Mergers in Medicare Part D: Assessing Market Power, Cost Efficiencies, and Bargaining Power

Anna Chorniy*
Daniel Miller
Tilan Tang †

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Abstract

We empirically examine horizontal mergers amongst Part D insurers with the aim of assessing how market power, cost efficiencies, and bargaining power affect premiums and coverage characteristics, including drug access and out-of-pocket (OOP) cost. Our results reveal that market power raises premiums, but this is only a local effect that occurs in markets where the merging firms overlap. Mergers alter the bargaining process with upstream suppliers at both local and national levels, affecting drug access and OOP cost. We find evidence of cost efficiencies when firms restructure by consolidating their plan offerings.

*Author correspondence: Anna Chorniy (corresponding author): anna.chorniy@northwestern.edu; Feinberg School of Medicine, Northwestern University, 420 E Superior St., Chicago, IL 60646; Daniel Miller, Clemson University (work completed prior to joining Amazon), dmille7@g.clemson.edu, and Tilan Tang, Temple University, tuh48372@temple.edu

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1 Introduction

The landscape of competition in the health insurance industry has experienced many changes in the past years, including the introduction of managed care plans in the 1980s, privatized Medicare plans, expanded prescription drug coverage, and most recently the reforms in the 2010 Patient Protection and Affordable Care Act. Throughout this period there have been waves of merger and acquisition (M&A) activity as insurers adapted to the evolving marketplace (Park and Town, 2014).

In this paper, we examine the effect that horizontal M&A activity amongst health insurers has on prices and coverage characteristics of prescription drug plans offered in the Medicare Part D market. Part D established a regulated and subsidized insurance exchange for Medicare beneficiaries to purchase prescription drug coverage from competing private insurers. It is the largest health exchange in the U.S., insuring over 40 million individuals. Since the program's inception in 2006, there have been more than a dozen large scale horizontal M&A deals involving the parent companies of insurers offering Part D plans. Twenty three of the top 25 Part D insurers have gone through at least one horizontal merger. Each year in our sample, M&A deals affect an average of 15% of all plans in the market.

Theory posits three major channels through which mergers affect markets. First, horizontal mergers increase market concentration which gives firms more market power. Reduced competition can lead to higher premiums for consumers or lower product quality if firms compete on quality dimensions. The program rules regulate general coverage parameters such as deductibles. However, Part D contracts vary considerably along other coverage dimensions that could be eroded by market power: namely, drug access (the comprehensiveness of formulary coverage) and drug pricing which determines the amount enrollees pay out-of-pocket (OOP) in copays.

Second, horizontal mergers offer benefits if they result in increased productive efficiency on national or local levels. In health insurance, efficiency gains can be achieved through scale economies that appear as insurers streamline their administrative and marketing activities. These cost have taken on a greater importance as new minimum loss ratios (MLR) in the Affordable Care Act require 85% of premium dollars to be spent on drug claims, leaving only 15% available for administrative and marketing expenses.

Third, horizontal mergers alter bargaining dynamics with upstream suppliers as the combined firm gains monopsony power. For health insurers the upstream suppliers are the providers of healthcare goods and services (doctors, hospitals, drug manufacturers, and pharmacies). With greater bargaining power, an insurer may be able to negotiate more favorable coverage terms and lower its cost. This merger effect is particularly important in Part D.

The program relies heavily on the ability of private insurers to bargain with drug suppliers and pharmacies and explicitly prohibits the government from participating in negotiations (Duggan and Scott-Morton, 2010; Frank and Newhouse, 2008). Mergers could have a positive effect if the increased bargaining power allows insurers to increase the scope of covered drugs or negotiate lower drug acquisition costs, which can be passed to enrollees either directly through reduced cost sharing on drug copays or indirectly through lower insurance premiums.

These deals have come under the scrutiny of anti-trust authorities. They are tasked with determining whether the beneficial effects of mergers (cost efficiencies and bargaining power) in fact exist, and if so, whether they outweigh negative market power effects. Two major deals between Aetna and Humana and Anthem-Cigna were blocked by the court in early 2017 after years of virtually no anti-trust or regulatory action to block or restrain merging insurers. In the former, the judge specifically cited harm to Medicare consumers as one of the reasons. Stylized facts about Medicare Part D, indeed, give reason for concern. Table 3 shows that by 2012, just six years since the program's inception, premiums increased by more than 26% in real terms. While the typical consumer still had many choices — an average of 25 plans available in each market in 2012 — there has been a drastic 31% decrease in the number of plan offerings (Table 4). Coverage has declined and drug costs have risen. The number of drug offerings on plans' formularies has fallen by 31% and OOP costs paid by enrollees for the most popular drugs have nearly doubled (Table 4). The latest government projections forecast a 3.8% annualized per capita cost growth rate for the Part D program.[1] Understanding whether mergers contribute to or thwart these glooming trends is critical for the viability of the program.

In our application to Medicare Part D, we analyze the effects that horizontal mergers have on market outcomes with the aim of shedding light on the interplay of the three channels through which M&As affect plans: cost efficiencies, bargaining power with upstream suppliers, and market power. Although our results do not fully attribute the effects to each channel, we develop a theoretical framework that provides a compelling interpretation of the empirical findings on the role of the three forces. We contribute to the health economics literature and, more broadly, to the literature on horizontal merger analyses in three ways.

First, we use rich panel data on all stand-alone Part D plans from 2006 to 2012 that include detailed product-level characteristics such as plan premiums and coverage parameters. We combine these data with all M&A deals consummated during this time period between insurers offering Part D plans, among other services. There are 10 mergers – a much larger

[1]Source: 2017 Annual Report of the Boards of Trustees of the Federal Hospital Insurance and Federal Supplementary Medical Insurance Trust Funds, Table III.D4.

sample of merger events than in many M&A articles.

These detailed data on plans also make our work stand-out conceptually. Commonly, the M&A literature focuses on price effects of mergers. We explicitly address the effects of mergers on multi-dimensional non-price plan characteristics — formularies, drug OOP costs, and measures of access — to flesh out a quite complicated bargaining process between insurers and suppliers in which coverage terms, beyond just drug prices, are being negotiated. Part D program data are also uniquely suitable for the analysis of the heterogeneous effects of mergers. The program rules draw market boundaries that allow us to distinguish overlapping from non-overlapping markets and document spillover effects and the interplay of national-level bargaining with drug manufacturers and local level bargaining with pharmacies.

Second, we write down a multi-lateral, multi-level bargaining game in the spirit of Ho and Lee (2017), in which insurers bargain with drug manufacturers and pharmacies over drug rebates, pricing, and access. Combining the model with rich panel data on plans and Part D institutional design (overlapping and non-overlapping markets), we can shed some light on the merger effects coming through bargaining channels.

Third, we provide suggestive evidence on local-level cost efficiencies. The Part D market has experienced not only a wave of mergers, but also a flurry of plan consolidations. Understanding whether they have similar effects to mergers is important for anti-trust and regulatory purposes. In 2010, CMS issued its first regulations to encourage insurers to consolidate low enrollment and "meaningfully" similar plans.[2] Changes to the subsidy rules design in 2009 have also reduced insurers' incentives to have many plans. If an insurer can realize the beneficial effects of mergers by organically consolidating its own plans without engaging in a merger with an outside firm, then there is a weaker case to be made in favor of mergers and stronger case for mandating reductions in the number of plans per insurer.

Empirically, to identify the treatment effect that M&A deals have on plans we use a differences-in-differences approach. First, we examine how plans of merging firm change in the year following a merger as compared to the control group of plans that do not undergo a merger in the previous year in that market. Due to the extent of mergers in this industry virtually all markets are impacted by at least one merger in any given year in our data. Therefore, our approach can not measure the full equilibrium effect of mergers and instead can be interpreted as the lower bound of the effects. The combined effect of all three channels reveals whether the beneficial effects of mergers outweigh the negative effects. For anti-trust purposes, this test provides perhaps the most important metric for evaluating merger

[2]Memorandum, April 16, 2010. Department of Health and Human Services. "2011 Part D Plan Benefit Package (PBP) Submission and Review Instructions." https://www.cms.gov/Medicare/Prescription-Drug-Coverage/PrescriptionDrugCovContra/Downloads/Plan-benefit-Memo-for-CY-2011-04-16-10-FINALwo-disclaimer.pdf

outcomes. However, there are limitations; simply comparing outcomes of merged and non-merged plans is not informative about the magnitudes of the three competing effects. For example, if the results were to reveal no effect of mergers on premiums, that could indicate each of the three channels has zero effect or it could be indicative of large market power effects that are canceled out by equally large cost efficiency and bargaining power effects. Moreover, this test indicates nothing about whether the benefits of mergers can be achieved internally through plan consolidation nor does it provide guidance about how specific characteristics of a merger deal affect outcomes.

Second, we exploit variation in the market overlap of merging insurers to distinguish local merger effects from national merger effects. The majority of merger deals involve near-national insurers operating in many geographic markets delineated by state boundaries, but not necessarily all of them. While the overlapping markets are affected by all of the merger channels, non-overlapping markets, due to the program design, can experience changes only through spillover effects from overlapping markets and more nuanced interactive bargaining effects across Part D upstream suppliers: pharmacies and drug manufacturers.

Finally, we modify the differences-in-differences set up to distinguish plan consolidation from mergers. We are interested in comparing similarities and contrasting differences between consolidation and merger effects, which is useful for determining whether regulatory decisions should promote or discourage mergers or consolidation. We also test for synergy effects when merging firms consolidate plans.

We acknowledge that the difference-in-difference treatment effect of consolidation may be a less accurate measure of the causal impact than our results for the merger effect. This is due to the fact that consolidation events occur at the plan level, whereas mergers occur at the firm level. To support the analysis, we conduct two robustness exercises related to adverse selection and gaming of the subsidy design that recent studies on Part D (Polyakova (2016), Decarolis (2015)) have shown to be significant factors in insurers' decisions to consolidate plans.

Our results show that mergers have a strong market power effect on premiums that rise by an average of 5.2% across all market and 7.3% in markets in which the merging parties overlap. In overlapping markets, the premium rise reflects the combined effects of increased market power and cost savings that insurers bargain for in the form of rebates from drug manufacturers. In non-overlapping markets, we do not find evidence of large effecs. The premium declined slightly, by \$0.69 (1.54%), although the point estimate is imprecise. Since a merger does not induce any change in market structure in non-overlapping markets, this outcome is a result of higher rebates achieved in overlapping markets spilling over to non-overlapping markets. However, our empirical estimates suggest that the gain obtained through national

bargaining for drug rebates is rather small. Much higher premiums in overlapping markets indicate that rebate increases dwarf in comparison to merging insurers' gain in market power and no sizable cost efficiencies are realized and/or passed to the enrollees through premiums.

On average, post-merger plans cover more drugs at negligibly higher OOP costs and somewhat higher level of restrictions (e.g. prior authorization). But similar to premiums, in non-overlapping markets the plan coverage outcomes are divergent from the outcomes in overlapping markets. In overlapping markets, there are nearly no gains in formulary comprehensiveness relative to non-merger plans and usage restrictions became more stringent. These results suggest that local market power not only raises premiums, but also negates benefits of mergers related to drug access. However, in overlapping markets, enrollees benefit from a reduction in drug OOP copay/coinsurance rates. In contrast, the drug basket cost rises and access improves in non-overlapping markets. The divergent results across markets and across outcomes (rebates, access, and drug OOP costs) highlight the nuanced interactions in the bargaining process between insurers, drug-suppliers, and pharmacies.

The results for plan consolidation stand in stark contrast to those for mergers. Premiums of consolidated plans decrease by an average of 9.6%, larger in magnitude than the price increase attributed to mergers. In other words, cost efficiencies arise through plan consolidation, not merger. The premium decrease can be primarily attributed to marketing/administrative cost efficiencies. We find little evidence of a bargaining power effect; coverage quality with respect to drug access and OOP costs decreases modestly. However, we find a very large effect on coverage when merging insurers engage in plan consolidation. All measures of drug coverage improve dramatically, suggesting that there exist synergies to restructuring plan offerings following a merge.

These results suggest that anti-trust authorities should scrutinize merger deals involving a large share of overlapping markets for market power and be skeptical of cost efficiency claims. They should weigh a trade-off between coverage access and drug OOP costs in their assessment of bargaining gains. Our suggestive evidence on the effects of plan consolidation points to a possibility of allaying these concerns by defining the rule on plan offerings that induce plan consolidation.

2 Healthcare competition literature

Economists have long been concerned about whether healthcare markets are competitive and, if so, whether unfettered competition achieves desired outcomes. Ellis (2012) cites evidence of high levels of concentration and raises concerns about market power in both provider markets (hospitals, physician networks, pharmaceuticals) and insurance markets. Apart from market

power, two other channels — cost efficiencies and the balance of bargaining power in the vertical relationship between insurers and healthcare providers — determine the performance of markets. This article contributes to the literature by illuminating the relative importance of these three channels as they apply to health insurance markets. Merger studies provide an excellent avenue for analyzing competition because merger events change the industry structure.

The literature on health insurance posits that an insurer's scale, measured by enrollment, is an important determinant of its cost efficiency. There is a strong correlation between scale and insurance loads: the difference between what is collected in premiums and paid out in benefits. For employer-sponsored health insurance plans Karaca-Mandic et al. (2011) document loads ranging from 4% for the largest insurance plans with over 10,000 enrollees to over 40% for the smallest with under 50. In Part D, the size of plans spans the same range. A leading cause is that large insurance plans economize on administrative costs. In Part D, they may be particularly high due to Medicare's stringent compliance and reporting standards and the added complexities of real-time pharmacy claims processing at the point of sale. In the Medigap market, insurers have high loads because of marketing costs (Starc, 2014). Insurers use the same marketing tools for their Part D plans. Horizontal mergers may have tremendous benefits if the increased scale of merging insurers reduces administrative and marketing costs. Legislation in the ACA aims to reduce loads by imposing minimum loss ratios (MLR) on insurers. Starting in 2014, MLRs was implemented in Medicare Part D. Mergers may be one of the most effective ways for insurers to reduce costs so that they can meet the new MLR requirements. A recent paper by Schmitt (2017) uses difference-in-difference design applied to a large waive of hospital mergers to look at whether they brought about cost efficiencies. The author finds that hospitals that were acquired, on average realized cost savings of 4–7 percent in the years following the merger.

The next channel we consider is the vertical market relationship between insurers and providers. The industry has shifted towards a model where insurers selectively contract with providers through a bargaining process. Insurers decide which providers to include in their network, providers decide which networks to join, and the two parties negotiate over reimbursement rates and the terms of enrollee cost sharing. There is a large literature on bargaining from the perspective of hospitals (Ho, 2009; Ho and Lee, 2019, 2017; Dafny et al., 2019; Gowrisankaran et al., 2015; Lewis and Pflum, 2015), but less is known about the insurance side, particularly for prescription drugs. Conceptually, the bargaining process in Part D is unfathomably complicated because there are thousands of manufacturers and pharmacies at the bargaining table negotiating over a multitude of contract terms including formulary inclusion, drug prices, copay rates, and usage restrictions. Brown et al. (2014)

shows how insurers are able to manipulate these complicated contract terms to cream-skim improperly risk adjusted enrollees, and Carey (2014) provides evidence from Part D that copay rates are the primary tool for cream-skimming. Otherwise, little is known about how insurers use these contract terms as bargaining levers. Evidence from the early years of the program has shown that bargaining led to significant reductions in drug prices for non-protected therapeutic classes (Duggan and Scott-Morton, 2010) that, in the aggregated, lowered drug price levels for the Medicare population (Duggan and Scott-Morton, 2011).

Our study allows us to gain a greater understanding of how insurer competition impacts the bargaining process. Mergers alter bargaining positions. The number of people enrolled by the insurer determines the threat point in the Nash bargaining models applied to the industry. Insurers can expand their base of enrollees through merger to gain greater bargaining power. We show how bargaining gains translate into a combination of lower premiums, expanded drug access, and reduced cost sharing for enrollees. Our analysis decomposes the effects for each of the contract terms, revealing how they are used as bargaining levers. Our distinction between overlapping and non-overlapping merger markets allows us to determine whether there are national or local level bargaining effects, much in the same spirit as Lewis and Pflum (2017) who find bargaining gains in out-of-market hospital merger deals.

The healthcare merger and competition literature has extensively explored hospital mergers. We contribute to a more scarce literature on health insurer mergers. Two of the most comprehensive studies are Dafny (2010) and Dafny, Duggan, and Ramanarayanan (2012). Dafny (2010) uses a large panel of insurers offering plans in the employer sponsored health insurance market to investigate whether health insurers have market power. The authors find non-trivial market power as evident in their ability to price discriminate by charging higher premiums to more profitable employers, particularly in highly concentrated markets. A similar conclusion is reached by Bates et al. (2012) who find higher prices and lower rates of health insurance enrollment in more concentrated markets. Dafny et al. (2012) employ the same data set as Dafny (2010) to study the effect of concentration on premiums and reimbursements to physicians and nurses. They focus on the 1999 merger of Aetna and Prudential, two of the largest insurers in their sample. The deal between them resulted in a sharp change in the Herfindahl-Hirschman concentration Index (HHI) and represents a plausible exogenous shifter of market concentration. Their estimates show that the average market-level changes in HHI between 1998 and 2006 caused a 7 percentage point increase in premiums. They also find evidence of increased bargaining power with health care providers; payments to physicians and nurses decreased by 2% to 3% over the same time period.

We build on Dafny et al. (2012) in two important ways. Our first contribution is to examine the interplay of the three merger effects. Their results show market power dominates,

but are less informative about the extent to which the merger created cost efficiencies or altered bargaining power. Second regards the data. We have detailed plan-level data on coverage characteristics, not just premiums that we consider as merger outcomes. This is important as both premiums and the terms of coverage are jointly determined in insurance contracts.

We also take advantage of panel data that includes all merger activity between 2006 and 2012. The high churn rate of mergers yields a large treatment group of plans affected by a merger and a control group of plans "unaffected" by a merger which allows us to use a differences-in-differences approach to identify merger treatment effects. We do so at a trade-off: we are unable to address endogeneity of merger targets and their timing at the extent it was carried out by Dafny et al. (2012). Related to this, many plans in our control group are, strictly speaking, affected by mergers, due to the rising concentration in the markets where plans merged. Thus, our estimates are a lower bound of the true effects.

Last but not least, our article is closely related to Dafny et al. (2019). They look at horizontal mergers of firms (hospital systems) whose products are not viewed as direct substitutes for the same good or service, but are bundled by a common intermediary. The article provides a theoretical model and an empirical demonstration of how in a presence of common buyer, cross-market mergers can result in price increases. Dafny et al. (2019) look at "bystander" hospitals to address endogeneity concerns.

The effect of mergers on market performance is also an important topic in the finance literature. While we address the question using product-level data, much of the research in finance uses event studies applied to a set of multiple M&A deals. Most closely related is Fee and Thomas (2004) that specifically aims to identify how mergers affect market power, cost efficiencies, and vertical bargaining power. They use a large cross-industry sample of deals from 1980 to 1997 and examine stock price movements for the merging firms, horizontal rivals, and upstream suppliers. Maksimovic et al. (2011) examine post-merger plant closures and restructuring of supplier contracts as means of improving efficiency. The analog to plant closures and restructuring in our article is plan consolidation.

Finally, our article contributes to a growing literature on Medicare Part D. Several articles (Lucarelli et al., 2012; Miller and Yeo, 2019; Ericson, 2014; Decarolis, 2015; Miller, 2015) examine firm conduct and competition, including important institutional details related to subsidies and market regulations. We contribute by analyzing competitive and cost-side effects of mergers and plan consolidation. Another strand of the literature (Abaluck and Gruber, 2011; Ketcham et al., 2012; Kling et al., 2012; Heiss et al., 2013) uses individual level data on consumer choice and finds evidence that enrollees make poor plan choices. These studies have been influential in guiding policy decisions. The consumers' choice prob-

lem could be eased by reducing the number of available plan offerings. Standing proposals to reduce choice involve consolidation of either low enrollment plans or plans with "meaningfully similar" coverage characteristics. Other proposals would limit the number of plans sponsors that can participate in Part D or restrict the number of plans an insurer can offer. The question for regulators becomes a matter of how to implement policy to reduce choice — whether it be adopting a tolerant stance towards mergers to reduce the number of participating sponsors or promoting plan consolidation — in a way that does not compromise competition and coverage quality. This study informs the issue by showing the effect that mergers and consolidation have on premiums and coverage.

3 Medicare Part D background

Medicare Part D introduced a prescription drug benefit to the Medicare program. It was authorized under the 2003 the "Medicare Prescription Drug, Improvement, and Modernization Act" and fully enacted in 2006. The legislation created a coverage mandate requiring beneficiaries to obtain prescription drug coverage when they first become eligible for Medicare or face penalties for late enrollment. The act established a regulated and subsidized health insurance exchange where beneficiaries can choose amongst plans offered by competing private insurers. The prescription drug plans offered in this exchange are the focus of our study. During our sample period, about 60% of the Medicare population were covered by a Part D plan;[3] the remainder either lack coverage or obtain prescription coverage through other means such as employer/retiree benefits or another government program.

The Part D exchange was designed to rely on free market principles to provide competitively priced drug plans with attractive coverage. The benefit is offered by private insurers who may freely enter and exit the market, choose the number of plans to offer, and set monthly premiums. The government subsidizes premiums, facilitates risk adjustments, and sets a minimum coverage standard. Provided that the standard is met, insurers are largely responsible for the benefit design. Each insurer selectively chooses which drugs to cover on its formulary and sets cost-sharing copay/coinsurance rates on a drug-by-drug basis. Drug prices are determined through a bargaining process between insurers and drug manufacturers, wholesalers, pharmacies. Per regulation, negotiated prices must be passed on to enrollees. This is seen as a controversial feature of the program because the legislation explicitly prohibits the Secretary of Health and Human Services from being involved in price

[3]By 2019, this fraction increased to 75% (see CMS Fast Facts. July 2019 version. https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/CMS-Fast-Facts/index.html, accessed on August 10.

negotiations with the pharmaceutical industry (Frank and Newhouse, 2008) as is the case for other government drug benefits such as Medicaid (paragraph 1860D-11(i) of the Social Security Act). Despite several Office of Inspector General (OIG) reports concluding that Medicare Part D rebates are substantially lower than statutory-required Medicaid rebates, CMS refused to alter their approach arguing that Part D did better than expected.[4]

The regulations establish a set of coverage standards. All providers are required to offer at least one basic plan that meets (or is actuarially equivalent to) a minimum coverage level with respect to the deductible, coinsurance and copay rates, and the scope of drugs covered on the formulary. In addition to a basic plan, insurers may offer enhanced plans that have more generous coverage through a combination of lower deductibles, lower copay/coinsurance rates, and drug coverage for a larger set of medical conditions. Low income beneficiaries qualify for additional premium and copay subsidies over and above those available to all beneficiaries.

Plans have a large toolbox of "formulary management" techniques that they can use as bargaining levers with drug suppliers and as a means to steer enrollees' usage of drugs. With the exception of six therapeutic classes, they are allowed to selectively choose which drugs to include on their formularies, place drugs on pricing tiers such as "preferred," "non-preferred," and "specialty," as well as impose usage restrictions in the form of quantity limits, step therapy routines, and prior authorization requirements. These techniques are thought to be important tools for negotiating favorable drugs prices, which will ultimately be reflected in the generosity of plans coverage and premiums.

Nearly all major health insurance companies and many regional insurers entered the Part D market in the first two years of the program. There has been almost no entry in later years. Geographically, the market is separated into 39 markets drawn around state boundaries. Insurers offer and price plans individually for each market. In the typical market, enrollees can choose from about 40 plans offered by 20 insurers, on average during our sample period (see Table 3).

CMS policies targeted the number of plan offerings in several ways. First, in 2009 the CMS eliminated the subsidy-related incentive for the insurers to have multiple plan offerings. Second, regulations issued in 2010, specified additional bid guidelines by requiring larger benefit differences between plan offerings and restricting the number of plans overall. Prior to 2011 bidding period, CMS allowed a maximum of three plans per carrier per PDP region, at least one of which needed to be a basic plan with benefits actuarially equivalent to the

[4]For the most recent report, see "Medicaid Rebates for Brand-Name Drugs Exceeded Part D Rebates by a Substantial Margin", Department of Health and Human Services, Office of Inspector General. OEI-03-13-00650. April 2015.

Medicare Part D benefit. The new policy allowed only one basic plan and introduced stricter requirements on how different enhanced plans should be. Note that with the CMS proposed rule on the elimination of the coverage gap by 2020, required by the Affordable Care Act, the second enhanced plan will likely lose its meaningful difference. In addition, through regulations issued in 2010, CMS started a process to eliminate plans with low enrollment. CMS urged plans to consider withdrawal or consolidation if they had fewer than 1,000 enrollees.

4 Data

We utilize detailed longitudinal data on plans that include an average of 1,500 stand-alone, Part D plans (PDPs) per year. We exclude Medicare Advantage plans that bundle Part D coverage with other Medicare coverage components. By construction, MA-PD plan providers solve a different maximization problem not covered by our model and discussion. It is left for future research to look at the effects of mergers on Medicare managed care markets. The data set spans seven years from 2006, when Medicare Part D was introduced until 2012 and cover all 39 geographical markets. The sample is constructed using both publicly available and restricted use data obtained from the Centers for Medicare and Medicaid Services (CMS).

Enrollment in stand-alone Part D plans has grown from about 17 million in 2006 to over 20 million by 2012. The average plan has 11,592 individuals enrolled per year. However, the plans differ significantly on this margin. There are plans that have fewer than 10 insured, whereas others insure more than 300,000 individuals. About 40% of the enrollees receive premium and copay subsidies through the low income subsidy (LIS) program. Table 3 presents information on market level trends. In the first year of the program, there were only 1,446 plan offerings, which rose to 1,900 in the second year. But following 2007, the number of plan offerings has steadily decreased down to 995 by 2012. Much of this decrease can be attributed to plan consolidation. During the sample period, average premiums increased by 26% in real terms (by 43% in nominal terms), and the average plan's market share increased 37%.

We collect information on each plan's premium, deductible, gap coverage, and drug formulary. Table 4 reports summary statistics on the plan-level data for 2006-2012. A plan's *premium* is set once a year, when insurers submit their bids for contract with Medicare. The deadline to submit bids is the first Monday in June each year. The open enrollment period runs from October through December, and the contract year begins on January 1st. Premiums are paid monthly by the insured. Qualified individuals are provided with the "Extra Help", or low-income subsidy (LIS) by Medicare. This LIS program covers in full

or partially the monthly premium amount, deductible, copayments and coinsurance, and eliminates the coverage gaps.

The *deductible*, followed by the *initial coverage zone*, is the amount the insured must pay out-of-pocket before cost-sharing kicks in. The yearly deductible for what Medicare determines as the standard Part D benefit was set to $250 in 2006. Updated using annual percentage increases, it was raised to $320 by 2012. Most enhanced PDPs eliminate the deductible so that the enrollee receives first dollar coverage.

The gap in coverage or "*donut hole*" begins when the insured reaches the limit on the expenses covered by the initial coverage zone. Prescription costs beyond the limit ($2,250 in 2006) and below the "catastrophic" level ($5,100 in 2006) are paid by the insured out-of-pocket. Many enhanced PDPs provide full or partial coverage in the donut hole. The ACA legislation began a phase-out of the donut hole in 2011. It will be completely closed in 2020.

The *formulary* is a comprehensive list of the medicines covered by the plan, identified by the National Drug Code (NDC).[5] The drugs on the formulary are organized into broad therapeutic categories called pharmacological classes. Each formulary must include at least two drugs within a class. Also, a formulary must include "all or substantially all" drugs in six categories, which are often referred to as protected classes.[6] The formulary files contain data on the drug's tier, usage restrictions, and copay/coinsurance provisions that determine the cost to a beneficiary. Since 2009, the formulary file is complemented with drug pricing data. They contain information on the average monthly drug prices for every NDC and plan. Specifically, the reported price is the average transaction price, net of all rebates for a 30-day supply filled at the plan's preferred pharmacies in the third fiscal quarter of each year.[7] One of the outcomes that we use is an equally-weighted price of all brand drugs that were ever on any PDP formulary, drug list price. Brand drug manufacturers are one of the upstream suppliers in the stylized bargaining game that we introduce below. We set the retail price for uncovered drugs to the 95^{th} percentile of the pharmacy price in the region. We also take

[5]NDC is an 11-digit classification issued by the Food and Drug Administration (FDA) for all the approved drugs. Under this system, different package and dosage sizes of the same drug molecule have separate NDCs.

[6]Beginning 2011, insurers are required to include all drugs in categories and classes that CMS identifies as being of clinical concern. They are immunosuppressants, antidepressants, antipsychotics, anticonvulsants, antiretroviral, and antineoplastic classes.

[7]As per the CMS Prescription Drug Benefit Manual (Chapter 5, Section 20.6), "Part D sponsors must provide enrollees with access to negotiated prices for covered Part D drugs as part of their qualified prescription drug coverage. <...> Negotiated prices will take into account negotiated price concessions for covered Part D drugs that are passed through to enrollees at the point of sale, such as discounts, direct or indirect subsidies; rebates; and other direct or indirect remunerations." As it was rightly pointed out by one of the anonymous referees, volume-based rebates or rebates at the point of sale, by definition, cannot be accounted for in the current year's negotiated price. These rebates are reported to the CMS and are passed on the enrollees in the form of lower premiums.

advantage of the pharmacy networks file and count the number of retail pharmacies in the plan's network.

To measure the comprehensiveness of formulary coverage, we count the number of drugs listed on the plan's formulary. The first measure counts the number of top 100 drugs. In early years, the average plan covered more than 90 of the top 100 and fell to 75 by 2012. The second measure counts the total number of NDCs on a formulary which plans select from a set of 5,300 unique drugs that qualify for coverage under Part D.[8] Like the top 100 drug, the total number of covered NDCs fell throughout the sample period.

Part D formularies typically have three to five *pricing tiers* that separate preferred drugs with relatively more favorable coverage from non-preferred ones. Lower tiers indicate better coverage. For example, a three-tier plan that has 1/3 of its drugs on tier 1, 1/3 on tier 2, 1/3 on tier 3 has an average pricing tier of 2. Since the plans differ in the number of tiers (up to 7 tiers), for the purposes of comparison we normalize a 2 on a scale of 1 to 3, to 0.5 on a 0 to 1 scale. The formularies also might have up to three types of *restrictions* placed on drug consumption: step therapies, prior authorization, and quantity limits. We sum up these restrictions and calculate their average number on a formulary using a 0 to 3 scale.

We use drug prices and cost sharing rates to construct a drug cost index to compare OOP costs to beneficiaries across plans. This is our most refined measure of the generosity of plan coverage. It is calculated using copay/coinsurance rates in the initial coverage zone and pharmacy prices for a basket of the top 100 drugs ranked by the number of prescriptions filled, where each drug is weighted equally. If a drug is not covered on the formulary, the enrollee has to pay the full retail price out-of-pocket. We set the retail price for uncovered drugs to the average pharmacy price in the region. Three sources of variation affect the OOP cost index: number of covered drugs, drug pricing tiers, and a plan's negotiated price with the pharmacy and drug manufacturer. Greater formulary comprehensiveness, lower pricing tiers, and lower negotiated pharmacy prices all contribute to a lower value of the OOP cost index.

The *benchmark* indicator variable relates to the Low Income Subsidy (LIS) program. Benchmark plans are a subset of basic plans that are priced below a market weighted average premium of basic plans. Benchmark plans qualify for the full amount of the low income premium subsidy and as default plans for Medicare/Medicaid dual eligible beneficiaries. Dual eligibles account for about 20% of the Medicare population and 40% of Part D enrollment. They are randomly and uniformly assigned to an LIS benchmark plan if they don't actively select a plan. Given the large number of dual eligibles, LIS benchmark plans receive a big

[8] In 2006, all NDCs were reported on the formulary, including identical drugs made by different manufacturers. This duplication was eliminated starting in 2007.

boost in enrollment from random assignment, which creates a large discontinuity in demand at the benchmark level, making it an important consideration for premium setting, plan consolidation, and other decisions.

4.1 Data on M&A deals

We complement plan-level data with data on M&A activity from the Securities Data Company (SDC) merger and acquisition module. It contains detailed information on all deals involving public and private companies. From 2006 to 2011, we identified a total of 10 completed horizontal M&A deals amongst companies that offer Medicare Part D plans. Table 2 lists the details on each of the deals included in the sample. To be included in the sample, the deal has to involve two Part D providers. Mergers, in which only one party was offering Part D plans, are not in the sample.[9] For example, the 2007 merger between CVS and Caremark is excluded, because only Caremark provided PDP plans and CVS provided PBM services. However, the 2011 merger between CVS Caremark and Universal American is included because both were Part D providers prior to the merger. All of the deals involve major Part D insurers that offer plans across the entire nation with the exception of the Medical Mutual of Ohio/ Carolina Care Plan acquisition. Note that some of the major plan providers were involved in multiple deals during the sample period.

It is worth noting that we exclude a few large deals that took place in the second half of 2011 and in 2012 due to our assumption on the relative timing of the deal and its effects. The bids for each successive calendar year are submitted before the first Monday in June of the previous calendar year. Thus, for the deals completed prior to the deadline we measure the "before" period as the current calendar year and "after" as the following calendar year assuming that their bid will reflect the effects of merger. For example, case A in Figure 1 demonstrates a merger that was completed prior to first Monday in June of year (t-1). In this case, year (t-1) will represent the "before" period and year (t) - the "after" period. The merger from case B was completed after the bid date. It means that its "before" period is year (t) and "after" period is year (t+1). We also go through the news reports and companies' press releases for each of the 10 deals to obtain factual support to our assumption. The mergers that were completed after June 2011 when all the bids for 2012 calendar year had been submitted would require data from 2013. Including these later deals, 23 of the top 25 Part D insurers have been involved in an M&A deal with the notable exception being the

[9]It is worth noting that some PDP plan providers own their own PBM, pharmacies, or other related businesses. We do not differentiate the deals based on this criteria. Our definition of a horizontal merger only requires both parties to be offering a PDP plan before and after a merger, which is determined from the CMS crosswalk files.

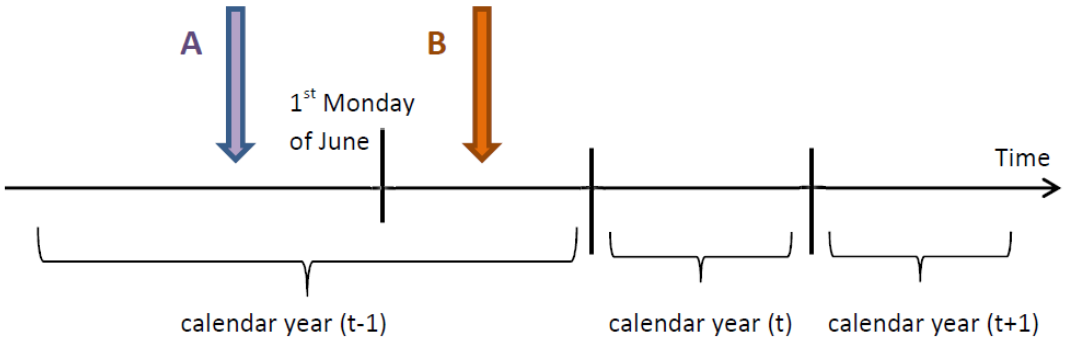

Figure 1: M&A deals timing with respect to the bid deadline date

number two insurer, Humana.

We match the SDC data on deals to the plan-level data by company name. There are about 100 unique parent companies whose subsidiaries offer Part D plans during the sample period. Some parent companies control more than one insurance company. As multi-product firms, insurers offer between one and three plans per region with the requirement that at least one plan qualifies as a basic plan.

We look at the short-term merger effects by comparing plan premiums and coverage characteristics before and after the deal was completed. From year-to-year, plans can evolve in one of four ways as depicted in Figure 2. Plans can be renewed, terminated, consolidated, or new plans can be introduced. To determine each plan's transition status we use the CMS "crosswalk" file that links plans across years. Renewed plans carry-over enrollees from the previous year and typically maintain the same product segment: basic or enhanced status. However, plan characteristics such as the monthly premium, formulary list, and copay/coinsurance tiers, and drug prices can change across years. Terminated plans simply stop being offered for the new calendar year, and previously enrolled individuals have to actively select another plan. New plans are introduced to the market for the first time and they have no enrollees from the previous calendar year. Consolidated plans combine two or more plans from the previous year into one plan. Enrollees from the previous year's plans carry over into the new plan. Like renewed plans, the product characteristics can differ from the previous year's plan characteristics. Most consolidations combine two or more basic plans or two or more enhanced plans, but there are examples of cross segment, basic-enhanced consolidation.[10] Long-run effects of mergers are out of scope of this article. A firm might become involved in several mergers over our time period making it difficult to trace a particular plan and to identify an effect of an earlier merger.

Consolidation of plans is undertaken by merging firms as well as by firms that did not

[10]When basic and enhanced plans are consolidated, the resulted plan must carry basic status.

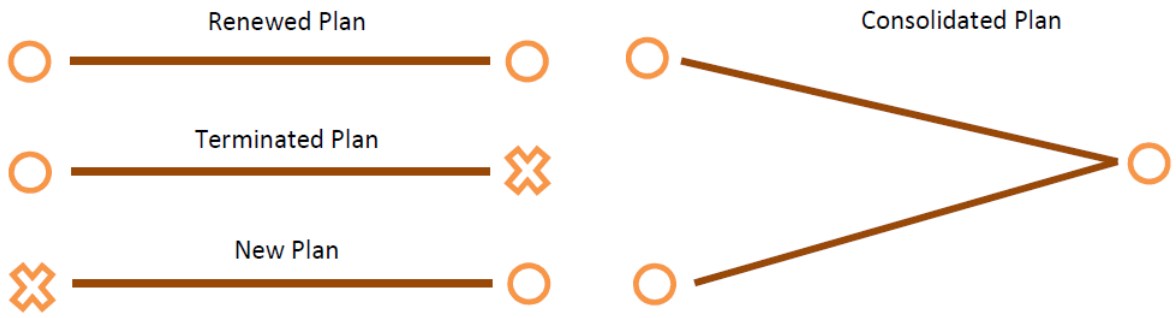

Figure 2: Plan transitions from year-to-year

participate in a deal. We posit that the main reasons behind plan consolidation are to achieve cost efficiency gains and as a means for merging insurers to restructure their business activities. A similar idea is presented by Maksimovic et al. (2011). They find evidence of extensive restructuring in a short period following an M&A deal. In the sample of U.S. manufacturing firms, acquirors were likely to sell or close down targets' plants. It resulted in a boost in productivity in the retained plants comparing to the industry. Health insurance is fundamentally different from manufacturing in that terminating plans is highly undesirable because enrollees are lost. Part D insurers are better off consolidating plans when they want to restructure plan offerings to retain enrollees.

For our analysis we restrict attention to renewed and consolidated plans because our empirical method requires a plan to be observed for at least two consecutive years. By definition, terminated and new plans do not meet this criteria. Excluding them from the sample is unlikely to bias results because they compose such a small fraction of the market. Table 3 shows the total number of plans offered during the sample period in each year and the number of plans directly affected by an M&A deal. In each year, an average of 15% of all plans are affected by a merger. Table 5 shows how all plans and M&A affected plans evolve. Merging insurers engage in plan consolidation at an almost identical frequency to the rest of the market.

Table 5 also reports comparative summary statistics for the control group, plans unaffected by merger, and treatment group, plans offered by companies involved in a merger deal. The pre-merger plan characteristics of merger affected plans are generally similar to all other plans.

5 Theoretical model outline

In this section, we outline a theoretical model of bargaining and competition in the spirit of Ho and Lee (2017) to illustrate how market power, cost efficiencies, and bargaining power affect merger outcomes. The model is a multi-lateral, multi-level bargaining game involving insurers, drug manufacturers, and pharmacies that determines premiums, formularies, drug rebates, and drug prices. It is specifically tailored to the institutional features of Part D discussed in sections 3 and 4. We discuss the model more formally in Appendix C. In what follows, we highlight the key points and predictions that this model makes for merger effects. We would like to stress that the model presented here cannot capture all of the of the complexities of the Part D market. Given the low level of transparency in the bargaining process, we defend the assumptions of the model based on CMS publications, news, and data themselves.

Several institutional features of the Part D program help us arrive at a compelling explanation of how the three channels affect outcomes. First, Part D insurers have two types of upstream suppliers, pharmacies and drug manufacturers. On the national level, Part D providers bargain with prescription drug manufacturers over the inclusion of their drug into the plan formulary in exchange for a rebate per prescription filled. Although rebates are proprietary information, they appear in premiums because the law requires that insurers pass the rebates through to the enrollees. On the local (market) level, insurers negotiate with pharmacies over access restrictions and drug prices in exchange for the pharmacy being a part of the plan's network.[11] We look at how mergers change the bargaining dynamics with drug manufacturers using data on formularies and premiums; and with pharmacies using data on drug prices and access restrictions.

Second, we exploit market boundaries in Part D to distinguish local and national bargaining effects by examining mergers in overlapping and non-overlapping markets. Part D markets are defined by law. They are geographic regions drawn around state borders, some including multiple states. Consumers cannot shop across market boundaries, and providers are required to offer a market-specific plan for every region they operate in. Insurers can provide plans in one or more markets. Thus, mergers may happen among parties that either overlapped or did not overlap in a market prior to the deal.

We take a "traditional" IO literature approach in defining market power and cost efficiencies effects. Market power effects directly impact plan premiums charged by insurers; they are only present in the overlapping markets, where merging insurers competed prior to the

[11] We also consider a variant of the model in which drug access is negotiated with the local suppliers of drug manufacturers.

deal. We attribute cost efficiencies to savings that stem from a reduction in administrative, marketing, and bidding expenses.

The bargaining model is essential for highlighting direct and interactive merger effects on the bargaining outcomes: drug rebates, access and pricing (Table 14). There are two bargaining channels that are *directly* affected by a merger. The first channel is the market share effect. Following a merger, the threat of enrollees switching to a rival insurer's plan decreases, enabling the merged insurer to negotiate better terms. The second, countering channel, is the premium effect that stems from the traditional argument about mergers creating market power. With higher premiums, drug manufacturers and pharmacies may be able to share in surplus and negotiate more favorable terms.

The direct bargaining effects are present in markets in which the merging insurers overlap. In non-overlapping markets, there is no change in market power or local bargaining power after a deal (Table 14). Instead, non-overlapping markets can be affected through spillovers from the overlapping markets and through indirect, or interactive effects between upstream suppliers. That is, the way in which insurer-drug manufacturer bargaining interacts with insurer-pharmacy bargaining. For example, a merging insurer may be able to negotiate substantial rebates from drug manufacturers which will spillover into non-overlapping markets. The interactive effect could in turn allow pharmacies in the overlapping markets to charge higher prices now that the insurer receives greater rebates. There are many scenarios for how the merger effects can interact and spillover that we formally outline in the Appendix C.

The interactive effects also shed light on the relative importance of pharmacy networks and formularies for the enrollees. If the market share (substitutability) effect is relatively strong with respect to drug formularies, but not with respect to pharmacies (that is, enrollees care relatively more about formularies than about pharmacy networks when choosing plans), then higher rebates prevail and pharmacy prices and access will be little changed. If instead, plan enrollment responds more to the composition of the pharmacy networks, then rebates will be little changed, whereas pharmacy prices and drug access will decrease.

Since the three merger forces affect plan outcomes in different ways, and the bargaining model predictions for direct overlapping market effects and indirect effects are ambiguous, we next turn to the empirical model to be able to make a statement on the contribution of all the above effects to the realized merger outcomes in Medicare Part D.

6 Estimation strategy: Differences-in-differences

To estimate the effect of mergers and plan consolidation, we use a differences-in-differences (DD) identification strategy. Although this approach is more common to labor, health,

and development economics fields (Bertrand et al., 2004), there are notable applications in IO literature as well – Hastings (2004) (retail gas stations), Dafny et al. (2012) (health insurance), Allen, Clark, and Houde (2014) (banking), Lewis and Pflum (2017) (hospitals), Ashenfelter, Hosken, and Weinberg (2015) (breweries). The detailed panel of product-level data and large sample of merger-"treated" plans make such a DD approach feasible and provide an attractive alternative to structural-based modeling and estimation of merger outcomes (Angrist and Pischke, 2010).

6.1 Merger treatment effects

We construct several DD specifications to estimate the treatment effect of a merger on plan outcomes. Specification (1) considers the effect of mergers on the monthly premium, p.

$$p_{it} - p_{it-1} = \alpha + \beta D_{it-1} + (\mathbf{X}_{it} - \mathbf{X}_{it-1})'\gamma + \mathbf{Z}'_{it-1}\delta + \varphi_{mkt\times year} + \varphi_{insurer} + \epsilon_{it-1} \qquad (1)$$

where i indexes the plan, and t, the year. The merger treatment $D_{it-1} = 1$ if plan i was involved in an M&A deal that was completed in year $t-1$, such that the effect of the merger would appear in year t. Note that the deal dummy "turns on" according to the timeline in Figure 1 and does not necessarily match the calendar year in which the deal was officially announced. The plan characteristic controls in first differences ($\mathbf{X}_{it} - \mathbf{X}_{it-1}$) include various measures of plan design, excluding drug coverage outcomes. The pre-treatment plan characteristic controls in levels ($\mathbf{Z}_{it-1}$) include the variables in $\mathbf{X}_{it-1}$ and drug coverage variables that could be potential outcomes of the merger. We include market-year fixed effects ($\varphi_{market\times year}$) in all specifications and insurer fixed effects ($\varphi_{insurer}$) in the most heavily controlled specification. The term ϵ_{it-1} is a plan-year specific error term. We apply the same DD approach to drug formulary counts, formulary restrictions, the OOP drug cost index, and pricing tiers to estimate the effects of mergers on drug coverage outcomes.[12]

To identify the merger effect, we take advantage of the two dimensions present in the data: time and merger status. First, we look at the across time variation in outcomes, i.e. plan premiums immediately before the deal as compared to premiums immediately after. This comparison is possible if a plan is observed in the data for at least two consecutive years. For this reason, our sample includes renewed and consolidated plans, excluding new and terminated plans (see Figure 2). The unit of observation is indexed to year $t-1$ in equation (1).[13] On the merger status dimension, we compare plans directly affected by a

[12] For exposition we only show equations for premium outcomes, p, because the econometric specifications are otherwise identical for the drug coverage outcomes.

[13] This timing issue matters for consolidated plans. For example if plans A and B sold in year $t-1$ are

merger to a control group of plans that do not belong to either merging party. Combining both sources of variation in the DD estimator provides a robust means of identifying average treatment effects.

To understand the intuition behind the DD approach, it is useful to separate the components of the estimator. In the raw data, a before and after comparison across time of average premiums for merger-treated plan shows a (44.81-40.27=)$4.54 *increase* in premiums caused by a merger (see Table 5). A comparison of average premiums for merger (treatment group) and non-merger (control group) plans shows a (44.81-45.16=)$0.36 *decrease* in premiums caused by a merger. Neither of these results necessarily measures the causal treatment effect. The increase indicated by time differencing could simply reflect an increasing time trend in premiums that affects all plans. Such a trend is plausible given plans not affected by a merger experience average premium increases of (45.16-42.54=)$2.62. The decrease indicated by differencing the treated and untreated group could be attributed to differences in unobserved plan and market characteristics of the two groups. The DD estimate of (44.81-40.27)-(45.16-42.54=)$1.92 controls for both confounding time trend effects and unobserved plan characteristics. The estimate of $1.92 is the causal average treatment effect if firms' decisions about merging are orthogonal to plan and market characteristics.

To control for selection on observables, we include first differences in plan characteristics ($\mathbf{X}_{it} - \mathbf{X}_{it-1}$) that are regulated by the Part D benefit parameters (basic plan status, deductible, gap coverage, LIS status) and not potential outcomes of the endogenous bargaining process between insurers and drug suppliers. For example, if merger-affected plans are more likely to lower the deductible between years than non-merger plans, the $1.92 could simply reflect the fact that lower deductible plans are more costly for insurers. In robustness checks we relax the exogeneity assumption on basic plan and LIS status. The market-year fixed effects control for their respective correlation with mergers. The year component is needed because mergers do not all occur in the same year. From the data (Table 3), mergers happened more intensively in the years following the 2010 health reform legislation, which itself may have altered trends in health insurance premiums. The market component controls for market characteristics, such as market structure (number of competing plans, market size) that could affect outcomes. The market-year fixed effects ensure treatment-control comparisons are made within the same market and year, not across markets and time (i.e. an M&A affected plan in Tennessee in 2008 as compared with an untreated plan in New Jersey in 2011).

consolidated into plan C for year t, there are two observations in the data for plans A and B in year $t-1$. Observations of A and B may have different p_{it-1} and Z_{it-1} values in year $t-1$, but will have the same p_{it} and Z_{it} values in year t because of consolidation. Note that there is no "splitting" of plans. That is, plan A in year $t-1$ cannot be split into plans B and C for year t.

The DD estimate of the merger effect is the causal treatment effect if the decision to merge is exogenous, conditional on the control variables and fixed effects. Two features of the insurance industry during this time period support the plausibility of merger exogeneity. First, the mergers in our sample involve large diversified insurance companies. Part D is just one component of these firms' business activities, which suggests merger decisions are not entirely endogenous to the Part D market. Second, nearly every major firm offering a Part D plan has been involved in a merger since 2006. The high intensity of merger activity suggests merger decisions are not a matter of "if" a firm will merge, but rather a question of "when" it will merge. Matters of "if" firms merge raise concerns about whether the DD estimator measures causal treatment effects; matters of "when" the industry experiences merger waves are controlled for by the year fixed effects. Pre-treatment variables help control for the more difficult issue of "if" and "when" firms merge. There may be pre-treatment plan specific supply/demand shocks in the Part D product market affecting premiums and enrollment and likewise shocks in the upstream bargaining processes with drug suppliers influencing drug coverage. The rich set of pre-treatment plan variables ($\mathbf{Z}_{it-1}$) helps control for these shocks that may affect the timing of when a particular firm decides to merge. For example insurers that experience a down tick in market share are more likely to merge.

To address these concerns, we investigate whether treatment and control groups are following the same trend pre-merger, or evaluate the "parallel trends" assumption underlying DD strategy. To perform this test in our particular setting, we created control-treatment groups based on the mergers that took place in 2009. This year is the first option that allows us to see several "pre"-period data points and has many plans affected by mergers (there are almost no plans affected in 2008). Using just a few periods at the start of the program also ensures that we are able to track back as many plans as possible. The event study plots are shown for every outcome and both "treatments", merger and consolidation (Figure 3 and Figure 4). Even in the very imperfect conditions that we are facing in identifying clean treatment and control groups, we can show that parallel trends assumption is reasonable for merger "treatment" as well as for our main outcome variables (premium, OOP costs) for consolidation "treatment". Also note that although we plot several "post" periods, our regression analysis only compares one year before and one year after for control and treatment groups.

Yet another way of addressing the endogeneity of merger/firm selection into mergers is to evaluate the relationship between the predicted premium changes with merger treatment. We regress premium changes (the left-hand side variable) on all the control variables, omitting the treatment dummy. Then, we use the predicted values from this regression and regress them on the treatment dummy. The estimated coefficient is statistically indistinguishable

from zero and therefore, the correlation is weak and lends credence to the interpretation of mergers as causal. This exercise provides us with one easy interpretable number in addition to the evidence presented in Table 5 that shows control and comparison groups characteristics.

These justifications aside, we cannot rule out the possibility that there are other unobserved insurer characteristics correlated with a specific insurer's decision to merge (or it's decision to merge in a particular year). Our results should be interpreted as the average treatment effect for the mergers that endogenously occur in Part D. Our most heavily controlled specifications include insurer fixed effects to explore robustness with respect to the identity of merging insurers. Insurer fixed effects control for factors that might explain why CVS Caremark frequently engages in horizontal mergers and, an otherwise similar insurer, Humana does not.

Interpreting the DD estimates requires care because of equilibrium effects and the possibility of multiple merger events occurring simultaneously in the same time period. In the product and upstream supplier market, equilibrium effects can cause a merger event to have an effect on all plans in a market, not just plans sold by the parties to the merger. In the product market, Bertrand pricing models of differentiated products predict that all firms, including rivals to merging parties, gain market power when a merger increases market concentration. Likewise, mergers can alter bargaining power with upstream suppliers for all firms in a market. The analysis in Dafny et al. (2012) estimates the market-wide effects of concentration induced by the Aetna-Prudential merger on product market pricing and payments to the upstream market for doctors and nurses. Lucarelli et al. (2012) estimate a structural discrete choice model of the Part D market under Bertrand pricing and simulates the effect on premiums from the 2006 merger of United Healthcare and Pacificare. They find an average premium increase of 4.7% for the plans of the merged firms, and just 0.9% for all other plans. Our DD results measure the merger effect on a treated plan over and above the equilibrium effects of mergers on the untreated group of plans in the market. For example, if outcomes match that in the simulated model in Lucarelli et al. (2012), the DD estimator on premium would show a (4.7-0.9=)3.8% increase in premiums. When there are multiple merger events occurring at the same time, the estimator measures the average effect of a merger, not the total effect of all simultaneously occurring mergers. Market-year fixed effects control for the effect that merger intensity has on market prices for all firms in a given year and market. For example, there was a lot of merger activity in 2008 when prices increased by a very large amount of $6 on average. The fixed effects for 2008 market-years would be higher than other years.

The last consideration for the DD estimator is sample selection. In Part D, plans are allowed to freely enter and exit the market. The DD estimator requires observation of a plan

across two consecutive years. As such, new and terminated plans must be dropped from the sample. The DD estimate is potentially biased by sample selection if factors that influence decisions to terminate or introduce a new plan are also related to merger decisions. The issue of plans selecting to enter into or exit out of the market is analogous to the issue of program participation decisions in the typical DD estimator used for household studies. In our case, selection is not a major concern because there is very little churn in plans entering and exiting the market, and the little churn that exists does not appear to be related to merger decisions.[14] In particular, plans of merged firms are not more or less likely to introduce new plans or terminate plans than non-merging firms (see Table 5). There are good reasons to expect little churn in Part D. First, lock-in effects stemming from switching costs give strong incentives for plans to renew plans from year-to-year and make it difficult for new plans to attract enrollees (Miller and Yeo, 2018; Ericson, 2014). Second, subsidy amounts are calculated based on the previous year's enrollment figures which discourages plan entry and exit (Miller and Yeo, 2019). For these reasons new insurers that want to enter the Part D market do so by acquiring the plans of incumbent insurers, not by organically creating new plans. The leading example is the 2012 acquisition of Medco by Express Scripts.

In light of all of the possible endogeneity, selection, and equilibrium effects, our empirical application should not be thought of a duplicating a scenario in which mergers are randomly assigned to plan sponsors. Mergers are by definition the result of strategic business decisions, not a policy experiment. Our goal is to control for confounding factors that are not paramount to economic theories of mergers. In principle, a policy intervention could mimic an experiment if anti-trust authorities were to block a proposed merger or force a divestiture, which may be the outcome of the ongoing CVS-Aetna case.

6.2 Merger treatment effects in overlapping markets

Mergers involve two parties agreeing to the deal which raises additional issues about not just "when" and "if", but also "with whom" to merge. Part of our interest is to determine which types of mergers generate more or less market power and cost-side benefits. To explore these margins, we consider market overlap as a specific "match" characteristic of the merger deals. One of the first order concerns in the horizontal merger guidelines is to determine whether the merger deal involves firms competing "head-to-head."[15] The M&A deals in Part D involve large national insurers offering plans in several geographic markets, but not necessarily all markets. There are some markets in which merging firms overlap and others in which only

[14] The exceptions where a lot of entry is observed are 2006, when all plans were new plans by definition, and 2007 when the market was still in its nascency.

[15] 2010 Horizontal Merger Guidelines section 2.1.4.

one of the merging firms operates. In the data, 74% of all plans affected by a merger are in markets in which both merging parties compete. Geographic variation allows us to pinpoint market power effects and separate out cost-side effects. Ashenfelter et al. (2015) apply a similar approach in the brewing industry. Oligopoly models of pricing predict mergers to increase market power in markets where merging parties compete head-to-head, but no effect in markets where they do not overlap. The Part D rules guarantee there are no market power effects that spill over across markets. Insurers set separate premiums across markets even if the insurance products are otherwise quite similar. Enrollees are strictly prohibited from shopping for plans across markets. Given these rules on market boundaries, merger effects on premiums for plans in isolated markets must be due to some national effect. We modify the treatment variable by including the term $D_{it-1}^{overlap} = 1$ when the other merging party offers at least one plan in year $t-1$ in the same market as plan i,[16]

$$p_{it} - p_{it-1} = \alpha + \beta_1 D_{it-1} + \beta_2 D_{it-1}^{overlap} + (\mathbf{X}_{it} - \mathbf{X}_{it-1})'\gamma + \mathbf{Z}'_{it-1}\delta + \varphi_{mkt \times year} + \varphi_{insurer} + \epsilon_{it-1} \quad (2)$$

We also apply this specification to the drug coverage outcomes. In the bargaining game with drug suppliers the market definitions are not as clear cut as in the premium setting game because national insurers negotiate with national drug suppliers. The local versus national distinction identifies the extent to which local market bargaining with pharmacy outlets and regional wholesalers affects drug coverage as compared to national market bargaining with drug manufacturers and pharmacy chains.

6.3 Plan consolidation treatment effects

The next set of DD specifications includes plan consolidation, C_{it-1}, as a treatment effect. It is a combination of two or more plans offered by an insurance company into a single plan for the upcoming year. Note that a non-merging insurer can consolidate its own plans. In periods when an insurer merges it can consolidate its own plans or consolidate with plans offered by its merger partner. Insurers cannot consolidate plans with a rival. We are interested in the distinction between mergers and plan consolidation to test whether market power or cost-side effects can be achieved organically through consolidation.

We specify the following DD estimator for consolidation:

$$p_{it} - p_{it-1} = \alpha + \beta_3 C_{it-1} + (\mathbf{X}_{it} - \mathbf{X}_{it-1})'\gamma + \mathbf{Z}'_{it-1}\delta + \varphi_{mkt \times year} + \varphi_{insurer} + \epsilon_{it-1} \quad (3)$$

[16] We carefully consider exactly which Part D assets are involved in the merger to properly code the merger treatment variable and overlap/non-overlap markets in cases in which the merger involves regional assets. For example, we do not include all plans under the umbrella of Universal American as being affected by the acquisition of the regional insurer Carolina Care Plans Inc., only those in the Carolinas.

The treatment dummy for plan consolidation $C_{it-1} = 1$ if plan i is consolidated with another plan between years $t-1$ and t. The same identification issues discussed above for mergers apply for plan consolidation treatment effects. Assuming strict exogeneity for consolidation is perhaps more tenuous than for mergers because the decisions are made at the local plan level as opposed to the national level for merger events. Very specific idiosyncratic factors may trigger plan consolidation that might otherwise have negligible effect on a merger decision. A major concern is that insurers consolidate under-performing plans as a way to remove them from the market. The pre-treatment control variables are particularly important in controlling for any tendencies of insurers to consolidate plans based on market performance. Analogous to the test carried out in Section 6.1 for merger treatment, we correlate the predicted price changes and consolidation treatment dummy. The coefficient is statistically significant, suggesting that decision to consolidate plans is endogenous, prompting us to address each potential concern head-on.

Another concern, is that at least some plan consolidations may be induced by the regulations to reduce the choice space issued by the CMS in 2010. If these consolidations disproportionately affected low-enrollment plans and these plans were low-enrollment because their premium was high conditional on plan characteristics, consolidation may mean that these plans' successors had a lower premium more in line with plan characteristics. Our main strategy for dealing with these concerns is to include a rich set of pre-treatment controls, such as premiums, coverage characteristics, enrollment and market-year fixed effects. These controls ensure the treatment effect is estimated on plans that otherwise resemble one another. The comparison of treatment effects in the specifications with and without controls shows a smaller estimated treatment effect, suggesting the controls mitigate selection issues related to premiums and enrollment. Market-year fixed effects control for year-specific policy impacts. We also provide additional evidence on the types of plans that get consolidated, focusing on low enrollment/high premium plans, and year effects. We plot the distribution of relative plan size and premiums of consolidating plans (see Figure 5 in the Appendix). The relative plan size is the ratio of the smallest and largest plan, by enrollment. The relative plan premium is the ratio of the "smaller" plan premium and "larger" plan premium. It is clear that smaller plans are not necessarily more expensive ones. Our robustness checks focus on further concerns.

Finally, we examine the interaction effect of mergers and consolidation to test whether there are greater cost synergies or bargaining gains when merging firms consolidate plans. Merging insurers consolidate about 20% of their plans in overlapping markets, which is quite similar to the frequency of consolidating by non-merging firms (see Table 5). We modify the DD specification to include merging treatments (D_{it-1} and $D_{it-1}^{overlap}$), consolidation

(C_{it-1}), and the interaction of merging and consolidating plans in overlapping markets ($C_{it-1}*$ $D_{it-1}^{overlap}$):[17]

$$\begin{aligned} p_{it} - p_{it-1} = \alpha + \beta_1 D_{it-1} + \beta_2 D_{it-1}^{overlap} + \beta_3 C_{it-1} + \beta_4 C_{it-1} * D_{it-1}^{overlap} \\ + (\mathbf{X}_{it} - \mathbf{X}_{it-1})'\gamma + \mathbf{Z}'_{it-1}\delta + \varphi_{mkt\times year} + \varphi_{insurer} + \epsilon_{it-1} \end{aligned} \tag{4}$$

Whether merging firms consolidate or not can be thought of as a more refined "match" characteristic of the merger deal, allowing us to draw conclusions about the merits of merger deals that involve plan consolidation.

In all specifications, we cluster standard errors on market-year level. Although in a similar set-up to ours, serial correlation could be a concern, our estimation resembles repeated cross-section more than time-series analysis, with only one period of "before" and "after" a merger, and this is why we do not cluster errors on plan level.

6.4 Robustness: Adverse selection and low income subsidy design

For additional robustness, we consider a more in-depth investigation of two institutional features of Part D that have been linked to plan consolidation: adverse selection and strategic gaming of the low income subsidy (LIS) design. Part D institutes a risk adjustment mechanism that is intended to mitigate adverse selection (Glazer and McGuire, 2000). Under risk adjustments, plans that attract a high cost pool of enrollees receive transfer payments to compensate for higher costs, whereas plans that attract a low cost pool have payments deducted. With a well-functioning risk adjustment mechanism, an insurer should be indifferent about the composition of its risk pool and price as if it enrolled an average risk pool. However, the market is susceptible to adverse selection because plans do not receive risk adjustment payments for the component of coverage attributable to enhanced coverage benefits. Micro-data evidence shows enhanced plans are more likely to attract high risk pools (Polyakova, 2016). The failure to fully risk adjust these plans may be leading to an adverse selection unraveling spiral in which the most generous enhanced plans are being dropped from the insurers' menu of plan offerings. Insurers can drop enhanced plans in three ways: renewing the plan and changing its status to basic coverage, consolidating it with a basic plan, and termination. Over two thirds is by consolidation with basic plans.[18] This oc-

[17] We use $C_{it-1} * D_{it-1}^{overlap}$ (consolidation in overlap markets) to measure the interaction effect and exclude $C_{it-1} * D_{it-1}$ because in the latter there can be no consolidation of merging firm's assets when they operate in separate markets. Moreover, there are only a small number of consolidated plans for just two of the merger deals that occur in non-overlapping markets.

[18] 22% termination, 10% renewal as basic.

curs frequently; about 25% of all plan consolidation events involve enhanced plans being consolidated with basic plans.

Given so many conversions occur through consolidation, the consolidation treatment effect may not capture intrinsic cost effects due to cost efficiencies or bargaining power. The effect could instead be an artifact of adverse selection. We control for the adverse selection phenomenon in all of our specifications by including first differences of plan status (basic/enhanced) and coverage measures that distinguish basic and enhanced plans (deductible and gap coverage) in $(\mathbf{X}_{it} - \mathbf{X}_{it-1})$ and extensive pre-treatment measures of coverage generosity in $\mathbf{Z}_{it}$. However, there may be unobservable differences in enrollee risk selection not captured by these controls. To directly assess whether the conversion of enhanced plans to basic plans reflects adverse selection, we estimate a specification that considers a treatment effect for enhanced plans converting to basic coverage status; $EtoB_{it-1} = 1$ if an enhanced plan in year $t-1$ converts to a basic plan in year t through either renewal or consolidation. We include the interaction of enhanced to basic conversion with consolidation $EtoB_{it-1} * C_{it-1}$ as a "match" characteristic of consolidation to separate risk selection effects from cost efficiency effects:

$$\begin{aligned} p_{it} - p_{it-1} =& \alpha + \beta_1 C_{it-1} + \beta_2 EtoB_{it-1} + \beta_3 EtoB_{it-1} * C_{it-1} \\ &+ (\mathbf{X}_{it} - \mathbf{X}_{it-1})'\gamma + \mathbf{Z}'_{it-1}\delta + \varphi_{mkt \times year} + \varphi_{insurer} + \epsilon_{it-1} \end{aligned} \tag{5}$$

Our next robustness exercise explores the relationship between plan consolidation and strategic gaming of the LIS subsidy design. The special rules to determine subsidy amounts and default plan assignments for LIS beneficiaries distort market outcomes in quite complicated ways, some of which we are able to control for using a plan's LIS benchmark status and prior year LIS enrollment.[19] Decarolis (2015) shows how multi-plan insurers can use plan consolidation as a tool to game the LIS subsidy design to raise premiums. Indeed, the LIS program appears to be a major driver of plan consolidation. The market-wide average frequency of consolidation is 22%; For plans that change their LIS status, the frequency rises to 29%. To test whether strategic consolidation raises premiums, we interact the consolidation treatment with a variable $LISInsurer_{it-1}$ that indicates whether the insurer offers an LIS eligible benchmark plan in the same region as plan i. The intuition behind this test hinges

[19] The default plan assignment rule creates a demand discontinuity at the LIS benchmark threshold inducing a bunching of prices at the threshold and a pricing gap above the threshold (Miller, 2015). Cost changes have no effect on pricing for insurers with sufficiently low cost; they continue to bunch at the threshold even if cost rises. For higher cost insurers on the margin of bunching, small changes in underlying cost result in large swings in pricing because of the pricing gap. The LIS status variable measured in first differences controls for the pricing gap. A plan's prior year LIS enrollment affects pricing decisions because the benchmark level is calculated as an average of market premiums weighted by prior year LIS enrollment.

on the weighting scheme that is used to calculate the LIS subsidy amount and threshold. LIS insurers carry a large weight in the calculation and thus possess market power to manipulate the threshold and subsidy level. As described in Decarolis (2015), consolidation can be used as a tool by LIS insurers to raise premiums and subsidy amounts while retaining LIS benchmark status. Similar gaming tactics could be occurring with mergers. To test whether mergers between LIS insurers generate more or less market power, we interact the merger treatment with a variable $LISmerger_{it-1}$ that indicates whether both insurers in a merger offer an LIS eligible benchmark plan in the same region as plan i.

7 Results

In this section we report the estimated effects of mergers consummated in 2006–2012 between Part D providers on prices and the generosity of coverage of their plan offerings. Throughout the discussion, we relate our findings to the stylized bargaining model (Appendix C) to characterize the three countervailing forces: market power, cost efficiencies, and bargaining power. We look at plan coverage using its two main attributes: drug access (usage restrictions, tiers, the number of drugs on formulary, and the number of pharmacies in the insurer's network) and drug cost (drug list prices and OOP cost for a basket of the top 100 drugs).[20] Several of these measures are a composite of the primitives predicted by the model or outcomes that cannot be predicted by a simple NiN framework (e.g. OOP cost, network and formulary composition). However, they are important in characterizing outcomes and getting us closer to understanding welfare implications for consumers. In what follows, our main results on drug access and cost are reported for the top 100 drugs. The results for the entire formulary (all NDCs), are very similar and are reported in the Appendix (see Tables 10, 11, 12). Drug prices are reported for the entire set of drugs to account for new drugs being included. In the interest of keeping the presentation tractable, the main result tables report treatment effects only. The entire set of estimated coefficients are reported in the Appendix.

In Section 7.1 we report average merger treatment effects for all plans; in Section 7.2 we distinguish overlapping markets from non-overlapping markets; in Section 7.3 we discuss plan consolidation results and their robustness; and in Section 7.4 we do back-of-the-envelope calculations of consumer welfare effects.

[20] OOP cost of drugs is a comprehensive measure that we constructed using drug transaction prices, tiers, and copays. It is our primary measure of drug cost to beneficiaries.

7.1 Average merger effects

Table 1 summarizes the average treatment effect of mergers on premiums and plan coverage across all plans. On average, mergers result in higher premiums, slightly more generous formularies, lower drug list prices, and higher usage restrictions. After a merger, premiums increase by \$2.3 relative to the premiums of plans offered in the same market by insurers that do not merge. The rise corresponds to a 5.2% increase based on the average premium of \$44.8 in our sample. The estimated change in premiums is larger (\$2.9) in the specification with insurer fixed effects (Table 6, Panel B), suggesting that mergers occur amongst insurance companies that have the most market power to gain from merging. The positive point estimate of the coefficient on plan premium indicates that market power effect dominates any savings stemming from cost efficiencies and from any increase in rebates that insurers are able to negotiate with drug manufacturers.

On average across all markets, drug list prices decline slightly, by \$1, or 0.5%. The basket of top 100 drugs, a comprehensive measure derivative of the point-of-sale prices, becomes negligibly more expensive (0.03% increase). Plans also include 0.6 drugs more out of the top 100 drugs, 0.7% increase. There was a 5.0% increase in the number of restrictions placed on drugs, which includes requirements of prior authorization, step therapy, and quantity limits. We also do not find a strong effect on pharmacy networks. The point-estimate is small and imprecise. This provides mixed and weak evidence on the existence of bargaining gains from mergers. First, premiums rise and second, list drug prices decline, while restrictions increase.

Table 1: Summary of Merger Effects on Plan Premiums and Coverage

Outcome/ Mkt type	**Premium**	**OOP Cost Index**	**Drug Prices**	**Access**		
				Restrictions	**Formulary**	**Network**
All markets	+5.2% [↓]	+0.03% [↓]	−0.5% [↑]	+5.0% [↓]	+0.7% [↑]	−1.5%$^{\diamond}$ [↓]
Overlap	+7.3% [↓]	−0.9% [↑]	−0.7% [↑]	+10.0% [↓]	+0.5%$^{\diamond}$ [↑]	−3.7% [↓]
No Overlap	−1.5%$^{\diamond}$ [↑]	+2.8% [↓]	+0.03%$^{\diamond}$ [↑]	−10.4% [↑]	+1.3% [↑]	+5.3% [↑]

Notes: The table shows the results presented in detail in Table 6, as compared to their respective mean values. Arrows show improvement, ↑ or deterioration, ↓ in plan terms from the consumer's standpoint. The columns with outcomes that are grayed-out are not directly predicted by our stylized bargaining model. "$\diamond$" indicates that the estimate of the effect is imprecise.

A quick inspection of Table 1 makes it evident that the average merger effects mask heterogeneity across markets. The outcomes in overlapping markets stand in a stark contrast to the outcomes in non-overlapping markets. While the two main take-aways from the average treatment effects are the presence of the strong market power and mixed evidence on bargaining gains, we, guided by our bargaining model (see Appendix C), turn to the

results in overlapping and non-overlapping markets to disentangle bargaining effects.

7.2 Merger effects in overlapping and non-overlapping markets

Overlapping markets are the locus of action. In these markets, as a result of a merger the market structure changes and alters market power and bargaining position of the insurer and suppliers. We observe a significant increase in premiums ($4.0) that comes exclusively from the overlapping markets (Table 6, specification (2)). The premiums are (4.0-0.7)=$3.3 higher for merger-affected plans in overlapping markets than for plans of non-merging insurers. The results with insurer fixed effects are similar (Table 6, Panel B).

In non-overlapping markets, the premium declines slightly, by $0.7 (1.5%). The effect is statistically imprecise, but we can rule out large changes in premiums. Mergers do not induce any change in market structure in non-overlapping markets, therefore the only two merger forces that could have produced this result are an increase in insurers' bargaining power and national-level cost efficiencies. Although we do not observe the realized source or size of cost savings after a merger directly, a higher rebate negotiated with drug manufacturers is the most probable mechanism behind the drop in premiums. In contrast to cost efficiency gains, insurers are required to pass gains in rebates onto consumers, by law. Thus, we argue that this case isolates the national-level (insurer–drug manufacturer) bargaining effect from market power effect. Results for the drug coverage outcomes, discussed later, corroborate the conclusion.

The empirical findings on premiums are consistent with our bargaining model's prediction that in mergers with partial overlap the higher rebates achieved in overlapping markets will spillover to non-overlapping markets. This result shows how mergers can have out-of-market effects, despite the fact that there are otherwise no direct effects through the bargaining channel. However, our empirical estimates suggest that the gain obtained through national bargaining is rather small. Much higher premiums in overlapping markets indicate that rebate increases dwarf in comparison to merging insurers' gain in market power and no sizable cost efficiencies are realized and/or passed to the enrollees through premiums.

Next, consider plan coverage generosity. Our stylized model generates predictions on list drug prices and access restrictions. The net direct effects in overlapping markets are ambiguous, while there are no direct effects in non-overlapping markets. Our empirical results show that there is no change in drug list prices in non-overlapping markets ($0.06, or 0.03%) and there is a small decline in overlapping markets ($1.4, or 0.7%). However, in terms of access restrictions, plans become less stringent in non-overlapping markets (0.03, or 10.4%) and more stringent in overlapping markets (0.03, or 10.0%). Note that the baseline

is very low. There are on average, just 0.26 restrictions placed on any given drug, with a maximum of three, making our result look like a large change in percentage terms, but not so much so in economic sense. Lower drug access (higher level of restrictions) and drug list prices are an outcome of the direct effect of mergers on the local bargaining solution with pharmacies. Empirically, the market share effect, which is related to the probability of enrollees switching to a rival plan, outweighs the premium effect, which is the stakes of losing premium revenue. Thus, following a merger, insurers improve their bargaining position and reimburse pharmacies less for the filled prescriptions and also restrict their enrollees' access to medications.

We can also estimate outcomes outside of our stylized NiN bargaining model: the composition of the formulary, the number of pharmacies in the plan's network, and a measure that will allow us to discuss welfare implications, OOP cost index. In overlapping markets, there are nearly no gains in formulary comprehensiveness relative to non-merger plans. Plans add less than one drug to their formularies, 0.5 drugs from the top 100 drugs (0.5%), and the estimate is not statistically significant. The number of pharmacies in the entire plan's network declines by 2,145 (3.7%). No change in formularies, narrower networks, higher restrictions, and lower drug list prices contribute to the composite measure of drug spending, OOP cost index. In overlapping markets, it declines by \$0.5 (0.9%).

In non-overlapping markets, our empirical results show that plans of merged insurers added 1.1 additional drugs to those they covered from the top 100 drugs in non-overlapping markets (Equation 2). Given that the average plan covers about 86 of the top 100 drugs, the change represents a 1.3% increase in percentage terms. The figure may seem small, but, stated equivalently, 1.1 additional drugs put on the formulary correspond to a 7.7% decrease in the number of top 100 drugs excluded from formularies. Plans in non-overlapping markets also broaden their pharmacy networks, adding on average 3,089 pharmacies to the entire plan's network (5.3%). Perhaps not surprisingly, these changes come up to a very different effect of mergers on the OOP drug cost paid by plan enrollees. It goes up by \$1.7, which corresponds to a 2.8% increase based on an average index value of \$62. OOP costs must be driven by copay/coinsurance rates. The tiers outcome could help us identify the exact component of the index that is responsible for the large change, but these estimates are statistically insignificant. We are reluctant to read too much into the tiers results because they are not standardized with respect to coinsurance provisions and mask differences in cost-sharing that could occur within a tier.

The large response of drug OOP costs, access, and number of pharmacies in the network in non-overlapping markets to what is likely a small change in rebates suggests that consumer demand responds more to changes in pharmacy networks than formulary composition and,

thus pharmacy networks are relatively more important for bargaining. In part, it could also be an artifact of the CMS requirements put on pharmacy networks (see section "Retail Pharmacy Access", Chapter 5 of the Prescription Drug Benefit Manual). For example, in urban areas, at least 90 percent of Medicare beneficiaries in the Part D sponsor's service area, on average, should live within 2 miles of a retail pharmacy participating in the sponsor's network (90%–5 miles in suburban areas and 70%–15 miles in rural areas).

Finally, we do not find strong evidence that access restrictions are negotiated nationally with drug manufacturers, otherwise we would expect drug access to decline in both overlapping and non-overlapping markets.

To summarize, our results for overlapping and non-overlapping markets are consistent with the predictions of the theoretical model (Appendix C). The divergent results for costs and access shed light on the way mergers impact the bargaining process. Bargaining between insurers and drug manufacturers at the national level is a major channel for determining drug rebates, whereas bargaining at the local level with pharmacies and wholesalers determines drug access and point of sale prices. Hence, the drug access improvements in non-overlapping markets serve as evidence of the presence of national level spillover effects from overlapping to non-overlapping markets.

7.3 Mergers with plan consolidation

Results

Table 7 reports results for plan consolidation. Premiums of consolidated plans decline by \$4.3 on average, or 9.6%. The magnitude is larger than any merger-induced effect. But, the drop in premiums only occurs for non-merging insurers; premiums rise for the consolidated plans of merged insurers. This is evidence that internal plan consolidation, not mergers, bring about significant cost-side improvements.

This reduction in cost is not accompanied by coverage gains. It becomes less generous for consolidated plans of non-merging insurers both in terms of formulary comprehensiveness and drug OOP costs, despite a slight decline in several components of the index, list prices and tiers. However, coverage effects attenuate in the specification with insurer fixed effects. This suggests that the reduced coverage is not necessarily caused by consolidation, but rather some other characteristics of insurers engaging in consolidation. The strong effect on premiums and weak effect on coverage also suggest that the benefits of plan consolidation can be attributed to marketing or administrative cost efficiencies, not bargaining. If bargaining were to explain the cost reduction, the results would likely show an accompanying effect on coverage.

The results differ markedly for consolidated plans of merging insurers. Premiums increase modestly, but drug coverage improves dramatically. The sum of the treatment effect interactions shows that premiums increase by $1.6 relative to the control group of renewed plans not affected by a merger in the previous year in that market. As in our main results, the market power effect dominates but is not as severe. For comparison, market power is stronger amongst the non-consolidated plans of merged insurers in overlapping markets; premiums increase by $2.7. The premium results are robust to the inclusion of insurer fixed effects.

The coverage of consolidated plans of merging insurers in overlapping markets becomes more generous on both measures, drug access and costs. Relative to the control group of renewed plans by non-merging insurers, top 100 formulary counts increase by 5.3 (equivalent to a 53% reduction in the number of excluded drugs), the OOP cost index falls by $6.3 (10% drop), restrictions ease by 0.024 (8.6%), and pharmacy network improves by 10,466 (18%). Greater formulary comprehensiveness and lower negotiated drug list prices ($-3.4, or 2%) contributed to the lower OOP index, while the pricing tiers remained nearly unchanged (increase by 0.002)

The results are robust to the inclusion of insurer fixed effects, providing further credence to the claim that any insurer engaged in merging and consolidating can achieve lower premiums/increased coverage, not just the specific insurers that did so in our sample. Finally, all of the results discussed in reference to Table 6 about merging and market overlap hold for renewed plans in the specification with consolidation treatments. However, the market power effects of mergers driving up premiums and eroding coverage are larger in magnitude for overlapping markets. Coverage results for consolidation are similar for top 100 drugs and all NDCs on the formulary.

Robustness

In this section we explore the robustness of our results on plan consolidation, which showed a large drop in premiums. We attribute this finding to marketing and administrative cost efficiencies, an interpretation that rests on the prior literature about insurance loads. However, there is less background to guide this interpretation than there is for our merger results that can be informed by longstanding economic theories and practical guidelines for anti-trust enforcement. Moreover, the high rate of consolidation (in more general terms product market restructuring) is somewhat unique to Part D and receives a lot of attention by regulators.

Studies on the Part D market (Polyakova, 2016; Decarolis, 2015; Miller, 2015) suggest alternative mechanisms related to adverse selection and gaming of the LIS subsidy design

that could explain the effects of consolidation on premiums. Full discussions of the institutional details, theory, and econometric approach are described in the methodology section. To briefly recap, the large drop in premiums found for consolidation could be the result of adversely selected enrollees in enhanced plans being folded into basic plans. Plan consolidation can be used as a tool to game the LIS subsidy design, in which case our consolidation results could reflect LIS benchmark insurers' market power over the subsidy.

For enhanced plans converted to basic status, premiums dropped by a larger amount than for the control group, particularly when the conversion is carried out through consolidation (Table 8, Panel A). Premiums decrease by $12.77 relative to other consolidated plans. The coefficient on the consolidation treatment is -$2.84, indicating that about half of the premium decrease reported in the main specification can be attributed to adverse selection and the other half to cost efficiency factors. Note that the robustness check conditions on coverage features that distinguish basic and enhanced plans, so the drop in premiums for enhanced-to-basic conversions is not simply due to higher deductibles or reduced coverage in the gap lowering the insurer's actuarial liability.

Table 8, Panel B shows the results on LIS gaming. The premiums of the consolidated plans of LIS insurers rose by $2.14 relative to the premiums of non-LIS insurers' consolidated plans. This accords with the results in Decarolis (2015) about plan consolidation being used to raise premiums. The insurer fixed effects absorb much of the effect, suggesting that only specific firms have engaged in the gaming. The coefficient on the consolidation dummy remains large and negative, indicating consolidation lowers cost independent of LIS gaming incentives.

The final robustness experiment (Table 8, Panel C) considers mergers between two LIS insurers. Our motivation for this test is the idea that some of the market power incentives stemming from the organization of the Part D market and related to consolidation could extend to mergers. We find that mergers of LIS firms have lower premium increases than mergers of non-LIS firms.

7.4 Consumer Welfare Effects

In an effort to understand the overall welfare effects of mergers on plan enrollees, we perform the following back-of-the-envelope calculation. We compare our two main dollar-based measures, annual premiums and OOP costs for an average beneficiary in 2013, $456 and $353, respectively[21]. Based on our estimates, the premium goes up by 5% ($23) and OOP cost

[21] Cubanski et al. (2019b) and Cubanski et al. (2019a)

index increases by 0.03% ($1), reducing welfare of an average beneficiary by $24, a year. For beneficiaries in overlapping markets, welfare reduction comes up to $30. It is an effect of 7% increase in premium ($33) and 0.9% in OOP drug costs ($3). Similarly, for beneficiaries in non-overlapping markets, the welfare reduction is $3. It is an effect of 1.5% reduction in premium ($7) and 2.8% increase in OOP drug costs ($10). Importantly, this estimate does not account the changes in formulary restrictions or pharmacy networks.

Note that despite a significant hike in premiums in overlapping markets, Part D enrollees with high OOP spending benefit. For those who spend at least $3,700 annually on drugs, drug cost savings would overweigh the increase in premium. This is still below the OOP threshold for catastrophic coverage of $4,750.[22] Winners and losers among consumers flip when we look at non-overlapping markets. Beneficiaries with relatively low drug expenditures, less than $244, which is well below the average deductible of $325,[23] benefit from the reduction in premium. However, beneficiaries whose OOP drug costs exceeded this amount, see their welfare reduced after the merger.

This welfare analysis only considers consumer welfare, which is the most (if not only) relevant welfare metric for anti-trust. A larger question remains — what are the welfare implications for all market participants: plan enrollees, insurers, and their upstream suppliers. To add complexity, the government is also affected because Part D is a subsidized exchange. We leave these considerations for future research.

8 Conclusion

In this paper, we document empirical evidence on the effects of horizontal mergers amongst Part D insurers on plan premiums and coverage characteristics with the aim of assessing the three channels through which mergers affect markets: market power, cost efficiencies, and bargaining power. We apply a differences-in-differences methodology comparing plans affected by a merger to other plans in a market covering ten merger deals between 2006 and 2012. The method isolates local market power effects from national effects by contrasting markets in which merging firms overlapped and markets with no overlap. Detailed data on plan coverage parameters (drug prices and access, OOP cost to consumers, formulary and pharmacy network composition) are a source of our empirical evidence on merger effects on the complicated bargaining process between insurers and suppliers, in which the terms of coverage, beyond just drug prices, are negotiated. We also estimate the effects of plan consolidation to understand whether the purported benefits of mergers can be achieved

[22] Cubanski et al. (2018)
[23] Cubanski et al. (2018)

organically, without merging, and whether synergies exist for merging insurers that restructure their plan offerings through consolidation. Consolidation also has received considerable interest amongst policy makers.

We draw three main conclusions. First, merger deals that involve market overlap create considerable market power, increasing premiums and, to some extent, drug access. These deals give insurers greater bargaining leverage at the local level that enables the merged firm to negotiate lower drug prices with pharmacies. Second, while there are no market power effects in non-overlapping markets, they are affected through the national-level spillovers, likely attributable to bargaining gains from negotiating with drug manufacturers. Premiums decline slightly – evidence that insurers improve bargaining over drug rebates, and drug access (formularies and pharmacy coverage) improves. Other coverage characteristics (drug point-of-sale prices and access restrictions) remain unchanged or decline, indicating no gains or slight weakening of local bargaining power.

Third, plan consolidation, absent a merger, stimulates large cost reductions that translate into lower premiums. We attribute this finding to cost efficiencies, not bargaining, since there is no accompanying effect on coverage characteristics. For merging firms that consolidate, premiums increase slightly indicating that cost efficiencies partially offset market power. Coverage also improves significantly in terms of both drug access and OOP costs. Given the rapid pace of M&A activity in the industry, there is keen interest amongst anti-trust authorities and healthcare policy makers to scrutinize these deals. Our conclusions have important ramifications as their investigations consider market power, bargaining power, and other cost efficiency effects. There are trade-offs with the outcome dependent on the specifics of the merger deal including market overlap and whether the merger parties integrate their business activities through plan consolidation. Cost efficiencies are less relevant because plan consolidation, not mergers, generate cost efficiency gains and can be achieved without merging. Outside anti-trust, the findings inform the policy debate in Part D about eliminating plans to reduce the burdens of choice. Policies that encourage consolidation should be favored over the alternative of adopting a lenient stance on mergers.

The wave of mergers occurring in the health insurance industry has a broader impact outside of Part D. Many of the conclusions of this study could extend to related markets (employer-sponsored plans, Medicare Advantage, ACA exchanges). There may be important differences with regards to bargaining because negotiations between insurers and hospitals/physicians occur at a more local level than in Medicare Part D, where drugs are sold nationally. The Part D market is also experiencing a wave of vertical mergers with retail pharmacies, such as the CVS-Caremark deal and Aetna-CVS, and with pharmacy benefits managers (PBMs) such as the UnitedHealth-Catamaran deal. As we find for horizontal

mergers, vertical integration could have profound effects on the bargaining process. We leave these other merger studies to future work.

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A Tables

Table 2: M&A Deals between Medicare Part D Providers in 2006-2012

N	Acquiror	Target	Value	Date	Form
1	United HealthCare Services	PacifiCare Health Systems	7,511	12.21.05	M
2	MemberHealth	AmeriHealth Ins Co-Medicare	N/A	11.16.06	AA
3	Medical Mutual of Ohio	Carolina Care Plan	N/A	05.18.07	AA
4	Universal Holding Corp	MemberHealth	780	09.21.07	AA
5	UnitedHealth Group	Sierra Health Services	2,425	02.25.08	M
6	CVS Caremark Corp	Longs Drug Stores Corp	2,637	10.30.08	M
7	United HealthCare Services	Health Net-US Northeast	630	12.11.09	AA
8	HealthSpring	Bravo Health	545	11.30.10	M
9	Munich Health North America	Windsor Health Group	131	01.04.11	M
10	CVS Caremark Corp	Universal American Corp	1,059	04.29.11	M

Notes: The table shows all merger and acquisition deals where both parties offered plans in the Medicare Part D market between 2006 and 2012. The company names are listed in accordance with the SDC records. Merger value is in millions of dollars. The date is merger completion date. "AA" stands for acquisition of assets and "M" for merger.

Table 3: Medicare Part D Market Trends: 2006-2012

	2006	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Plan-level data							
Monthly premium ($2012)	42.55	40.62	42.50	48.85	48.99	54.88	53.41
	(14.60)	(16.70)	(21.21)	(22.12)	(20.75)	(25.90)	(26.72)
Market share, in %	0.93	0.71	0.72	0.75	0.81	1.23	1.27
	(1.79)	(1.63)	(1.55)	(1.50)	(1.56)	(2.41)	(2.27)
Enrollment	10,730	8,469	8,778	9,329	10,387	16,154	17,297
	(25,159)	(23,060)	(21,056)	(21,783)	(23,700)	(37,149)	(36,155)
LIS enrollment	5,588	4,194	4,278	4,346	4,899	7,677	8,069
	(13,368)	(13,817)	(11,493)	(12,314)	(14,401)	(20,314)	(20,431)
Insurer-level data							
Regional presence	27.60	29.61	30.04	30.44	29.99	29.35	28.73
	(10.80)	(10.21)	(10.39)	(9.95)	(9.61)	(3.58)	(10.38)
Part D region-level data							
N plans offered	37.08	54.36	52.97	46.38	43.43	26.51	25.51
	(13.82)	(6.74)	(6.30)	(5.56)	(5.29)	(8.65)	(8.74)
Eligible population, in'000	1,275	1,280	1,304	1,328	1,363	1,398	1,480
	(951)	(964)	(988)	(1,010)	(1,026)	(1,051)	(1,104)
N regions		**39**					
N plans offered	**1,446**	**1,908**	**1,778**	**1,627**	**1,519**	**1,034**	**995**
N plans affected by merger		**293**	**2**	**505**	**173**	**82**	**204**
N plans merged in overlapping mkts		**188**	**0**	**374**	**170**	**10**	**191**

Notes: The table includes all plans on the market, including renewed, consolidated, new, and terminated plans in the next year. Number of plans affected by a merger counts the number of plans in year t that belong to one of the merger parties in a deal finalized in $t-1$. Standard deviations are in parentheses.

Table 4: Part D Plan-level Summary Statistics, 2006-2012

	2006	2007	2008	2009	2010	2011	2012
Premium	37.36	36.68	39.86	45.64	46.53	53.77	53.41
	(12.82)	(15.08)	(19.89)	(20.67)	(19.71)	(25.38)	(26.72)
Deductible	92.51	93.68	104.56	111.70	139.95	153.06	153.40
	(115.84)	(5.90)	(128.88)	(137.00)	(135.80)	(142.00)	(152.51)
Drug Access							
Formulary:							
all NDCs*	14,688	4,989	4,199	4,031	3,397	3,343	3,441
	(13,682)	(1,500)	(1,080)	(970)	(668)	(604)	(585)
top 100 drugs	91.58	93.66	90.76	88.04	83.11	77.78	74.52
	(5.92)	(121.84)	(7.70)	(9.15)	(7.19)	(7.03)	(7.38)
Restrictions:							
all drugs	0.16	0.19	0.27	0.31	0.33	0.32	0.36
	(0.19)	(0.08)	(0.13)	(0.13)	(0.12)	(0.11)	(0.13)
top 100 drugs	0.17	0.23	0.28	0.30	0.29	0.26	0.28
	(0.19)	(0.14)	(0.17)	(0.15)	(0.13)	(0.11)	(0.12)
Pharmacy network	59,079	55,855	58,220	60,654	55,621	58,213	64,512
	(16,708)	(15,215)	(11,908)	(10,094)	(20,439)	(17,459)	(5,948)
Drug Costs							
List drug prices	231.42	192.67	198.52	185.26	207.49	231.73	253.91
	(4.14)	(4.50)	(4.46)	(3.71)	(3.42)	(4.18)	(3.88)
OOP costs index	45.12	45.51	51.89	57.79	70.99	77.36	87.48
	(12.38)	(12.08)	(13.07)	(10.79)	(9.72)	(9.32)	(13.06)
Tier:							
all drugs	0.22	0.28	0.31	0.32	0.30	0.33	0.37
	(0.13)	(0.08)	(0.08)	(0.10)	(0.08)	(0.10)	(0.10)
top 100	0.20	0.26	0.26	0.27	0.22	0.23	0.25
	(0.14)	(0.09)	(0.09)	(0.12)	(0.09)	(0.09)	(0.10)
Plans with gap coverage	0.31	0.29	0.29	0.26	0.20	0.35	0.24
Basic plans	0.58	0.52	0.49	0.46	0.49	0.57	0.52
Benchmark plans	0.28	0.34	0.26	0.17	0.19	0.29	0.30
% renewed	82.64	80.14	84.42	78.49	46.28	75.53	
% consolidated	17.15	15.20	10.69	20.53	46.87	21.28	
% terminated	0.21	4.66	4.90	0.98	6.85	2.90	
% new plans	100.00	32.49	3.32	6.64	1.51	10.06	10.45
N plans offered	**1,446**	**1,908**	**1,778**	**1,627**	**1,519**	**1,034**	**995**

Notes: The unit of observation is a plan. All stand-alone Part D plans that are offered in a current year are included. Gap coverage and deductible standards for Part D plans were altered through 2006-2012 as described in detail in the text. In 2006, requirements on formulary listing of NDCs differ from the requirements in 2007-2012. Plan restrictions are summarized for all plans (0–3). Out-of-pocket cost of top 100 drugs assigns a 1/100 weight to each drug. The statistics on renewed, consolidated, and terminated represent the transition status for the upcoming year. The new plan statistic represents the percent of plans introduced as new plans for the current year. All dollar values are in nominal terms. Standard deviations are in parentheses.

Table 5: Control and Comparison Groups, 2006-2012

	M&A Plans		**non-M&A Plans**	
	Before	**After**	**Before**	**After**
Premium	40.27	44.81	42.54	45.16
	(16.83)	(19.51)	(19.94)	(22.03)
Deductible	121.46	117.78	112.52	118.14
	(139.07)	(145.21)	(130.37)	(135.06)
Drug Access				
Formulary: all NDCs*	3,983	3,847	4,036	3,712
	(1,143)	(960)	(1,190)	(900)
top 100 drugs	88.22	86.31	88.06	85.32
	(10.54)	(11.15)	(8.35)	(9.49)
Restrictions: all drugs	0.23	0.29	0.27	0.30
	(0.15)	(0.14)	(0.14)	(0.13)
top 100	0.19	0.23	0.27	0.28
	(0.14)	(0.13)	(0.16)	(0.14)
Pharmacy network	58,699	59,075	57,316	58,955
	(13,605)	(16,104)	(15,292)	(13,841)
Drug Costs				
List drug prices	200.64	204.03	198.31	208.38
	(16.44)	(27.29)	(13.25)	(21.16)
OOP costs index	57.90	63.47	56.71	63.45
	(16.65)	(18.03)	(15.78)	(17.59)
Tier: all drugs	0.30	0.32	0.29	0.31
	(0.09)	(0.08)	(0.10)	(0.09)
top 100	0.24	0.25	0.24	0.25
	(0.13)	(0.13)	(0.10)	(0.09)
Plan market share, %	1.38	1.91	0.76	0.90
	(0.024)	(3.26)	(1.58)	(1.67)
Enrollment	15,825	22,940	9,583	11,562
	(33,560)	(47,206)	(23,577)	(25,447)
LIS enrollment	8,681	12,167	4,436	5,276
	(18,393)	(25,319)	(13,244)	(14,171)
Plans with gap coverage	0.26	0.24	0.27	0.26
Basic plans	0.59	0.53	0.50	0.51
Benchmark plans	0.33	0.33	0.24	0.24
% renewal plans	78.54		77.65	
% consolidated plans	21.46		22.35	
N plans	**1,379**		**7,598**	

Notes: Only renewal and consolidated renewal stand-alone Part D plans are included. Since the requirements on formulary listing of NDCs differ from the requirements in 2007-2012, the data on NDC coverage in 2006-2007 are excluded. Out-of-pocket cost of top 100 drugs assigns a 1/100 weight to each drug. All dollar values are in nominal terms. Standard deviations are in parentheses.

Figure 3: Parallel Trends Assumption. Merger Treatment.

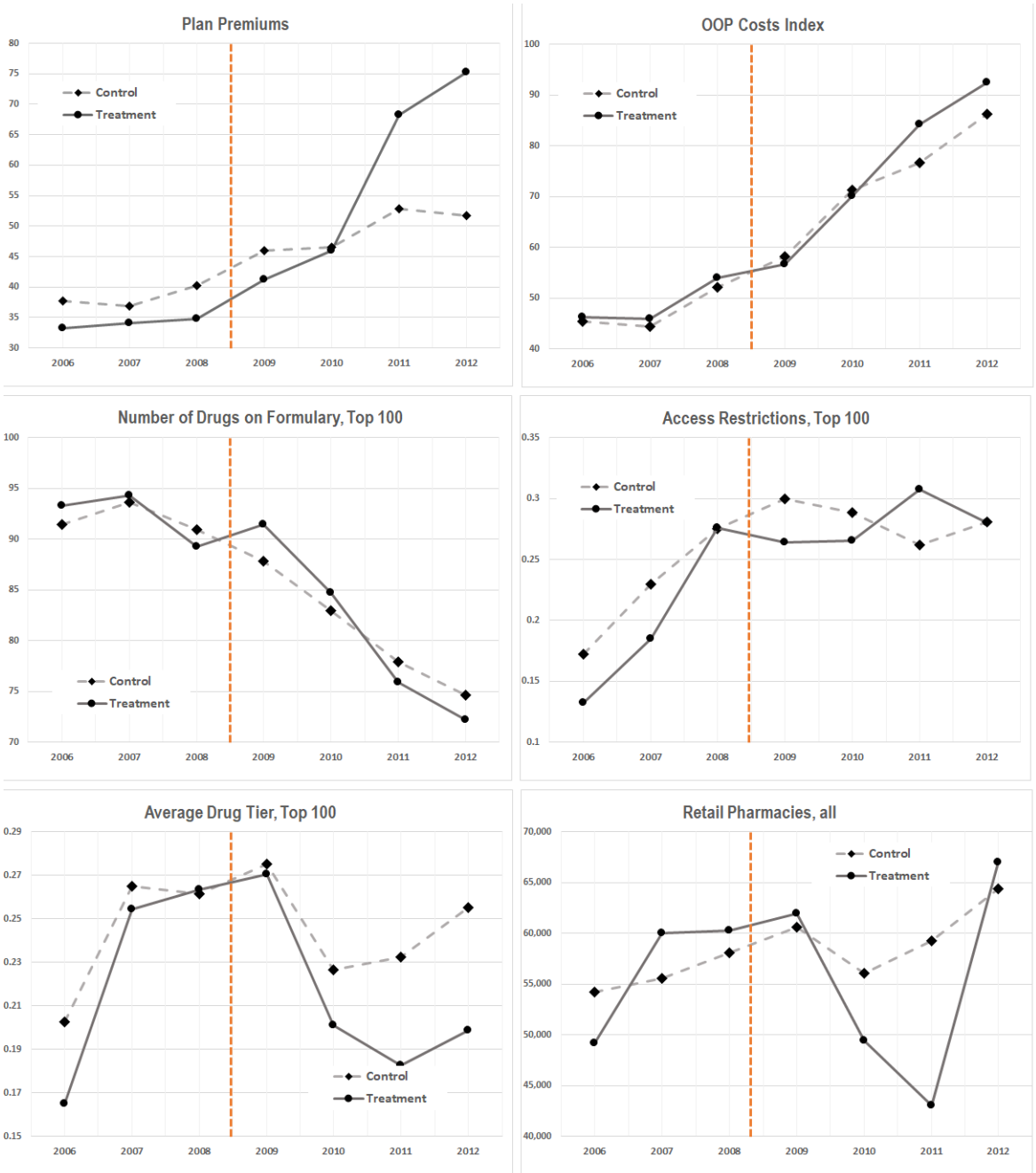

Figure 4: Parallel Trends Assumption. Consolidation Treatment.

Table 6: Merger (inter-firm) Results

	PREMIUM		OOP COST INDEX		LIST PRICES		DRUG ACCESS							
							RESTRICTIONS		TIERS		FORMULARY		NETWORK	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Panel A: Main specification														
Merger	2.307***	-0.686	0.016	1.729***	-1.006***	0.055	0.013***	-0.027***	-0.013***	-0.017	0.624***	1.106**	-859	3,089***
	(0.321)	(0.470)	(0.271)	(0.388)	(0.086)	(0.205)	(0.004)	(0.006)	(0.005)	(0.011)	(0.229)	(0.514)	(967)	(700)
Merger in		3.969***		-2.271***		-1.406***		0.053***		0.005		-0.639		-5,234***
overlapping market		(0.505)		(0.551)		(0.238)		(0.009)		(0.013)		(0.633)		(1,486)
Panel B: Insurer FEs														
Merger	2.910***	-0.427	0.777**	1.933***	-1.503***	-0.596***	0.012***	-0.029***	-0.012**	0.005	0.410*	1.716***	-2,832***	2,884***
	(0.428)	(0.673)	(0.381)	(0.494)	(0.110)	(0.254)	(0.004)	(0.004)	(0.006)	(0.009)	(0.234)	(0.360)	(924)	(952)
Merger in		4.330***		-1.500***		-1.177***		0.054***		-0.022**		-1.694***		-7,417***
overlapping market		(0.661)		(0.439)		(0.254)		(0.005)		(0.010)		(0.459)		(1,525)
Panel C: No Controls/FEs														
Merger	1.919***	1.179	-0.929***	-1.502**	-6.410***	-4.757***	0.025***	0.0003	0.010***	-0.012**	0.838***	0.871***	-906***	-224
	(0.383)	(0.722)	(0.318)	(0.598)	(0.407)	(0.766)	(0.003)	(0.006)	(0.003)	(0.006)	(0.172)	(0.323)	(419)	(789)
Merger in		0.985		0.764		-2.203***		0.033***		0.028***		-0.043		-908
overlapping market		(0.815)		(0.675)		(0.865)		(0.007)		(0.006)		(0.365)		(891)
Mean Values	44.75		62.31		204.79		0.26		0.24		85.64		57,918	

Notes: This table summarizes the effect of mergers on premiums and coverage for the top 100 drugs. The main specification shown in Panel A includes market-year fixed effects. In addition to that, Panel B includes insurer fixed effects. Both panels include a rich set of plan-level controls. Plan characteristics in first differences include basic/enhanced plan status, LIS benchmark status, deductible, gap coverage. In addition to that, characteristics taken at their pre-merger level include the premium, drug OOP cost index, number of drugs covered, restrictions, tiers, log enrollment, market share, log LIS enrollment, LIS market share. The results are robust to excluding plan market share. Standard errors are clustered by market-year. For comparison purposes, in Panel C we show a specification with no controls or fixed effects. Coefficient estimates that are significant at 1%, 5%, and 10% level are denoted with ***, **, and * respectively. Standard errors are in parentheses. The number of observations in Panels A&B is 8,790 and 8,978 in Panel C due to a few missing values in the CMS files; 15% of these plans are affected by a merger and 11% are merger-affected plans offered in overlapping markets.

Table 7: Plan Consolidation (intra-firm) Results

	PREMIUM		OOP COST INDEX		LIST PRICES		DRUG ACCESS							
							RESTRICTIONS		TIERS		FORMULARY		NETWORK	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Panel A: Main specification														
Plan consolidation	-4.341***	-4.855***	0.635*	1.773***	-0.682***	-0.403***	-0.011***	-0.004	-0.021***	-0.027***	-0.317	-1.260***	1,136***	-926***
	(0.379)	(0.419)	(0.328)	(0.368)	(0.124)	(0.109)	(0.003)	(0.003)	(0.003)	(0.002)	(0.265)	(0.237)	(412)	(346)
Merger & Plan consolidation		3.721***		-9.200***		-2.075***		-0.058***		-0.050***		7.437***		16,636***
in overlapping market		(0.698)		(0.907)		(0.384)		(0.008)		(0.010)		(0.810)		(1,712)
Merger		-0.452		1.643***		0.074		-0.026***		-0.016		1.167***		3,134***
		(0.493)		(0.409)		(0.201)		(0.006)		(0.011)		(0.530)		(686)
Merger in		3.179***		-0.509		-1.023***		0.064***		-0.005		-2.060***		-8,378***
overlapping market		(0.541)		(0.554)		(0.238)		(0.010)		(0.013)		(0.613)		(1,450)
Panel B: Insurer FEs														
Plan consolidation	-3.993***	-4.487***	-0.973***	-0.096	-0.555***	-0.364***	-0.013***	-0.011***	-0.014***	-0.019***	0.426***	-0.238*	3,305***	1,402***
	(0.326)	(0.375	(0.177)	(0.190)	(0.120)	(0.104)	(0.003)	(0.003)	(0.003)	(0.002)	(0.157)	(0.121)	(448)	(393)
Merger & Plan consolidation		4.231***		-6.358***		-1.739***		-0.011		0.035***		5.029***		13,610***
in overlapping market		(0.719)		(0.850)		(0.365)		(0.009)		(0.010)		(0.723)		(1,828)
Merger		-0.686		1.947***		-0.610***		-0.030***		0.004		1.688***		2,920***
		(0.714)		(0.480)		(0.225)		(0.004)		(0.009)		(0.375)		(827)
Merger in		3.586***		-0.363		-0.866***		0.056***		-0.029***		-2.592***		-9,853***
overlapping market		(0.697)		(0.448)		(0.253)		(0.005)		(0.009)		(0.424)		(1,490)
Panel C: No Controls/FEs														
Plan consolidation	-4.329***	-4.360***	1.083***	1.861***	6.488***	7.377***	-0.023***	-0.019***	-0.006**	-0.011***	-0.538***	-1.297***	348	-1,594***
	(0.330)	(0.348)	(0.275)	(0.290)	(0.351)	(0.365)	(0.003)	(0.003)	(0.003)	(0.003)	(0.149)	(0.155)	(364)	(380)
Merger & Plan consolidation		0.497		-7.361***		-9.205***		-0.030***		0.055***		7.264***		18,252***
in overlapping market		(1.075)		(0.894)		(1.125)		(0.009)		(0.009)		(0.479)		(1,170)
Merger		1.400		-1.589***		-5.1001***		0.001		-0.011*		0.931***		-150
		(0.716)		(0.595)		(0.749)		(0.006)		(0.006)		(0.319)		(779)
Merger in		0.544		2.350***		0.177		0.038***		0.017**		-1.566***		-4,606***
overlapping market		(0.837)		(0.696)		(0.876)		(0.007)		(0.007)		(0.373)		(911)
Mean Values	44.75		62.31		204.79		0.26		0.24		85.64		57,918	

Notes: This table summarizes the effect of consolidation on plan premium and coverage. Plan coverage characteristics are taken for the top 100 drugs. The preferred specification shown in Panel A includes market-year fixed effects. In addition to that, Panel B includes insurer fixed effects. Both panels include a rich set of plan-level controls. Plan characteristics in first differences are basic/enhanced plan status, deductible, gap coverage. Plan characteristics taken at their pre-merger level are plan premium, drug cost index, number of drugs covered, basic/enhanced plan status, enrollment, deductible, gap coverage, LIS status and enrollment, plan market share overall and on the LIS market. Standard errors are clustered by market-year. For comparison purposes, in Panel C we show a baseline specification that is stripped down of controls and fixed effects. Coefficient estimates that are significant at 1%, 5%, and 10% level are denoted with ***, **, and * respectively. Standard errors are in parentheses. The number of observations in Panels A&B is 8,790 and 8,978 in Panel C due to a few missing values in the CMS files; 15% of these plans are affected by a merger, 11% are merger-affected plans offered in overlapping markets, 22% are consolidated renewal plans, and 2% are consolidated renewals in overlapping markets.

Table 8: Robustness of Consolidation Effect on Premiums: Adverse Selection & LIS Gaming

	(1)	(2)
Panel A: Adverse Selection		
Plan Consolidation	-2.836***	-2.656***
	(0.344)	(0.304)
Enhanced plan conversion to basic	-7.767***	-3.853***
	(1.049)	(1.260)
Plan consolidation & enhanced	-5.002***	-6.720***
plan conversion to basic	(0.952)	(1.128)
Panel B: Plan Consolidation by LIS Benchmark Insurers		
Plan consolidation	-5.507***	-4.367***
	(0.500)	(0.485)
Plan consolidation by	2.143***	0.678
LIS insurer	(0.652)	(0.710)
Panel C: Merging of LIS Benchmark Insurers		
Merger	-0.689	-0.396
	(0.470)	(0.671)
Merger in overlapping market	4.485***	5.494***
	(0.613)	(0.771)
Merger of LIS insurers in	-0.821*	-1.924***
overlapping market	(0.494)	(0.570)
Mkt-Year FEs	Y	Y
Insurer FEs	N	Y

Notes: This table summarizes the results the three robustness checks related to adverse selection and LIS pricing incentives. All tests include a rich set of plan-level controls. Plan characteristics in first differences include basic/enhanced plan status, LIS benchmark status, deductible, gap coverage. In addition to that, characteristics taken at their pre-merger level include the premium, drug price index, number of drugs covered, restrictions, tiers, log enrollment, market share, log LIS enrollment, LIS market share. Standard errors are clustered by market-year. Coefficient estimates that are significant at 1%, 5%, and 10% level are denoted with ***, **, and * respectively. Standard errors are in parentheses.

B Appendix: Complete Output Tables

Table 9: Merger and Consolidation Results: Premium. Complete Output

	(1)		(2)	
	Coef Est	**Std Err**	**Coef Est**	**Std Err**
Merger	-0.686	(0.470)	-0.452	(0.493)
Merger in overlapping market	3.969***	(0.505)	3.179***	(0.541)
Plan consolidation			-4.855***	(0.419)
Merger & Plan consolidation in overlapping market			3.721***	(0.698)
Covariates in first differences				
Benefit type	-2.017***	(0.422)	-0.305	(0.455)
Deductible	-0.022***	(0.002)	-0.026***	(0.002)
Gap coverage	14.127***	(0.648)	13.940***	(0.609)
LIS eligibility	-8.041***	(0.344)	-7.916***	(0.326)
Covariates in levels, lagged				
Premium	-0.438***	(0.012)	-0.438***	(0.012)
Drug cost index	0.015	(0.015)	-0.001	(0.015)
N drugs covered, top100	0.162***	(0.025)	0.144***	(0.027)
N drugs covered, all	0.010***	(0.002)	0.010***	(0.002)
Average tier level, top100	5.702***	(1.703)	4.835	(1.752)
Average tier level, all	-9.789***	(2.258)	-9.859***	(2.321)
Average restriction level, top100	1.096	(2.578)	6.531***	(2.092)
Average restriction level, all	7.586***	(2.120)	3.154	(2.688)
Benefit type	-1.054	(0.658)	-0.500	(0.705)
LIS status	-4.575***	(0.399)	-4.440***	(0.393)
Deductible	-0.006***	(0.002)	-0.009***	(0.002)
Gap coverage	15.947***	(0.571)	15.836***	(0.583)
Plan market share	-82.824***	(13.030)	-80.761***	(13.062)
Log plan enrollment, in ('000)	1.345***	(0.212)	1.199***	(0.210)
Plan LIS market share	6.560	(22.837)	19.665	(22.390)
Log LIS plan enrollment, in ('000)	-0.487**	(0.211)	-0.519	(0.207)
% Merger plans		15.36		
% Merger plans in overlapping mkt		11.54		
% Consolidated plans		22.21		
% Consolidated merger plans in overlapping mkt		2.25		
N obs.		**8,790**		

Notes: This table details all of the coefficients on the controls from the main specification summarized in Tables 6 and 7. We report for the specification with market-year fixed effects; the control coefficients for the specification with insurer fixed effects are quantitatively similar. Coefficients on the number of drugs (NDCs) covered are scaled up by 100. Coefficient estimates that are significant at 1%, 5%, and 10% level are denoted with ***, **, and * respectively. Standard errors are in parentheses.

Table 10: Merger and Consolidation Results: Formulary. Complete Output

	TOP 100 DRUGS				ALL NDC			
	(1)		(2)		(1)		(2)	
	Coef Est	Std Err	Coef Est	Std Err	Coef Est	Std Err	Coef Est	Std Err
Merger	1.106***	(0.514)	1.167**	(0.530)	261.0***	(52.72)	269.9***	(54.79)
Merger in overlapping mkt	-0.639	(0.633)	-2.060***	(0.613)	-195.8***	(63.57)	-328.0***	(59.01)
Plan consolidation			-1.260***	(0.237)			-93.80***	(18.16)
Merger & Plan consolidation in overlapping market			7.437***	(0.810)			615.03***	(76.15)
Covariates in first differences								
Benefit type	1.759***	(0.241)	2.030***	(0.202)	403.4***	(23.02)	422.25***	(25.97)
Deductible	-0.005***	(0.001)	-0.006	(0.001)	-0.345***	(0.062)	-0.428***	(0.068)
Gap coverage	2.400***	(0.376)	2.227***	(0.356)	670.15***	(47.98)	639.3***	(46.15)
LIS eligibility	0.587**	(0.252)	0.403*	(0.242)	65.31***	(23.95)	44.28*	(23.44)
Covariates in levels, lagged								
Premium	-0.038***	(0.006)	-0.036***	(0.006)	-0.922*	(0.523)	-0.788	(0.526)
Drug cost index	-0.065***	(0.011)	-0.064***	(0.011)	-8.455***	(1.967)	-7.464***	(1.981)
N drugs covered*	-0.339***	(0.018)	-0.346***	(0.017)	17.90***	(2.026)	18.26***	(1.981)
N drugs covered	0.007***	(0.002)	-0.006***	(0.002)	-0.600***	(0.029)	-0.604***	(0.029)
Avg tier*	-1.334	(1.340)	-0.932	(1.252)	-142.0	(243.7)	-33.22	(238.0)
Avg tier	-1.463	(1.591)	-1.253	(1.540)	-735.2***	(236.6)	-681.1***	(233.3)
Avg restriction*	7.764***	(1.385)	-6.558***	(1.054)	-171.5	(120.6)	-218.3*	(120.5)
Avg restriction	-5.939***	(1.071)	8.844***	(1.318)	335.8*	(189.4)	471.6**	(185.5)
Benefit type	0.909***	(0.203)	1.174***	(0.196)	200.0***	(21.57)	217.4***	(22.48)
LIS status	0.467*	(0.249)	0.419*	(0.238)	56.41*	(29.94)	41.06	(29.37)
Deductible	-0.004***	(0.001)	-0.006***	(0.001)	-0.145*	(0.080)	-0.275***	(0.080)
Gap coverage	2.689***	(0.183)	2.625***	(0.180)	320.1***	(28.27)	317.0***	(27.67)
Market share	9.781	(7.318)	10.295	(7.480)	3,288***	(844.0)	3,345***	(850.6)
Log enrollment	0.337***	(0.091)	0.333***	(0.092)	25.51**	(12.56)	24.21*	(12.64)
LIS mkt share	-64.50***	(11.37)	-55.86***	(11.46)	-7,113***	(1,243)	-6,297***	(1,230)
Log LIS enrollment	-0.095	(0.078)	-0.170**	(0.079)	-10.52	(10.22)	-13.93	(10.24)
% Merger plans				15.36				
% Merger plans in overlapping mkt				11.54				
% Consolidated plans				22.21				
% Consolidated merger plans in overlapping mkt				2.25				
N obs.				**8,790**	**7,401**			

Notes: This table details all of the coefficients from the main specification summarized in Table 6. We report for the specification with market-year fixed effects; the control coefficients for the specification with insurer fixed effects are quantitatively similar. Plan enrollment is in thousands of enrollees. Both formulary composition and restriction dependent variables are calculated for the top 100 drugs. A star, *, denotes that the covariate is calculated for top 100 drugs rather than for the entire set of NDCs. Coefficients on the covariate number of drugs (NDCs) covered are scaled up by 100. All coefficients in regressions with restrictions as a dependent variable are scaled up by 100. Coefficient estimates that are significant at 1%, 5%, and 10% level are denoted with ***, **, and * respectively. Standard errors are in parentheses.

Table 11: Merger and Consolidation Results: Restrictions. Complete Output

	TOP 100 DRUGS				ALL NDC			
	(1)		(2)		(1)		(2)	
	Coef Est	**Std Err**	**Coef Est**	**Std Err**	**Coef Est**	**Std Err**	**Coef Est**	**Std Err**
Merger	-2.668***	(0.634)	-0.026***	(0.006)	0.094	(0.474)	0.034	(0.481)
Merger in overlapping mkt	5.305***	(0.892)	0.064	(0.010)	0.040***	(0.008)	0.056***	(0.009)
Plan consolidation			-0.004	(0.003)			0.012***	(0.002)
Merger & Plan consolidation in overlapping market			-0.058***	(0.008)			-0.083***	(0.008)
Covariates in first differences								
Benefit type	2.404***	(0.218)	0.027***	(0.002)	0.008***	(0.002)	0.005***	(0.002)
Deductible	-0.009***	(0.002)	-0.009***	(0.002)	-0.012***	(0.002)	-0.011***	(0.002)
Gap coverage	3.148***	(0.354)	0.032***	(0.004)	0.026***	(0.003)	0.028***	(0.003)
LIS eligibility	-1.835***	(0.355)	-0.016***	(0.004)	-0.006*	(0.003)	-0.003	(0.003)
Covariates in levels, lagged								
Premium	-0.027***	(0.010)	-0.029***	(0.001)	-0.025***	(0.009)	-0.027***	(0.009)
Drug cost index	0.031	(0.025)	0.024	(0.025)	0.051**	(0.021)	0.048**	(0.021)
N drugs covered*	0.054	(0.038)	0.054	(0.037)	0.026	(0.034)	0.032	(0.033)
N drugs covered	-0.003	(0.001)	-0.003	(0.001)	-0.002***	(0.001)	-0.002***	(0.001)
Avg tier*	4.782	(3.463)	0.041	(0.036)	-0.127***	(0.026)	-0.132***	(0.027)
Avg tier	-9.918***	(3.590)	-0.101	(0.036)	0.060*	(0.033)	0.057*	(0.033)
Avg restriction*	-24.856***	(4.391)	-0.125***	(0.027)	0.018	(0.028)	0.191***	(0.028)
Avg restriction	-12.722***	(2.711)	-0.252***	(0.044)	-0.555***	(0.047)	-0.566***	(0.047)
Benefit type	-0.906***	(0.316)	-0.010***	(0.003)	-0.016***	(0.002)	-0.019***	(0.002)
LIS status	-0.001	(0.502)	0.001	(0.005)	0.007*	(0.004)	0.007**	(0.004)
Deductible	-0.012***	(0.002)	-0.011***	(0.002)	-0.011***	(0.002)	-0.009***	(0.002)
Gap coverage	-0.475	(0.420)	-0.005	(0.004)	-0.005	(0.004)	-0.004	(0.004)
Market share	-29.751***	(9.372)	-0.295	(0.094)	-0.239***	(0.071)	-0.244***	(0.073)
Log enrollment	0.542***	(0.167)	0.005***	(0.002)	0.007***	(0.001)	0.007***	(0.001)
LIS mkt share	10.752	(15.315)	0.070	(0.153)	0.383***	(0.135)	0.290**	(0.134)
Log LIS enrollment	0.021	(0.151)	0.001	(0.002)	-0.001	(0.001)	-0.001	(0.001)
% Merger plans				15.36				
% Merger plans in overlapping mkt				11.54				
% Consolidated plans				22.21				
% Consolidated merger plans in overlapping mkt				2.25				
N obs.				**8,790**	**7,401**			

Notes: This table details all of the coefficients from the main specification summarized in Table 6. We report for the specification with market-year fixed effects; the control coefficients for the specification with insurer fixed effects are quantitatively similar. Plan enrollment is in thousands of enrollees. Both formulary composition and restriction dependent variables are calculated for the top 100 drugs. A star, *, denotes that the covariate is calculated for top 100 drugs rather than for the entire set of NDCs. Coefficients on the covariate number of drugs (NDCs) covered are scaled up by 100. All coefficients in regressions with restrictions as a dependent variable are scaled up by 100. Coefficient estimates that are significant at 1%, 5%, and 10% level are denoted with ***, **, and * respectively. Standard errors are in parentheses.

Table 12: Merger and Consolidation Results: OOP Cost Index. Complete Output

	(1)		(2)	
	Coef Est	**Std Err**	**Coef Est**	**Std Err**
Merger	1.729***	(0.389)	1.643***	(0.409)
Merger in overlapping mkt	-2.271***	(0.551)	-2.060***	(0.613)
Plan consolidation			1.773***	(0.368)
Merger & Plan consolidation in overlapping market			-9.200***	(0.907)
Covariates in first differences				
Benefit type	-1.614***	(0.368)	-2.029***	(0.328)
Deductible	-0.004***	(0.001)	-0.002**	(0.001)
Gap coverage	-2.176***	(0.500)	-1.958***	(0.475)
LIS eligibility	1.513	(0.345)	1.729***	(0.334)
Covariates in levels, lagged				
Premium	0.043	(1.121)	-0.002	(0.011)
Drug cost index	-0.589***	(0.023)	-0.590***	(0.021)
N drugs covered*	-0.392	(0.028)	-0.383***	(0.027)
N drugs covered	0.010***	(0.003)	0.009***	(0.003)
Avg tier*	-13.486***	(2.232)	-13.929***	(2.120)
Avg tier	4.129	(2.812)	3.878	(2.731)
Avg restriction*	14.408***	(1.173)	15.212***	(1.131)
Avg restriction	-19.837	(1.636)	-21.249***	(1.523)
Benefit type	0.094	(0.382)	-0.255	(0.378)
LIS status	0.915	(0.476)	0.967**	(0.455)
Deductible	-0.005***	(0.001)	-0.003**	(0.001)
Gap coverage	-2.070***	(0.440)	-1.986***	(0.419)
Market share	-36.138***	(11.568)	-36.865***	(11.828)
Log enrollment	-0.216	(0.169)	-0.203	(0.165)
LIS mkt share	85.301***	(18.760)	74.170***	(18.966)
Log LIS enrollment	0.014	(0.167)	0.107	(0.164)
% Merger plans		15.36		
% Merger plans in overlapping mkt		11.54		
% Consolidated plans		22.21		
% Consolidated merger plans in overlapping mkt		2.25		
N obs.		**8,790**		

Notes: This table details all of the coefficients from the main specification summarized in Table 6. We report for the specification with market-year fixed effects; the control coefficients for the specification with insurer fixed effects are quantitatively similar. Plan enrollment is in thousands enrollees. Both formulary composition and restrictions dependent variable is calculated for the top 100 drugs. A star, *, denotes that the covariate is calculated for top 100 drugs rather than for the entire set of NDCs. Coefficients on the covariate number of drugs (NDCs) covered are scaled up by 100. All coefficients in regressions with restrictions as a dependent variable are scaled up by 100. Coefficient estimates that are significant at 1%, 5%, and 10% level are denoted with ***, **, and * respectively. Standard errors are in parentheses.

Table 13: Merger and Consolidation Results: Tiers. Complete Output

	TOP 100 DRUGS				ALL NDC			
	(1)		(2)		(1)		(2)	
	Coef Est	**Std Err**	**Coef Est**	**Std Err**	**Coef Est**	**Std Err**	**Coef Est**	**Std Err**
Merger	-0.017	(0.011)	-0.016	(0.011)	-0.007	(0.006)	-0.006	(0.006)
Merger in overlapping mkt	0.005	(0.013)	-0.005	(0.013)	-0.012	(0.065)	-0.003	(0.064)
Plan consolidation			-0.027***	(0.002)			-0.019***	(0.003)
Merger & Plan consolidation in overlapping market			0.050***	(0.010)			-0.007	(0.006)
Covariates in first differences								
Benefit type	0.009***	(0.003)	0.018***	(0.003)	0.026***	(0.002)	0.033***	(0.003)
Deductible	0.004***	(0.001)	0.001	(0.001)	-0.004***	(0.002)	-0.006***	(0.002)
Gap coverage	0.028***	(0.003)	0.026***	(0.003)	0.036***	(0.003)	0.036***	(0.003)
LIS eligibility	0.002	0.003	0.002	(0.003)	0.010***	(0.003)	0.011***	(0.003)
Covariates in levels, lagged								
Premium	-0.028	(0.009)	-0.027***	(0.009)	-0.047***	(0.006)	-0.047***	(0.006)
Drug cost index	0.167***	(0.014)	0.161***	(0.015)	0.044***	(0.010)	0.036***	(0.010)
N drugs covered*	0.005***	(0.001)	0.466***	(0.040)	0.286***	(0.035)	0.280***	(0.035)
N drugs covered	0.003***	(0.0001)	0.003***	(0.001)	0.002***	(0.0001)	0.002***	(0.0001)
Avg tier*	-0.696***	0.018	-0.698***	(0.018)	-0.242***	(0.017)	-0.248***	(0.017)
Avg tier	0.062**	(0.024)	0.062***	(0.024)	-0.346***	(0.025)	-0.347***	(0.025)
Avg restriction*	-0.010	(0.024)	-0.017	(0.024)	0.006	(0.012)	0.003	(0.012)
Avg restriction	-0.043	(0.027)	-0.029	(0.025)	-0.066***	(0.016)	-0.060***	(0.016)
Benefit type	0.007**	(0.003)	0.011***	(0.003)	0.010***	(0.002)	0.012***	(0.002)
LIS status	0.013***	(0.003)	0.014***	(0.004)	0.023***	(0.003)	0.024***	(0.003)
Deductible	0.004***	(0.001)	0.002	(0.001)	-0.002***	(0.001)	-0.003***	(0.001)
Gap coverage	0.037***	(0.003)	0.037***	(0.003)	0.033***	(0.002)	0.032***	(0.002)
Market share	0.378***	(0.095)	0.389***	(0.095)	0.319***	(0.070)	0.327***	(0.070)
Log enrollment	0.006***	(0.002)	0.005***	(0.002)	0.006***	(0.001)	0.005***	(0.001)
LIS mkt share	-0.608***	(0.183)	-0.511***	(0.188)	-0.333**	(0.153)	-0.298*	(0.154)
Log LIS enrollment	-0.009***	(0.001)	-0.009***	(0.001)	-0.009***	(0.001)	-0.008***	(0.001)
% Merger plans				15.36				
% Merger plans in overlapping mkt				11.54				
% Consolidated plans				22.21				
% Consolidated merger plans in overlapping mkt				2.25				
N obs.				**8,790**	**7,401**			

Notes: This table details all of the coefficients from the main specification summarized in Table 6. We report for the specification with market-year fixed effects; the control coefficients for the specification with insurer fixed effects are quantitatively similar. Plan enrollment is in thousands enrollees. Both formulary composition and restrictions dependent variables are calculated for the top 100 drugs. A star, *, denotes that the covariate is calculated for top 100 drugs rather than for the entire set of NDCs. Coefficients on the covariate number of drugs (NDCs) covered are scaled up by 100. All coefficients in regressions with restrictions as a dependent variable are scaled up by 100. Coefficient estimates that are significant at 1%, 5%, and 10% level are denoted with ***, **, and * respectively. Standard errors are in parentheses.

Table 14: Summary of direct merger effects on bargaining outcomes

Suppliers/Effects:	**Market Share**	**Premium**	**Net Effect**
I. Drug manufacturers (rebate)			
Overlap	↑ lower chance of losing enrollees	↓ higher stakes of losing enrollees	**ambiguous**
No overlap	**no change** no cross-market substitution	—	**none**
II. Pharmacies: Access			
Overlap	↓ lower chance of losing enrollees	↑ higher stakes of losing enrollees	**ambiguous**
No overlap	—	—	**none**
III. Pharmacies: Drug Prices			
Overlap	↓ lower chance of losing enrollees	↑ higher stakes of losing enrollees	**ambiguous**
No overlap	—	—	**none**

Notes: The table summarizes direct merger effects predicted by the bargaining model outlined in the Appendix C. Negotiation with drug manufacturers over rebates is on the national level; with pharmacies – on local level over drug access and drug prices. After a merger, the probability of losing enrollees to a rival plan if no agreement is reached with a supplier, diminishes if the merged insurer gains market share; this is the market share effect. On the other hand, a merger that results in market power gains and increases in premiums, raises the stakes of losing an enrollee if a drug is excluded from the formulary or a pharmacy is excluded from pharmacy network; we call this effect premium effect.

C Theoretical Framework

In this section we outline a multi-level, multi-lateral bargaining model developed within the Ho and Lee (2017) framework. The model captures the key features of national and local level bargaining in Medicare Part D markets and puts structure on our empirical work. It allows us to interpret our results on the effects of changing competition on plan premiums and coverage.

In this section, we outline a simplified theoretical model of bargaining and competition in the spirit of Ho and Lee (2017) to illustrate how market power, cost efficiencies, and bargaining power affect merger outcomes. The model introduces the concept of a multi-lateral, multi-level bargaining game involving insurers, drug manufacturers, and pharmacies that determines premiums, formularies' composition, drug rebates and prices. It is specifically tailored to the institutional features of Part D discussed in sections 3 and 4. We discuss the model more formally in Appendix C. In what follows, we highlight the key points and predictions that this model makes for merger effects.

C.1 Setup

Medicare Part D plans are offered by private insurance companies that set premiums and determine coverage (formulary composition, coinsurance, and drug access provisions). Insurers can operate in multiple markets (Medicare Part D "regions") and offer multiple plans in each market that differ in their coverage characteristics.

Insurers negotiate plan coverage parameters with two types of upstream suppliers. On the national level, Part D providers bargain with prescription drug manufacturers over the inclusion of their drug into the plan formulary in exchange for a rebate per prescription filled. On the local (market) level, insurers negotiate with pharmacies over access restrictions and drug prices in exchange for the pharmacy being a part of the plan's network. We assume the following timing of the events:

1. Insurers negotiate with upstream suppliers

   (a) Part D providers, $j \in 1 \dots J$ engage in simultaneous bilateral Nash bargaining with drug manufacturers, $d \in 1 \dots D$ over the inclusion of drugs on formularies in exchange for rebates. If insurer j and drug manufacturer d reach an agreement to include the drug on the formulary, the manufacturer pays a rebate r_{jd} per prescription filled by insurer j's enrollees. If the parties fail to reach an agreement, the drug is not covered under any of insurer j's plans and no rebates are paid.

   (b) Simultaneously, at the local level, in each market m, Part D providers engage in simultaneous bilateral Nash bargaining with local pharmacies, k about access restrictions for drugs, a_{jkm} and pharmacy pricing, p_{jkm}. A pharmacy is excluded from the network if no agreement is reached.

   We assume that local level negotiations over access and pricing are common across all drugs and that insurers and pharmacies do not negotiate over terms for each specific drug on the insurer's formulary. We also assume that pharmacies are not affiliated with drug manufacturers.[24] Therefore, drug rebate negotiations at the national level are separate from access and pharmacy pricing negotiations that occur at the local level. However, in a "Nash-in-Nash" bargaining solution, the equilibrium outcome of negotiations at each level will be affected by the outcome on the other level, in much the same way that bilateral negotiations amongst different drug manufacturers will affect one another.

[24] There are some vertically integrated insurer-pharmacy companies such as CVS Caremark, but to the best of our knowledge, there are no vertically integrated drug manufacturer-pharmacies.

We also consider a variant of the model in which drug access is negotiated with the local suppliers of drug manufacturers. In this case, access is denoted by a_{djm}. It varies across markets and drugs, but not pharmacies. Upon disagreement, the drug d is removed from the formulary in market m, even if an agreement has otherwise been reached at the national level. We assume that the drug manufacturer's bargaining representative at the local supplier level does not coordinate with the representative in charge of negotiating national level rebates. In data, we observe measures of access (restrictions and copay tiers) that vary across markets, pharmacies, and drugs. Thus, a blend of pharmacy and local drug supplier negotiations over drug access, a_{djkm} most realistically captures the market. We show the solution for bargaining outcomes for the main model. When they differ for the proposed variation, we specify both, the results for the model where pharmacies negotiate drug access and prices with insurers and for the model where drug access is negotiated with the local suppliers of drug manufacturers.

2. Insurers submit plan bids. Bids have three essential components:

   (a) Premiums, ϕ_{jm}: by law, they include (an estimate of) negotiated rebates;

   (b) Drug formularies, $\mathcal{F}_j$, and pharmacy networks, $\mathcal{P}_{jm}$;

   (c) Drug access (a_{jkm}) and prices (p_{jkm}) of drugs on formularies that are negotiated with pharmacies.

3. Individuals eligible for Medicare, select plans, j in their home market, m based on premiums, ϕ_{jm}, drug formularies, $\mathcal{F}_j$, and local pharmacy networks, $\mathcal{P}_{jm}$. We assume that demand for Part D plans does not depend on drug access or pharmacy pricing directly. It is a function of the plan's premium, formulary, and the size of its pharmacy network. Individual demand for plan j in market m, $D_{jm}(\phi_m, \mathcal{F}, \mathcal{P}_m)$, is decreasing in premium, and increasing in the scope of drugs on the formulary and the size of the pharmacy network.

4. When individuals become sick, they fill out prescriptions. Demand for drug d at pharmacy k by enrollees of insurer j in market m depends on formulary composition $\mathcal{F}_j$, pharmacy networks $\mathcal{P}_{jm}$, and is a linear function of pharmacy access, a_{jkm}. It is given by $D^{rx}_{djkm}(\mathcal{F}_j, \mathcal{P}_{jm})a_{jkm}$.

   Alternatively, let $D^{rx}_{jkm}a_{jkm}$ (no drug subscript) denote patient demand for a representative basket of drugs by enrollees in plan j at pharmacy k. If drug access is negotiated with drug suppliers, demand for drug d at a representative pharmacy is given by $D^{rx}_{djm}(\mathcal{F}_j, \mathcal{P})a_{djm}$.

Insurers seek to maximize profits when setting premiums and negotiating drug coverage terms. Insurer j's profit is a sum of market-level profits, and each market profit is a difference between collected premiums and payments for filled prescriptions less rebates from drug manufacturers:

$$\pi_j(\mathcal{F}, \mathcal{P}, \mathbf{r}, \mathbf{a}, \mathbf{p}) = \sum_m \left(D_{jm}\phi_{jm} - \sum_{k \in \mathcal{P}_{jm}} \sum_{d \in \mathcal{F}_j} D^{rx}_{djkm} a_{djkm}(p_{jkm} - r_{dj}) \right), \tag{6}$$

where $\mathbf{r}$ is a vector of negotiated rebates for drugs on the plan; $\mathbf{a}$ represents a vector of drugs' access restrictions, and $\mathbf{p}$ represents a vector of drugs' prices.

Drug manufacturer profits are the payments collected from all pharmacies that sold its drug d, less the rebate paid to the insurers based on the number of enrollees who filled a prescription, and less the cost of drug production. The profits are given by:

$$\pi_d(\mathcal{F}, \mathcal{P}, \mathbf{r}, \mathbf{a}, \mathbf{p}) = \sum_m \sum_{k \in \mathcal{P}_{jm}} \sum_{j \in \mathcal{F}_d} D^{rx}_{djkm} a^{rx}_{djkm}(p^w - r_{dj} - c_d), \tag{7}$$

where the value p^w is the wholesale price of drugs sold to pharmacies, c_d is the manufacturing cost, and $\mathcal{F}_d$ is the set of formularies that cover drug d. We assume that wholesale drug prices are determined by manufacturers and pharmacies outside of the Part D bargaining context. For ease of notation we normalize wholesale prices for all drugs to a common value, p^w, so that negotiated pharmacy prices, p_{jkm} can be viewed as the markup that pharmacies charge over the wholesale price.

A local pharmacy maximizes the difference between drug sales at the prices negotiated with insurers and the amount it pays drug manufacturers. Its profits are given by:

$$\pi_k(\mathcal{F}_m, \mathcal{P}_m, \mathbf{r}, \mathbf{a}_m, \mathbf{p}_m) = \sum_{j \in \mathcal{P}_{km}} \sum_{d \in \mathcal{F}_{jm}} D^{rx}_{djkm} a_{jkm} (p_{jkm} - p^w) \tag{8}$$

C.2 National Level: Bargaining with Drug Manufacturers

Institutional Details

Our modeling decisions rest on the institutional set-up of the Medicare Part D program. In the model, insurers bargain with drug manufacturers over the inclusion of drugs on plan formularies in exchange for rebates. Providers report the expected rebate amount to the CMS when they submit their bid each year. They also provide the information on the actual rebate received from drug manufacturers in the CMS Direct and Indirect Remuneration (DIR) Reports for Payment Reconciliation. DIR data are reported at the plan level and at the manufacturer-drug level, rolled up to include multiple strengths, package sizes, dosage formulations, or combinations.[25] CMS maintains confidentiality of these records.

The report by Levinson (2011) distinguishes between two features of the rebates that they observed in the reviewed plan sponsors: formulary-based payment and payment based on prescriptions volume. Insurers received rebates for including a drug on formulary and a variable amount based on how many enrollees purchased the drug. In their data, insurers with higher number of enrollees reported higher rebate amounts per beneficiary.

In 2008, Medicare Part D insurers reported \$6.5 billion in drug manufacturer rebates that translated into \$275 per beneficiary (Levinson (2011)). Relative to drug expenditures, the rebates were approximately 10% of total gross Part D drug costs (\$63 billion). By law, insurers are required to pass these savings on to the plan enrollees. In practice, it can be achieved in two ways. First, insurers are required to include their expected rebates and other price concessions in their bids, which lowers the premiums (42 U.S.C. §1395w-113). Second, insurers may pass the cost savings stemming from rebates directly on to enrollees at the time they fill prescriptions in the form of point-of-sale rebates. According to the report by Levinson (2011), only 4 out of 258 Part D providers offered point-of-sale rebates in 2008. Importantly, the insurers are also required to pass the difference between the estimated and actual rebate on to the government. Actual rebate amounts are used to adjust Part D payments in reconciliation process.

We assume that the rebate is common across all plans, ruling out the possibility of contracting for different rebates based on geography or plan type. Medicare requires insurers to pass along a proportional share of rebates received when determining the government's liability for low income cost sharing, risk corridors, and reinsurance. For this reason, we suspect our assumption is plausible. Otherwise insurers would be able to allocate rebates in a way that games the subsidy and risk sharing design.

Note that it is also typical for an insurer to have the same formulary across plans and markets, supporting the assumption about a common rebate. By formulary here we mean a list of drugs (NDC codes). Drug prices are plan-specific and may differ for two plans that have the same formulary. For

[25] CMS, Medicare Part D Reporting Reporting Requirements for 2011, p.21; https://www.cms.gov/Medicare/Prescription-Drug-Coverage/PrescriptionDrugCovContra/Downloads/ CY2011PartDReportingRequirements012011.pdf. *Accessed on July 22, 2016.*

that reason, we model drug pricing negotiation as a part of the pharmacy-insurer bargaining problem and discuss it below (see Section C.3).

Over 24% of formularies are used across over 34 Medicare regions, and 56% are used in more than one region (this does not exclude insurers who operate in just one region). Within a region, conditional on offering several plans, 32% of insurers use the same formulary for all of their plans. We also compared formularies of insurers who have more than one formulary for their plans within a region. On average, only 9% of drugs are not covered by a narrower formulary (6% between 2009 and 2012).[26]

Model

Let $\mathcal{F}_j$ denote the set of drugs included on insurer j's formulary. For any given insurer, j drug manufacturer, d pair, rebates are negotiated via Nash Bargaining. The rebate maximizes the bilateral Nash product:

$$r_{dj} = \underset{}{argmax} \left[\pi_j(\mathcal{F}, \mathcal{P}, \mathbf{r}, \mathbf{a}, \mathbf{p}) - \tilde{\pi}_j(\mathcal{F}_{-jd}, \mathcal{P}, \mathbf{r}_{-jd}, \mathbf{a}, \mathbf{p})\right]^{\tau_j} \left[\pi_d(\mathcal{F}, \mathcal{P}, \mathbf{r}, \mathbf{a}, \mathbf{p}) - \tilde{\pi}_j(\mathcal{F}_{-jd}, \mathcal{P}, \mathbf{r}_{-jd}, \mathbf{a}, \mathbf{p})\right]^{\tau_d}, \tag{9}$$

where $\tilde{\pi}_j$ is the insurer's j profit if drug d is excluded from the formulary; $\mathbf{r}_{-jd}$ is the vector of negotiated rebates if drug d is not on the formulary, τ_j and τ_d are insurer and drug manufacturer bargaining weights, respectively.

For intuition about the bargaining process, consider an example with one insurer offering plans in m markets and two drug manufacturers (A and B) in which there is some degree of therapeutic substitutability across drugs. Let pharmacy prices, p_m and access, a_m represent average negotiated values across pharmacies. The Nash bargaining problem for insurer j and the manufacturer of drug A solves:

$$\begin{aligned} r_{jA} = & \\ & \underset{}{argmax} \left[\sum_m \left(D_m\phi_m - D^{rx}_{Am}a_m(p_m - r) - D^{rx}_{Bm}a_m(p_m - r_B) - \left[\tilde{D}_m\phi_m - \tilde{D}^{rx}_{Bm}a_m(p_m - r_B)\right]\right)\right] \\ & \times \left[\sum_m D^{rx}_{Am}a_m(p^w - r - c_A)\right], \end{aligned} \tag{10}$$

where the terms $\tilde{D}_m$ and $\tilde{D}^{rx}_{Bm}$ represent demand for the insurer's plan and demand for drug B if the insurer's formulary excludes drug A. Assuming equal bargaining weights, $\tau_j = \tau_d = 1/2$ and taking the first order conditions yields a solution drug A's rebate, r_A:

[26] We compared two randomly selected formularies if insurer had more than two formularies within a region.

$$
\begin{aligned}
r_{jA} = & - \overbrace{\left[\sum_m D_m \phi_m - \sum_m \tilde{D}_m \phi_m\right] / (2 \sum_m D^{rx}_{Am} a_m)}^{\text{Premium and enrollment effects (Ho and Lee (2017))}} \\
& + \overbrace{\left[\sum_m D^{rx}_{Bm} a_m (p_m - r_B) - \sum_m \tilde{D}^{rx}_{Bm} a_m (p_m - r_B)\right] / (2 \sum_m D^{rx}_{Am} a_m)}^{\text{Drug substitutability}} \\
& + \underbrace{p_m/2}_{\text{connection to pharmacy problem}} \\
& + \underbrace{(p^w - c_A)/2}_{\text{price-cost margin}}
\end{aligned} \tag{11}
$$

The solution to the bargaining problem is characterized by four terms. The first term is the premium and enrollment effects as described in Ho and Lee (2017). The gains from trade created when drug A is included in the insurer's formulary stem from higher premium revenue generated from additional enrollees. Since consumers' plan demand depends on formulary composition, the insurer would lose enrollees substituting to other plans (or the outside option) if it excludes drug A from its formulary; that is $D_m - \tilde{D}_m > 0$. The greater the loss in enrollees, the more leverage drug manufacturer has over the insurer's revenue. The weaker is the insurer's bargaining position, the lower is the rebate it can obtain from drug manufacturers.

The second term accounts for the degree of substitutability in prescription demand across drugs. If drug A and B are therapeutic substitutes, demand for drug B increases when A is excluded from the formulary: $D^{rx}_{Bm} - \tilde{D}^{rx}_{Bm} < 0$. The higher is the degree of substitutability, the better is the insurer's bargaining position to negotiate a higher rebate. If the insurer negotiates a high rebate r_B on drug B it can also negotiate a high rebate on drug A. In contrast, if the drugs are complements, $D^{rx}_{Bm} - \tilde{D}^{rx}_{Bm} > 0$, then the insurer will not be able negotiate as high of a rebate on drug A.

The third term highlights the effect that local bargaining with pharmacies over drug prices, p_{jm} has on negotiated national drug rebates, r_j. If the insurer negotiates favorable (drug-usage weighted average) pricing terms with pharmacies in local markets, low p_{jm}, then the insurer will get smaller rebates from national drug manufacturers.

The final term reflects the bargaining position of the drug manufacturer with respect to its cost, c_d. The higher the wholesale price-cost, $p^w - c_A$ margin on the drug A, the higher is the rebate that the manufacturer pays.

Drug access negotiated with pharmacies, a_m, affects national bargaining over rebates through two channels. First, it enters the premium and enrollment effects term. With a lower level of drug access, the premium effect attenuates, weakening the drug manufacturer's bargaining position and raising the rebate. In the special case, when $a_m = a$ for all markets and drugs, the drug access term vanishes from the drug substitutability effect (second term). Otherwise, it has a second order effect based on variability in drug demand, D^{rx}_{dm} and access, a_m across markets.

Our alternative assumption on the nature of drug access negotiations leads to a more complex case. If drug access is negotiated with the local suppliers of drug manufacturers on a drug-by-drug and market-by-market basis, a_{dm}, rather than solely on a market basis a_m, the second term in the bargaining solution equation changes. Equation 11 can then be rewritten as follows:

$$
\begin{aligned}
r_{jA} = &- \left[\sum_m D_m \phi_m - \sum_m \tilde{D}_m \phi_m \right] / (2 \sum_m D^{rx}_{Am} a_{Am}) \\
&+ \left[\sum_m D^{rx}_{Bm} a_{Bm} (p_m - r_B) - \sum_m \tilde{D}^{rx}_{Bm} a_{Bm} (p_m - r_B) \right] / (2 \sum_m D^{rx}_{Am} a_{Am}) \\
&+ p_m/2 \\
&+ (p^w - c_A)/2
\end{aligned} \tag{12}
$$

In this case, the relative drug access levels between drug A and drug B, a_{Bm}/a_{Am} matter for rebate negotiations. If drug B has high access levels and it is a substitute for drug A, then the insurer improves its bargaining position to negotiate a high rebate, but if A has high access, its bargaining position for rebates on drug A weakens.

C.3 Local Bargaining with Pharmacies

Institutional Details

A recent Office of Inspector General report (Levinson (2015)) found that although the rebates received from the manufacturers were lower for Medicare Part D than for State Medicaid agencies, both programs paid pharmacies similar amounts for the drugs selected for the study. In our model, Part D providers, j bargain with local pharmacies, k over access restrictions for drugs, a_{jkm} and pharmacy pricing, p_{jkm}. A pharmacy is excluded from the network if no agreement is reached.[27] Part D data support this modeling decision. Drug prices do not differ across plans of the same insurer in a given region. The average standard deviation is 31 cents and average drug price (NDC-level) is \$356 and the median price is \$85. For contracts that offer the same drugs across regions, the average standard deviation of the drug list price is \$6.35, or 2% of the average price (\$360) and 8% of the median price (\$78).

Model

Denote by $\mathcal{P}_{jm}$ the network of pharmacies that insurer j reaches an agreement with in market m. For each market m and insurer-pharmacy pair (jk), drug prices and access are negotiated via simultaneous Nash bargaining. The access level and price maximize the bilateral Nash product:

$$
\begin{aligned}
(p_{jk}, a_{jk}) = argmax \, &\left[\pi_j(\mathcal{F}, \mathcal{P}, \mathbf{r}, \mathbf{a}, \mathbf{p}) - \tilde{\pi}_j(\mathcal{F}, \mathcal{P}_{-jk}, \mathbf{r}, \mathbf{a}_{-jk}, \mathbf{p}_{-jk}) \right]^{\tau_j} \\
&\times \left[\pi_k(\mathcal{F}, \mathcal{P}, \mathbf{r}, \mathbf{a}, \mathbf{p}) - \tilde{\pi}_j(\mathcal{F}, \mathcal{P}_{-jk}, \mathbf{r}, \mathbf{a}_{-jk}, \mathbf{p}_{-jk}) \right]^{\tau_k},
\end{aligned} \tag{13}
$$

where $\tilde{\pi}_j$, $\mathbf{a}_{-jk}$, and $\mathbf{p}_{-jk}$ is the insurer's j profit, vector of drug access, and drug prices respectively if the pharmacy network $\mathcal{P}_{jm}$ is excluded from the plan. Market m subscripts have been dropped because bargaining occurs strictly at the local market level and there are no cross-market pharmacy bargaining effects.

Consider an example with one insurer and two competing pharmacies (A, B) in which the parties have equal bargaining weights. Since pharmacies and insurers do not contract on a drug-by-drug basis, but rather over uniform price and access levels for all drugs, the rebate term r can be interpreted as an average rebate level across all drugs, and drug demand, D_{jk} as the pharmacy demand for a representative

[27] Formally, "contracted pharmacy network" is defined by the CMS in Chapter 5 of the Prescription Drug Benefit Manual as "licensed pharmacies, including retail, mail-order, and institutional pharmacies, under contract with a Part D sponsor to provide covered Part D drugs at negotiated prices to Part D enrollees."

basket of drugs covered by the insurer. The terms $\tilde{D}$ and $\tilde{D}_B$ represent the demand for the insurer's plans and drug demand of the insurer's enrollees at the pharmacy B if the insurer fails to reach an agreement with pharmacy A. The Nash bargaining problem solves

$$\begin{aligned}(a_{jA}, p_{jA}) = argmax \left[\left(D\phi - D_A^{rx} a_A(p-r) - D_B^{rx} a_B(p_B - r) - \left[\tilde{D}\phi - \tilde{D}_B^{rx} a_B(p_B - r)\right]\right)\right] \\ \times \left[D_A^{rx} a_A(p - p^w)\right]\end{aligned} \tag{14}$$

Assuming equal bargaining weights, $\tau_j = \tau_k = 1/2$, the solution to the bargaining problem satisfies the first order conditions in price, p and access, a given by:

$$\begin{aligned} p = & \overbrace{+\phi\left[D - \tilde{D}\right]/(2D_A^{rx}a)}^{\text{Premium and enrollment effects (Ho and Lee (2017))}} \\ & \overbrace{-\left[D_B^{rx} a_B(p_B - r) - \tilde{D}_B^{rx} a_B(p_B - r)\right]/(2D_A^{rx}a)}^{\text{Substitutability of pharmacies}} \\ & \underbrace{+(p^w + r)/2}_{\text{Direct effect of cost to pharmacies and rebates on pharmacy prices}} \end{aligned} \tag{15}$$

$$\begin{aligned} a = & \overbrace{+\phi\left[D - \tilde{D}\right]/(2D_A\left[p - r\right])}^{\text{Premium and enrollment effects (Ho and Lee (2017))}} \\ & \underbrace{-\left[D_B a_B(p_B - r) - \tilde{D}_B a_B(p_B - r)\right]/(2D_A\left[p - r\right])}_{\text{Substitutability of pharmacies}} \end{aligned} \tag{16}$$

Similar to the solution for the rebate, we can decompose the solutions for drug prices and access into meaningful components. Negotiated pharmacy prices depend on three terms. The first term is the revenue effect. Insurers reimburse pharmacies for drugs at a higher rate if excluding the pharmacy would lead to a large decrease in demand for its plan; that is if $D - \tilde{D} > 0$. The size of the substitution effect will largely depend on the sensitivity of consumers' demand for insurers' plans to pharmacy networks.

The second term captures the degree of substitutability across pharmacies. If the insurer negotiates favorable drug pricing, p_B and access, a_B terms with pharmacy B and enrollees easily substitute to that pharmacy if A is excluded, $D_B^{rx} - \tilde{D}_B^{rx} < 0$, then the insurer has a better bargaining position to negotiate lower prices with A. The magnitudes of the revenue and pharmacy competition effects depend on drug access levels (it appears in the denominator). There is also a trade-off between drug prices and access in negotiations. If the pharmacy agrees to lower access, it is able to negotiate higher prices.

Finally, the third term in the Equation 15 captures the direct effect of drug wholesale prices, p^w and manufacturer rebates, r on pharmacy prices, p. High wholesale prices, a cost to pharmacies, translate into high drug prices paid by insurers. The direct effect of the rebate on drug prices is positive. The higher is the rebate, the higher are the gains from trade to divide between pharmacies and insurers. However, the substitutability of pharmacies limits their ability to extract the rebate from insurers (second term).

Negotiated drug access levels, the second part of drug coverage negotiation between insurers and pharmacies, can be decomposed into a revenue and pharmacy competition effects (Equation 16). Analogous to drug prices, greater enrollment substitution from the insurer plan if it excludes a pharmacy

from its network, results in higher drug access, which is beneficial for pharmacy sales. Conversely, the more substitutable are the pharmacies, or the higher is pharmacy competition, the better is the insurer's bargaining position.

The trade-off between drug prices and access that we described in the solution for drug prices, is also apparent in the solution for drug access. Higher drug prices induce lower drug access. The rebates obtained by insurers from drug manufacturers influence access through the premium and pharmacy competition channels. Higher rebates improve the pharmacy's bargaining position, opening up higher drug access.

Finally, we show the solution for the special case when drug access is negotiated between the insurer and local drug manufacturer representatives rather than pharmacies. Consider an example of two drug suppliers A and B, then the bargaining solution over access is:

$$\begin{aligned} a_A = &+ \phi \left[D - \tilde{D} \right] / (2D_A^{rx} [p - r_A]) \\ &- \left[D_B^{rx} a_B (p - r_B) - \tilde{D}_B^{rx} a_B (p - r_B) \right] / (2D_A^{rx} [p - r_A]) \end{aligned} \tag{17}$$

Importantly, we now have demand for drugs A and B (D_A^{rx} and D_B^{rx}), not pharmacies in the solution. Another notable difference of the special case from the solution, where drug access is negotiated with local pharmacies is that although drug prices do not vary across drugs, rebates do (r_A and r_B).

The two terms that comprise the solution have a similar interpretation to the general case. First, the premium effect increases drug access if enrollees substitute away easily from the insurer's plan, when drug A is excluded. A strong drug substitutability effect allows insurers to negotiate lower drug access, and the trade-off between drug prices and drug access remains. Higher pharmacy prices translate into lower drug access. As for the rebates, higher drug A rebate improves access, because the gains from trade from the inclusion of drug A to split between the insurer and drug suppliers are larger. The drug B rebate has the opposite effect. The higher is the rebate on the substitute drug B, the lower is negotiated drug A access.[28]

There is an important limitation of our model. Since we use a Nash-in-Nash (NiN) framework, it does not allow the bargaining parties to adjust their contracts when evaluating disagreement points in the bargaining process. In other words, an insurer can only threaten to drop a particular pharmacy but cannot threaten to replace it with another one, which might add value to the insurer. Since there is no negotiation loss from including pharmacies and variety is generally valuable to consumers, NiN typically predicts complete networks. A potential solution for future research that would explicitly model and estimate a structural model, would be to apply the concept developed in Ho and Lee (2019) who specifically account for the Threat of Replacement.[29]

C.4 Effect of Mergers on Bargaining Outcomes

In this subsection we derive theoretical predictions that inform the interpretation of our empirical results on mergers between Part D providers. Since Part D providers can operate in one or more markets ("regions"), we consider three types of mergers based on the structure of the market:

1. Mergers with no market overlap of merging parties (insurers offered plans in different markets before the merger);

[28] We do not consider the case of drug complements in our model for practical reasons and to avoid unnecessary complications. In our data, formularies include only a subset of drugs suggesting that most medications are substitutes and not complements.

[29] We sincerely thank one of the anonymous referees for pointing out the possibility of this important improvement for the future research that would tackle the issue structurally.

2. Mergers with complete market overlap of merging parties (both insurers offered plans in the same markets before the merger);

3. Mergers with partial market overlap of merging parties (some of the regions where insurers offered plans before mergers were the same, but not all of them).

When insurers merge, the bargaining positions with both upstream suppliers, drug manufacturers and pharmacies change. The outcomes vary depending on market overlap. These differences stem from the fact that a formulary is negotiated with drug manufacturers at the national level (across markets), whereas drug access and prices are negotiated with pharmacies at the local level (within a market). Among mergers in our data, all but one (deal#2 in Table 2) are mergers with partial market overlap of merging parties. On average, a deal covers 33 markets, over 20 of which are overlapping markets. There are no mergers with complete market overlap in our sample.

Each upstream supplier is *directly* affected by the merger through two channels (see Table 14). First, when insurers merge, it may affect the probability of their enrollees switching to a "rival" plan following the exclusion of a drug from the formulary or a pharmacy from the network. In particular, if it is a merger with market overlap, the *market share effect* will reduce the threat of enrollees substituting away from the insurer's plan. Second, we distinguish a *premium effect* that stems from the "traditional" argument about mergers creating market power. Increases in premiums raise the stakes of losing enrollees by the merger parties.

There are also *indirect, or interactive* merger effects that arise due to the presence of multiple types of upstream suppliers (pharmacies and drug manufacturers). In what follows we describe direct and indirect effects in more detail.

Direct Merger Effects

Drug Manufacturers

For mergers with market overlap, the threat of enrollees leaving their plans following an exclusion of a drug diminishes after the deal. Some of the enrollees leaving an insurer's plan if it dropped drug A, would substitute to a plan offered by the merging partner, not necessarily to a rival insurer. In the premium revenue effect component of the bargaining equation 11, the enrollment substitution term, $D_j - \tilde{D}_j$, shrinks, which leads to a higher rebate paid by drug manufacturers. In addition, the market share effect also acts through the drug manufacturer competition channel (second term in the equation 11), because under disagreement the merged insurer would direct a larger share of consumers towards the rival drug. That is, the market share effect improves the insurer's bargaining position.

The second direct effect comes from the market power effect on plan premiums. It implies that merging insurers raise premiums in markets with overlap. An increase in plan premium raises the bargaining stakes via the premium revenue channel, resulting in lower rebates. In sum, the net direct effect of mergers on rebates is ambiguous, depending on whether the market share or premium effect dominates.

In the case with no market overlap, there is no market share effect, nor premium effect. Due to the Part D market "boundaries", enrollees cannot substitute to a plan offered by the merging partner in a different region by law. The premium effect is absent, because insurers do not gain local market power to raise premiums. Thus, the net effect is not ambiguous in this case, rebates do not change.

Pharmacies

Just like the negotiations with drug manufacturers, both the market share and premium effects matter in the markets with overlap. Following a merger, there is less substitution of enrollees to rival insurers, and the merged insurers improve their bargaining position to negotiate lower pharmacy prices

and lower access. However, with higher premiums at stake, pharmacies can bargaining for higher prices and greater access. The net direct effect of mergers on both coverage parameters is ambiguous.

In markets with no overlap, all direct effects vanish, because there is no change in market structure. These effects are analogous for bargaining with local drug suppliers over access.

Interactive Merger Effects

In the previous sections that detailed the model setup, we showed that the outcomes of multi-level, multi-lateral negotiations over rebates and drug access and prices are interrelated (equations 11, 15, and 16). This means that due to the presence of multiple types of suppliers, in addition to the direct merger effects, there are also indirect, or interactive effects. The presence of interactive effects explains why we are seeing a change in premiums in non-overlapping markets and gives us insights about the relative importance of pharmacy networks and formularies for the enrollees.

We first turn to the merger effects in overlapping markets. The net direct effects on rebates, pharmacy prices, and drug access are ambiguous. As an example, consider a merger that improves the insurers bargaining position due to a strong market share effect. The direct channels predict higher rebates, lower pharmacy prices, and lower access in overlapping markets (Table 14). The interactive effects (drug price and access on rebates, rebates on drug price and access), tend to attenuate the magnitude of direct effects (see bargaining solution equations 11, 15, and 16). In the language of the bargaining literature, the interactive effects illustrate how a surplus gained from one of the suppliers with be shared with the other supplier.

The interactive effects also shed light on the relative importance of pharmacy networks and formularies for the enrollees. If the market share (substitutability) effect is relatively strong with respect to drug formularies, but not with respect to pharmacies (that is, enrollees care relatively more about formularies than about pharmacy networks when choosing plans), then higher rebates prevail and pharmacy prices and access will be little changed. If instead, plan enrollment responds more to the composition of the pharmacy networks, then rebates will be little changed, whereas pharmacy prices and drug access will decrease.

The conclusions change slightly in the case when we assume that drug access is negotiated with drug suppliers, instead of pharmacies. If the market share effect is strong with respect to formularies, rebates increase and drug access declines, whereas pharmacy prices remain little changed. If enrollment responds relatively more to pharmacies, then rebates and access will be little changed, whereas prices decline.

For mergers with partial market overlap, the higher rebates achieved in overlapping markets will spillover to non-overlapping markets. That is, changes in rebates would affect the bargaining outcome at the local level, despite the fact that there are otherwise no direct effects. With higher rebates, negotiated pharmacy prices increase and access improves.

We discuss how our empirical results relate to the bargaining model predictions in Section 7.

D Supplementary Figures

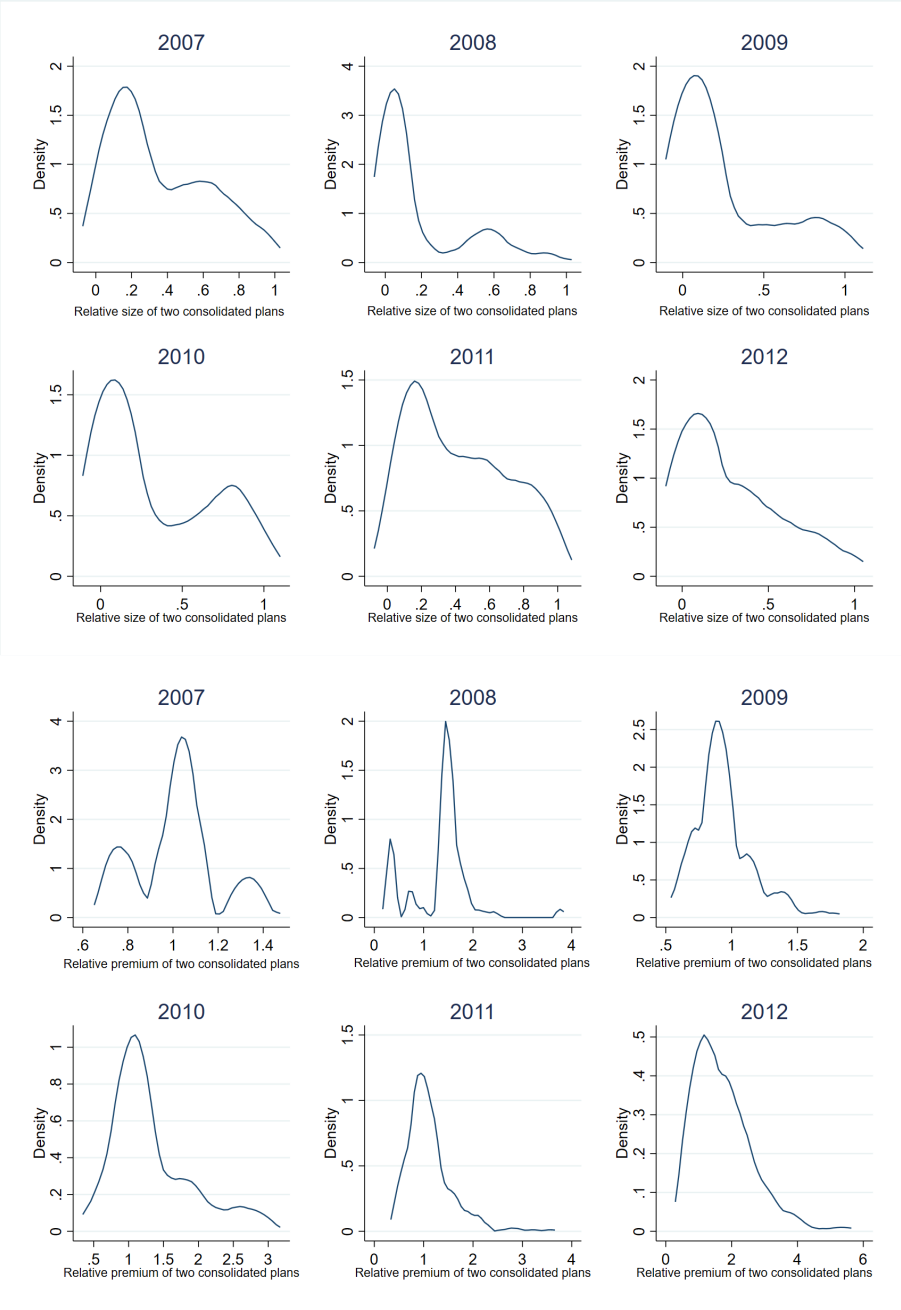

Figure 5: Relative plan size and premiums consolidated plans, by year