacy 18-month effect	−0.813	−0.950	−4.905	−4.059	0.132	0.091	0.092	0.122
	(0.781)	(0.818)	(7.822)	(8.571)	(0.174)	(0.084)	(0.194)	(0.093)
Health insurance	All	Public	All	Public	All	Public	All	Public
Mean of dep. var. in 2014	17.93	19.18	158.2	172.7	1.725	1.908	0.736	0.829
County fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Counties	344	344	344	344	344	344	344	344
Observations (county-month-years)	28,896	28,896	28,896	28,896	28,896	28,896	28,896	28,896

Notes: This table presents our estimates for the impact of public pharmacies on avoidable health outcomes. The outcomes of interest are the number of hospitalizations (columns 1–2), days of hospitalizations (columns 3–4), number of surgeries (columns 5–6), and number of deaths (columns 7–8). For each outcome, the first column uses the count of the outcome per 100,000 inhabitants in a county regardless of individual health insurance, and the second column restricts that count to individuals with publicly provided insurance. We observe a panel of counties every month in the period 2013–2019 and exploit the staggered entry of pharmacies in a parametric event study analysis. The 18-month effect is the linear combination of regression coefficients $\pi^{jump} + (18 + 1) \times \pi^{phaseIn}$. Online Appendix Table A.5 presents full regression results, i.e., estimates of π^{jump} and $\pi^{phaseIn}$. We focus on 18-month effects to use the same horizon of effects as in the previous estimates in the paper. We report the mean of the dependent variable for 2014 among counties that ever introduce a public pharmacy, the year before most public pharmacies entered the market. Standard errors clustered at the county level are displayed in parentheses.

hospitalizations are considered avoidable, we follow the Prevention Quality Indicators in AHRQ (2019), which lists all diagnosis codes (ICD-10) for avoidable admissions associated with asthma, chronic obstructive pulmonary disease, diabetes, and hypertension. We restrict our sample of hospitalizations for this analysis to these diagnoses. We normalize these variables by population and measure them per 100,000 inhabitants.

Our estimates suggest that public pharmacies did not improve health outcomes, at least in the short period of time we are able to examine. Table 4 presents our main results, and online Appendix Table A.5 presents coefficient estimates of equation (3). For each outcome, we show results for all individuals and for those under public insurance who on average, have lower income and are more likely to benefit from a public pharmacy. Across all outcomes and samples, we find no statistically significant effect of the entry of a public pharmacy to a local market after 18 months. That said, our estimates are not precise enough to rule out effects that could be quantitatively meaningful. In particular, our estimates can reject at the 5 percent level reductions of 2.6 hospitalizations, 20.9 hospitalization days, 0.07 surgeries, and 0.06 deaths per 100,000 inhabitants with public insurance as the effect of public pharmacies, which are equivalent to reductions of between 4 percent and 13 percent in these outcomes relative to their baseline levels.[31,32]

[31] Online Appendix Figure A.8 shows the results of an event study version of equation (3). For all outcomes and samples, we again find no evidence that public pharmacies affected health outcomes. Reassuringly, these results show a lack of differential trends across counties leading up to the entry of public pharmacies, which provides evidence against reverse causality.

[32] An additional analysis of school attendance and sick leaves—arguably related to the health of children and the working population—also suggests a null impact of public pharmacies in the short run. See online Appendix Table A.6 and online Appendix Figure A.9.

Overall, our interpretation of these results is that public pharmacies did not affect access to drugs to an extent such that adherence improved enough to reduce avoidable hospitalizations. It is important to note that the lack of a health effect is likely to be mediated by contextual factors such as the elasticity of demand and access to health services, among others. Regardless, these results suggest that if public pharmacies had any market-creation effect, it was small, and most of the effect was through business stealing from private pharmacies.

C. *Comparing Costs and Benefits*

In this section, we use our previous results to compare the benefits and costs of public pharmacies. Our measure of benefits from public pharmacies focuses on reduced expenditure in drugs for consumers, given that we find no evidence of health effects. We develop a simple accounting framework to estimate effects on consumer expenditure by combining our results on economic effects from Section III with basic statistics from the market.

Let r denote private pharmacies and u denote the public pharmacy. Moreover, let $t = 0$ indicate the period before entry of the public pharmacy and $t = 1$ the period after its entry. Using this notation, total consumer expenditure in period t is given by $e_t = M_t(s_t^r p_t^r + s_t^u p_t^u)$, where M_t is the amount of drugs consumers need; s_t^r and s_t^u are market shares of the private and the public pharmacy, respectively; and p_t^r and p_t^u are composite drug prices at each of them. We impose two assumptions. First, we assume that the market size remains constant over time, such that $M_t = M$ for $t = 0, 1$. Second, given that we are unable to estimate aggregate effects on drug quantity with the available data, we rule out such effects and impose $s_t^r + s_t^u = 1$ for $t = 0, 1$.

The object of interest is the change in drug expenditure upon entry of the public pharmacy:

$$\Delta e = M(s_1^r p_1^r + s_1^u p_1^u) - M(s_0^r p_0^r + s_0^u p_0^u),$$

which we can rearrange to be a function of our estimates and data. First, note that $s_0^r = 1$ and $s_0^u = 0$ by definition. Second, we use our estimates of effects on private pharmacies from Section IIIB to express the sales and prices of private pharmacies after the entry of the public pharmacy as $s_r^1 = (1 - \beta_s)s_0^r$ and $p_r^1 = (1 + \beta_p)p_0^r$, respectively. Finally, we use results from Section IIIA on price differences between public and private pharmacies to express public pharmacy prices as $p_u^1 = \phi_1^u p_r^1$, where ϕ_1^u is the average discount public pharmacies offer relative to private pharmacies. After replacing and rearranging, we get

$$\Delta e = \underbrace{Mp_0^r}_{\substack{\text{Baseline}\\ \text{expenditure}}} \times \left[\underbrace{(1 - \beta_s)(1 + \beta_p) - 1}_{\substack{\Delta\text{ expenditure}\\ \text{in private pharmacies}}} + \underbrace{\beta_s \phi_1^u(1 + \beta_p)}_{\substack{\Delta\text{ expenditure}\\ \text{in public pharmacy}}}\right].$$

To measure the change in drug expenditure, we proceed as follows. We measure baseline expenditure using data from the 2016/2017 National Household Spending Survey (EPF 2016), which states that the average yearly drug expenditures were

US$213.4. Furthermore, our estimates from Section IIIB imply that $\beta_s = 0.039$ and $\beta_p = 0.010$. Finally, we know from Section IIIA that public pharmacies set prices at an average of $\phi_1^u = 0.34$ of private pharmacy prices.

The average consumer saves US$3.4 per year, according to these estimates. This average masks substantial heterogeneity: those who stayed at private pharmacies increased their annual spending by US$2.2, whereas those who switched to the public pharmacy reduced theirs by US$143.6. A population of particular interest is consumers with chronic conditions, who are the main target of public pharmacies and account for 22 percent of the population, according to the 2016–2017 ENS. Our estimates imply that these consumers decreased their yearly expenditure by an average of US$17.3. Of them, those who stayed with private pharmacies increased their yearly expenditure by US$8.4, whereas those who switched decreased it by US$551.1. To put these numbers in context, the median monthly wage among working-age individuals in 2017 was around US$670. Adding across consumers, these estimates imply that consumers in the average county decreased their aggregate spending by US$178,636 per year. If all counties in the country introduced public pharmacies, aggregate spending would decrease by US$61.5 million per year—equivalent to 1.58 percent of total expenditure according to the EPF. Accounting for equilibrium price responses by private pharmacies is quantitatively relevant; omitting them would lead to overestimating the reduction in expenditure by 62 percent.

Our estimates imply that consumer benefits in terms of reduced drug expenditure on inframarginal units are 8.6 percent higher than the cost of public pharmacies a year and a half after their entry. Public pharmacies achieve reductions in consumer expenditure higher than their costs for two reasons: public pharmacies hold a cost advantage relative to private pharmacies when purchasing from manufacturers, and private pharmacies hold substantial market power in the retail market (FNE 2019). Public pharmacies thus address two salient market failures in this industry. Because of this, the introduction of a state-owned firm likely performs better than an alternative policy of subsidizing drug purchases. In this simple framework, the cost of a subsidy is the reduction in drug expenditure and is thus higher than that of the public pharmacy, according to our estimates. This is because subsidies are able to reduce drug expenditure but do not address market power in the private market and therefore must incur a higher cost to achieve the same effects as the public pharmacy.[33]

Of course, this is not a full welfare analysis. On the one hand, we do not account for potential market expansion effects, which implies that we may underestimate the benefits of public pharmacies. On the other hand, we do not account for consumer valuation of the relative convenience of private and public pharmacies. The fact that relatively few consumers switch despite the large potential savings for switchers suggests that the valuation of these nonprice pharmacy attributes is high.[34] A richer

[33] Enriching the framework to account for aggregate effects would exacerbate the extent to which state-owned firms outperform subsidies since subsidies would in that case induce an additional deadweight loss.

[34] To provide a lower bound on the relative inconvenience of public pharmacies, we estimated the cost of additional travel time to public pharmacies. To do so, we combined standard assumptions from the transportation literature with data on (i) the spatial distribution of households, private pharmacies, and public pharmacies and (ii) the distribution of hourly wages. We find that an individual with an average hourly wage has an average annual cost of additional travel time to public pharmacies of US$14.2, with twenty-fifth and seventy-fifth percentiles of US$2.6 and US$21.5, which are well below our estimates of average savings for switchers. These patterns suggest

model of consumer demand and pharmacy pricing is needed to conduct such an analysis.[35]

V. Political Returns of Public Pharmacies

Budget constraints and electoral incentives are crucial drivers of policy decisions (Besley and Case 1995; Lizzeri and Persico 2001; List and Sturm 2006). The small negative impact on a large number of consumers suggests that the public option might not be politically profitable. This section uses an informational field experiment, along with self-reported voting behavior, to estimate the causal effect of the awareness of public pharmacies among consumers in the pharmaceutical market on political support for the incumbent who opened the pharmacy.

A. *The Field Experiment*

We designed a field experiment to study whether the availability of public pharmacies affected consumers. To induce variation in awareness of the public pharmacy within local markets, we implemented an informational intervention. The decision to provide information was based on a survey we conducted before the experiment, which revealed that consumers were only partially informed along two dimensions. First, some households were unaware of the existence of a public pharmacy in their county. Second, even when households knew about the pharmacy, they were not perfectly informed about the lower prices and other attributes. The existence of imperfect information provides us with a unique opportunity to randomly expose consumers to public pharmacies using our experiment and thus measure individual responses to them.

The treatment consisted of an informational flyer, displayed in online Appendix Figure A.10. It provided information about the presence of a public pharmacy in the county and stated that it offered lower prices but longer waiting times than private pharmacies. Also, it included the pharmacy's location, contact information, opening hours, and eligibility requirements. We delivered the flyer to consumers exiting private pharmacies in the 20 counties with public pharmacies in Santiago, displayed in online Appendix Figure A.11. The information was tailored to each county.

In terms of recruitment, enumerators approached consumers leaving a private pharmacy in each county and assessed their eligibility. Eligible participants were those who (i) lived and were registered to vote in the county, (ii) had purchased a prescription drug, and (iii) were not registered with the public pharmacy. To incentivize participation, everyone who responded to the five-minute survey automatically entered a lottery for a television set. Overall, 1,855 individuals were approached, and 826 enrolled in the study. The baseline survey collected information on awareness of public pharmacies and their attributes, intention to vote for the incumbent mayor

that while their inconvenient locations may indeed contribute to the low switching rate to public pharmacies, other differences between public and private pharmacies play a relevant role as well. Calculations are available from the authors.

[35] Other unmeasured welfare effects include potential decreases in incentives for R&D. However, we believe that this effect is likely small given the Chilean market represents only a small share of the revenues of the pharmaceutical companies doing R&D.

in the upcoming election, age, education, and access to the Internet, among others. When the survey was completed, participants were randomly assigned to treatment and control groups. The enumerator only learned the assignment of the individual after completing the survey. We conducted this survey between October 12 and 20, 2016, right before the local elections. Online Appendix Figure A.12 summarizes the timeline of the events in the experiment.

Two months after the baseline survey, we conducted a follow-up survey to measure the same variables as in the baseline. We also collected information about their relationship with the public pharmacy in their county. We conducted this survey by phone and were able to complete the survey for 514 participants—almost two-thirds of the sample.[36,37]

Online Appendix Table A.9 compares both groups at baseline. Participants are on average 45 years old, and 61 percent of them are female. More than 60 percent work, and most use the Internet frequently. Half of the participants planned to vote for the incumbent, and almost three out of four reported having participated in the previous election. Slightly less than 70 percent knew about the existence of a public pharmacy. As expected, column 4 shows that almost all variables are balanced across groups. The exception is awareness of the public pharmacy, which we control for in the analysis.

B. *Experimental Results*

Table 5 presents results for political outcomes. Columns 1 and 4 study self-reported voting behavior. As many as 25 and 23 percent of the control group individuals reported voting for the incumbent mayor and incumbent party, respectively. The reported vote increases by approximately 6 percentage points for the treatment group in both cases. While these point estimates are large in magnitude, they are not statistically significant at conventional levels, with p-values of 0.21 and 0.12. To increase the precision of the analysis, columns 2 and 5 control for the intention to vote for the mayor at baseline along other covariates and include county fixed effects. Treatment effects using this specification remain similar in magnitude but are indeed more precise, with p-values of 0.06 and 0.11.[38]

Effects on voting behavior are concentrated among individuals from households with members with chronic conditions. Columns 3 and 6 examine these patterns of heterogeneity. Households with someone with a chronic condition report having voted 8 percentage points more for the incumbent, larger than the 2–7 percentage points higher vote share among treated households without a chronic condition. Although the small sample prevents us from rejecting the null of a similar impact

[36] Online Appendix Table A.7, panel A shows that attrition was higher among younger participants, males, with higher support for the incumbent, less turnout in the last election, and less knowledge of the public pharmacy. While this changes the sample composition and decreases the statistical power of the experiment, it does not necessarily threaten its internal validity. Online Appendix Table A.7, panel B shows that all variables remain balanced across groups among nonattriters.

[37] The survey also verified the delivery of the treatment. Online Appendix Table A.8 shows that treated individuals acknowledged receiving information more often than those in the control group and recalled public pharmacies being the core of the information content almost twice as often as the latter.

[38] To account for the effects of attrition, Table 5 presents Lee bounds. The lower bound is positive but not statistically significant, and the upper bound is positive and statistically significant across the three outcomes we study.

Table 5—Experimental Results for Political Outcomes

	Voted incumbent mayor			Voted incumbent party			Voted in the election		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Treatment	0.057	0.075		0.064	0.056		0.066	0.052	
	(0.045)	(0.039)		(0.040)	(0.035)		(0.046)	(0.044)	
Treatment × *chronic* (β_C)			0.080			0.081			0.040
			(0.051)			(0.044)			(0.055)
Treatment × *nonchronic* (β_{NC})			0.067			0.020			0.068
			(0.065)			(0.058)			(0.073)
Dependent variable at baseline		0.366	0.367		0.348	0.350		0.418	0.416
		(0.051)	(0.051)		(0.048)	(0.048)		(0.052)	(0.052)
Lee bounds		[0.033, 0.182]			[0.048, 0.170]			[0.014, 0.159]	
p-value for H_0: $\beta_C = \beta_{NC}$	–	–	0.883	–	–	0.408	–	–	0.763
Mean for control group	0.249	0.249	0.249	0.226	0.226	0.226	0.503	0.503	0.503
Observations	398	368	368	475	435	435	475	435	435
R^2	0.004	0.515	0.515	0.005	0.488	0.488	0.004	0.641	0.641
Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
County fixed effects	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes

Notes: This table presents our estimates of the political impact of public pharmacies using data from the field experiment described in Section V. The unit of observation is an individual who buys pharmaceuticals at private pharmacies in the capital city of Santiago. The treatment is information about public pharmacies delivered in the form of a flyer by enumerators after completing the baseline survey in October 2016, before the local election. All dependent variables were measured in follow-up surveys conducted in December 2016, after the local election. We present cross-sectional results using three specifications, one without controls (columns 1, 4, and 7), one with controls (columns 2, 5, and 8), and one with controls and interacting the treatment with an indicator for individuals with a chronic condition (columns 3, 6, and 9). The set of control variables includes age and indicators for chronic condition, having completed high school education, female, and public insurance. Reported Lee bounds are computed using only the treatment indicator as covariate. Robust standard errors in parentheses.

across these groups, the result is consistent with the hypothesis that people most affected by the policy are more likely to support the incumbent.

Finally, columns 7–9 repeat the previous estimations but now use as dependent variable an indicator that takes the value of one if the person voted in the election. Estimates reveal a positive impact on the probability of turning out to vote—with point estimates similar in magnitude to previous estimates—although in this case none is statistically significant at conventional levels. All in all, these results suggest that awareness of public pharmacies and their characteristics increased consumer support for the incumbent mayor.

We combine these results with estimates of consumer savings from Section IVC to estimate the political returns of public pharmacies. The experiment suggests that introducing a public pharmacy increases the number of votes for the incumbent by 1,055, relative to an average of 16,105 total votes across counties in the 2012 local election. Our estimates of the effects on drug expenditure imply that the incumbent obtains 1 additional vote per US$169 of yearly consumer savings. We also consider the monthly savings of consumers who switch to public pharmacies and focus on consumers with chronic conditions. Within that population, the average individual realizes monthly savings of US$45.9. These "transfers" increased political support of the incumbent mayor by 8.1 percentage points. For reference, Manacorda, Miguel, and Vigorito (2011) find that in Uruguay, a targeted monthly transfer of US$70 increased political support for the incumbent government by 11 percentage points.

VI. Conclusion

State-owned firms compete with the private sector in a variety of markets. The costs and benefits of such competition have been difficult to evaluate empirically. In this paper, we leverage the decentralized entry of state-owned firms to a fully deregulated private market of pharmaceutical retailers. We show that the public option emerged as a low-price and low-quality option and affected the shopping behavior of local consumers, which generated market segmentation and higher prices in the private sector. Although public pharmacies created winners and losers within local markets, overall consumer savings outweighed the costs of public pharmacies.

While our study focuses on a particular form of public-private competition, it provides general lessons. First, the equilibrium effects of the public option are shaped by the nature of demand responses. In our context, the public option is less attractive to consumers with a high willingness to pay for service quality relative to drug prices. Market segmentation makes these consumers worse off due to price increases in the private sector.[39] Second, our analysis highlights the fact that public competition may be effective in reducing consumer expenditure. In industries with substantial market power in input and retail markets, retail prices are set at markups over marginal costs. Whenever state-owned firms have higher bargaining power in the input market or decide not to exercise market power in the retail market, they may be able to effectively reduce consumer expenditure. Our setting indeed features these two conditions.

The political rewards of state-owned firms could be interpreted as showing that, as a whole, state-owned firms increased welfare. However, we highlight the fact that recent research shows that people may overvalue policies when they do not internalize the general equilibrium effects that affect them (Dal Bó, Dal Bó, and Eyster 2018). Our findings are somewhat consistent with this interpretation since the majority of consumers in the market are worse off after the entry of public pharmacies due to increased private pharmacy prices.[40] These findings demonstrate the need to evaluate the market effect of policies instead of drawing conclusions about their desirability based on voting behavior.

Our analysis leaves many questions for future research. Of particular relevance is understanding the choice of quality among state-owned firms. If the quality of state-owned firms were higher, we would expect more consumers to switch to them and strengthen the equilibrium effects toward the private sector. However, changes in the quality of state-owned firms could influence their targeting properties by modifying the population that adopts them (Kleven and Kopczuk 2011). Furthermore, it is also possible that a higher quality of state-owned firms triggers other strategic responses in the private sector. In the context of retail, these could include changes in the location, prices, or quality of private stores. Our findings thus call for attention to how the interplay between public and private firm attributes may

[39] Selection markets, like the market for health insurance, are another important context where the nature of demand responses is key for understanding the general equilibrium effects of the public option. A key feature of those settings would be whether the public option is differentially attractive to consumers with different levels of risk.

[40] Recent work by Illanes and Moshary (2020) on the deregulation of retail liquor markets in Washington state also finds evidence consistent with this phenomenon.

shape equilibrium effects in the market and determine the overall and distributional impacts of state-owned firms.

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