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Health Care Reform and Firm Dynamics: Evidence from Medicare Part D and the Retail Pharmacy Industry

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Abstract

Retail pharmacies fill over 4 billion prescriptions each year and are the most frequent service delivery touchpoint in the U.S. health care system. Despite this important role, relatively little is known about the economic factors driving pharmacy access. We provide new evidence on how Medicare Part D shaped the retail pharmacy industry using 2000-2007 National Establishment Time-Series data and a difference-in-differences identification strategy leveraging variation in the share of the customer base likely comprised of Medicare beneficiaries. We find that Medicare Part D was associated with a 5 percent reduction in the number of pharmacies due to a reduction in the number of pharmacy openings; we do not detect a change in pharmacy closures. Next, we show that this reduction was most pronounced in racial and ethnic minority communities. Finally, we show that existing pharmacies located in previously competitive markets benefitted from reduced market entry.

JEL Codes: I18; M20
Key words: Medicare Part D; pharmacy; sales; employment

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1. Introduction

Retail pharmacies are an integral part of the U.S. health care system. Pharmacies fill over 4 billion prescriptions each year (Kaiser Family Foundation 2019) and are the most frequent service delivery touchpoint in the health care system (Trygstad 2020). Patients with commercial insurance (Valliant et al. 2022) and Medicare (Berenbrock et al. 2020) visit a pharmacy almost twice as often as they visit a physician, and pharmacists are among the most trusted members of the health care community (McHugh et al. 2022). Recognizing the potential for pharmacists to relieve a shortage of primary care physicians (Manolakis and Skelton 2010), states have passed scope-of-practice expansions allowing pharmacists to prescribe and administer a growing list of medicines, including vaccines (Trogdon et al. 2016; McConeghy and Wing 2016; Poudel et al. 2019), rescue inhalers and insulin pens (Shakya et al. 2024), and medications to prevent opioid overdoses (Abouk et al. 2019; Smart et al. 2024). Indeed, pharmacies' expanded role in delivering health care was highlighted during the COVID-19 pandemic (Viscari et al. 2021), and pharmacists played a central role in the nationwide COVID-19 vaccination campaign (Brownstein et al. 2022).

Despite pharmacies' ever-growing role in health care delivery, the industry has experienced significant challenges over the last few decades (Guadamuz et al. 2019). Between 2003 and 2018, one in six independent (i.e., non-chain) rural pharmacies closed (Salako et al. 2018). While the closure rate has generally been lower for chain pharmacies, many of these establishments have also struggled. From 2018 to 2020, CVS Health closed 244 stores and announced plans to close an additional 900 stores by the end of 2024 (CNN 2024). Likewise, Rite Aid announced the closure of approximately 25 percent of their stores when it filed for bankruptcy in 2023 (Bloomberg 2024). Pharmacy closures have disproportionately

occurred in areas serving low-income patients and members of racial and ethnic minority communities (Guadamuz et al. 2024), potentially exacerbating existing health disparities (Essien et al. 2021). While these location decisions have important implications for health care access, relatively little is known about the determinants of retail pharmacy formation, performance, and dissolution.

In this paper, we provide novel evidence on the role of government policy in shaping the retail pharmacy industry by studying the passage and implementation of Medicare Part D. Established by the Medicare Prescription Drug, Improvement, and Modernization Act of 2003, Medicare Part D provides prescription drug coverage to over 53 million enrollees (Sayed et al. 2024). At the time of its passage, it was the largest public health insurance expansion in the United States in over forty years (Oliver et al. 2004). Medicare Part D spending is projected to be $137 billion in 2025, representing 15 percent of all Medicare spending (Kaiser Family Foundation 2024). While existing work has clearly shown that Medicare Part D increased prescription drug utilization and lowered out-of-pocket costs for seniors (Lichtenberg and Sun 2007; Ketcham and Simon 2008; Yin et al. 2008; Kaestner and Khan 2012), the implication of these shifts for retail pharmacies is not theoretically clear. For one, this increased prescription volume was accompanied by a substantial reduction in drug prices (Duggan and Morton 2010; Duggan and Morton 2011; Lakdawalla and Yin 2015), and there is evidence that prescription drug expenditures fell among the sizable group of Medicare Part D enrollees who previously had more generous coverage (Zhang et al. 2009; Lakdawalla and Yin 2015).[1] Indeed, retail pharmacies were able to earn high margins on underinsured and insured cash customers prior to Medicare Part D (Berndt and Newhouse 2010), and gross margins on prescriptions covered by Medicare Part D were lower than

[1] Engelhardt and Gruber (2011) estimate that Medicare Part D resulted in 75 percent crowd-out of prescription-drug insurance coverage and expenditures of those aged 65 or older.

those covered by Medicaid, commercial insurance, or cash customers (Spooner 2008).[2]

To explore how Medicare Part D affected the retail pharmacy industry, we utilize 2000-2007 National Establishment Time-Series (NETS) data and a difference-in-differences identification strategy leveraging variation in the share of the local customer base that was presumably comprised of Medicare beneficiaries. The NETS provides us with establishment-level data on openings and closings, sales, and the number of employees (Currie et al. 2010; Neumark and Kolko 2010; Neumark et al. 2011; Orrenius et al. 2020). Meanwhile, our identification strategy compares changes occurring among pharmacies located in counties where adults aged 65 or older comprised an above median share of the population in the year 2000 to the concurrent changes occurring among pharmacies located in below median counties (Alpert et al. 2023).

We document several key findings. First, we show that Medicare Part D was associated with a 5 percent reduction in the number of pharmacies located in counties where elderly adults comprised a larger share of the population. This finding is robust to a variety of specification choices, sample restrictions, and methods for conducting statistical inference. Additionally, we show that this reduction was more pronounced for racial and ethnic minority communities, suggesting that Medicare Part D may have widened existing disparities in pharmacy access. Event study analyses indicate that the change was not driven by a differential pre-trend, and the magnitude of post-period estimates is consistent with the timing of Medicare Part D's implementation (Alpert 2016; Huh and Reif 2017). While the pre-period estimates are small in magnitude and statistically

[2] For example, CVS Caremark noted in its 2007 10-K that, "The Medicare Drug Benefit became effect on January 1, 2006. Since its inception the program has resulted in increased utilization and decreased pharmacy gross margin rates as higher margin business (such as cash and state Medicaid customers) migrated to the new Part D coverage."

insignificant, we detect a 1.1 percent reduction in 2004 following Medicare Part D's passage, a 4.4 percent reduction in 2005 when interim prescription discount cards became widely available, and a 6.0-6.3 percent reduction following full implementation in 2006. While we find evidence of reductions in both the number of standalone (i.e., non-chain) pharmacies and non-standalone pharmacies, the estimated reduction in the number of standalone pharmacies is 75 percent larger in magnitude.

Second, we show that the reduction in the number of pharmacies following the passage of Medicare Part D was driven by a reduction in the number of pharmacy openings. In contrast, we do not find any evidence that Medicare Part D was associated with increases in the number of pharmacy closures. Together, these patterns suggest that while Medicare Part D did not systematically put existing pharmacies out of business, it discouraged firm formation. As a result, we show that pharmacies located in counties where a higher share of the population was comprised of elderly adults subsequently faced a less competitive landscape than their counterparts in counties where elderly individuals comprised a smaller share of the population. Using information on the GPS coordinates of each pharmacy, we show that Medicare Part D was associated with a 4.7 to 12.3 percent reduction in the volume of sales occurring at nearby pharmacies and a 4.1 to 5.2 percent reduction in the number of nearby pharmacies.

Finally, we explore whether existing pharmacies benefitted from the lower level of competition attributable from Medicare Part D. While we do not detect within-establishment changes in annual sales or the number of employees for the full sample, we show that – in the areas that were the most competitive prior to Medicare Part D – pharmacies experienced a 2 to 4 percent increase in sales. Similarly, we show that standalone pharmacies had a 0.5 to 1.0 percent increase in sales. These results indicate that while Medicare Part D dampened growth for the industry as a whole, it was associated with modest increases in performance for

surviving pharmacies. Collectively, these results highlight the important role government policies play in determining winners and losers within the health care sector.

By providing the first quasi-experimental evidence that Medicare Part D reduced the size of the retail pharmacy industry, we contribute to a broad literature studying how government policies affect firm formation and competition (Reynolds et al. 1994; Acs and Szerb 2007; Shane 2009; Neumark and Kolko 2010; Lee et al. 2011; Figueroa-Armijos and Johnson 2016; Lu et al. 2019). Within the health care context, much of this work has focused on the causes (Gaynor et al. 2012; Avdic 2016; Aghamolla et al. 2024; Hollingsworth et al. 2024) and consequences (Kessler and McClellan 2000; Lindrooth et al. 2003; Buchmueller et al. 2006; Capps et al. 2010; Petek 2022) of changes in hospital competition. In contrast, there has been less work studying retail pharmacies, with some notable exceptions. Bennett and Yin (2019) found that the entry of chain pharmacies improved drug quality and lowered prices at incumbent independent pharmacies in India. Likewise, Moura and Barros (2020) found that supermarket entry lowered the prices that incumbent pharmacies charged for over-the-counter medications by 4 to 6 percent in Portugal. In contrast, Atal (2024) found that public pharmacy entry in Chile induced market segmentation and price increases in the private sector, harming those who did not switch to public pharmacies. Finally, a recent paper by Janssen and Zhang (2023) showed that independent pharmacies in the U.S. responded to competitive pressure by dispensing more prescription opioids.

The rest of the paper proceeds as follows: Section 2 describes the policy history of Medicare Part D, as well as the existing literature examining the effects of Medicare Part D on various aspects of the health care industry. Section 3 discusses the National Establishment Time-Series data we use to study changes in business formation and firm performance, as well as our difference-in-differences identification strategy. Section 4 presents our results examining changes in the

number of pharmacies in a county, pharmacy openings and closures, and various performance metrics for surviving establishments. Finally, Section 5 discusses the policy implications and limitations of our results.

2. Policy Background and Existing Literature

2.1 Policy Background

When Medicare was signed into law by President Lyndon B. Johnson in 1965, it was intended to protect senior citizens from financial devastation associated with hospital stays and certain medical procedures. Beneficiaries were automatically enrolled in hospital coverage (Medicare Part A), and coverage for physician services (Medicare Part B) was offered as optional, supplementary insurance. At this point, prescription benefits were not covered, though over the next forty years they became both more medically important and more expensive (Duggan et al. 2008). By 2003, Medicare beneficiaries were spending an average of $2,500 per year on prescription drugs, or twice what the average American spent on health care in 1965 when adjusting for inflation (Engelhardt and Gruber 2011).[3]

On December 8, 2003, President George W. Bush signed the Medicare Prescription Drug, Improvement, and Modernization Act of 2003, which created Medicare Part D. Though prescription drug benefits were not fully available until Part D was fully launched in 2006, the law established a transitional discount card program that became widely available in mid-2004. Medicare beneficiaries were free to sign up for Medicare Part D coverage until May 15, 2006, while those enrolling afterwards were subject to a financial penalty to mitigate adverse selection. However, beneficiaries eligible for both Medicare and Medicaid (i.e.,

[3] Yet even at this point many Medicare beneficiaries had some form of prescription drug coverage. For example, Engelhardt and Gruber (2011) found that, prior to Medicare Part D, 72.2 percent of adults aged 65 to 70 had coverage through private prescription drug plans or Medicare Advantage plans.

"duals") were required to receive prescription benefits through Medicare (Basu et al. 2010; Abaluck and Gruber 2011). The law also included a low-income subsidy to help beneficiaries who could not otherwise afford the prescription drug benefit (Megellas 2006; Decarolis 2015).

2.2 Existing Literature on Medicare Part D

We build on prior work studying the effects of Medicare Part D on the pharmaceutical industry. Leveraging variation across branded drugs in their pre-existing Medicare market share, Duggan and Morton (2010) found that Medicare Part D increased drug utilization and reduced the growth in branded drug prices by up to 20 percent. These effects were due to large changes in utilization among those who previously lacked prescription drug coverage (Zhang et al. 2009), as well as more modest effects among those who previously had less generous coverage (Yin et al. 2008; Engelhardt and Gruber 2011). For example, Kaestner and Khan (2012) found that gaining prescription coverage through Medicare Part D was associated with a 30 percent increase in the number of annual prescriptions and a 40 percent increase in expenditures on prescription drugs among those previously lacking coverage. Meanwhile, Lichtenberg and Sun (2007) used data from a large retail pharmacy chain and estimated that Medicare Part D reduced out-of-pocket costs for elderly adults by 18 percent and increased prescription drug utilization by nearly 13 percent. There is also evidence that Medicare Part D had important spillovers. Using variation in insurers' potential Part D enrollment and data from a national retail pharmacy chain, Lakdawalla and Yin (2015) found that Part D enrollment increases lowered drug prices and reduced profits from individuals enrolled in commercial insurance plans external to Medicare Part D.[4]

[4] Other work has explored the relationship between Medicare Part D and patient outcomes. Comparing changes in mortality among those eligible for Medicare Part D (i.e., those aged 66) to the concurrent changes among those whose age made them ineligible (i.e., those aged 64), Huh and Reif (2017) found that Medicare Part D reduced mortality by approximately 2 percent, primarily

Several studies have also explored the ways in which Medicare Part D may have altered strategic firm behaviors, such as innovation and advertising. Blume-Kohout and Sood (2013) found that Medicare Part D increased pharmaceutical research and development for therapeutic classes with higher Medicare market share, consistent with evidence that increases in market size (Kremer 2002; Acemoglu and Linn 2004) and government purchasing support (Finkelstein 2004) drive investment in research and development. Meanwhile, Lakdawalla et al. (2013) found that Medicare Part D resulted in a 14 to 19 percent increase in advertising expenditures, particularly among the least competitive drug classes, while Alpert et al. (2023) found that Medicare Part D led to larger increases in advertising in geographic areas with higher concentrations of Medicare beneficiaries. These results suggest that Medicare Part D increased pharmaceutical companies' perceived return to advertising. Indeed, both Lakdawalla et al. (2013) and Alpert et al. (2023) documented increased drug utilization among near-elderly individuals who, while not covered by Medicare Part D, presumably were exposed to the increased advertising. Relatedly, Sanzenbacher and Wettstein (2020) found a reduction in generic entry following Medicare Part D, in part because of an increased frequency of evergreening on the part of branded drug manufacturers.

Finally, we add to an interdisciplinary literature exploring the implications of Medicare Part D for retail pharmacies. Much of this work has used surveys and structured interviews to discern pharmacists' satisfaction with the program (Radford et al. 2007; Radford et al. 2009; Bono and Crawford 2010; Zhang et al. 2010; Kahn 2012). In their responses, pharmacists regularly cited low reimbursement rates and increased administrative burdens as challenges, particularly among independent pharmacies. Yet projections made shortly after

due to reductions in cardiovascular-related mortality. Using a complementary research design leveraging pre-existing county-level differences in prescription drug coverage rates, Dunn and Shapiro (2019) similarly found that Medicare Part D reduced cardiovascular-related mortality.

Medicare Part D's implementation indicated that while net income would fall by approximately 22 percent – attributable to a 0.7 percent decline in the gross margin for prescriptions – the average independent pharmacy would remain profitable (Carroll 2008).[5] However, examining descriptive trends in the number of pharmacies over time, Klepser et al. (2011) noted a nationwide increase in the number of independent pharmacy closures beginning in late 2007 through 2008, though they were unable to disentangle whether these changes were due to Medicare Part D or the start of the Great Recession.

We make several important contributions relative to the existing literature. While prior evidence suggests that Medicare Part D increased the profitability of prescription drugs for pharmaceutical companies (Friedman 2009), its effect on the retail pharmacy industry is unclear. While retail pharmacies may have benefitted from utilization increases, this benefit may have been partially offset by falling prices. Moreover, their gross margins may have fallen if they were previously earning high margins from underinsured and insured cash customers (Berndt and Newhouse 2010). By using the NETS data, we provide direct evidence on the relationship between Medicare Part D and retail pharmacy outcomes. Additionally, much of the existing evidence on the relationship between Medicare Part D and retail pharmacy outcomes is based on samples from a single large national pharmacy chain (Lichtenberg and Sun 2007; Yin et al. 2008; Lakdawalla and Yin 2015). Yet Ketcham and Simon (2008) provide evidence that estimates from this limited sample may understate the increase in prescription drug utilization by 2.6 times compared to estimates obtained from a larger collection of pharmacies. As such, our ability to explore whether Medicare Part D was differentially related to changes in outcomes for the retail pharmacy industry more broadly represents an

[5] Spooner (2008) responded to these projections by noting that evaluating the model using the median values for revenues, expenses, and prescription volume – rather than the mean values – produced scenarios where independent pharmacies were no longer profitable.

important contribution. Finally, we provide the first evidence on how Medicare Part D may be contributing to racial and ethnic health disparities in pharmacy access.

3. Data and Methodology

3.1 Data: National Establishment Time-Series

To examine how Medicare Part D affected the retail pharmacy industry, we use National Establishment Time-Series (NETS) data from 2000 through 2007.[6] The NETS is a longitudinal dataset sourced from the Dun & Bradstreet Duns Marketing Information file tracking outcomes and characteristics of over 60 million business establishments in the United States. The data report when each establishment opened, when the establishment exited the data due to closure, as well as each establishment's annual sales, number of employees, and location. Importantly, the NETS also contains Standard Industrial Classification (SIC) codes, which allows us to identify retail pharmacies (SIC 5912). The NETS data have previously been used by researchers to explore a variety of topics related to business performance (e.g., Currie et al. 2010; Neumark and Kolko 2010; Neumark et al. 2011; Kolko 2012; Orrenius et al. 2020; Carpenter et al. 2023). To ensure that our results are not being driven by changes in the composition of counties contributing to identification, we restrict our analyses to a balanced county-year panel.

Table 1 provides the summary statistics for the outcomes of interest and covariates. Column 1 reports summary statistics for the full sample. Column 2 reports statistics for establishments located in counties that had a below median elderly population in the year 2000 (i.e., counties where elderly adults presumably comprised a lower share of the customer base). Likewise, column 3 reports statistics for establishments located in counties that had an above median elderly population

[6] We stop our sample period in 2007 to ensure that our results are not being driven by the Great Recession. However, we test the robustness to using additional years of data in the appendix.

in the year 2000 (i.e., counties where elderly adults presumably comprised a higher share of the customer base). Panel A reports statistics for outcomes measured at the county level, including the number of pharmacies, the number of pharmacy openings, and the number of pharmacy closures. Panel B reports statistics for outcomes measured at the establishment level, including pharmacy sales and the number of pharmacy employees. On average, we see that counties that had a below median elderly population in the year 2000 had considerably more pharmacies than counties where a higher share of the population was comprised of elderly adults. One explanation for this is that these younger counties were also considerably larger. Similarly, we see that pharmacies located in counties where elderly adults comprised a larger share of the population had lower levels of sales and fewer employees than those in counties where elderly adults comprised a smaller share of the population.[7]

3.4 Empirical Strategy: Difference-in-Differences

To examine the relationship between Medicare Part D and changes in the number of retail pharmacies, we leverage variation in the share of the county population comprised of elderly individuals through a difference-in-differences identification strategy (Alpert et al. 2023). The intuition behind this empirical decision is that Medicare beneficiaries are more likely to make up a greater share of the customer base in counties with relatively older populations. Specifically, we estimate:

$$Y_{cst} = \alpha + \beta \cdot \mathbf{1}\{\text{ABOVE MEDIAN SHARE}\}_c \times \mathbf{1}\{\text{Year} \geq 2004\}_t + \mathbf{X}'_{cst}\lambda + \theta_c + \tau_{st} + \varepsilon_{cst} \quad (1)$$

where the dependent variable, Y_{cst}, is the number of pharmacies in county *c* located in state *s* in year *t*. We also examine changes in the number of pharmacy openings and closings. To model the count nature of these data, we estimate equation (1)

[7] We obtain data on county-level unemployment rates from the U.S. Bureau of Labor Statistics and county-level population from the National Cancer Institute's Surveillance, Epidemiology, and End Results (SEER) Program.

using a Poisson regression. As such, we interpret β as measuring the change in the natural log of our outcomes of interest.

Our coefficient of interest, β, measures how Medicare Part D differentially affected pharmacy outcomes based on whether the customer base was likely comprised of elderly adults by interacting a variable indicating that the county had an above median share of the population comprised of adults aged 65 or older in the year 2000, $\mathbf{1}\{\text{ABOVE MEDIAN SHARE}\}_c$, with a post-period indicator, $\mathbf{1}\{\text{Year} \geq 2004\}_t$. We begin our post-period in 2004 to account for the passage of the Medicare Prescription Drug, Improvement, and Modernization Act in December 2003. While Part D was not fully implemented until January 2006, beginning our post-period in 2004 accounts for interim programs intended to bridge the gap between passage and implementation (Huh and Reif) and anticipatory changes in business decisions and drug utilization (Alpert 2016).[8]

We include a vector of county-level economic and demographic characteristics, $\mathbf{X}_{cst}$, to account for time-varying factors that may affect pharmacy outcomes independent of Medicare Part D. These include the county-level unemployment rate, the natural log of the county population, the share of the county comprised of Black individuals, and the share of the county comprised of Hispanic individuals. We account for time-invariant county-level characteristics through the inclusion of county fixed effects, θ_c, though in some specifications we replace these with more granular establishment fixed effects. Finally, we account for time-varying state-level policies and economic trends through the inclusion of state-by-year fixed effects, τ_{st}. Standard errors are clustered at the county level (Bertrand et al. 2004).

[8] The Medicare Drug Discount Card and Transitional Assistance Programs began offering prescription discount cards in mid-2004 and provided $1.5 billion on prescription drug subsidies for low-income elderly adults (Huh and Reif 2017). Moreover, Alpert (2016) showed that patients reduced drug utilization for chronic but not acute conditions between Medicare Part D's passage and implementation.

In the presence of our covariates and fixed effects, our identification assumption is that the number of pharmacies in counties with an above median share of elderly individuals would have evolved similarly to the number of pharmacies in counties with a below median share. While fundamentally untestable, we assess the validity of this assumption with the following event study specification:

$$Y_{cst} = \alpha + \sum_{t=2000,\, t\neq 2003}^{2007} \beta^{t} \cdot \mathbf{1}\{\text{ABOVE MEDIAN SHARE}\}_{c} \times \mathbf{1}\{\text{Year} = t\}_{t} + \mathbf{X}'_{cst}\lambda + \theta_{c} + \tau_{st} + \varepsilon_{cst} \quad (2)$$

where the coefficients of interest, β^{t}, measure the evolution of pharmacy outcomes in counties with an above median concentration of elderly individuals in the year 2000 relative to those counties with a lower concentration. In addition to allowing us to examine differential trends in the pre-period, this specification allows us to model potential dynamic treatment effects.

After exploring the relationship between Medicare Part D and the number of retail pharmacies, we turn our attention to changes in outcomes for existing establishments using the following specification:

$$\ln(Y)_{icst} = \alpha + \beta \cdot \mathbf{1}\{\text{ABOVE MEDIAN SHARE}\}_{c} \times \mathbf{1}\{\text{Year} \geq 2004\}_{t} + \mathbf{X}'_{cst}\lambda + \theta_{i} + \tau_{st} + \varepsilon_{icst} \quad (3)$$

where our dependent variables of interest are the natural log of sales and the natural log of the number of employees for pharmacy *i* located in county *c* in state *s* in year *t*. Annual sales and the number of employees are strictly positive for all pharmacies, so we can take the natural log of these values (Mullahy and Norton 2023; Chen and Roth 2024) and estimate equation (3) via ordinary least squares. Another difference, relative to equation (1), is that we account for all time-invariant pharmacy-specific characteristics by including establishment fixed effects. The inclusion of these additional fixed effects means that the estimates will be identified from within-establishment changes in the outcomes over time.

Finally, we examine dynamic changes in establishment-level outcomes using the following event study specification:

$$\ln(Y)_{icst} = \alpha + \sum_{t=2000,\, t\neq 2003}^{2007} \beta^t \cdot \mathbf{1}\{\text{ABOVE MEDIAN SHARE}\}_c \times \mathbf{1}\{\text{Year} = t\}_t + \mathbf{X}'_{cst}\lambda + \theta_i + \tau_{st} + \varepsilon_{icst} \quad (4)$$

where we account for composition changes in the pharmacies identifying each β^t by limiting the sample to pharmacies that remained open continuously from 2000 through 2007.

4. Results

4.1 Effect on the Number of Pharmacies

We begin by examining the relationship between the introduction of Medicare Part D and changes in the size of the retail pharmacy industry. The dependent variable in Table 2 is the number of pharmacies in a county, and we estimate equation (1) as a Poisson model. Column 1 reports the results from a sparse specification including only county and year fixed effects. Column 2 augments this specification with the share of the county population comprised of Black individuals, the share of the county population comprised of Hispanic individuals, and the natural log of the county population. Column 3 accounts for local economic conditions by further including the county-level unemployment rate. Finally, column 4 accounts for state-level time-varying policies and conditions through the inclusion of state-by-year fixed effects. Across all columns, we find that Medicare Part D was associated with a statistically significant 5.0 to 7.1 percent reduction in the number of pharmacies.

Table 2 indicates that Medicare Part D reduced the number of retail pharmacies in areas where the customer base was presumably more likely to be comprised of elderly adults. Importantly, this reduction does not appear to have been due to an existing difference in pharmacy availability. The pre-period

estimates in Figure 1 are small in magnitude, do not display any downward trend, and are statistically insignificant. Instead, we estimate that the number of pharmacies initially fell by 1.1 to 4.4 percent in the years following Part D's passage but prior to its full implementation.[9] This reduction increased in magnitude following implementation, such that counties that had a higher share of the population comprised of elderly adults in the year 2000 experienced a 6.0 to 6.3 percent reduction in the number of pharmacies relative to their relatively younger counterparts.[10]

So far, we have compared changes in the number of pharmacies in counties where elderly individuals comprised an above median share of the population to the concurrent changes in counties where they comprised a below median share. In Table 3, we test the sensitivity of our results to alternative ways of defining the treatment group. Column 1 reprints our baseline result showing a 5.1 percent reduction in the number of pharmacies in counties where elderly individuals comprised an above median share of the population. Column 2 reports changes based on the quartile of the distribution. Relative to counties in the first quartile, we estimate that those in the second quartile experienced a 4.4 percent reduction in the number of pharmacies following the passage of Medicare Part D. Meanwhile, we detect a 7.3 and 7.5 percent reduction for those in the third and fourth quartiles, respectively. Finally, column 3 flexibly models the relationship by interacting the post-period indicator with the continuous share of the population comprised of elderly adults in the year 2000. Following the passage of Medicare Part D, we find a standard deviation increase in this share was associated with a 3.6 percent reduction in the number of pharmacies ($-0.877 \times 0.041 = -0.036$).

[9] We report these estimates and tests of joint significance in Appendix Table 1.

[10] Our sample period ends in 2007 to minimize the likelihood our results are being driven by the Great Recession. However, we show in Appendix Figure 1 that the pattern is unchanged if we extend the sample period to 2009.

Prior work suggests that the NETS data may be less reliable for the largest and smallest establishments (Neumark et al. 2005; Barnatchez et al. 2017), particularly establishments with fewer than five employees. To test whether this may be driving our findings, in Figure 2 we report the results from re-estimating our event study specification when limiting the sample to pharmacies with 5 to 34 employees (dark grey triangles) and 10 to 34 employees (light grey circles). Reassuringly, the pattern is unchanged.[11] There is no evidence that the number of pharmacies was trending downward in counties where a higher share of the population was comprised of elderly individuals in the year 2000. We then find evidence of a modest reduction in the number of pharmacies between the passage and enactment of Medicare Part D, as well as a more sizable 4.5 to 6.0 percent reduction in the years following full implementation.

To further increase confidence that we are detecting a meaningful relationship between Medicare Part D and a reduction in the number of pharmacies, we adopt a variant of Fisher's (1935) permutation test. First, we match each county to another random county's population share in the year 2000. Second, we re-estimate equation (1) and save the resulting coefficient. After repeating this process 100 times, we compare the actual estimate to the distribution of these placebo coefficients (Buchmueller et al. 2011; Cunningham and Shah 2018; Churchill 2021). Figure 3 shows that the reduction in the number of pharmacies we estimate as being attributable to the passage of Medicare Part D is well outside of the placebo distribution, indicating that we are unlikely to have obtained this value by chance.[12] We also show in Figure 4 that the results are robust to iteratively excluding observations from each state.

[11] We set the lower bounds at 5 and 10 employees based on the recommendation of Barnatchez et al.'s (2017). Setting the upper bound at 34 employees drops pharmacies in the top 5 percent of the employment distribution.

[12] Appendix Figure 2 plots the coefficient and corresponding confidence intervals for the actual result (dark grey triangle) and the 100 placebo results (light grey circles).

At the time of Medicare Part D's passage, there were concerns that independent pharmacies would be put at a disadvantage relative to chain establishments. Independent pharmacies tend to operate on smaller margins than their chain counterparts (Berndt and Newhouse 2010), and the average independent pharmacy receives a higher share of its revenue from prescription drug sales than chain pharmacies (Spooner et al. 2008; Weigel et al. 2013). As a result, independent pharmacies were thought to be particularly vulnerable to reimbursement changes, including individuals shifting from being high-margin cash customers to those with insurance. In Table 4, we leverage the fact that the NETS includes information about whether the observation is a standalone (i.e., non-chain) establishment or a non-standalone establishment. Column 1 shows that Medicare Part D was associated with a 6.5 percent reduction in the number of standalone pharmacies and a 3.7 percent reduction in the number of non-standalone pharmacies. These results suggest that concerns that Part D would be especially detrimental for independent pharmacies were justified.

We have found clear evidence that Medicare Part D was associated with a reduction in the number of pharmacies in counties where elderly individuals were more likely to comprise a larger share of the customer base. In Table 5, we now explore whether these changes were attributable to a reduction in the number of new pharmacy openings and/or an increase in the number of pharmacy closures. Column 1 shows that Medicare Part D was associated with a statistically significant 13.5 percent reduction in the number of new pharmacy openings. In contrast, the relationship between Medicare Part D and closures in column 2 is nearly 90 percent smaller in magnitude and statistically insignificant. Therefore, it appears that the estimated reduction in the number of pharmacies was entirely due to a reduction in the number of pharmacy openings.[13] We show in Appendix Table 2 that this pattern

[13] Because there are more pharmacies in a county than there are new pharmacy openings in a county each year, a unit reduction will yield a smaller percent change in establishments than in openings.

is robust to alternative ways of defining treatment status, in Appendix Table 3 that patterns are robust to excluding the openings and closures of the smallest and largest establishments, and in Appendix Figure 3 that the results are robust to the randomization placebo test previously employed. Overall, the evidence suggests that while Medicare Part D shrank the pharmacy industry in counties where elderly adults were more likely to comprise a larger share of the customer base, it did so primarily by discouraging the formation of new businesses, rather than by closing existing pharmacies.[14]

In Figure 5, we use our event study specification to explore the dynamic relationships between Medicare Part D, pharmacy openings (Panel A), and pharmacy closures (Panel B).[15] Prior to the passage of Medicare Part D, there is no evidence that pharmacy openings were differentially trending in counties where elderly individuals comprised an above median share of the population relative to counties where they comprised a below median share of the population. However, we estimate a 12.4 and 24.3 percent reduction in the number of pharmacy openings in the two years following passage of Medicare Part D, respectively. While we detect a statistically significant 12.9 percent reduction in the year following full implementation, we do not detect any change in the subsequent year, suggesting that these reductions may have been driven by uncertainty regarding the program

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However, when converting the results to changes in pharmacies, we continue to detect a stronger relationship when examining the number of establishments vs. the number of openings. Using the *margins* command, we calculate the average marginal effect to be a 0.88 reduction in the number of pharmacies and a 0.22 reduction in the number of new openings.

[14] Appendix Table 4 shows that Medicare Part D was associated with a 11.9 percent reduction in the number of standalone pharmacy openings and an 18.2 percent reduction in the number of non-standalone pharmacy openings (Panel A). These estimates imply an average marginal reduction of 0.14 standalone pharmacies and 0.16 non-standalone pharmacies. There is no evidence that Medicare Part D was associated with an increase in standalone pharmacy closures (Panel B). Indeed, the point estimate in column 1 is negative and statistically insignificant, which is consistent with projections indicating that many existing independent pharmacies would remain profitable (Carroll 2008). However, we do detect weak evidence of an increase in the number of non-standalone pharmacy closures, though the estimate is only significant at the 10 percent level.

[15] These estimates are also reported in Appendix Table 1.

that was resolved over time. Finally, consistent with the static difference-in-differences results, we do not detect any change in pharmacy closures in either the pre- or post-period.

Existing work indicates that racial and ethnic minority communities have limited access to retail pharmacies (Essien et al. 2021; Guadamuz et al. 2021), in part because these communities experience elevated rates of pharmacy closure (Guadamuz et al. 2024). In Table 6, we explore whether Medicare Part D may have inadvertently widened this disparity. Column 1 reports results examining changes in the number of pharmacies, column 2 the number of pharmacy openings, and column 3 the number of pharmacy closures. Panel A limits the sample to counties that had an above median share of the population comprised of Asian, Black, Hispanic, and Other Race/Ethnicity individuals in the year 2000, while Panel B limits the sample to the below median counties. Panel C then considers the full sample of counties but fully interacts the right-hand side of the regression equation with an indicator for whether the county had an above median share of the population comprised of Asian, Black, Hispanic, and Other Race/Ethnicity individuals in the year 2000.

Overall, Table 6 indicates that Medicare Part D was associated with larger reductions in the number of pharmacies in more racially diverse counties. Among these counties, column 1 shows those where an above median share of the population was comprised of elderly adults in the year 2000 experienced a 5.3 percent reduction in the number of pharmacies following the passage of Medicare Part D (Panel A). In contrast, we only estimate a 2.0 percent reduction for counties where a below median share of the population was comprised of racial and ethnic minority individuals in the year 2000 (Panel B). Moreover, we find that the additional reduction experienced by the more racially diverse counties is statistically different from zero (Panel C). Interestingly, column 2 shows a reduction in the number of pharmacy openings for the more racially diverse

counties (Panel A) and the less racially diverse counties (Panel B), though only the former estimate is statistically significant. While the point estimates in column 3 suggest that the additional reduction in the number of pharmacies in counties where a larger share of the population was comprised of racial and ethnic minority individuals may also be due to an increase in pharmacy closures, the estimates are not statistically distinguishable from zero.

4.2 Effects on Surviving Pharmacies

In the prior section, we showed that, after the passage of Medicare Part D, counties where elderly individuals likely comprised a larger share of the customer base saw a reduction in the number of pharmacies compared counties where they likely comprised a smaller share. We now explore the consequences of these changes for surviving pharmacies using the establishment-level NETS data. These data allow us to examine changes in a variety of economically meaningful outcomes for the same pharmacy over time, including the level of competition, annual sales, and pharmacy employment. Our baseline model when examining these outcomes includes establishment and year fixed effects, county-level demographic controls, the county-level unemployment rate, and state-by-year fixed effects.

An important feature of the NETS database is that it includes the GPS coordinates of each establishment, which allows us to examine how Medicare Part D changed the competitive landscape faced by surviving pharmacies. While there is no standard definition of what constitutes a retail pharmacy market area (Chen 2019; Starc and Swanson 2021; Janssen and Zhang 2023; Atal et al. 2024), Medicare Part D's retail pharmacy "network adequacy" standards require that 90 percent of urban beneficiaries reside within 2 miles of a network pharmacy, 90 percent of suburban beneficiaries reside within 5 miles, and 70 percent of rural beneficiaries reside within 15 miles (Centers for Medicare and Medicaid Studies 2006). Based on these standards, for each pharmacy we determine the sales volume

of other pharmacies located within a 1,000-meter radius (~0.62 miles), a 5,000-meter radius (~3.1 miles), and a 10,000-meter radius (~6.2 miles). We also calculate the number of pharmacies in these radii.[16] Regardless of the radius used, Table 7 shows that Medicare Part D was associated with a 4.7 to 12.2 percent reduction in nearby sales (Panel A) and a 4.1 to 5.2 percent reduction in the number of nearby pharmacies (Panel B). Overall, Table 7 indicates that Medicare Part D was associated with a less competitive landscape for surviving establishments.[17]

Given that Medicare Part D reduced the number of pharmacies, it is possible that surviving establishments – particularly those that previously faced more competitive pressure – were able to improve their business outcomes. To test this possibility, we utilize the distribution of sales volume from nearby pharmacies in 2003 prior to the passage of Medicare Part D. We classify locations in the bottom quartile of this distribution as being in a "low-competition area," those in the middle 50 percent of the distribution as being in a "moderate-competition area," and those in the top quartile of the distribution as being in a "high-competition area." While we do not find evidence in Table 8 that Medicare Part D was associated with changes in annual sales or the number of employees for the entire sample, these results mask important heterogeneity. In Figure 6 we report estimates when stratifying the sample by the level of competition in 2003. We find that Medicare Part D was associated with a 2.8-4.6 percent increase in annual sales for pharmacies that were located in high-competition areas in the year prior to passage (Panel A), though we do not detect a change in employment for any group (Panel B).[18]

[16] We report summary statistics for these measures in Appendix Table 5.
[17] Appendix Figure 4 shows that these reductions were not driven by a differential pre-trend. Instead, they occurred only following the passage of Medicare Part D.
[18] Appendix Figure 5 shows a similar pattern when defining low-competition, medium-competition, and high-competition areas based on the distribution of the number of nearby pharmacies in 2003.

In Table 9, we explore whether Medicare Part D differentially affected surviving standalone and non-standalone pharmacies.[19] The dependent variable in columns 1 and 2 is the natural log of the real value of annual sales, and the dependent variable in columns 3 and 4 is the natural log of the number of employees. Columns 1 and 3 limit the sample to standalone pharmacies, and columns 2 and 4 limit the sample to non-standalone pharmacies. Panel A reports the results from our baseline specification comparing changes in outcomes for pharmacies in counties where an above median share of the population was comprised of elderly adults in the year 2000 to pharmacies in below median counties. The remaining two panels report results using the alternative specifications previously used in Table 3. Panel B modifies the independent variables of interest to be the interaction between the post-period indicator and indicators for being in the 2nd, 3rd, and 4th quartile of the elder share distribution. Panel C replaces the independent variable with the interaction between the post-period indicator and the continuous share of the county-level population in the year 2000 comprised of elderly adults.

In Table 9, our baseline specification shows suggestive evidence that Medicare Part D was associated with a 1.0 percent increase in standalone pharmacy sales. This relationship becomes starker when we allow for a more flexible functional form. Relative to standalone establishments in the first quartile of the elder share distribution, we estimate that Medicare Part D was associated with a statistically significant 1.5 to 2.3 percent increase in sales for surviving standalone establishments located in counties where elderly adults comprised a higher share of the population. Indeed, when allowing for a fully flexible relationship, we estimate

[19] Appendix Tables 6 and 7 explore whether Medicare Part D was differentially associated with changes in the volume of sales at nearby pharmacies and the number of nearby pharmacies for standalone and non-standalone locations. Appendix Table 6 suggests that standalone pharmacies experienced the most robust reduction in competition following the passage of Medicare Part D.

that each standard deviation increase in the share of the population in the year 2000 comprised of elderly adults was associated with a 0.8 percent reduction in standalone pharmacy sales (-0.225 × 0.036 = -0.008), following the passage of Medicare Part D.[20,21]

We assess the dynamics of this change in Figure 7. Given our prior results showing that Medicare Part D reduced the total number of pharmacies, we limit the sample to establishments that remained open from 2000 through 2007. This ensures that the results are not being driven by changes in the composition of pharmacies identifying each event-time estimate.[22] There is no evidence that sales were differentially trending for standalone pharmacies located in counties where an above median share of the population was comprised of elderly adults relative to standalone pharmacies in below median counties prior to the passage of Medicare Part D. However, we find that sales rose by 0.3 to 1.0 percent in the years following passage but prior to enactment and by approximately 1.2 percent in the years following enactment.[23] Overall, these findings suggest that while Medicare Part D ultimately reduced the number of standalone and non-standalone pharmacies, it modestly benefitted surviving standalone establishments.

5. Conclusion

Retail pharmacies play a key role in the U.S. health care system. In addition to dispensing prescription medication, pharmacies serve as sources of broader types

[20] When using the establishment-level data, the average share of the population comprised of elderly adults is 0.129 with a standard deviation of 0.036. For standalone pharmacies these values are 0.130 and 0.036, while for non-standalone pharmacies they are 0.128 and 0.036.
[21] We show in Appendix Tables 8-10 that the results are robust to limiting the sample to pharmacies with 5-34 employees and 10-34 employees (Barnatchez et al. 2017).
[22] Appendix Figure 6 shows that the results are robust to using a longer post-period. We continue to detect increases in sales in 2008 and 2009.
[23] Appendix Figure 7 does not reveal any change in the number of employees for standalone pharmacies in the post-period. Nor do we find any clear pattern among non-standalone pharmacies in Appendix Figure 8. We report these results for completeness.

of patient care, particularly for members of rural, low-income, and racial and ethnic minority communities (McConeghy and Wing 2016; Brownstein et al. 2022; Shakya et al. 2024; Smart et al. 2024). Yet the retail pharmacy industry has experienced significant challenges (Salako et al. 2018; Guadamuz et al. 2019), limiting access for groups vulnerable to health disparities (Essien et al. 2021; Guadamuz et al. 2024). Despite these industry-wide trends and their implications for patient welfare, relatively little is known about the factors driving retail pharmacy business performance.

In this paper, we study the relationship between Medicare Part D and retail pharmacy outcomes. While Medicare Part D increased prescription drug utilization among Medicare beneficiaries (Lichtenberg and Sun 2007; Ketcham and Simon 2008; Yin et al. 2008; Kaestner and Khan 2012), it also lowered pharmaceutical prices (Duggan and Morton 2010; Duggan and Morton 2011; Lakdawalla and Yin 2015) and imposed administrative costs on pharmacies (Spooner 2008; Radford et al. 2009). Using 2000-2007 National Establishment Time-Series data and a difference-in-differences identification strategy leveraging variation in the share of the local customer base presumably comprised of Medicare beneficiaries, we show that Medicare Part D was associated with a 5 percent reduction in the number of pharmacies located in counties where elderly adults comprised a larger share of the population. Next, we show that this reduction was larger for racial and ethnic minority communities, implying that Medicare Part D may have widened disparities in pharmacy access. We then show that this change was driven by a reduction in the number of pharmacy openings, while estimates for pharmacy closures are smaller in magnitude and statistically insignificant.

By reducing the number of new pharmacy openings, we show that Medicare Part D lowered retail pharmacy competition. Using establishment-level data to examine within-pharmacy changes over time, we find that Medicare Part D was associated with a 4.7 to 12.3 percent reduction in the volume of sales at nearby

pharmacies and a 4.1 to 5.2 percent reduction in the number of nearby pharmacies. As a result, we show that pharmacies located in the most competitive areas prior to the passage of Medicare Part D experienced a 2 to 4 percent increase in sales. Overall, these results offer new insights into the pathways through which government policies can create winners and losers within the health care sector.

This study is subject to some limitations. First, we are unable to directly identify the pathway through which Medicare Part D discouraged business formation (e.g., lower reimbursement rates, additional administrative burdens, etc.). Prior work has largely focused on demonstrating the degree to which Medicare Part D reduced pharmaceutical prices (Zhang et al. 2009; Lakdawalla and Yin 2015) and identifying the relative importance of alternative channels remains an important area for future research. Second, because our sample period includes the years immediately following the introduction of Medicare Part D, we are unable to determine whether the estimated relationships have been affected by more recent health care reform efforts. The Inflation Reduction Act of 2022 included several provisions intended to lower prescription drug prices (Hwang et al. 2022), and it will be important to study whether this reform similarly discourages growth in the retail pharmacy industry. Despite these limitations, this study provides important new evidence that Medicare Part D has stunted growth of the retail pharmacy industry at a time when patients are more frequently turning to pharmacies as a source of preventive care.

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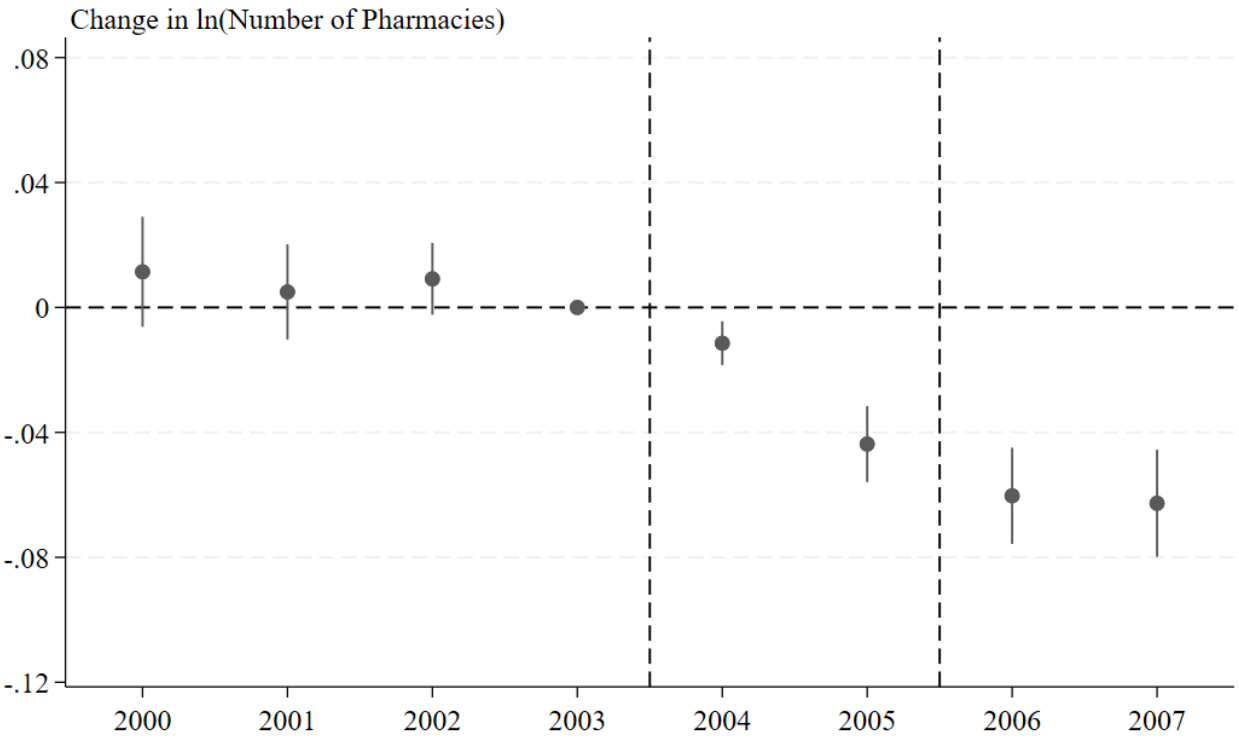
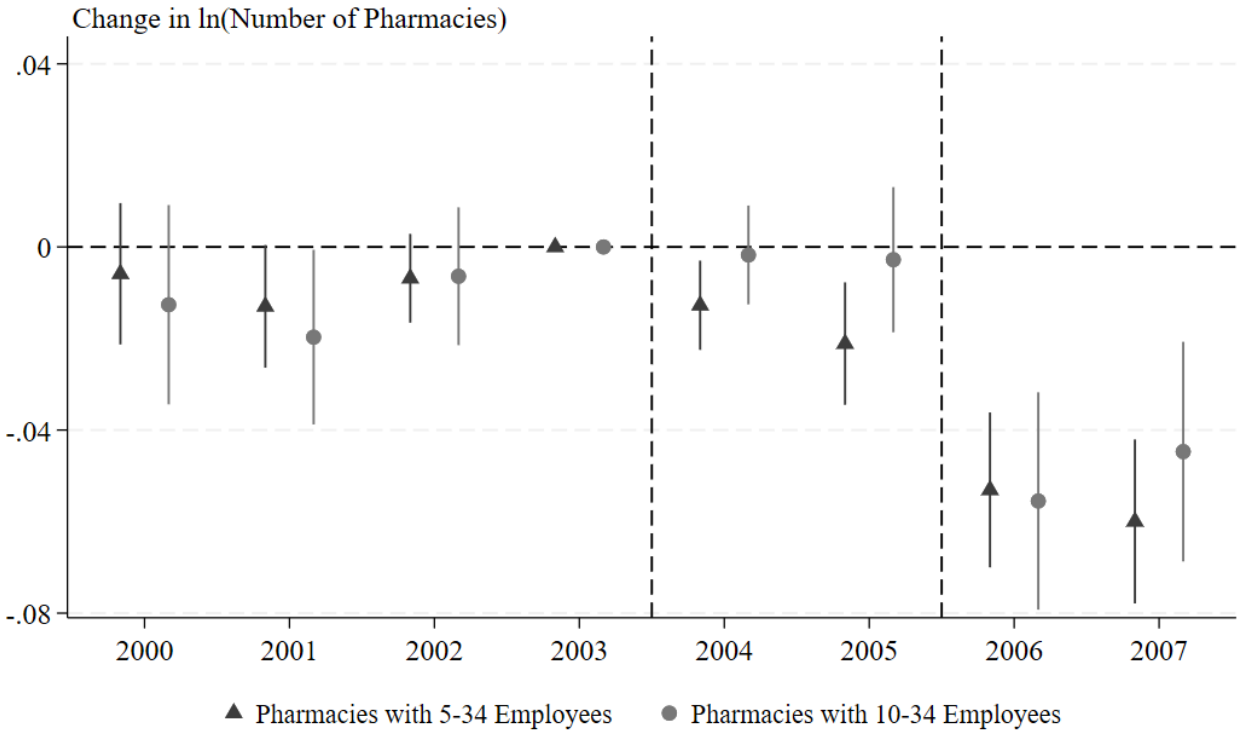
Figure 1: Medicare Part D Was Associated with a Reduction in the Number of Pharmacies



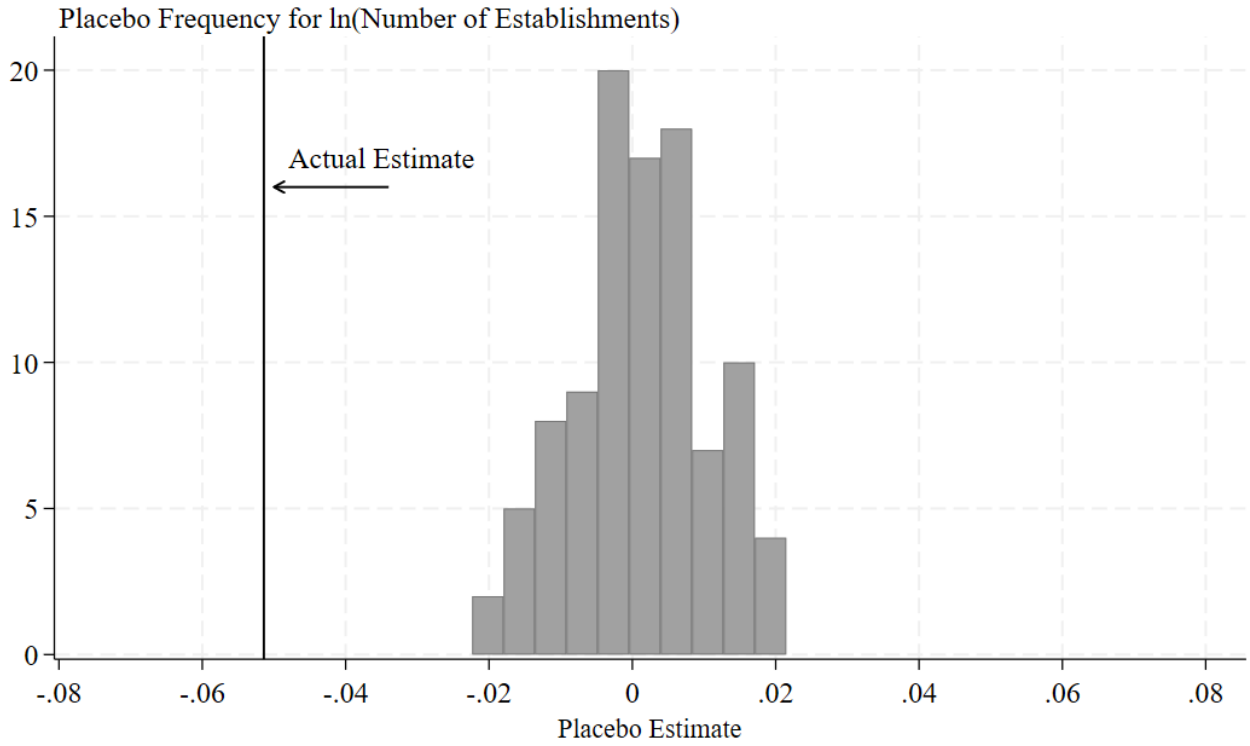
Source: National Establishment Time-Series, 2000-2007.
Note: The dependent variable is the number of pharmacies in a county. The grey circles indicate the coefficients and the vertical lines the 95 percent confidence intervals obtained from the event study specification shown in equation (2) comparing counties that had an above median share of the population comprised of elderly adults in the year 2000 to counties that had a below median share. The regression is estimated using a Poisson specification, so the results are interpreted as changes in natural log of the dependent variable. Standard errors are clustered at the county level.

Figure 2: The Relationship Between Medicare Part D and the Number of Pharmacies is Robust to Excluding the Smallest and Largest Establishments



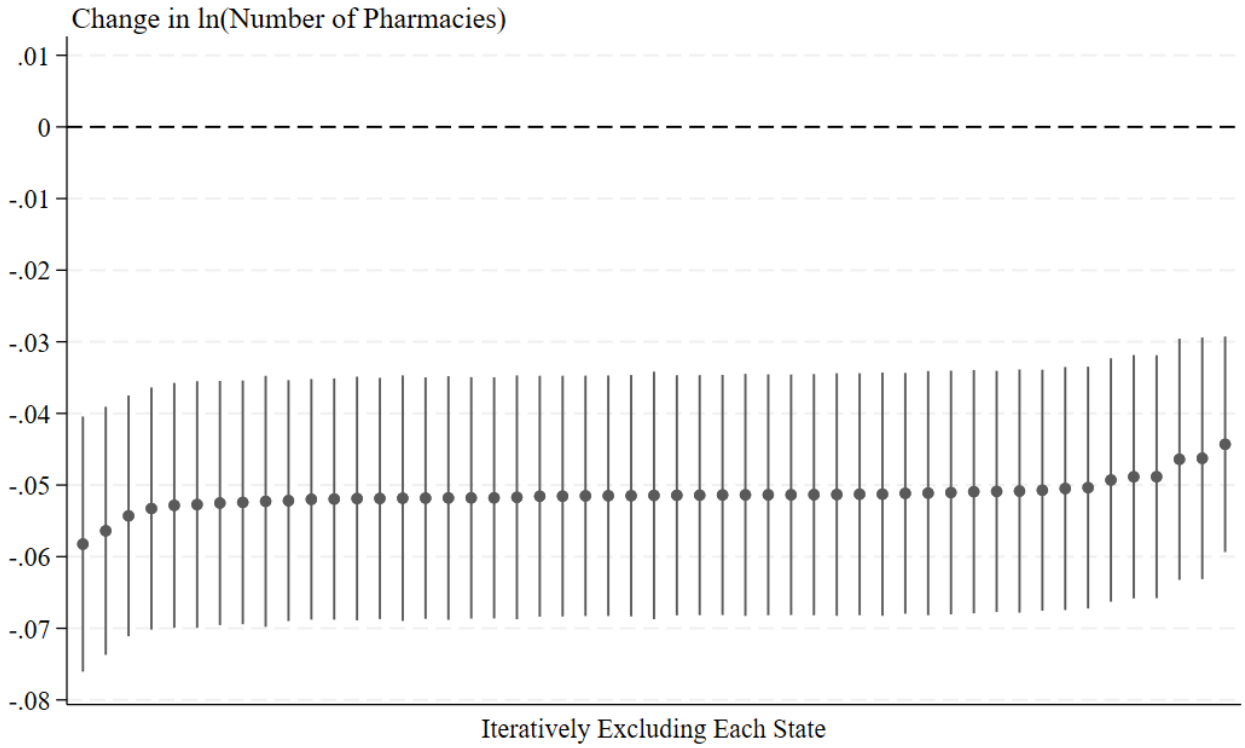
Source: National Establishment Time-Series, 2000-2007.
Note: The dependent variable is the number of pharmacies in a county. The markers indicate the coefficients and the vertical lines the 95 percent confidence intervals obtained from the event study specification shown in equation (2) comparing counties that had an above median share of the population comprised of elderly adults in the year 2000 to counties that had a below median share. The regression is estimated using a Poisson specification, so the results are interpreted as changes in natural log of the dependent variable. The dark grey triangles denote results where the sample is limited to pharmacies with 5-34 employees, while the light grey circles denote results where the sample is limited to pharmacies with 10-34 employees. Standard errors are clustered at the county level.

Figure 3: The Relationship Between Medicare Part D and the Number of Pharmacies is Robust to Randomization Inference



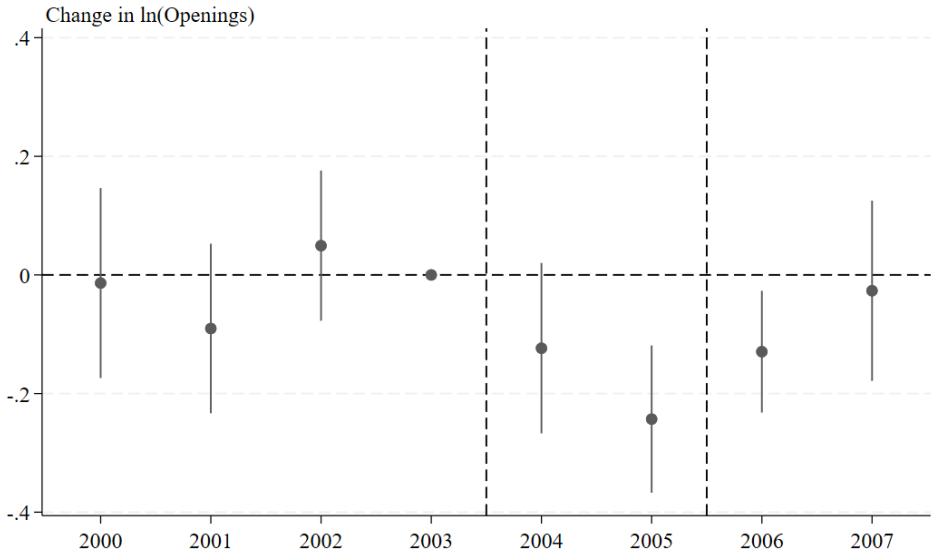
Source: National Establishment Time-Series, 2000-2007.
Note: The dependent variable is the number of pharmacies in a county. The independent variable of interest captures how the number of pharmacies changed following the passage of Medicare Part D in counties with an above median share of the population comprised of elderly adults in the year 2000 relative to counties with a below median share. The regressions include the full set of controls from equation (1). Because they are estimated via a Poisson specification, the results are interpreted as changes in natural log of the dependent variable. The histogram plots the distribution of placebo coefficients obtained from 100 iterations randomly matching each county to a county population share in the year 2000. These placebo estimates and their confidence intervals are also plotted in Appendix Figure 2. The estimate we use from the correct match between counties and their population shares, shown in the vertical black line, are outside the placebo distribution, indicating that the result was unlikely to have been obtained by chance.

Figure 4: The Relationship Between Medicare Part D and the Number of Pharmacies is Robust to Iteratively Excluding Observations from Each State

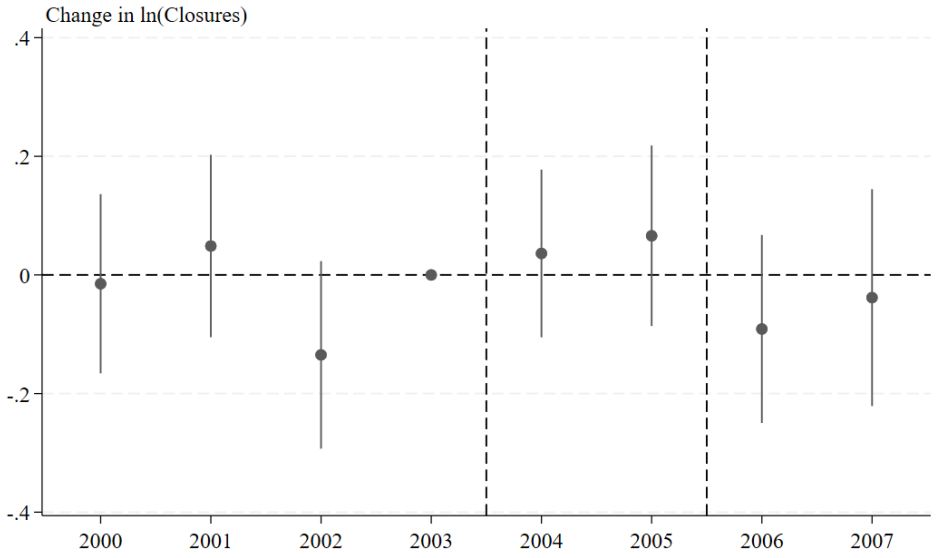


Source: National Establishment Time-Series, 2000-2007.
Note: The dependent variable is the number of pharmacies in a county. The independent variable of interest captures how the number of pharmacies changed following the passage of Medicare Part D in counties with an above median share of the population comprised of elderly adults in the year 2000 relative to counties with a below median share. The regressions include the full set of controls from equation (1). Because they are estimated via a Poisson specification, the results are interpreted as changes in natural log of the dependent variable. The grey circles denote the point estimates and the vertical lines the corresponding 95 percent confidence interval. The figure plots the distribution estimates obtained from iteratively excluding observations from each state. Standard errors are clustered at the county level.

Figure 5: Medicare Part D Was Associated with a Reduction in the Number of Pharmacy Openings



(A)

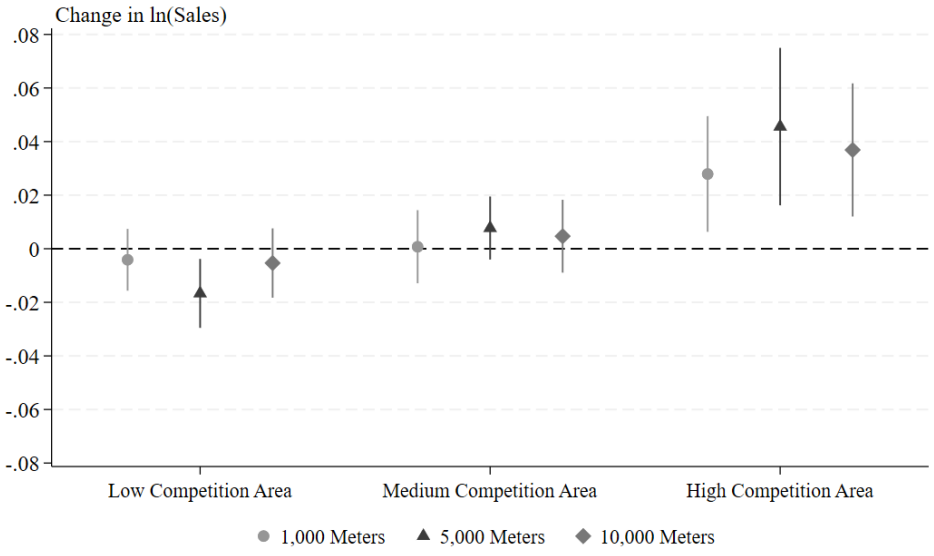


(B)

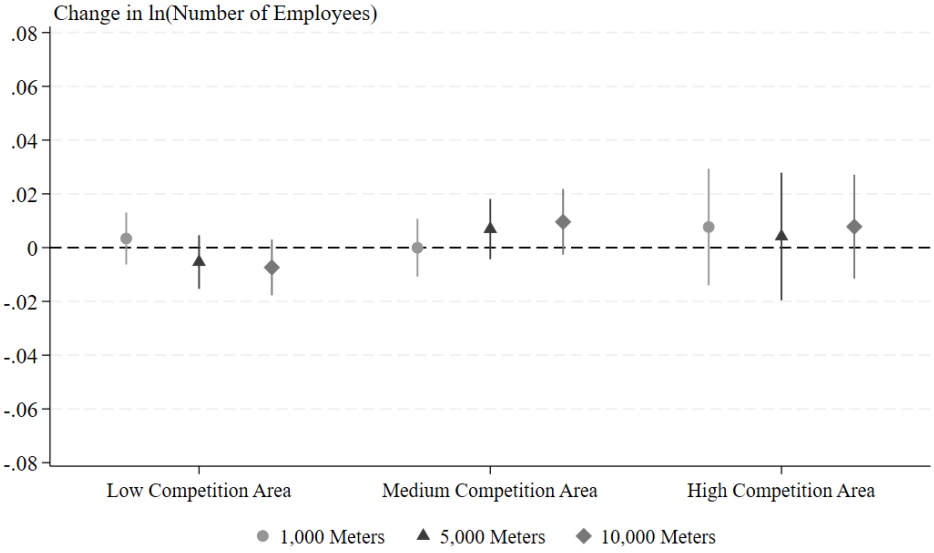
Source: National Establishment Time-Series, 2000-2007.

Note: The dependent variable in Panel A is the number of pharmacy openings in a county. The dependent variable in Panel B is the number of pharmacy closures in a county. The grey circles indicate the coefficients and the vertical lines the 95 percent confidence intervals obtained from the event study specification shown in equation (2) comparing counties that had an above median share of the population comprised of elderly adults in the year 2000 to counties that had a below median share. The regression is estimated using a Poisson specification, so the results are interpreted as changes in natural log of the dependent variable. Standard errors are clustered at the county level.

Figure 6: The Relationship Between Medicare Part D and Pharmacy Sales, by Competition Level Prior to Medicare Part D's Passage



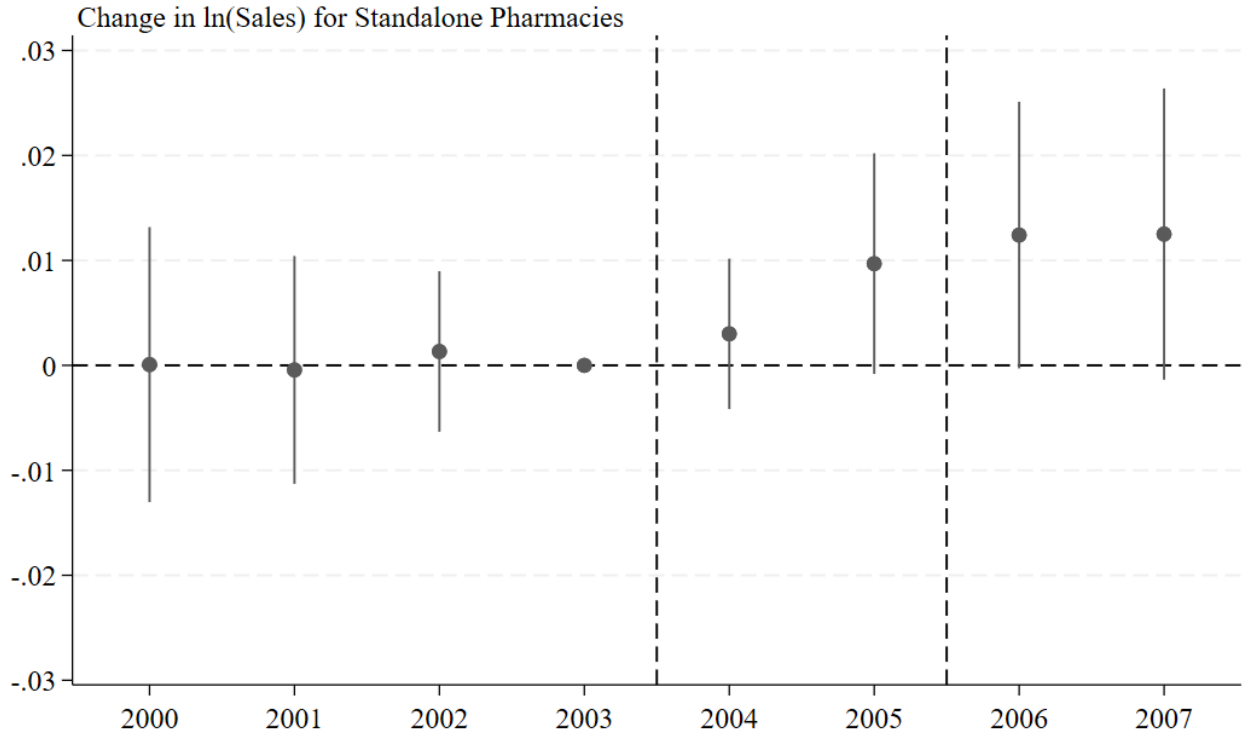
(A)



(B)

Source: National Establishment Time-Series, 2000-2007.
Note: The dependent variable in Panel A is the natural log of sales, and the dependent variable in Panel B is the natural log of the number of employees. The independent variable of interest captures how the number of pharmacies changed following the passage of Medicare Part D in counties with an above median share of the population comprised of elderly adults in the year 2000 relative to counties with a below median share. The regressions include the full set of controls from equation (3). Each estimate is from a separate regression where the sample is limited to establishments in low, medium, or high competition areas in the year 2003 based on the total sales volume from nearby pharmacies. The light grey circles denote results where we define a competition area using a 1,000-meter radius, the dark grey triangles denote results where we define a competition area using a 5,000-meter radius, and the grey diamonds denote results where we define a competition area using a 10,000-meter radius. Standard errors are clustered at the county level.

Figure 7: Medicare Part D was Associated with Increases in Sales Among Surviving Standalone Pharmacies



Source: National Establishment Time-Series, 2000-2007.
Note: The dependent variable is the natural log of the pharmacy's sales. The grey circles indicate the coefficients and the vertical lines the 95 percent confidence intervals obtained from the event study specification shown in equation (4) comparing pharmacies in counties that had an above median share of the population comprised of elderly adults in the year 2000 to pharmacies in counties that had a below median share. The sample is limited to standalone pharmacies. To ensure that the results are not being driven by composition changes, the sample is limited to pharmacies that remained open in all years between 2000 and 2007. Standard errors are clustered at the county level.

Table 1: Summary Statistics

	(1)	(2)	(3)
Sample →	Overall	Below Median Share	Above Median Share
Panel A: County-Level			
Pharmacies	17.23	25.25	9.09
	(54.46)	(71.98)	(24.15)
Openings	1.21	1.89	0.51
	(5.50)	(7.30)	(2.42)
Closures	0.74	1.12	0.36
	(2.70)	(3.49)	(1.42)
ln(Population)	10.38	10.93	9.83
	(1.33)	(1.30)	(1.11)
Share Black	0.03	0.13	0.06
	(0.15)	(0.17)	(0.11)
Share Hispanic	0.07	0.09	0.05
	(0.12)	(0.15)	(0.09)
Unemployment Rate	5.30	5.37	5.24
	(1.86)	(1.93)	(1.77)
Observations	23,504	11,848	11,656
Panel B: Establishment-Level			
Sales	$3,366,464	$3,493,561	$3,007,509
	($11,206,819)	($6,145,506)	($14,783,397)
Employees	13.39	13.70	12.50
	(45.97)	(47.65)	40.83
ln(Population)	12.65	13.03	11.58
	(1.71)	(1.56)	(1.65)
Share Black	0.136	0.156	0.083
	(0.138)	(0.145)	(0.097)
Share Hispanic	0.131	0.157	0.057
	(0.155)	(0.169)	(0.070)
Unemployment Rate	5.14	5.16	5.07
	(1.59)	(1.61)	(1.54)
Observations	405,032	299,121	105,911

Source: National Establishment Time-Series, 2000-2007.
Note: The table reports the sample mean and standard deviations (in parentheses).

Table 2: Medicare Part D was Associated with a Reduction in the Number of Retail Pharmacies in Counties with an Above Median Elderly Population in the Year 2000

	(1)	(2)	(3)	(4)
1{Year ≥ 2004} ×	-0.071***	-0.050***	-0.052***	-0.051***
1{High Share 65+ in 2000}	(0.015)	(0.013)	(0.012)	(0.009)
Psuedo-R^2	0.915	0.915	0.915	0.916
Observations	23,504	23,504	23,504	23,504
County & Year FE?	Y	Y	Y	Y
County Demographics?		Y	Y	Y
County Unemployment Rate?			Y	Y
State-by-Year FE?				Y

Source: National Establishment Time-Series, 2000-2007.

Note: The estimates are obtained via the Poisson specification shown in equation (1). The dependent variable is the number of pharmacies in a county. The independent variable of interest is an indicator for the passage of Medicare Part D interacted with an indicator for whether the county had an above median share of elderly adults in the year 2000. Column 1 includes county and year fixed effects. County 2 further includes county-level demographic characteristics, including the natural log of the county population, the share of the county population comprised of Black individuals, and the share of the county population comprised of Hispanic individuals. Column 3 further controls for the county-level unemployment rate. Finally, column 4 includes state-by-year fixed effects. Because they are estimated via a Poisson specification, the results are interpreted as changes in natural log of the dependent variable. Standard errors, shown in parentheses, are clustered at the county level.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Table 3: The Relationship Between Medicare Part D and the Number of Pharmacies is Robust to Alternative Ways of Specifying the Independent Variable

	(1)	(2)	(3)
1{Year ≥ 2004} × **1**{High Share 65+ in 2000}	-0.051*** (0.009)		
1{Year ≥ 2004} × **1**{Q2 Share 65+ in 2000}		-0.044*** (0.009)	
1{Year ≥ 2004} × **1**{Q3 Share 65+ in 2000}		-0.073*** (0.011)	
1{Year ≥ 2004} × **1**{Q4 Share 65+ in 2000}		-0.075*** (0.012)	
1{Year ≥ 2004} × Share 65+ in 2000			-0.877*** (0.121)
Psuedo-R^2	0.916	0.916	0.916
Observations	23,504	23,504	23,504

Source: National Establishment Time-Series, 2000-2007.

Note: The estimates are obtained via the Poisson specification shown in equation (1). The dependent variable in column 1 is the number of pharmacies in a county, the dependent variable in column 2 is the number of pharmacy openings in a county, and the dependent variable in column 3 is the number of pharmacy closures in a county. The independent variable of interest in column 1 is an indicator for the passage of Medicare Part D interacted with an indicator for whether the county had an above median share of elderly adults in the year 2000. The independent variable of interest is in column 2 are the interaction of the post-period indicator with indicators for whether the share of the county population comprised of elderly individuals in the year 2000 was in the 2nd, 3rd, or 4th quartile. The independent variable of interest in column 3 is the post-period indicator interacted with the share of the county population in the year 2000 comprised of elderly individuals. All columns include county and year fixed effects, county-level demographic and economic controls, and state-by-year fixed effects. Because they are estimated via a Poisson specification, the results are interpreted as changes in natural log of the dependent variable. Standard errors, shown in parentheses, are clustered at the county level.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Table 4: Medicare Part D was Associated with a Reduction in Both Standalone and Non-Standalone Pharmacies

	(1)	(2)
Sample →	Standalone Pharmacies	Non-Standalone Pharmacies
1{Year ≥ 2004} × **1**{High Share 65+ in 2000}	-0.065***	-0.037***
	(0.012)	(0.011)
Psuedo-R^2	0.869	0.874
Observations	23,054	23,054

Source: National Establishment Time-Series, 2000-2007.

Note: The estimates are obtained via the Poisson specification shown in equation (1). The dependent variable is the number of pharmacies in a county. The independent variable of interest is an indicator for the passage of Medicare Part D interacted with an indicator for whether the county had an above median share of elderly adults in the year 2000. All columns include county and year fixed effects, county-level demographic and economic controls, and state-by-year fixed effects. Column 1 explores changes among standalone (i.e., non-chain) pharmacies, while column 2 explores changes among non-standalone pharmacies. Because they are estimated via a Poisson specification, the results are interpreted as changes in natural log of the dependent variable. Standard errors, shown in parentheses, are clustered at the county level.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Table 5: Medicare Part D was Associated with a Reduction in the Number of Pharmacy Openings

	(1)	(2)
Outcome →	Openings	Closures
1{Year ≥ 2004} ×	-0.135***	0.018
1{High Share 65+ in 2000}	(0.038)	(0.047)
Psuedo-R^2	0.708	0.578
Observations	23,054	23,054

Source: National Establishment Time-Series, 2000-2007.
Note: The estimates are obtained via the Poisson specification shown in equation (1). The dependent variable in column 1 is the number of pharmacy openings in a county, and the dependent variable in column 2 is the number of pharmacy closures in a county. The independent variable of interest is an indicator for the passage of Medicare Part D interacted with an indicator for whether the county had an above median share of elderly adults in the year 2000. All columns include county and year fixed effects, county-level demographic and economic controls, and state-by-year fixed effects. Because they are estimated via a Poisson specification, the results are interpreted as changes in natural log of the dependent variable. Standard errors, shown in parentheses, are clustered at the county level.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Table 6: Medicare Part D was Associated with a Larger Reduction in the Number of Pharmacies in Racial and Ethnic Minority Communities

	(1)	(2)	(3)
Outcome →	Pharmacies	Openings	Closures
Panel A: Above Median Asian, Black, Hispanic, and Other Race/Ethnicity Population in 2000			
1{Year ≥ 2004} ×	-0.053***	-0.134***	0.062
1{High Share 65+ in 2000}	(0.012)	(0.047)	(0.059)
Psuedo-R^2	0.940	0.759	0.636
Observations	11,768	11,768	11,768
Panel B: Below Median Asian, Black, Hispanic, and Other Race/Ethnicity Population in 2000			
1{Year ≥ 2004} ×	-0.020**	-0.113	-0.055
1{High Share 65+ in 2000}	(0.010)	(0.072)	(0.082)
Psuedo-R^2	0.708	0.329	0.268
Observations	11,736	11,736	11,736
Panel C: Full Sample			
1{Year ≥ 2004} ×	-0.020**	-0.113	-0.055
1{High Share 65+ in 2000}	(0.010)	(0.072)	(0.082)
1{Year ≥ 2004} ×	-0.032**	-0.021	0.118
1{High Share 65+ in 2000} ×	(0.016)	(0.086)	(0.101)
1{High Share Non-White in 2000}			
Psuedo-R^2	0.916	0.710	0.581
Observations	23,054	23,054	23,054

Source: National Establishment Time-Series, 2000-2007.

Note: The estimates are obtained via the Poisson specification shown in equation (1). The dependent variable in column 1 is the number of pharmacies in a county, the dependent variable in column 2 is the number of pharmacy openings in a county, and the dependent variable in column 3 is the number of pharmacy closures in a county. The independent variable of interest in Panels A and B is an indicator for the passage of Medicare Part D interacted with an indicator for whether the county had an above median share of elderly adults in the year 2000. The independent variables of interest in Panel C are the interaction of the indicator for the passage of Medicare Part D interacted with an indicator for whether the county had an above median share of elderly adults in the year 2000, as well as a further interaction between these terms an indicator for whether the county had an above median share of the population comprised of Asian, Black, Hispanic, and other race/ethnicity individuals in the year 2000. All columns include county and year fixed effects, county-level demographic and economic controls, and state-by-year fixed effects. In Panel C, we interact all the right-hand side variables with the indicator for having an above median share of the population comprised of Asian, Black, Hispanic, and other race/ethnicity individuals in the year 2000. Because they are estimated via a Poisson specification, the results are interpreted as changes in natural log of the dependent variable. Standard errors, shown in parentheses, are clustered at the county level.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Table 7: Medicare Part D was Associated with a Reduction in the Number of Establishments Competing with Surviving Pharmacies

	(1)	(2)	(3)
Distance →	1,000 Meters	5,000 Meters	10,000 Meters
Panel A: Change in ln(Nearby Pharmacy Sales + 1)			
1{Year ≥ 2004} ×	-0.123**	-0.097***	-0.047*
1{High Share 65+ in 2000}	(0.051)	(0.028)	(0.026)
R^2	0.900	0.946	0.956
Observations	405,032	405,032	405,032
Panel B: Change in ln(Number of Nearby Pharmacies)			
1{Year ≥ 2004} ×	-0.050***	-0.052***	-0.041**
1{High Share 65+ in 2000}	(0.011)	(0.014)	(0.017)
R^2	0.572	0.894	0.956
Observations	405,032	405,032	405,032

Source: National Establishment Time-Series, 2000-2007.

Note: The estimates are obtained from estimating equation (3). Panel A uses ordinary least squares, while Panel B uses a Poisson specification. The dependent variable in Panel A is the natural log of the real value of total sales at nearby pharmacies + 1. The dependent variable in Panel B is the number of nearby competitors. Column 1 defines nearby as being within 1,000 meters, column 2 defines nearby as being within 5,000 meters, and column 3 defines nearby as being within 10,000 meters. The independent variable of interest is an indicator for the passage of Medicare Part D interacted with an indicator for whether the county had an above median share of elderly adults in the year 2000. All columns include establishment and year fixed effects, county-level demographic and economic controls, and state-by-year fixed effects. Standard errors, shown in parentheses, are clustered at the county level.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Table 8: Medicare Part D was Inconclusively Related to Changes in Sales and the Number of Employees Among Surviving Pharmacies

	(1)	(2)
Outcome →	ln(Sales)	ln(Number of Employees)
1{Year ≥ 2004} ×	0.002	0.002
1{High Share 65+ in 2000}	(0.005)	(0.004)
R^2	0.946	0.947
Observations	405,032	405,032

Source: National Establishment Time-Series, 2000-2007.

Note: The estimates are obtained from equation (3) estimated via ordinary least squares. The dependent variable in column 1 is the natural log of pharmacy sales, while the dependent variable in column 2. The independent variable of interest is an indicator for the passage of Medicare Part D interacted with an indicator for whether the county had an above median share of elderly adults in the year 2000. All columns include establishment and year fixed effects, county-level demographic and economic controls, and state-by-year fixed effects. Standard errors, shown in parentheses, are clustered at the county level.

*** p < 0.01, ** p < 0.05, * p < 0.10

Table 9: Medicare Part D was Associated with an Increase Sales Among Surviving Standalone Pharmacies

	(1)	(2)	(3)	(4)
Outcome →	ln(Sales)		ln(Number of Employees)	
Sample →	Standalone Pharmacies	Non-Standalone Pharmacies	Standalone Pharmacies	Non-Standalone Pharmacies
Panel A: Above Median				
1{Year ≥ 2004} ×	0.010*	-0.000	0.001	0.005
1{High Share 65+ in 2000}	(0.006)	(0.006)	(0.005)	(0.005)
R^2	0.934	0.930	0.925	0.935
Observations	214,659	190,373	214,659	190,373
Panel B: Elderly Quartile				
1{Year ≥ 2004} ×	0.017***	0.003	0.004	0.005
1{Q2 Share 65+ in 2000}	(0.006)	(0.006)	(0.005)	(0.005)
1{Year ≥ 2004} ×	0.015*	0.005	0.003	0.008
1{Q3 Share 65+ in 2000}	(0.008)	(0.008)	(0.007)	(0.007)
1{Year ≥ 2004} ×	0.023***	-0.004	0.002	0.006
1{Q4 Share 65+ in 2000}	(0.008)	(0.010)	(0.007)	(0.008)
R^2	0.934	0.930	0.925	0.935
Observations	214,659	190,373	214,659	190,373
Panel C: Continuous Share				
1{Year ≥ 2004} ×	0.235***	0.053	0.034	0.108
Share 65+ in 2000	(0.078)	(0.085)	(0.064)	(0.071)
R^2	0.934	0.930	0.925	0.935
Observations	214,659	190,373	214,659	190,373

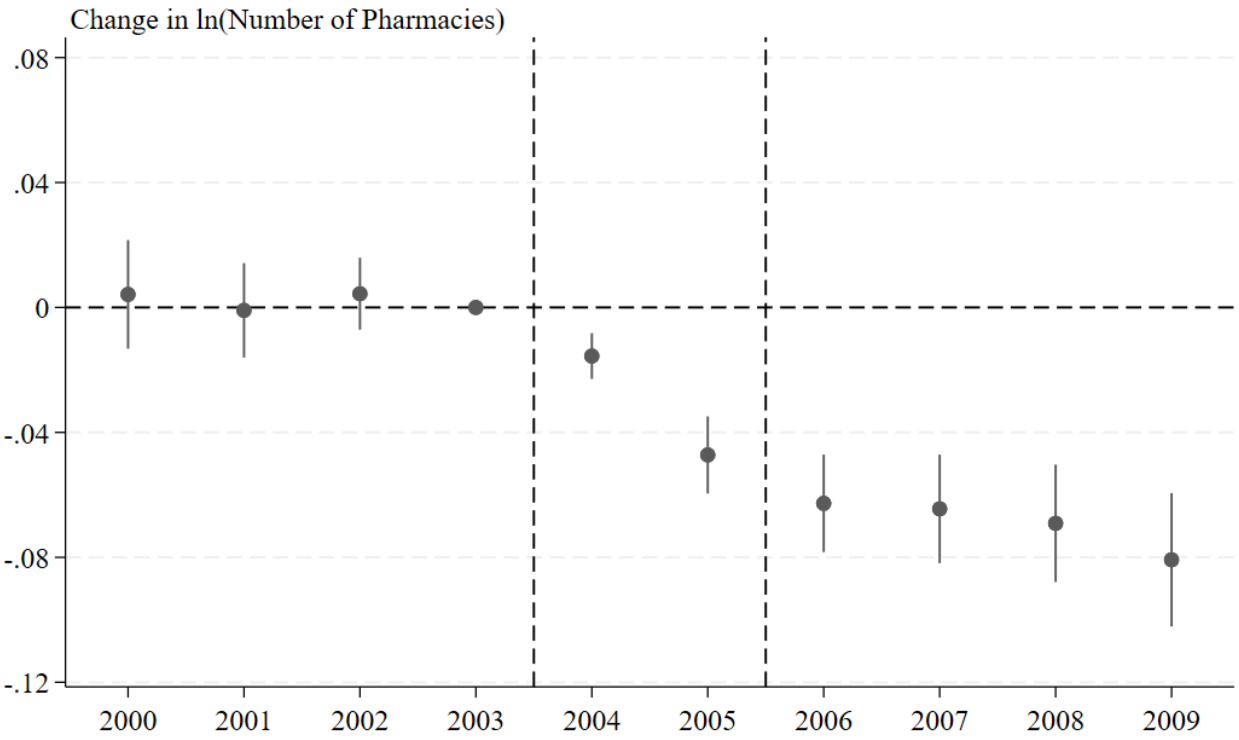
Source: National Establishment Time-Series, 2000-2007.

Note: The estimates are obtained via the ordinary least squares specification shown in equation (3). The dependent variable in columns 1 and 2 is the natural log of pharmacy sales, while the dependent variable in columns 3 and 4 is the natural log of the number of pharmacy employees. The independent variable of interest is in Panel A an indicator for the passage of Medicare Part D interacted with an indicator for whether the county had an above median share of elderly adults in the year 2000. The independent variables of interest in Panel B are the interaction of the post-period indicator with indicators for whether the share of the county population comprised of elderly individuals in the year 2000 was in the 2nd, 3rd, or 4th quartile. The independent variable of interest in Panel C is the post-period indicator interacted with the share of the county population in the year 2000 comprised of elderly individuals. Columns 1 and 3 limit the sample to standalone pharmacies, while columns 2 and 4 limit the sample to non-standalone pharmacies. All columns include establishment and year fixed effects, county-level demographic and economic controls, and state-by-year fixed effects. Standard errors, shown in parentheses, are clustered at the county level.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

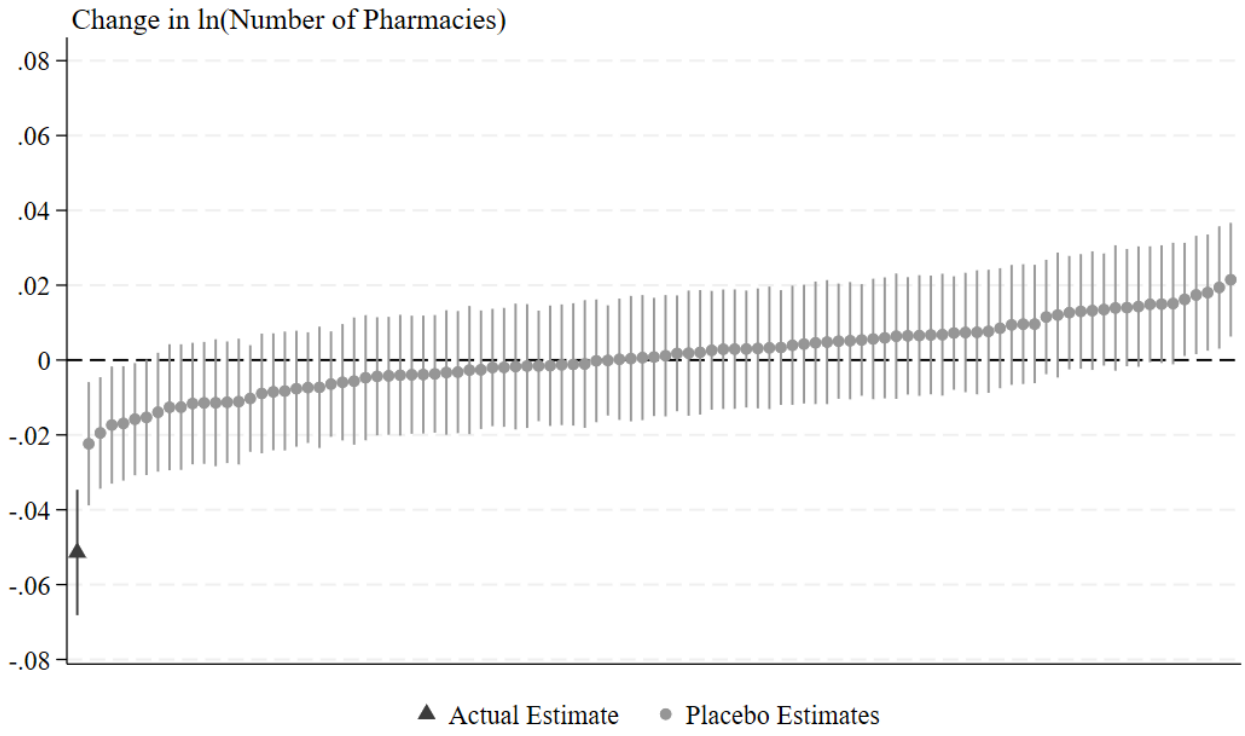
7. Appendix

Appendix Figure 1: The Relationship Between Medicare Part D and the Number of Pharmacies is Robust to Using a Longer Post-Period



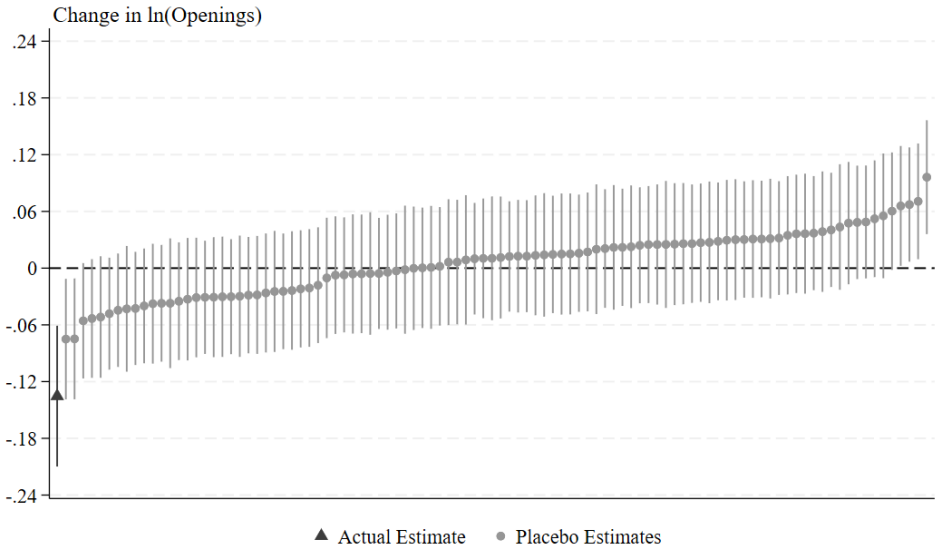
Source: National Establishment Time-Series, 2000-2009.
Note: The dependent variable is the number of pharmacies in a county. The grey circles indicate the coefficients and the vertical lines the 95 percent confidence intervals obtained from the event study specification shown in equation (2) comparing counties that had an above median share of the population comprised of elderly adults in the year 2000 to counties that had a below median share. The regression is estimated using a Poisson specification, so the results are interpreted as changes in natural log of the dependent variable. Standard errors are clustered at the county level.

Appendix Figure 2: Comparison of the Actual Result to 100 Placebo Estimates

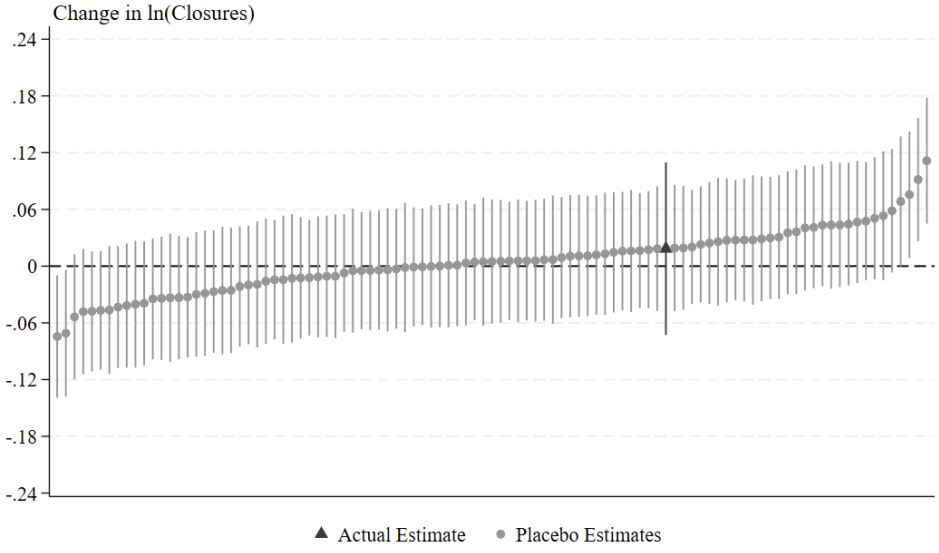


Source: National Establishment Time-Series, 2000-2007.
Note: The dependent variable is the number of pharmacies in a county. The independent variable of interest captures how the number of pharmacies changed following the passage of Medicare Part D in counties with an above median share of the population comprised of elderly adults in the year 2000 relative to counties with a below median share. The regressions include the full set of controls from equation (1). Because they are estimated via a Poisson specification, the results are interpreted as changes in natural log of the dependent variable. The light grey circles denote the placebo coefficients obtained from 100 iterations randomly matching each county to a county population share in the year 2000, while the vertical lines denote the corresponding 95 percent confidence interval. The dark grey triangle indicates the estimate obtained when matching counties to their actual population shares.

Appendix Figure 3: Comparisons of the Actual Relationship Between Medicare Part D and Changes in Pharmacy Openings and Closings to 100 Placebo Estimates



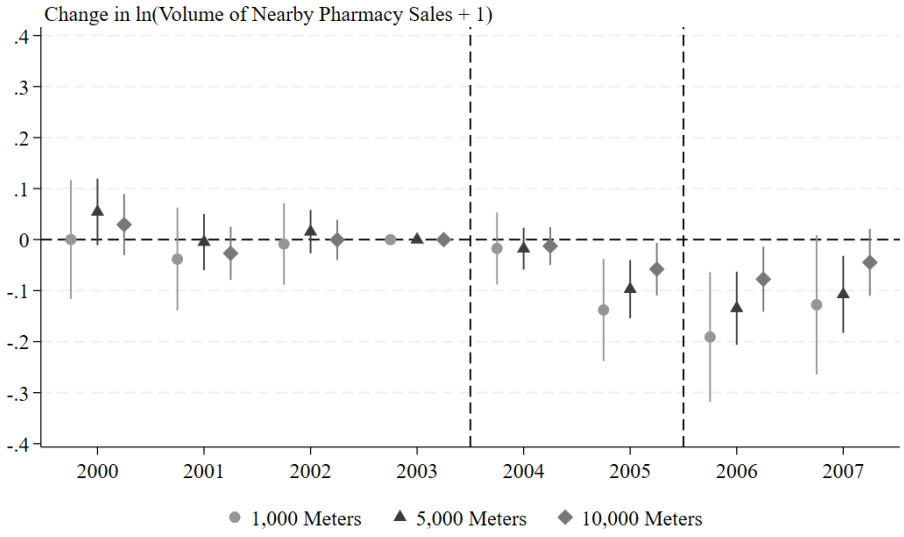
(A)



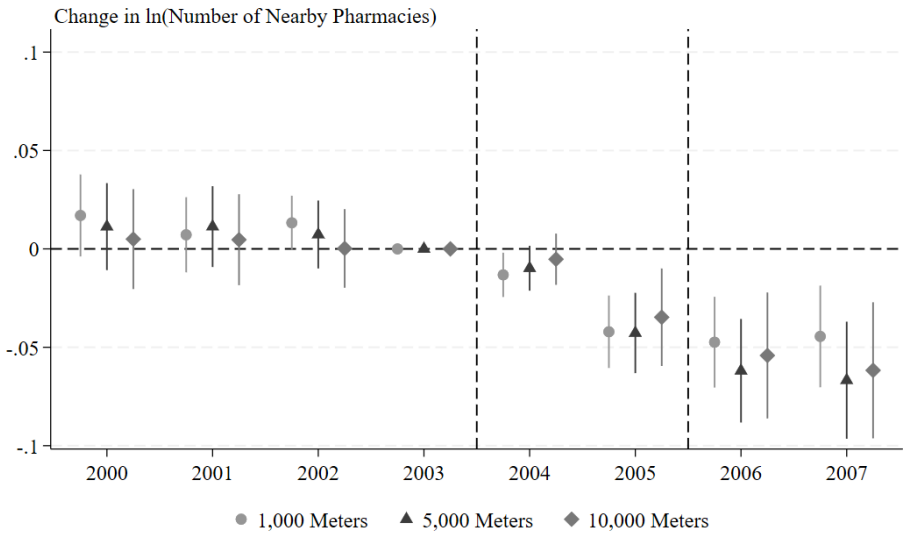
(B)

Source: National Establishment Time-Series, 2000-2007.
Note: The dependent variable in Panel A is the number of pharmacy openings in a county, and the dependent variable in Panel B is the number of pharmacy closures in a county. The independent variable of interest captures how the number of pharmacies changed following the passage of Medicare Part D in counties with an above median share of the population comprised of elderly adults in the year 2000 relative to counties with a below median share. The regressions include the full set of controls from equation (1). Because they are estimated via a Poisson specification, the results are interpreted as changes in natural log of the dependent variable. The light grey circles denote the placebo coefficients obtained from 100 iterations randomly matching each county to a county population share in the year 2000, while the vertical lines denote the corresponding 95 percent confidence interval. The dark grey triangle indicates the estimate obtained when matching counties to their actual population shares.

Appendix Figure 4: Medicare Part D was Associated with Reductions in Competition in the Post-Period



(A)



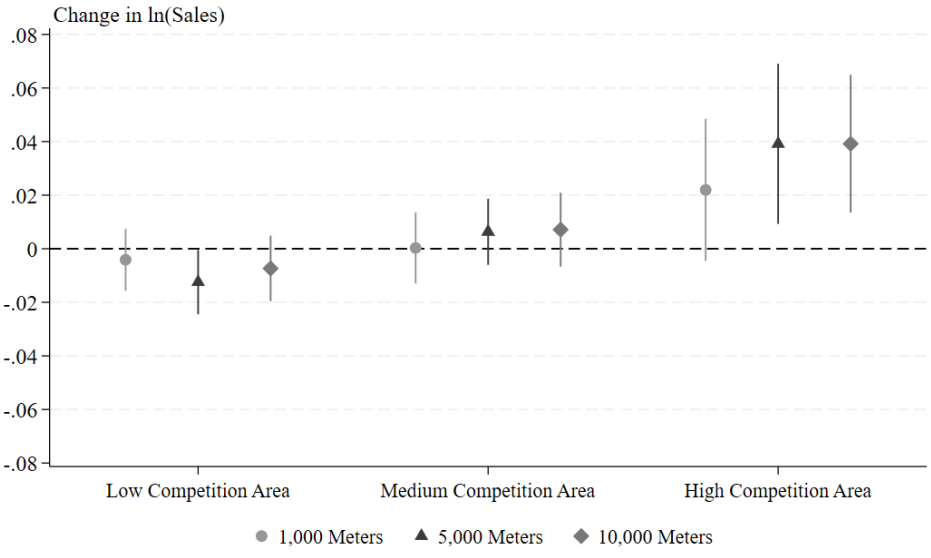
(B)

Source: National Establishment Time-Series, 2000-2007.

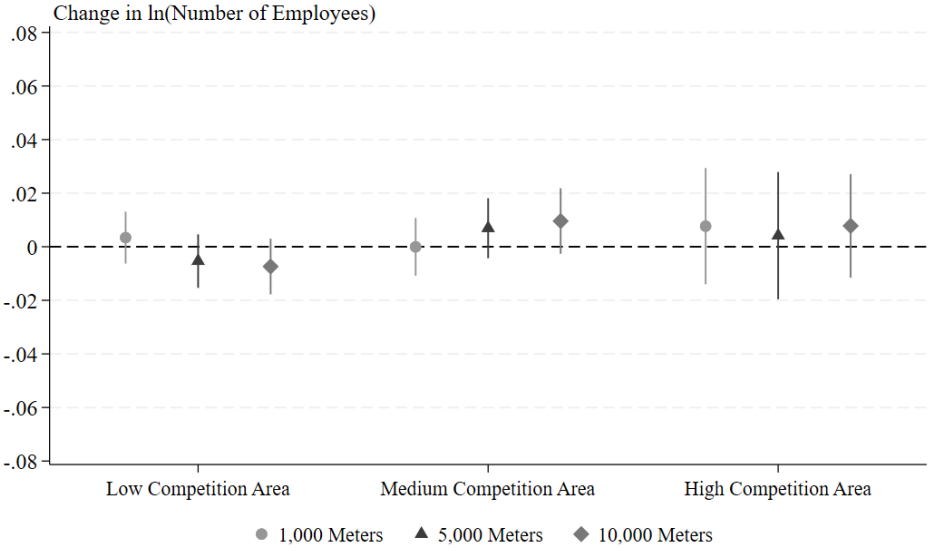
Note: The dependent variable in Panel A is the natural log of the total amount of sales at nearby pharmacies + 1. The dependent variable in Panel B is the number of nearby pharmacies.

The light grey circles indicate results where nearby is defined as a 1,000-meter radius, the dark grey triangles indicate results where nearby is defined as a 5,000-meter radius, and the grey diamonds indicate results where nearby is fined as a 10,000-meter radius. The vertical lines denote the corresponding 95 percent confidence intervals. The estimates are obtained using the event study specification shown in equation (4) comparing pharmacies in counties that had an above median share of the population comprised of elderly adults in the year 2000 to pharmacies in counties that had a below median share. The sample is limited to standalone pharmacies. To ensure that the results are not being driven by composition changes, the sample is limited to pharmacies that remained open in all years between 2000 and 2007. Standard errors are clustered at the county level.

Appendix Figure 5: The Relationship Between Medicare Part D and Pharmacy Sales, by Number of Competitors Prior to Medicare Part D's Passage



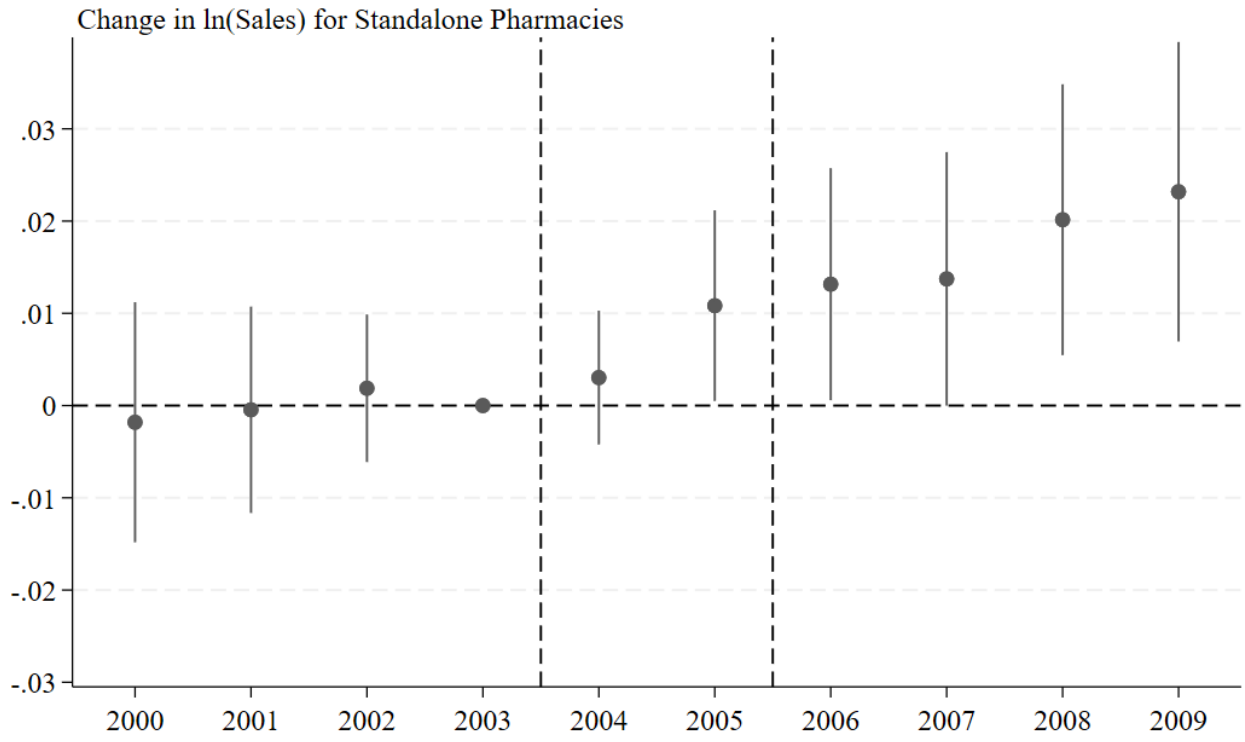
(A)



(B)

Source: National Establishment Time-Series, 2000-2007.
Note: The dependent variable in Panel A is the natural log of sales, and the dependent variable in Panel B is the natural log of the number of employees. The independent variable of interest captures how the number of pharmacies changed following the passage of Medicare Part D in counties with an above median share of the population comprised of elderly adults in the year 2000 relative to counties with a below median share. The regressions include the full set of controls from equation (3). Each estimate is from a separate regression where the sample is limited to establishments in low, medium, or high competition areas in the year 2003. The light grey circles denote results where we define a competition area using a 1,000-meter radius, the dark grey triangles denote results where we define a competition area using a 5,000-meter radius, and the grey diamonds denote results where we define a competition area using a 10,000-meter radius. Standard errors are clustered at the county level.

Appendix Figure 6: Medicare Part D Was Associated with Increases in Sales Among Surviving Standalone Pharmacies When Using a Longer Post-Period

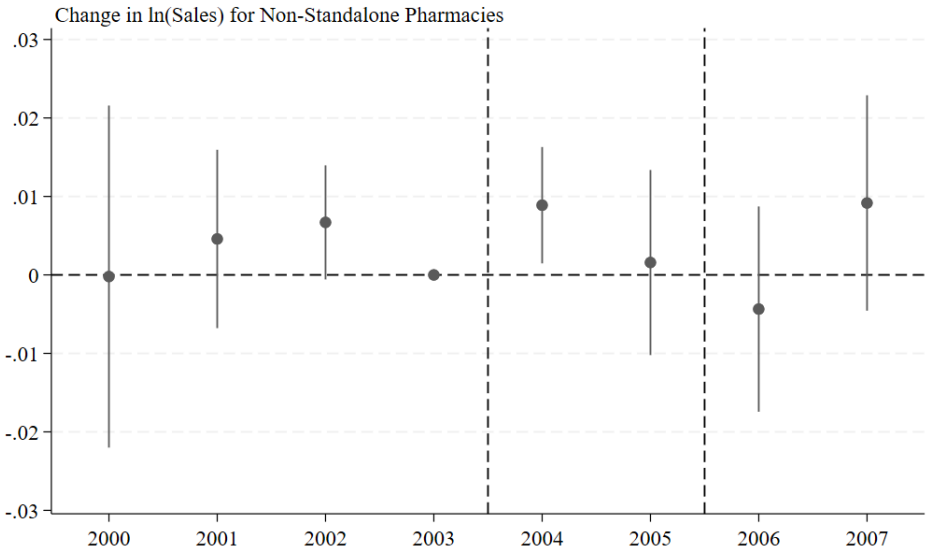


Source: National Establishment Time-Series, 2000-2009.
Note: The dependent variable is the natural log of the pharmacy's sales. The grey circles indicate the coefficients and the vertical lines the 95 percent confidence intervals obtained from the event study specification shown in equation (4) comparing pharmacies in counties that had an above median share of the population comprised of elderly adults in the year 2000 to pharmacies in counties that had a below median share. The sample is limited to standalone pharmacies. To ensure that the results are not being driven by composition changes, the sample is limited to pharmacies that remained open in all years between 2000 and 2009. Standard errors are clustered at the county level.

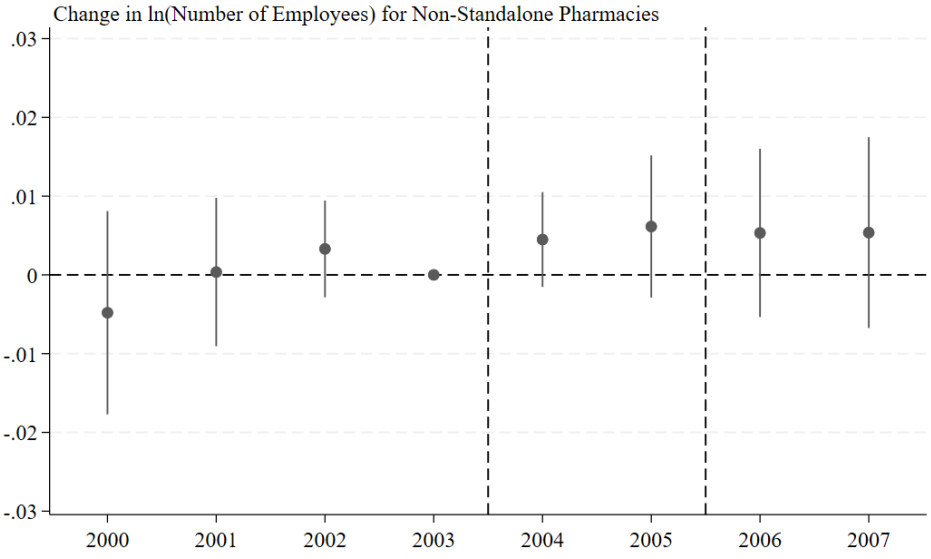
Appendix Figure 7: Medicare Part D Was Unrelated to Changes in Employment Among Surviving Standalone Pharmacies

Source: National Establishment Time-Series, 2000-2007.
Note: The dependent variable is the natural log of the number of employees. The grey circles indicate the coefficients and the vertical lines the 95 percent confidence intervals obtained from the event study specification shown in equation (4) comparing pharmacies in counties that had an above median share of the population comprised of elderly adults in the year 2000 to pharmacies in counties that had a below median share. The sample is limited to standalone pharmacies. To ensure that the results are not being driven by composition changes, the sample is limited to pharmacies that remained open in all years between 2000 and 2007. Standard errors are clustered at the county level.

Appendix Figure 8: Medicare Part D Was Unrelated to Changes in Employment Among Surviving Non-Standalone Pharmacies



(A)



(B)

Source: National Establishment Time-Series, 2000-2007.

Note: The dependent variable in Panel A is the natural log of the pharmacy's sales, and the dependent variable in Panel B is the natural log of the number of employees. The grey circles indicate the coefficients and the vertical lines the 95 percent confidence intervals obtained from the event study specification shown in equation (4) comparing pharmacies in counties that had an above median share of the population comprised of elderly adults in the year 2000 to pharmacies in counties that had a below median share. The sample is limited to standalone pharmacies. To ensure that the results are not being driven by composition changes, the sample is limited to pharmacies that remained open in all years between 2000 and 2007. Standard errors are clustered at the county level.

Appendix Table 1: Event Study Estimates

	(1)	(2)	(3)
Outcome →	ln(Establishments)	ln(Openings)	ln(Closures)
Pre-Period			
1{Year = 2000} ×	0.011	-0.014	-0.015
1{Above Median Share}	(0.009)	(0.082)	(0.077)
1{Year = 2001} ×	0.005	-0.090	0.049
1{Above Median Share}	(0.008)	(0.073)	(0.078)
1{Year = 2002} ×	0.009	0.049	-0.135*
1{Above Median Share}	(0.006)	(0.065)	(0.081)
Post-Period			
1{Year = 2004} ×	-0.011***	-0.124*	0.036
1{Above Median Share}	(0.004)	(0.073)	(0.072)
1{Year = 2005} ×	-0.044***	-0.243***	0.066
1{Above Median Share}	(0.006)	(0.063)	(0.078)
1{Year = 2006} ×	-0.060***	-0.129**	-0.091
1{Above Median Share}	(0.008)	(0.052)	(0.081)
1{Year = 2007} ×	-0.063***	-0.027	-0.038
1{Above Median Share}	(0.009)	(0.078)	(0.093)
Pre = 0?	F = 6.20	F = 2.64	F = 5.29
	p = 0.102	p = 0.450	p = 0.152
Post = 0?	F = 69.72	F = 20.43	F = 5.53
	p = 0.000	p = 0.000	p = 0.237
Pre = Post?	F = 77.05	F = 25.97	F = 10.24
	p = 0.000	p = 0.001	p = 0.175
Observations	23,054	23,054	23,054

Source: National Establishment Time-Series, 2000-2007.

Note: The dependent variable in column 1 is the number of pharmacies in a county, in column 2 the number of pharmacy openings, and in column 3 the number of pharmacy closures. The estimates are obtained from the event study specification shown in equation (2) comparing counties that had an above median share of the population comprised of elderly adults in the year 2000 to counties that had a below median share. The regression is estimated using a Poisson specification, so the results are interpreted as changes in natural log of the dependent variable. The F-tests for Pre = 0 evaluate whether pre-period coefficients are jointly zero, the tests for Post = 0 assess the joint significance of post-period effects, and Pre = Post evaluates for differences on average coefficient between pre and post period. Standard errors, shown in parentheses, are clustered at the county level.

*** p < 0.01, ** p < 0.05, * p < 0.10

Appendix Table 2: The Relationship Between Medicare Part D and the Number of Pharmacy Openings is Robust to Alternative Ways of Specifying the Independent Variable

	(1)	(2)	(3)	(4)	(5)	(6)
	Change in ln(Openings)			Change in ln(Closures)		
1{Year ≥ 2004} ×	-0.135***			0.018		
1{High Share 65+ in 2000}	(0.038)			(0.047)		
1{Year ≥ 2004} ×		-0.069*			-0.065*	
1{Q2 Share 65+ in 2000}		(0.039)			(0.039)	
1{Year ≥ 2004} ×		-0.206***			-0.042	
1{Q3 Share 65+ in 2000}		(0.047)			(0.061)	
1{Year ≥ 2004} ×		-0.102*			0.037	
1{Q4 Share 65+ in 2000}		(0.061)			(0.061)	
1{Year ≥ 2004} ×			-1.190**			0.020
Share 65+ in 2000			(0.517)			(0.516)
Psuedo-R^2	0.708	0.708	0.708	0.578	0.578	0.578
Observations	23,054	23,054	23,054	23,054	23,054	23,054

Source: National Establishment Time-Series, 2000-2007.

Note: The estimates are obtained via the Poisson specification shown in equation (1). The dependent variable in columns 1-3 is the number of pharmacy openings in a county, and the dependent variable in columns 4-6 is the number of pharmacy closures in a county. The independent variable of interest in column 1 is an indicator for the passage of Medicare Part D interacted with an indicator for whether the county had an above median share of elderly adults in the year 2000. The independent variable of interest is in column 2 are the interaction of the post-period indicator with indicators for whether the share of the county population comprised of elderly individuals in the year 2000 was in the 2nd, 3rd, or 4th quartile. The independent variable of interest in column 3 is the post-period indicator interacted with the share of the county population in the year 2000 comprised of elderly individuals. All columns include county and year fixed effects, county-level demographic and economic controls, and state-by-year fixed effects. Standard errors, shown in parentheses, are clustered at the county level.

*** p < 0.01, ** p < 0.05, * p < 0.10

Appendix Table 3: The Relationship Between Medicare Part D and the Number of Pharmacy Openings is Robust to Excluding the Smallest and Largest Establishments

	(1)	(2)	(3)	
Outcome →	Change in ln(Openings)		Change in ln(Closures)	
Sample →	Pharmacies with 5-34 Employees	Pharmacies with 10-34 Employees	Pharmacies with 5-34 Employees	Pharmacies with 10-34 Employees
1{Year ≥ 2004} ×	-0.180***	-0.163*	0.012	0.009
1{High Share 65+ in 2000}	(0.067)	(0.090)	(0.055)	(0.074)
Psuedo-R^2	0.551	0.541	0.465	0.431
Observations	23,054	23,054	23,054	23,054

Source: National Establishment Time-Series, 2000-2007.

Note: The estimates are obtained via the Poisson specification shown in equation (1). The dependent variable in columns 1 and 2 is the number pharmacy openings in a county, and the dependent variable in columns 3 and 4 is the number of pharmacy closures in a county. The independent variable of interest is an indicator for the passage of Medicare Part D interacted with an indicator for whether the county had an above median share of elderly adults in the year 2000. All columns include county and year fixed effects, county-level demographic and economic controls, and state-by-year fixed effects. Columns 1 and 3 only consider establishments with 5-34 employees, while columns 2 and 4 only consider establishments with 10-24 employees. Standard errors, shown in parentheses, are clustered at the county level.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Appendix Table 4: Medicare Part D was Associated with a Reduction in Both Standalone and Non-Standalone Openings

	(1)	(2)
Sample →	Standalone Pharmacies	Non-Standalone Pharmacies
Panel A: Change in ln(Openings)		
1{Year ≥ 2004} ×	-0.119***	-0.182***
1{High Share 65+ in 2000}	(0.045)	(0.069)
Psuedo-R^2	0.670	0.562
Observations	23,054	23,054
Panel B: Change in ln(Closures)		
1{Year ≥ 2004} ×	-0.091	0.120*
1{High Share 65+ in 2000}	(0.069)	(0.068)
Psuedo-R^2	0.506	0.477
Observations	23,054	23,054

Source: National Establishment Time-Series, 2000-2007.

Note: The estimates are obtained via the Poisson specification shown in equation (1). The dependent variable in Panel A is the number of pharmacy openings in a county, and the dependent variable in Panel B is the number of pharmacy closures in a county. The independent variable of interest is an indicator for the passage of Medicare Part D interacted with an indicator for whether the county had an above median share of elderly adults in the year 2000. All columns include county and year fixed effects, county-level demographic and economic controls, and state-by-year fixed effects. Column 1 explores changes among standalone (i.e., non-chain) pharmacies, while column 2 explores changes among non-standalone pharmacies. Standard errors, shown in parentheses, are clustered at the county level.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Appendix Table 5: Summary Statistics of the Competition Measures

	(1)	(2)	(3)
Sample →	Overall	Below Median Share	Above Median Share
Sales w/in 1,000m	$7,643,350	$7,194,470	$8,911,109
	($48,612,020)	($30,405,156)	($80,150,768)
Sales w/in 5,000m	$58,790,724	$67,764,936	$33,445,144
	($134,876,976)	($141,880,288)	($108,848,704)
Sales w/in 10,000m	$169,032,928	$199,830,048	$82,053,632
	($322,043,808)	($356,739,648)	($164,177,952)
Pharmacies w/in 1,000m	1.82	2.03	1.23
	(3.83)	(4.00)	(3.21)
Pharmacies w/in 5,000m	17.64	21.18	7.65
	(36.84)	(41.81)	(10.84)
Pharmacies w/in 10,000m	51.98	62.93	21.06
	(107.65)	(121.45)	(36.93)
Observations	405,032	299,121	105,911

Source: National Establishment Time-Series, 2000-2007.
Note: The table reports the sample mean and standard deviations (in parentheses).

Appendix Table 6: Medicare Part D was Associated with a Reduction in the Sales Volume of Establishments Competing with Surviving Standalone and Non-Standalone Pharmacies

	(1)	(2)	(3)
Outcome →	Change in ln(Sales of Pharmacies within 1,000 Meters)	Change in ln(Sales of Pharmacies within 5,000 Meters)	Change in ln(Sales of Pharmacies within 10,000 Meters)
Panel A: Standalone Pharmacies			
1{Year ≥ 2004} ×	-0.126**	-0.108***	-0.077**
1{High Share 65+ in 2000}	(0.057)	(0.037)	(0.033)
R^2	0.921	0.956	0.994
Observations	214,659	214,659	214,659
Panel B: Non-Standalone Pharmacies			
1{Year ≥ 2004} ×	-0.092	-0.069*	-0.008
1{High Share 65+ in 2000}	(0.078)	(0.040)	(0.035)
R^2	0.876	0.918	0.937
Observations	190,373	190,373	190,373

Source: National Establishment Time-Series, 2000-2007.

Note: The estimates are obtained from estimating equation (3) via ordinary least squares. The dependent variable in column 1 is the natural log of the real value of volume of sales occurring within 1,000 meters, the dependent variable in column 2 is the natural log of the real value of volume of sales occurring within 5,000 meters, and the dependent variable in column 3 is the natural log of the real value of the volume of sales occurring within 10,000 meters. Panel A limits the sample to standalone pharmacies, and Panel B limits the sample to non-standalone pharmacies. The independent variable of interest is an indicator for the passage of Medicare Part D interacted with an indicator for whether the county had an above median share of elderly adults in the year 2000. All columns include establishment and year fixed effects, county-level demographic and economic controls, and state-by-year fixed effects. Because they are estimated via a Poisson specification, the results are interpreted as changes in natural log of the dependent variable. Standard errors, shown in parentheses, are clustered at the county level.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Appendix Table 7: Medicare Part D was Associated with a Reduction in the Number of Establishments Competing with Surviving Standalone and Non-Standalone Pharmacies

	(1)	(2)	(3)
Outcome →	Change in ln(Number of Pharmacies within 1,000 Meters)	Change in ln(Number of Pharmacies within 5,000 Meters)	Change in ln(Number of Pharmacies within 10,000 Meters)
Panel A: Standalone Pharmacies			
1{Year ≥ 2004} ×	-0.053***	-0.046***	-0.032**
1{High Share 65+ in 2000}	(0.011)	(0.013)	(0.015)
Psuedo-R^2	0.586	0.914	0.965
Observations	214,659	214,659	214,659
Panel B: Non-Standalone Pharmacies			
1{Year ≥ 2004} ×	-0.040***	-0.052***	-0.043**
1{High Share 65+ in 2000}	(0.013)	(0.015)	(0.019)
Psuedo-R^2	0.546	0.851	0.936
Observations	190,373	190,373	190,373

Source: National Establishment Time-Series, 2000-2007.

Note: The estimates are obtained from estimating equation (3) with a Poisson specification. The dependent variable in column 1 is the number of competitors within 1,000 meters, the dependent variable in column 2 is the number of competitors within 5,000 meters, and the dependent variable in column 3 is the number of competitors within 10,000 meters. The independent variable of interest is an indicator for the passage of Medicare Part D interacted with an indicator for whether the county had an above median share of elderly adults in the year 2000. All columns include establishment and year fixed effects, county-level demographic and economic controls, and state-by-year fixed effects. Because they are estimated via a Poisson specification, the results are interpreted as changes in natural log of the dependent variable. Panel A examines standalone pharmacies, while Panel B examines non-standalone pharmacies. Standard errors, shown in parentheses, are clustered at the county level.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Appendix Table 8: The Relationships Between Medicare Part D, Pharmacy Sales, and Pharmacy Employees, Excluding the Smallest and Largest Establishments

	(1)	(2)	(3)	(4)
Outcome →	Change in ln(Sales)		Change in ln(Employees)	
Sample →	Pharmacies with 5-34 Employees	Pharmacies with 10-34 Employees	Pharmacies with 5-34 Employees	Pharmacies with 10-34 Employees
Panel A: All Pharmacies				
1{Year ≥ 2004} ×	-0.001	-0.002	0.005**	0.000
1{High Share 65+ in 2000}	(0.004)	(0.003)	(0.002)	(0.002)
R^2	0.955	0.938	0.967	0.963
Observations	257,928	149,071	257,928	149,071
Panel B: Standalone Pharmacies				
1{Year ≥ 2004} ×	0.007	0.011	0.004	-0.002
1{High Share 65+ in 2000}	(0.005)	(0.008)	(0.004)	(0.005)
R^2	0.951	0.957	0.947	0.943
Observations	113,945	35,554	113,945	35,554
Panel C: Non-Standalone Pharmacies				
1{Year ≥ 2004} ×	-0.002	-0.006*	0.003	-0.001
1{High Share 65+ in 2000}	(0.004)	(0.003)	(0.003)	(0.002)
R^2	0.944	0.924	0.964	0.966
Observations	143,983	113,517	143,983	113,517

Source: National Establishment Time-Series, 2000-2007.

Note: The estimates are obtained via the ordinary least squares specification shown in equation (3). The dependent variable in columns 1 and 2 is the natural log of pharmacy sales, and the dependent variable in columns 3 and 4 is the natural log of the number of pharmacy employees. The independent variable of interest is an indicator for the passage of Medicare Part D interacted with an indicator for whether the county had an above median share of elderly adults in the year 2000. All columns include county and year fixed effects, county-level demographic and economic controls, and state-by-year fixed effects. Columns 1 and 3 only consider establishments with 5-34 employees, while columns 2 and 4 only consider establishments with 10-24 employees. Panel A examines all pharmacies, Panel B examines standalone (i.e., non-chain) pharmacies, and Panel C examines non-standalone pharmacies. Standard errors, shown in parentheses, are clustered at the county level.

*** p < 0.01, ** p < 0.05, * p < 0.10

Appendix Table 9: Robustness of the Moderately Flexible Relationship Between Medicare Part D, Pharmacy Sales, and Pharmacy Employees, Excluding the Smallest and Largest Establishments

	(1)	(2)	(3)	(4)
Outcome →	ln(Sales)		ln(Number of Employees)	
Pharmacies with →	5-34 Employees	10-34 Employees	5-34 Employees	10-34 Employees
Panel A: All Pharmacies				
1{Year ≥ 2004} ×	0.000	0.001	0.007***	0.004
1{Q2 Share 65+ in 2000}	(0.004)	(0.004)	(0.003)	(0.003)
1{Year ≥ 2004} ×	0.001	-0.000	0.009***	0.002
1{Q3 Share 65+ in 2000}	(0.004)	(0.004)	(0.003)	(0.003)
1{Year ≥ 2004} ×	-0.005	-0.003	0.009**	0.002
1{Q4 Share 65+ in 2000}	(0.006)	(0.006)	(0.004)	(0.003)
Panel B: Standalone Pharmacies				
1{Year ≥ 2004} ×	0.012*	0.004	0.005	-0.002
1{Q2 Share 65+ in 2000}	(0.006)	(0.010)	(0.004)	(0.005)
1{Year ≥ 2004} ×	0.015**	0.015	0.008	-0.000
1{Q3 Share 65+ in 2000}	(0.007)	(0.011)	(0.005)	(0.007)
1{Year ≥ 2004} ×	0.009	0.009	0.004	-0.008
1{Q4 Share 65+ in 2000}	(0.008)	(0.014)	(0.005)	(0.007)
Panel C: Non-Standalone Pharmacies				
1{Year ≥ 2004} ×	-0.000	0.002	0.004	0.003
1{Q2 Share 65+ in 2000}	(0.004)	(0.004)	(0.003)	(0.003)
1{Year ≥ 2004} ×	-0.001	-0.004	0.005	-0.001
1{Q3 Share 65+ in 2000}	(0.005)	(0.004)	(0.004)	(0.003)
1{Year ≥ 2004} ×	-0.004	-0.005	0.006	0.002
1{Q4 Share 65+ in 2000}	(0.007)	(0.006)	(0.005)	(0.004)

Source: National Establishment Time-Series, 2000-2007.

Note: The estimates are obtained via the ordinary least squares specification shown in equation (3). The dependent variable in columns 1 and 2 is the natural log of pharmacy sales, while the dependent variable in columns 3 and 4 is the natural log of the number of pharmacy employees. The independent variables of interest B are the interaction of the post-period indicator with indicators for whether the share of the county population comprised of elderly individuals in the year 2000 was in the 2nd, 3rd, or 4th quartile. Panel A examines all pharmacies, Panel B examines standalone pharmacies, and Panel C examines non-standalone pharmacies. All columns include establishment and year fixed effects, county-level demographic and economic controls, and state-by-year fixed effects. Standard errors, shown in parentheses, are clustered at the county level.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Appendix Table 10: The Flexible Relationships Between Medicare Part D, Pharmacy Sales, and Pharmacy Employees, Excluding the Smallest and Largest Establishments

	(1)	(2)	(3)	(4)
Outcome →	Change in ln(Sales)		Change in ln(Employees)	
Sample →	Pharmacies with 5-34 Employees	Pharmacies with 10-34 Employees	Pharmacies with 5-34 Employees	Pharmacies with 10-34 Employees
Panel A: All Pharmacies				
1{Year ≥ 2004} ×	-0.012	0.034	0.092***	0.035
Share 65+ in 2000	(0.050)	(0.053)	(0.031)	(0.030)
R^2	0.955	0.938	0.967	0.963
Observations	257,928	149,071	257,928	149,071
Panel B: Standalone Pharmacies				
1{Year ≥ 2004} ×	0.125*	0.220*	0.034	-0.062
Share 65+ in 2000	(0.075)	(0.129)	(0.049)	(0.068)
R^2	0.951	0.957	0.947	0.943
Observations	113,945	35,554	113,945	35,554
Panel C: Non-Standalone Pharmacies				
1{Year ≥ 2004} ×	0.004	-0.009	0.069*	0.026
Share 65+ in 2000	(0.060)	(0.056)	(0.039)	(0.032)
R^2	0.944	0.924	0.964	0.966
Observations	143,983	113,517	143,983	113,517

Source: National Establishment Time-Series, 2000-2007.

Note: The estimates are obtained via the ordinary least squares specification shown in equation (3). The dependent variable in columns 1 and 2 is the natural log of pharmacy sales, and the dependent variable in columns 3 and 4 is the natural log of the number of pharmacy employees. The independent variable of interest is an indicator for the passage of Medicare Part D interacted with the share of the population comprised of elderly adults in the year 2000. All columns include county and year fixed effects, county-level demographic and economic controls, and state-by-year fixed effects. Columns 1 and 3 only consider establishments with 5-34 employees, while columns 2 and 4 only consider establishments with 10-24 employees. Panel A examines all pharmacies, Panel B examines standalone (i.e., non-chain) pharmacies, and Panel C examines non-standalone pharmacies. Standard errors, shown in parentheses, are clustered at the county level.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$