Regulating the Middleman: State Legislation on Pharmacy Benefit Managers

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REGULATING THE MIDDLEMAN:

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To: My brother, Steven.

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ABSTRACT

Pharmacy benefit managers (PBMs) are third-party administrators that assist employers and insurers in managing prescription drug benefits. The practices of PBMs remain largely unregulated at the national level and lack transparency, despite their growing influence over the pharmaceutical market. This project offers insight into the complexity of the pharmaceutical supply chain in the U.S. by first detailing the context of which pharmacy benefit managers have evolved and fallen under scrutiny for their practices. Second, I characterize PBMs and the companies that contract out to them through a principal-agent relationship and find evidence to suggest that PBMs wield their drug formularies as imperfect agents. This is done by assessing the relationship between the three largest PBMs' formularies and pharmaceutical costs by analyzing the drugs included on their yearly formulary plans and the National Average Drug Acquisition Cost (NADAC) of these drugs. Third, I explain the spread of PBM targeted regulatory legislation across the states through interest group pressure from a market adversary, PhRMA. To gain a market advantage, I argue that pharmaceutical manufacturers used their state-level influence to reduce the power of PBMs. I develop a Cox proportional hazards model to estimate the influence of PhRMA's monetary contributions to state-level campaigns on the adoption rate of PBM regulatory policies by state governments from 2000-2013. Fourth, I assess the effectiveness of state-level maximum allowable cost (MAC) transparency regulations in reducing the PBM practice of spread pricing from 2013-2018. I rely on a difference-in-differences design to evaluate changes in the markup of reimbursement rates in states before and after legislation was enacted and find evidence that these regulations are effective in reducing the markup in reimbursements from state Medicaid programs.

CHAPTER 1

INTRODUCTION: THE ROLE OF PHARMACY BENEFIT MANAGERS

Drug Prices in the U.S.

Prescription drugs have played an increasing role in improving both quality of life and health outcomes for Americans, providing an alternative to invasive treatments, and speeding up the recovery process for patients who have received those treatments (Assistant Secretary for Planning and Evaluation 2000). However, increases in prescription drug prices threaten the health of individuals who learn that the drugs that they need are either unaffordable or difficult to access. At risk are roughly 60 percent of Americans (Kantor et al 2015), including nearly 90 percent of seniors (Barrett 2005), who take prescription drugs. In 2016, U.S. citizens paid about $50 billion out-of-pocket for prescription drugs and the federal government paid another $126 billion through Medicaid, Medicare, and other programs (Collins & McCaskill 2016). In particular, Hua & Carvalho (2016) found that from 2002-2013 the mean price of insulin, which 30 million Americans with diabetes rely on (Popken 2016), increased by 200 percent. Additionally, since 2009, there was a 500 percent increase in the price of EpiPens, epinephrine auto-injectors used to protect people with severe allergies (Ramsey 2016). These price shocks affect all citizens, whether or not they depend on prescription drugs, as taxpayers assume a considerable share of the cost of government health care programs.

Who's to Blame for High Drug Prices

This dissertation aims to estimate the specific effect of PBMs on drug prices amidst the highly salient and high stakes blame game going on among the various players in the prescription drug market. The intricacies of the pharmaceutical market complicate analyses of drug prices, which involve interactions among manufacturers, retailers, insurers, wholesalers, pharmacy benefit managers (PBMs), the U.S. Food and Drug Administration (FDA), and consumers (Assistant Secretary for Planning and Evaluation 2000). Accordingly, the causes for high pharmaceutical costs have been placed on a multitude of actors with constant reframing and blame shifting.

Many blame the drug makers for high prices. Pharmaceutical companies consider many aspects when setting prices for their products: the market for the drug, the cost of research and development, the price of ingredients, the cost of substitutable treatments, and profit maximization. The Special Committee on Aging in the United States Senate reviewed pharmaceutical companies (Turing Pharmaceuticals, Retrophin, Valeant Pharmaceuticals International, and Rodelis Therapeutics) that attained off-patent drugs, in which they did not develop (Collins & McCaskill 2016). They find that there are several off-patent drugs that are considered the best drug available for the condition it treated, are developed by a single manufacturer, and are served to a relatively small market. Under these market conditions, the pharmaceutical companies take advantage of monopoly pricing power even without the patent protections from the FDA. This demonstrates the common belief that pharmaceutical companies have unlimited control over drug prices. Indeed, a Kaiser Health Tracking Poll asked Americans about the major factors contributing to the prices of prescription drugs and discovered that 77 percent of the public blamed drug company profits (DiJulio et al. 2015).

But the drug makers blame others—the chief executive of Pharmaceutical Research and Manufacturers of America (PhRMA), Stephen Ubl (2016), argues that high drug prices are due to the barriers and regulations imposed by the FDA that prevent pharmaceutical companies from moving towards value-based pricing arrangements. Federal policies try to both promote the development of new drugs while also maintaining their affordability for patients, however, the FDA slows competition by taking years to approve new drugs (Herrick 2017). Although the FDA's approval requirements for generic drugs is streamlined compared to the approval for new drugs, the process is still extensive (Collins & McCaskill 2016). For instance, the median times for generic drug approval went from 16 months to 31 months in 2011, and then jumped to 36 months in 2013, increasing to 43 months in 2014 and 48 months in 2015 (FDA 2015).

While fault for high drug prices has historically been placed on either profit-seeking pharmaceutical companies or an overly restrictive bureaucracy, a new target has recently emerged: pharmacy benefit managers. Even the controversial pharmaceutical company and producer of EpiPen, Mylan, pushed the blame onto other actors in the supply chain, including pharmacy benefit managers (PBMs) who personally pocket large amounts of the drug rebates that they negotiate (Herman 2017). PBMs fall under suspicion because a manufacturer provides a cash rebate to a PBM if the manufacturer's drug is used by the PBM's enrollee. Information

regarding the relative size, characteristics and prevalence of these rebates is rather limited. Mylan's CEO, Heather Bresch, stated in a 2016 CNBC interview that "there are four or five hands that the product touches and companies that it goes through before it ever gets to that patient at the counter." Additionally, Mylan argued that 55 percent of the EpiPen's $608 list price is the result of this supply chain (Fein 2016).

Although drug prices have consistently been a salient issue, the staggering markup of Mylan's EpiPen has served as a triggering event, recapturing the attention of the public and bringing both Mylan and its pharmaceutical competitors under increased scrutiny. Heather Bresch testified in front of the House Committee on Oversight and Government Reform about the EpiPen price hike along with the economics of the pharmaceutical industry (Mukherjee 2016). Bresch has used the recent publicity as a platform to deride the distribution channels of drugs, saying "this isn't an EpiPen problem. This is a health care problem" (CNBC 2016). In January 2017, the CEO of the National Community Pharmacists Association (NCPA), Douglas Hoey, sent a letter to the Senate Special Committee on Aging requesting that they investigate how PBMs are contributing to the rising drug costs and to develop policies to address them. Hoey argues that PBMs "decide what medications are covered by the plan, what pharmacies are in the network, what the consumer will pay, what the plan sponsor will be charged, and what the pharmacy will be paid." In both Chapter 2 and Chapter 4, I attempt to estimate the contribution of PBMs to prescription drug costs using novel approaches isolating drug costs in situations in which PBMs do and do not have leverage to affect a drug's cost.

The Evolution of Pharmacy Benefit Managers (PBMs)

PBMs administer drug benefit plans for their payers, including federal and state governments, health insurers, managed care organizations, self-insured employers, and unions (Krulwich 1995). Beginning in the early 1970s, PBMs mainly sorted through paper claims sent by pharmacies on behalf of employer-sponsors (Rentmeester & Garis 2008). After collecting payments from employers, a PBM would pay each pharmacy that filled prescriptions for that sponsor's employees. For their service of managing these payments, PBMs charged a fee. This served as their only source of revenue. By the 1980s, PBMs were providing claims management and volume purchasing services for government programs and large corporations to control pharmacy benefit expenditures (Shulman 1998). Inflating drug prices in the 1980's prompted

more sponsors to hire PBMs to manage their benefits. The prosperity of PBMs at this time was due to both an increase in demand for their services but also an increase to their operational efficiency as they began to process claims electronically with the advancements in computer technology. PBMs further facilitated networking among pharmacies, improving communication and running software to monitor patient safety through drug interactions and allergies, along with detecting potential drug overdoses before the medication was dispensed to patients (Rentmeester & Garis 2008). Their involvement later extended to utilization review functions and mail-order prescription dispensing. In the 1990s, their influence continued to grow, including a range of clinically oriented services that influenced prescriptions and had profound impact on pharmaceutical access for patients (Shulman 1998). Throughout the 1990s and 2000s, PBMs started generating profit in ways other than charging administration fees to employer-sponsors.

Formularies & Rebates

In 2016, 78 percent of prescription claims were processed by the three largest PBMs: Express Scripts, CVS Health, and OptumRx (NCPA to Congress 2016). Mergers and acquisitions continue to transpire but these three PBMs reported covering over 180 million Americans. A group of smaller PBMs, comprising an estimated 10% of the market, have a more transparent model in which they receive a flat administrative fee for each prescription and disclose what they are paying (Eban & October 2013). PBMs work through formularies or lists of drugs which a plan sponsor will provide insurance coverage for, with usually one or two preferred drugs included in each therapeutic category. Preferred drugs are included over similar drugs in their therapeutic class. Ideally, PBMs and plan-sponsors (like employers or state Medicaid programs) collaborate on the creation of these formularies, which are used as a reference list of drugs covered by their benefit plan (Rentmeester & Garis 2008). In reality, PBMs have significant discretion in the design of these formularies and are looked towards for advice about the most cost-effective selections. For example, a PBM might choose Aciphex as a preferred product to treat acid reflux instead of other proton pump inhibitors like Nexium, Pepcid, Protonix, Prevacid and Zantac. PBMs work simultaneously to maximize market share for drug manufacturers and to administer employee's pharmacy benefits for employers. Pharmacies purchase the drugs that are dispensed to patients, plan-sponsors pay for those dispensed drugs, and PBMs mediate those payments from plan-sponsors to pharmacies. Formularies allow PBMs

to increase purchase volume of select drugs, which maximizes their opportunities to obtain rebates from manufacturers (Rentmeester & Garis 2008). Obtaining the preferred drug label on a formulary is critical for the success of drug manufacturers. PBMs either charge their payers per transaction or through flat administrative fees per member per month (PMPM) (Garis et al. 2004). The flat administrative fee provides a level of predictability, as these charges are not modified from month to month. PBMs receive other revenues through rebate contracting with drug companies, spread pricing, selling data, and owning a mail-order pharmacy.

A rebate is a price discounting strategy for pharmaceutical manufacturers where money is returned to a purchaser by a seller after a sales transaction (Kreling 2000). The rebates are often based on a percent of the value, or manufacturer's transaction price, of a drug dispensed. PBMs usually negotiate the rebates for drug plan payers, which can result in a 4-20% saving from the average manufacturer price (Garis et al. 2004). PBMs profit from these rebates by charging administrative fees. Of these fees, flat rebates pay the PBM the same percent rebate for every unit of a product, whereas performance rebates provide a PBM with larger compensation for greater use by patients whose benefits they manage. While rebates can produce savings for overall costs, they also maintain a focus on newer and generally more expensive drugs which can reduce the emphasis on more cost-effective options (Kreling 2000). In addition, PBMs have been scrutinized for not disclosing rebate dollars that they withheld from payers, with lawsuits revealing that Medco Health Solutions kept more than $2.8 billion in drug manufacturer rebates between 1995 and 1999 like Merck and Pfizer. Worse, PBMs made deals with pharmaceutical manufacturers to promote prescriptions of their most expensive drugs (Fritz 2002; Freudenheim 2003). Prescription plans typically require patients to share in the costs through copays and deductibles. These cost-sharing mechanisms are often applied to the retail price for prescriptions and in recent years there has been an increase in invoice prices for patients coupled with a ten-fold increase in manufacturer rebates to PBMs between 2011 and 2015 (Goldberg 2015).

PBMs argue that fully disclosing their financial arrangements would weaken their power to negotiate rebates and discounts, however, analysts contend that decisions to include preferred drugs on formularies are based heavily on rebate maximization (Freudenheim & Pear 2003). Manufacturers for competitive drug classes are especially willing to rebate PBMs to ensure their drug's spot on the formularies. Neither the rebate amounts manufacturers pay to PBMs, nor the proportion of those total rebates that are ultimately paid to the plan-sponsor, are disclosed to the

plan-sponsor. Since they represent so many health plan participants, PBMs possess vast market power that can be used to obtain discounts from drug manufacturers (Krulwich 1995).

Spread Pricing

In simplest terms, spread pricing is when the PBM charges health plan-sponsors a higher price for a drug than the PBM pays the dispensing pharmacy for that same drug (Garis & Syed 2003). Spread pricing mainly occurs with generic drugs, particularly those with multiple distributors, as they have widely different net and list prices (Rentmeester & Garis, 2008). More specifically, a spread can occur as a result of the difference between a drug's Average Wholesale Price (AWP) and the drug's maximum allowable cost (MAC), which is much lower than the AWP. MAC lists are the maximum amount, or upper limit, that a PBM will pay for generic drugs or brand name drugs with generic alternatives available (NCPA 2012). A spread occurs for a particular drug when the PBM bills a plan-sponsor with a large discount off the drug's AWP and then pays the pharmacy the much lower MAC while taking the gap in between as profit. Spreads up to $200 have been found for a single prescription of Ranitidine 300 mg, where the PBM billed the health plan $215 for a prescription purchased from a pharmacy for $15 (Garis & Clark 2004). Problematically, spread pricing obscures the actual cost of a PBM's service.

Mail-Order Pharmacies & Transparency

Another revenue stream for PBMs are mail-order pharmacies, which they use to manage prescription drug costs. Patients who require repeated refills, due to chronic conditions, can obtain discounts from the 90-day prescriptions that mail-order pharmacies offer (Federal Trade Commission 2005). PBMs have maintained that they have better control over the drugs offered through their own pharmacies and, hence, can deliver superior formulary compliance. Critics allege that this creates a conflict of interest by providing PBMs additional opportunities to increase their own profits by avoiding generic substitution and switching to more expensive brand-name drugs with higher rebates (Green 2008). Indeed, Langenfeld and Manes (2003) project that such a conflict of interest could cost Medicare beneficiaries and the US government $30 billion from 2004-2013. Nevertheless, a 2005 report by the Federal Trade Commission came to a different conclusion: the average total prices in 2002 and 2003 were higher at the mail-order pharmacies not owned by large PBMs.

The current lack of transparency for the largest three PBMs raises alarms for spread pricing. According to the National Community Pharmacists Association's (NCPA) address to Congress in 2016, if health plan-sponsors knew the amount of money that is being made by PBMs then they could better negotiate competitive contracts with these vendors. Another transparency issue is the lack of a standardized method for determining pharmacy reimbursements for generic drugs. Considering the PBM profit-structure of reimbursements, pharmacies may be skeptical of how PBMs decide which drugs to place on their formularies. Not only are pharmacies unaware of how drug products become preferred, they also are kept in the dark on how prices are determined and updated (NCPA 2016).

Due to the largest PBMs having great influence over the health plans of millions of patients, PBMs have disproportionate market power in negotiating contracts with small business pharmacies. If they want to continue to serve their patients, these community pharmacies might have to accept unfavorable deals with large PBMs. Also, PBMs directly set the reimbursement rates for retail pharmacies, which are in competition with the PBMs' mail-order pharmacies. Given the large role PBMs play in the pharmaceutical market, it comes as a surprise that they are not subject to the same type of comprehensive regulation required of health insurers, and lack national regulations specific to their industry.

Although PBMs have existed since the 1960's, the mechanisms by which PBMs earn profits—and their effects on drug prices—have only recently captured the attention of Congress (Dickerson et al. 2016). On March 1st, 2017 Rep. Doug Collins (R-GA) led a hearing proposing the MAC Transparency bill to increase transparency of PBMs in the reimbursement of generic drugs to pharmacies (Cong. Rec. H1449). Rep. Dave Loebsack (D-IA) explains that the bill will increase transparency in three ways: 1) PBMs will provide pricing updates at least once a week, 2) PBMs will disclose the sources used to update maximum allowable costs (MAC), and 3) PBMs will notify pharmacies of drug price changes before they can be used as a foundation for reimbursement (Cong. Rec. H1449). This bipartisan bill demonstrates the growing perception that large PBMs play a substantial role in rising prescription drug prices in the United States, and that Congress is prepared to challenge every stage in the drug supply chain to combat these price increases.

Mergers

Since the 1990's, there has been rapid growth and consolidation through both vertical and horizontal integration in the PBM industry. A particularly controversial example of integration was the merger between the pharmaceutical manufacturer Merck and the PBM Medco, when Medco's formularies substantially increased their representation of Merck's drugs while the negotiations of the merger were still in progress (US General Accounting Office 1995). In 1998, the FDA issued a draft guidance (which represents the current thinking of the agency) to prevent the release of misleading or false communications by subsidiary PBMs owned by pharmaceutical manufacturers (Lipton et al. 1999). The American Medical Association (AMA) supported the FDA's decision, but many others criticized their approach. Pharmaceutical manufacturers, PBMs, and employers contended that it was an overly broad response that would prevent PBMs from using rebates and discounts, because these activities could be interpreted as pharmaceutical promotions. Finally, the FDA rescinded its draft guidance, noting that the relationships between PBMs and pharmaceutical manufacturers are more complicated than the agency previously thought (Lipton et al. 1999). In September of 2018, federal regulators approved the health insurer Cigna's $52 billion acquisition of the last stand-alone major PBM, Express Scripts (Demko et al. 2018). Additionally, in 2018, the Justice Department approved CVS Health's $69 billion acquisition of Aetna (Abelson 2018).

Challenges from Market Adversaries

According to the National Community Pharmacists Association (NCPA), pharmacies have limited to no options to protect against abuses from PBMs. In response, states have begun to require PBMs to become registered or licensed with the state department of insurance or board of pharmacy to provide the state more oversight authority over PBMs. In addition, PBMs audit pharmacies to detect improper payment on behalf of the plan or consumer and to ensure that the correct medication and dose were administered. Problematically, PBM auditors can go beyond detecting fraud, waste, and abuse and instead focus on administrative or typographical errors which they can then use to regain money from the pharmacy. Even more, MAC lists are lists of products determined by PBMs that indicate the maximum amount the plan will pay for generic drugs and brand-name drugs with generic alternatives. Due to a lack of standardization in the industry regarding criteria for drug inclusions, a PBM can freely pick and choose products for

their list. PBMs can use these lists to reimburse low and charge high, leading to spread pricing. This means that pharmacies end up signing contracts without knowing how they will be paid. Accordingly, states have introduced MAC transparency legislation to provide standardization and clarity about how pricing is determined. This transparency legislation also weakens the bargaining power of PBMs by showing their hand to pharmaceutical manufacturers when negotiating placements on their formularies.

CHAPTER 2

THE PRINCIPAL-AGENT PROBLEM: CONTRACTING WITH PBMS

Introduction

The purpose of this chapter is to evaluate the association between PBM formularies and pharmaceutical costs by analyzing the drugs included on their yearly national formulary plans and the weekly National Average Drug Acquisition Cost (NADAC) of these drugs. In doing so, this chapter characterizes the connection between health plan-sponsors and PBMs as a principal-agent relationship. As a result, this chapter provides insight into the least regulated aspect of the pharmaceutical supply chain in the United States.

The advantage of agency theory is its capability of exploring problems in which information is unequally distributed between the agent and the principal or when directly observing the agent's activities is not feasible (Scrapens 1991). Agency theory posits that a firm consists of contracts between the owners of economic resources (principals) and managers (agents) who are tasked with controlling and administering these resources (Adams 1994). When a plan-sponsor hires a PBM to bargain on their behalf and manage the prescriptions of their employees, the plan-sponsor is the principal and the PBM is their agent. Moreover, agency theory is based on the premise that agents have access to more information than their principals and that this information asymmetry negatively affects the principals' ability to monitor whether their interests are being served by their agents (Adams 1994). If the principal cannot directly observe or infer the agent's activities, and if their incentives are not properly aligned, then the agent might not act in the principal's interests (Swanson & Weissert, 2017). Another type of agency problem is adverse selection (Adams 1994). A principal that does not have access to all the information available to the agent cannot know whether the decisions made by the agent were appropriately selected or whether the agent has taken advantage of them (Scrapens 1991). Furthermore, if an agent is isolated from risks then they have an incentive to behave recklessly at the expense of the principal. This problem is referred to as moral hazard (Vera-Hernandez 2003). Both adverse selection and moral hazard are the result of information asymmetries.

Only the PBM has full understanding of the costs between the various actors involved in prescription plans (Garrett & Garis 2007). This is the result of the PBM acting as the middleman

in obscure transactions involving pharmacies, pharmaceutical manufacturers and plan-sponsors. This unique information of the PBM coupled with the lack of transparency in these transactions leads to information asymmetries, giving the PBM leverage in its interactions. I argue in this chapter that PBMs use their massive information advantages over plan-sponsors to act as imperfect-agents that select preferred and excluded drugs based on rebate maximization. This chapter takes a macroscopic look at national formularies to look for a relationship between pharmaceutical costs and formulary status. Without the ability to observe the exact formularies that a particular plan-sponsor operates under, I am not making direct causal-claims. Instead, I am evaluating the association between national formularies and prescription drug costs to estimate trends in drug costs related to preferred versus excluded status.

Empirical Strategy

This study examines the claim that pharmacy benefit managers contribute to rising pharmaceutical costs in the United States. Accordingly, I hypothesize that receiving the preferred status on a formulary increases the National Average Drug Acquisition Cost per unit of a given drug. While nominally aiming to reduce drug costs, PBMs profit more from larger rebates and higher prices which incentivizes them to act as imperfect agents. PBMs further develop the formularies that decide what drugs will be reimbursed to which patients, which gives them negotiating power over pharmacies and pharmaceutical manufacturers. I refer to this as the *Market Power Hypothesis*. However, PBMs are unable to leverage their market power in situations in which there are no in-class competitors for a drug. Thus, I hypothesize that when all three of the PBMs prefer the same drug on their formularies then the National Average Drug Acquisition Cost per unit of that given drug will decrease. Mainstream drugs enjoy massive economies of scale that contain costs independent of PBMs. These drugs are included on formularies due to either their overwhelming popularity or lack of competition in their class. When each PBM covers the same drug, they lack the ability to act as independent price manipulators. I refer to this as the *Dominant Drug Hypothesis*.

This study conducts multiple regression analysis to estimate the influence of PBM formularies on National Average Drug Acquisition Cost for pharmacies, controlling for time trends, and treating the individual drugs as fixed effects to control for time invariant

characteristics of the drugs. In doing so, this analysis can evaluate the change in cost for a particular drug when its formulary status shifts between excluded and preferred.

Pharmaceuticals span a wide range of treatments and can vary substantially in price, and therefore, comparisons should only be made within a particular drug. Furthermore, given that drug prices in the United States have varied over time, this trend needs to be taken into account to ensure that time effects are not being interpreted as a relationship between PBM formularies and NADAC prices.

The primary explanatory variables of interest are formulary status for each major PBM: Express Scripts, CVS Caremark, and OptumRx. This results in three binary variables, Express Formulary, CVS Formulary, and Optum Formulary. For example, Express Formulary equals 1 if the drug has the preferred status on the Express Scripts formulary and 0 otherwise. In addition, a binary variable, All Formulary, represents the situation in which a drug has the preferred status on each formulary for a given year.

Data

Weekly drug cost data are obtained from the National Average Drug Acquisition Cost (NADAC) provided by the Centers for Medicare and Medicaid Services. NADAC was developed as an improvement to the Average Wholesale Price (AWP) or Wholesale Acquisition Cost (WAC) used by state Medicaid programs to reimburse pharmacies (Health Industry Washington Watch, 2016). This information reflects the costs that pharmacies incur from acquiring drugs and is valuable in analyzing the relationship between formularies and pharmaceutical costs. Data are also collected from the yearly national formulary and exclusion lists of the top PBMs. National formularies come into effect on January 1st each year. A binary variable for each PBM indicates whether a drug is on that particular formulary for the given year. The drug classes selected are those that are included on the formulary and exclusion lists of Express Scripts, CVS Caremark, and OptumRx for the observed time period. The specific drugs included in the study are those with the preferred status on the formularies in the selected drug classes along with those that are specified as excluded in those same classes.

Results

The NADAC data starts from 11/28/2013 and this analysis uses data from 01/01/2014 to 08/30/2017, to align the NADAC data with the yearly formularies. I compare the National Average Drug Acquisition Cost for a drug under preferred status on a formulary with the NADAC of that same drug when excluded from the formulary. As presented in Table 2.1, though PBMs are hired by sponsors to bring prices down, in fact the per unit NADAC for a drug is on average higher under the preferred status of each observed PBM, holding all else equal. For Express Scripts, preferred status results in an average increase of $1.1268 per unit, compared to cases in which each PBM has a drug under preferred status. CVS Caremark's formulary has a substantively larger effect, resulting in an increase of $7.8717 per unit. Finally, preferred status on the OptumRx formulary results in a $1.9802 increase in the NADAC per unit. In addition, when all the PBMs studied give preferred status to the same drug, the NADAC of that drug decreases by an additional $4.8476 per unit. Given that the sum of the formulary increases minus the All Formulary coefficient is $6.1311, this still reflects an increase in the NADAC per unit. From these results, the national formularies appear to be unsuccessful in containing pharmaceutical costs.

Table 2.1: Unanimous Status Model: Influence of PBM Formularies on NADAC

Predictor	Estimate	Standard Error
Express Formulary	1.1268***	0.5313
CVS Formulary	7.8717***	0.0662
Optum Formulary	1.9802***	0.0977
All Formulary	-4.8476***	0.0813
Date	0.0015***	0
Constant	-27.4363***	0.5313
Adjusted R^2	0.9754	

Note: N= 137108. *** = p < 0.001, ** = p < 0.01, * = p < 0.05. Fixed effects are omitted for readability.

The second model excludes the predictor for unanimous formulary status among the PBMs (Table 2.2). In doing so, the OptumRx formulary, the smallest of the three PBMs, entirely loses its significance in predicting changes to the NADAC. Even more, the estimated effect of the CVS Formulary on NADAC per unit increases to $10.1695. The estimate of the Express Scripts formulary decreases to $0.4265 but remains positive. This model provides more evidence that

the national formularies of the top PBMs may have an influence on rising drug prices in the United States.

Table 2.2: Influence of PBM Formularies on NADAC

Predictor	Estimate	Standard Error
Express Formulary	0.4265***	0.1137
CVS Formulary	10.1695***	0.2125
Optum Formulary	0.0013	0.1343
Date	0.0017***	0
Constant	-32.485***	1.2961
Adjusted R^2	0.9748	

Note: N= 137108. *** = p < 0.001, ** = p < 0.01, * = p < 0.05. Fixed effects are omitted for readability.

Discussion

According to these findings, preferred drug status on the national formularies of Express Scripts, CVS Caremark, and OptumRx are associated with increases in the National Average Drug Acquisition Cost, suggesting that the largest PBMs act as imperfect agents. This provides evidence for the *Market Power Hypothesis* that when PBMs have market power they are incentivized to negotiate for higher rebates, which raises the costs of acquiring drugs for pharmacies. The situation in which each PBM prefers the same drug may be reflective of a dominant drug in the market. PBMs face pressure to cover popular drugs which also experience large economies of scale. In this case the PBMs lose leverage. Unlike the case presented in Chapter 1 of Turing Pharmaceuticals, Retrophin, Valeant Pharmaceuticals International, and Rodelis Therapeutics, that serve a relatively small market for rare conditions, pharmaceutical manufacturers appealing to a broad market are incentivized to keep costs down to remain competitive and enjoy their large market share.

There are reasons for caution when interpreting these results. For one, there is potential for reverse causation. The primary role of PBMs is to use their market power to negotiate the lowest price from pharmaceutical manufacturers. Thus, an argument can be made that when drugs become more expensive, they are more likely to be put on a formulary to drive the cost down. However, PBMs make the case that they use their exclusion lists to remove the most expensive alternatives from their formularies in order to provide the cheapest alternative for their customers, rather than attempting to contain the costs of the most expensive prescriptions in a

drug class. These results find that a drug is on average costlier when receiving the preferred status and less costly when excluded from a formulary. This provides evidence that PBMs are maximizing rebate revenue at the expense of drug costs by negotiating with manufacturers to give preferred status to their drug. A theoretically stronger argument for reverse causation is that drug prices are lower when a drug is unanimously preferred because it is the cheapest and most popular alternative in its class. PBMs must cover these popular drugs to remain competitive and keep purchasers on their plans. These drugs will reduce in price even while receiving the preferred status because they are experiencing large economies of scale, but they appear to be going down in price as a result of their preferred status. Problematically, this design cannot settle that dispute. Further research can account for the market share of each drug to identify the point at which the power for price control shifts between PBMs and pharmaceutical manufacturers.

Ultimately, the perverse incentives of PBMs suggest multiple pathways for their influence in pharmaceutical costs. While aiming to reduce drug costs, PBMs profit more from larger rebates and higher prices. Additionally, the practice of spread pricing artificially raises the cost of prescription drugs. PBMs further develop the formularies that decide what drugs will be reimbursed to which patients, which gives them negotiating power over pharmacies and drug manufacturers. Even more, many PBMs control their own mail-order delivery pharmacies which means they are negotiating the prices of drugs that they themselves are distributing (Garis et al. 2004). Nevertheless, previous research—which has been based primarily on data generated by PBMs—suggests that PBMs are successful in reducing the rate of drug cost increases for their clients (Lipton et al. 1999). Other research has been primarily descriptive rather than empirical. This study provides insight into the least regulated aspect of the pharmaceutical supply chain and raises questions about the incentives of PBMs and their performance in cost containment by evaluating the relationship between the national formularies of the top PBMs and the costs of acquiring drugs for pharmacies.

CHAPTER 3

THE FOX GUARDING THE HENHOUSE: PHRMA LOBBYING FOR PBM REFORM

Introduction

To gain a market advantage, I argue that pharmaceutical manufacturers used their state-level influence to rein in the power of PBMs. This chapter models the influence of an interest group, the Pharmaceutical Research and Manufacturers of America (PhRMA), on the adoption of PBM regulatory policies by state governments from 2000-2013. Interest group efforts are measured as the campaign contributions from PhRMA to political candidates for state offices. Using a Cox proportional hazards model, support is found for the influence of campaign contributions on the yearly risk of a state adopting legislation that limits the business practices of PBMs.

Issue-Framing, Interest Groups & Federalism

Policies can be complex, resulting in uncertain benefits. Political leaders often rely on specialists for technical information regarding the effects of any given change in policy (Baumgartner et al. 2006). However, politicians do not need help from technical specialists when deciding to be on the side of their party or if they want to support or oppose a policy being promoted by a colleague, the President, or by a key committee chair. While partisanship matters tremendously, it does not determine all policy outcomes. Indeed, the way interest groups frame a policy debate can have a significant impact on legislation (Baumgartner et al. 2009; Klüver et al. 2015). Interest groups frame issues by strategically communicating and promoting definitions and arguments in order to influence policy decisions (Baumgartner et al. 2008; De Bruycker 2017). Entman (1991) describes frames as "selecting and highlighting some features of reality while omitting others." The Pharmaceutical Research and Manufacturers of America (PhRMA) have framed the pharmaceutical costs debate by emphasizing the role that other actors in the pharmaceutical supply chain—PBMs—play in contributing to rising drug costs. The Executive Vice President of Public Affairs at PhRMA, Robert Zirkelbach, wrote: "PBMs nearly quadrupled the fees they charge biopharmaceutical companies – such as administrative and service fees –

between 2014 and 2016" and "these fees – which are typically based on the list price of a medicine – contribute to a system of misaligned incentives where middlemen make more money when the list price of medicines increase" (2019). This is an example of what Druckman (2004) refers to as emphasis framing: emphasizing one part of an issue over others (De Bruycker 2017). Issues relating to the pharmaceutical supply-chain are especially interesting for issue-framing as they are highly complex and do not clearly fall into party platforms.

Following both Lowi's (1979) concept of 'interest-group liberalism', and Olson's (1965) analysis of mobilization, interest groups play a major role in the development of public policy, particularly regarding health policy (Weissert & Weissert 2012). PhRMA, the drug industry's main trade group, has spent nearly $8.1 million on lobbying in the first quarter of 2017, ranking third among top lobbying spenders in the United States (Almashat 2014; Balcerzak 2017). One avenue that the pharmaceutical lobby takes to influence policymaking is through the use of direct contributions to individual politicians, which in 2016, amounted to $14 million to congressional candidates (The Center for Responsive Politics). Moreover, pharmaceutical manufacturers have attempted to shift the blame of high pharmaceutical prices in the United States towards PBMs, who threaten their profits (Herman 2017).

Outside of lobbying, PhRMA regularly monitors legal issues and cases that have significant impact on the pharmaceutical industry—e.g. *Astra USA, INC., et al. v. County of Santa Clara*, 2011; *Merck & Co., Inc. v. Reynolds*, 2010; *eBay Inc. v. MercExchange L.L.C.*, 2006 (Counsel for Amicus Curiae PhRMA, 2010). From ensuring a fair patent system to challenging the power of states to regulate drug prices, court decisions have far-reaching implications on the activities of the pharmaceutical industry. PhRMA goes to court to constrain state actions that could harm the profits of the pharmaceutical industry (Weissert & Weissert 2012). For instance, in the Supreme Court case *PhRMA v. Walsh* (2003) PhRMA challenged Maine's state law that made pharmaceutical manufacturers sell their products at the Medicaid price in non-Medicaid transactions. PhRMA argued that this state law would influence the federal Medicaid pricing system, thereby making it a federal issue. Interestingly, after the court ruled in favor of state laws, PhRMA turned back to Congress to take away state drug purchasing power through the passage of the MMA (Weissert & Weissert 2012).

In response to the problem of high pharmaceutical costs, PhRMA has attempted to shift the blame onto other actors in the pharmaceutical industry. In April of 2017, PhRMA launched a

campaign titled “Share the Savings,” which attempts to educate the public and question why patients do not receive a share of the payer-negotiated cost savings that PBMs offer. The interest group representing PBMs, the Pharmaceutical Care Management Association (PCMA), responded by stating “This latest campaign is an attempt to deflect blame for high drug prices onto the employers, unions, and insurers that struggle to provide affordable coverage. It’s a losing strategy” (Bulik 2017) The PCMA instead proposed that a shortened biologic exclusivity period, more biosimilar medications, and higher levels of generic competition could reduce drug prices (Sagonowsky 2017).

Across many regulatory policies, the national government sets broad parameters while state governments respond as the implementing agents (Gerbe & Teske 2000). Unlike other components of the pharmaceutical supply chain, PBMs have avoided any targeted national legislation and have instead been regulated at the state-level. Only recently have PBMs garnered attention at the national level during the MAC transparency Congressional hearing in 2017, which has yet to materialize into enacted legislation. This is an example of what Shipan & Volden (2006) refer to as bottom-up federalism, where policies diffuse vertically from one level of government up to another. By taking a state-level approach to policy change, PhRMA was able to draw national attention to technically complex policies. Drawing from Olsonian logic, political power imbalances are theoretically worse at the state-level, in favor of business groups. Moore & Giovinazzo (2012) refer to this power imbalance as the incongruity between interest groups and voters, however, in the case of PBM regulations, this incongruity is between a middleman in the pharmaceutical supply chain (PBMs) and the producers (pharmaceutical manufacturers). Interests groups have multiple pathways to influence public policy, including mobilizing the electorate, financing campaigns, going to court, and lobbying (Potters & Sloof 1996). As such, there are many ways to conceptualize interest group activity. For instance, Gray & Lowery’s top-down energy, stability, area (ESA) model relies on the number of lobby registrations by state to represent interest group influence. This chapter conceptualizes interest group pressure as the campaign contributions from PhRMA to political candidates for state offices.

With this approach, campaign contributions are treated as investments to receive favorable policy because money is valuable to candidates to both run their campaign and attract voters. A potential problem with this characterization is simultaneity bias; if the interest group

primarily donates to state-level policymakers who have similar views, then the impact of the money on the policymaker can be overestimated. Nevertheless, considering the complexity of PBM regulation, and the lack of party platforms addressing this issue, it is unlikely that candidates have a strong viewpoint on this policy before receiving campaign contributions.

Diffusion and Innovation

Building off Berry & Berry's (1990) state lottery adoption model, I use a survival model to estimate the risk of policy adoption. The model for this chapter asks: given that a state has not adopted a PBM regulation by time *t*, what is the risk that it would adopt a regulatory policy during time *t* (Jones & Branton 2005)? The diffusion literature addresses similar questions of policy adoption but relies on communication between state actors. Policy learning between states describes interactions between policymakers as the motivator for diffusion (Kile 2005). A central component of the state diffusion literature is that political actors actively seek new policy information or innovations (Haider-Markel 2001; Shipan & Volden 2012). State policy innovation and diffusion research primarily focuses on regional diffusion and internal determinants (Berry & Berry 1990). The regional diffusion model of policy innovation suggests that as each state adopts the policy, other nearby or regional states become more likely to adopt. In contrast, the internal determinants model suggests that the internal characteristics of states determine policy adoptions (Berry 1994). Policy entrepreneurs also participate in information networks and facilitate communication among policymakers in particular areas (Mintrom 1997). Another important consideration is how organizations outside the state can contribute to national information networks and policy decisions (Hale 2011). Interest and advocacy groups can influence diffusion by providing state officials with opportunities to learn about developments in their policy area and by formulating foundations for policy development (Balla 2001). In contrast to policy networks, advocacy coalitions and interest groups are not solely comprised of policy experts and are concerned with broad political outcomes across the states (Sabatier & Jenkins-Smith 1993; Mintrom 1997). Rogers (1983; 2003) conceives of diffusion as a process through which innovation spreads over time through certain channels among members of a social system. For the purposes of this chapter, the American states are treated as the social system, with interest group efforts of PhRMA being the channel of communication used to push for legislation that advantage pharmaceutical manufacturers by weakening the bargaining power of PBMs.

PBM Policy Adoption

The legislation chosen for this analysis reforms the business practices of the PBM industry in ways that are intended to limit the market power of PBMs. Although the states vary considerably on the provisions in each of these laws, they can be broken down into four broad categories: regulation, transparency, licensure, and fair pharmacy audits. Figure 3.1 and Table 3.1 below depict the states that have adopted at least one policy that falls under one of these categories between 2000 and 2013.

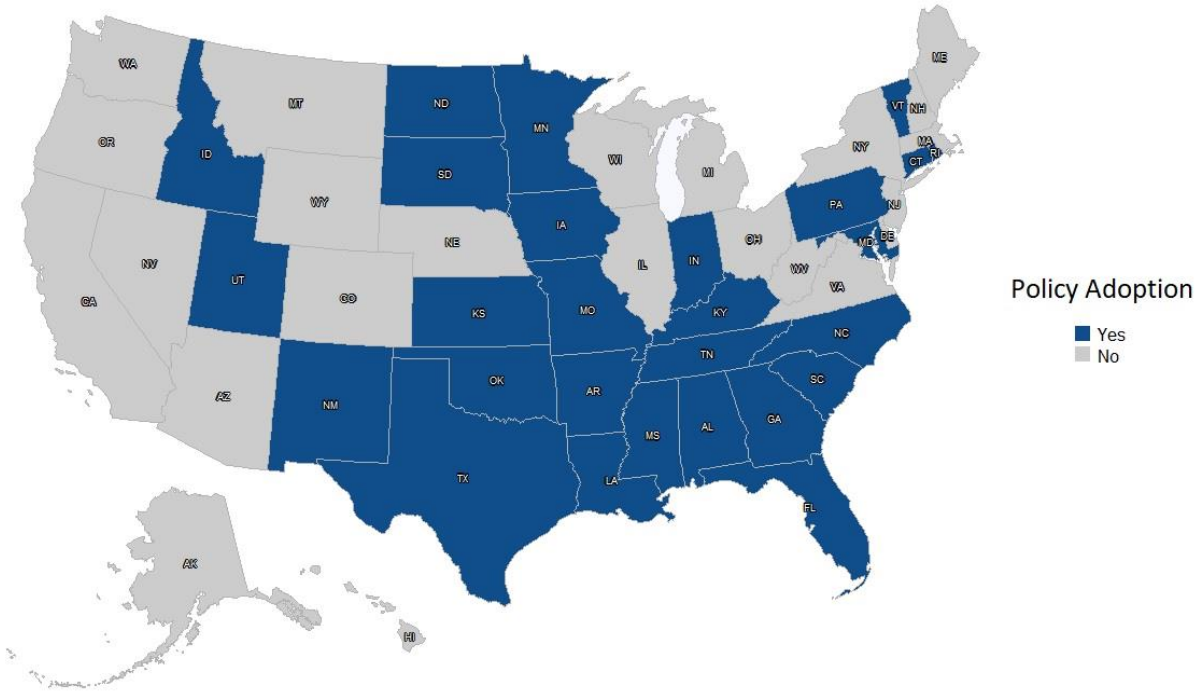

Figure 3.1 PBM Policy Adoption by State, 2000-2013

Table 3.1 Policy Adoption by State, 2000-2013

State	Legislation	Description	Effective Date
GA	Title 26, Chapter 26-4.110.1	PBM Licensure	5/22/2002
MD	Title 15, Subtitle 10B, Section 15-10B-20	PBM Regulation	5/13/2003
RI	Title 27 – Insurance Chapter 27-29.1	PBM Regulation	7/5/2004
SD	Chapter 58-29E	PBM Regulation	3/9/2004
ND	Chapter 26.1-27	PBM Regulation	8/1/2005
KS	Chapter 154	PBM Registration	4/28/2006
MS	Title 73 – Chapter 21– Sections 73- 21-151 – 73-21-159	PBM Regulation	6/30/2006
AR	Title 17, Chapter 92, Section 17-92-1201, et.seq.	Fair Pharmacy Audit	4/3/2007
NM	Chapter 61 – Article 11 61-11-18.2	Fair Pharmacy Audits	7/1/2007
TN	Titles 56 and 63	Fair Pharmacy Audits	7/1/2007
VT	18 V.S.A. Chapter 221, Sections 9421, 9471 – 9473	PBM Regulation	7/1/2007
CT	Public Act No. 07-200	PBM Registration	1/1/2008
IA	Title XIII Commerce	PBM Regulation	1/1/2008
OK	Title 59, Section 356	Fair Pharmacy Audits	11/1/2008
KY	KRS Chapter 304, Subtitle 17A, Sections 1-5	Fair Pharmacy Audits	3/24/2009
MO	Chapter 338 Pharmacists and Pharmacies Section 338.600	Fair Pharmacy Audits	8/1/2009
TX	Chap. 2158, Subchapter H	PBM Regulation and Mail Order	9/1/2009
FL	465.188 Medicaid audits of pharmacies	Fair Pharmacy Audits	1/16/2011
NC	Ch. SL 2011-375	Fair Pharmacy Audits	6/27/2011
UT	49-20-501; 49-20-502; and 49-20-503	PBM Regulation	3/21/2011
AL	Act No. 2012-306, S.B. 383	Fair Pharmacy Audits	8/1/2012
ID	Indiana Code 25-26-22	Fair Pharmacy Audits	7/1/2012
MN	Amendment to Minnesota Stature 151: Pharmacy Sections [151.60] – [151.70]	Fair Pharmacy Audits	8/1/2012
PA	S.B. 201	Anti-Mandatory Mail Order	11/1/2012
LA	Act 856- RS 22:1856.1	Fair Pharmacy Audits	1/1/2013
SC	Title 38 Section 1, Chapter 71 of the 1976 Code	Fair Pharmacy Audits	1/1/2013

Regulations are the most general category of these laws and include requirements for PBMs to follow guidelines on how drugs can be substituted (North Dakota; Chapter 26.1-27, 2005), to be subjected to examinations by the state insurance department (Maryland; Title 15, Subtitle 10B, Section 15-10B-20, 2003), and even "to perform its duties exercising good faith and fair dealing" (Iowa; Title XIII Commerce, Chapter 510B.1 – 510B.9, 2008). Drug substitution guidelines prevent PBMs from pitting pharmaceutical manufacturers who compete in the same therapeutic class against each other and requires PBMs to make their preferred drug decision based on objective factors, like costs to the patient and ease of use (instead of the rebates the PBM could receive from the manufacturer).

Transparency legislation requires PBMs to disclose data relating to drug costs, rebates, and fees obtained from their clients (Arkansas; Code Title 9 Chapter 88 Sec. 801-804, 2009). By forcing PBMs to disclose sensitive financial information, this legislation can severely limit the ability of PBMs to negotiate with pharmaceutical manufacturers. Manufacturers can observe the deals a PBM gives to others and demand to receive the same arrangement, limiting the bargaining power of PBMs and granting leverage to manufacturers.

Licensure legislation develops a more structured path for PBM oversight and enforcement by requiring them to register as a third-party administrator (Iowa; Title XIII Commerce, Chapter 510B.1 – 510B.9, 2008). In particular, Mississippi adopted legislation that gave the state's Board of Pharmacy regulatory authority over PBMs, resulting in the legislative consideration in several other states (Mississippi; Title 73 – Chapter 21– Sections 73- 21-151 – 73-21-159, 2006).

PBMs conduct audits of pharmacies and can fine pharmacies that make errors in their record keeping and/or dispensing of drugs. Notably, a PBM can require that a pharmacist withhold information about a drug from a patient if that drug is not on the PBM's plan. In some cases, fair pharmacy audit legislation removes this liability and allows pharmacists to educate patients on alternative drugs that their plan does not cover. Alternatively, fair pharmacy audits can require the auditor to consult with a licensed pharmacist to make claims (Missouri, Chapter 338 Pharmacists and Pharmacies Section 338.600, 2009).

Empirical Strategy

Data & Methods

To capture the characteristics of candidates in state elections, I rely on a combination of PhRMA contributions records from 1998-2010 (reported by followthemoney.org) and a subset of the ICPSR State Legislative Election Returns from 1998-2010 (Klarner et al. 2013). The PhRMA contribution records provide data on the characteristics of candidates running for state office that received campaign contributions from PhRMA, along with the total amount received and a count of the number of contributions received. Klarner et al.'s (2013) ICPSR State Legislative Election Returns fills in the data for candidates of state offices that did not receive contributions from PhRMA and provides the margin of the vote received by each of the candidates running for state office (including those that received contributions from PhRMA). These datasets are matched and cleaned to have the full range of variables for each candidate. In addition, the real state gross domestic product (GDP) for each year is taken from the Bureau of Economic Analysis of the United States Department of Commerce to reflect the size of the economy in each state for each point in time. The outcome variable, state adoption of a PBM legislation, was pulled from a legislative lookup database (legiscan.com) along with validating legislation tracked by the National Community Pharmacists Association (NCPA). The primary hypothesis of this chapter is as follows:

H1: An increase in campaign contributions by the Pharmaceutical Research and Manufacturers of America (PhRMA) in a state increases the likelihood that the state adopts legislation that constrains the marketing practices of PBMs.

A limitation to using campaign contributions to represent interest group activity is that PhRMA was concerned with a wide range of policies during the period studied, which makes it difficult to know what the contributions were meant to accomplish. In particular, PhRMA supported the Patient Protection and Affordable Care Act (ACA) and lobbied to ensure that no price controls were included in the legislation. Indeed, President Obama commented that "the pharmaceutical industry, oppose any change to drug pricing, no matter how justifiable and modest, because they believe it threatens their profits" (Obama 2016). Although PhRMA

publicly supported the ACA and contributed to candidates to ensure beneficial provisions in the legislation, the trade group was the second largest contributor to the American Legislative Exchange Council (ALEC), a conservative group that launched their Health Care Freedom Initiative which offered states policy recommendations to oppose the ACA (Clifton 2012). Since the path to influence for Republican-controlled states on the ACA was done through ALEC and not direct contributions from PhRMA, campaign contributions made to Republican candidates at this time are more likely to have been focused towards PBM legislation. Another possible confounder is PhRMA's show of lobbying force in California to defeat a 2005 ballot initiative that would have compelled pharmaceutical manufacturers to offer discounts to 6-10 million Californians (Rau 2005). Jan Faiks, PhRMA vice-president, perceived the initiative "as such a serious threat to the health and welfare of the pharmaceutical industry that we have to make a stand here" (Rau 2005). At the same time, Rhode Island and Washington state were considering legislation to control pharmaceutical prices.

PhRMA has historically had a close relationship with ALEC. PhRMA received ALEC's Private Sector Member of the Year Award in 2011 and became a member of ALEC's corporate board (American Legislative Exchange Council 2011). Despite these close ties, PhRMA not only broke away from ALEC's position on the ACA but also pushed for contradicting policies towards PBMs. In fact, ALEC disseminated a model policy, *Resolution Opposing Government Mandated Disclosure of Proprietary, Trade Secret Information*, that is "in opposition to recent efforts by some state legislatures to mandate that Pharmacy Benefit Managers (PBMs) disclose competitive, proprietary, and trade secret information" (ALEC 2007). The ALEC board of directors reapproved this model policy in 2013 and 2017. In contrast, Stephen Ubl, CEO of PhRMA, stated "Shining a light on opaque PBM practices is a crucial first step… transparency measures also capture the significant fees and administrative costs PBMs often require of biopharmaceutical companies, pharmacies and employers. In addition, we will continue to work with policymakers to advance reforms that ensure PBMs share negotiated savings" (PhRMA 2019). Although PBM legislation has been bipartisan, campaign contributions to state-level Democrats from PhRMA could reflect involvement in confounding policies. Therefore, I predict that campaign contributions from PhRMA better reflect the interest group's efforts to enact policies that constrain PBMs when those contributions are directed to Republicans. That is to

say, the effect of campaign contributions on the enactment of PBM policies will be more apparent among Republicans.

H2: Campaign contributions by the Pharmaceutical Research and Manufacturers of America (PhRMA) to Republican candidates in a state increases the likelihood that the state adopts legislation that constrains the marketing practices of PBMs.

In order to capture the link between campaign contributions and policy outcomes, the percentage of the observed candidate's vote subtracted from the percentage of the winning candidate's vote is included in the analysis (*Winner%Vote-Cand%)*. The importance of this variable is that it equals 0 when the observed candidate won the election, so it represents whether the candidate won or lost. Theoretically, the effect of PhRMA's campaign contributions should disappear in the case that the candidate lost the election. In addition, the severity of the candidate's loss increases the effect of this variable. By interacting *Winner%Vote-Cand%* with partisanship (*Republican*), the effect of a Republican candidate winning the election on the likelihood of policy adoption can be estimated. Finally, campaign contributions are interacted with state *Real GDP* to maintain proportionality of the contributions both across states and across time.

With these variables in mind, a Cox proportional hazards model is developed to estimate the yearly hazard rate, or likelihood of a state adopting a PBM policy at year *t*, given that it has yet to adopt a PBM policy at time *t*. The advantage of a Cox duration model over a logit-probit approach, or even a Weibull duration model, is that the form of the baseline hazard rate is unspecified (Jones & Branton 2005). This semi-parametric approach allows for the covariates to have a multiplicative effect on the hazard function, which can take the form the data suggests rather than being assumed. Due to the limited timespan of the ICPSR State Legislative Election Returns data, information on candidates stops after 2010, so only policies that could have been enacted by candidates in this dataset are considered. Since the data are censored on the same year for each state, this is referred to as Type 1 censoring (Crumer 2011). This means that censoring time is statistically independent of the event time. In this model, there are 98,471 candidates for state office and 26 states that have adopted a PBM policy. By using the candidate as the unit of analysis, this results in 5056 events being analyzed, with events being categorized as a state

adoption of a PBM policy, and the adoptions being matched to candidates in that state who would be in office during this adoption had they won the election.

Results

The first Cox proportional hazards model uses the interaction between *Campaign Contributions* and *Real GDP* as the key explanatory variable for PhRMA's influence on state adoptions. According to this model, when holding *Real GDP* at zero and all other variables constant, a dollar increase in PhRMA's *Campaign Contributions* increases the yearly hazard of adopting a PBM regulation by a factor of 1.0052 or .52%. Although this effect seems small, this model predicts that a mere $100 increase in *Campaign Contributions* results in a 52% increase in the yearly hazard of adopting a PBM regulation. However, holding *Real GDP* at zero is unrealistic, and the negative coefficient associated with both *Real GDP* and its interaction with *Campaign Contributions* demonstrates the higher costs of influencing policy outcomes in states with larger economies. Another interesting finding is that the candidate belonging to the Republican party increases the yearly hazard of adopting a PBM regulation by a factor of 12.47%, when that candidate wins the election (meaning *Cand%Vote-Winner%*= 0). Moreover, if the Republican candidate loses the election, then the effect of party on the yearly hazard of adopting a PBM regulation decreases by .72% for each percentage point of the v2ote share that the candidate lost by (so 12.47%- .72%). For example, if a Republican candidate lost by 17.32% of the vote share, then the effect of the Republican party disappears.

Table 3.2: Dollars Contributed to a Candidate

		Hazard Ratio	
Predictor	Coefficient		Pr(>|z|)
Campaign Contributions	.0052	1.0052	1.28e-07***
Real GDP	-.0001	.9999	< 2e-16***
Republican	.1175	1.1247	.0006***
Cand%Vote-Winner%	-.0001	1.0001	.8973
Campaign Contributions:Real GDP	-.0000	1.0000	5.20e-09***
Republican: Cand%Vote-Winner%	-.0072	.9928	9.91e-07 ***

Note: *** = p < 0.001, ** = p < 0.01, * = p < 0.05.

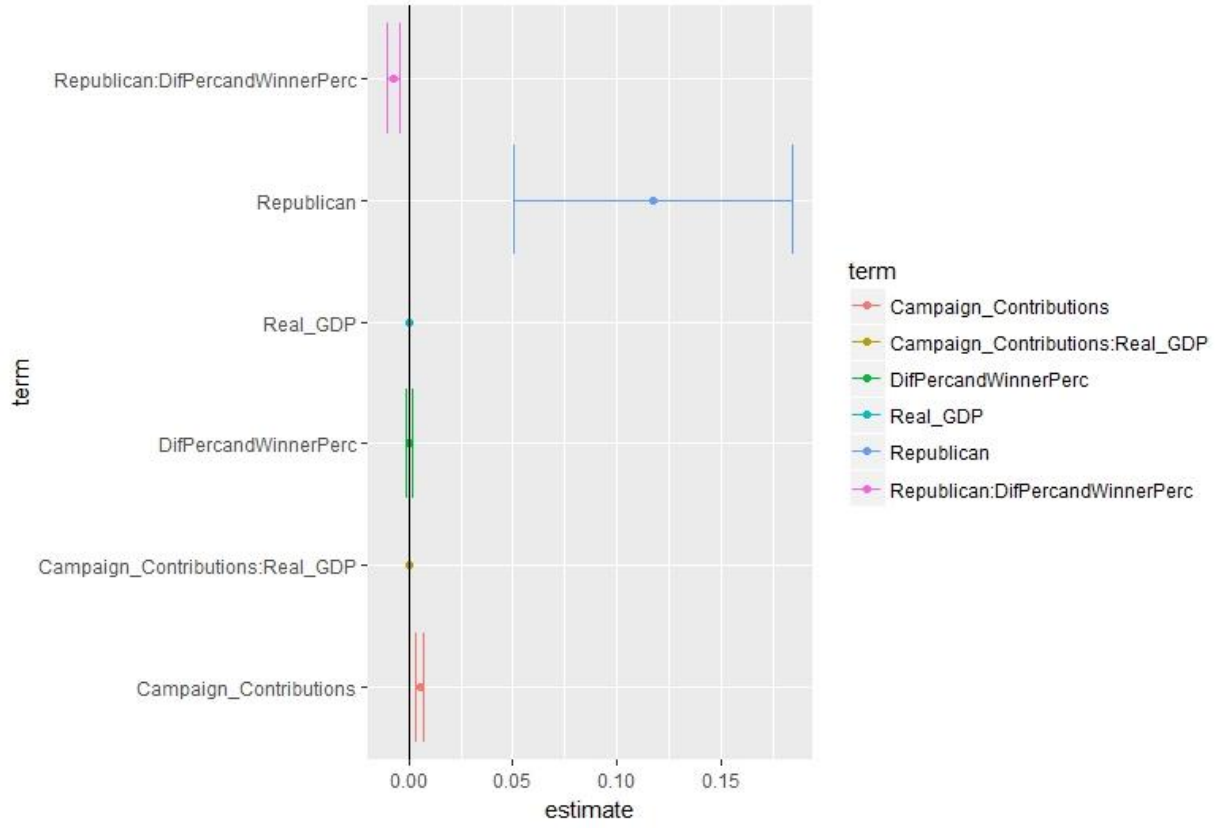

Figure 3.2: Coefficient Plot of Campaign Contributions to a Candidate

The second model replaces the dollar amount of *Campaign Contributions* with the number of times PhRMA contributed to a candidate (*Records*). According to this model, when holding *Real GDP* at zero and all other variables constant, an additional *Record* of a contribution from PhRMA increases the yearly hazard of adopting a PBM regulation by a factor of 17.54 or 1754%. This effect is much larger given that a one-unit increase in *Records* could signify a $2000 increase in *Campaign Contributions.* Nevertheless, holding *Real GDP* at zero is unrealistic, and there is again a negative coefficient associated with the *Real GDP* in a state. Both the substantive and statistical significance of party and vote share in this model are unchanged.

Table 3.3: Records Contributed to a Candidate

Predictor	Coefficient	Hazard Ratio	Pr(>|z|)
Records	2.864	17.5368	4.42e-09***
Real GDP	-.0001	0.9999	< 2e-16***
Republican	.1154	1.1223	.0007***
Cand%Vote-Winner%	-.0001	1.0001	.9045
Records:Real GDP	-.0000	.9999	9.54e-11***
Republican: Cand%Vote-Winner%	-.0071	.9929	1.18e-06***

Note: *** = p < 0.001, ** = p < 0.01, * = p < 0.05.

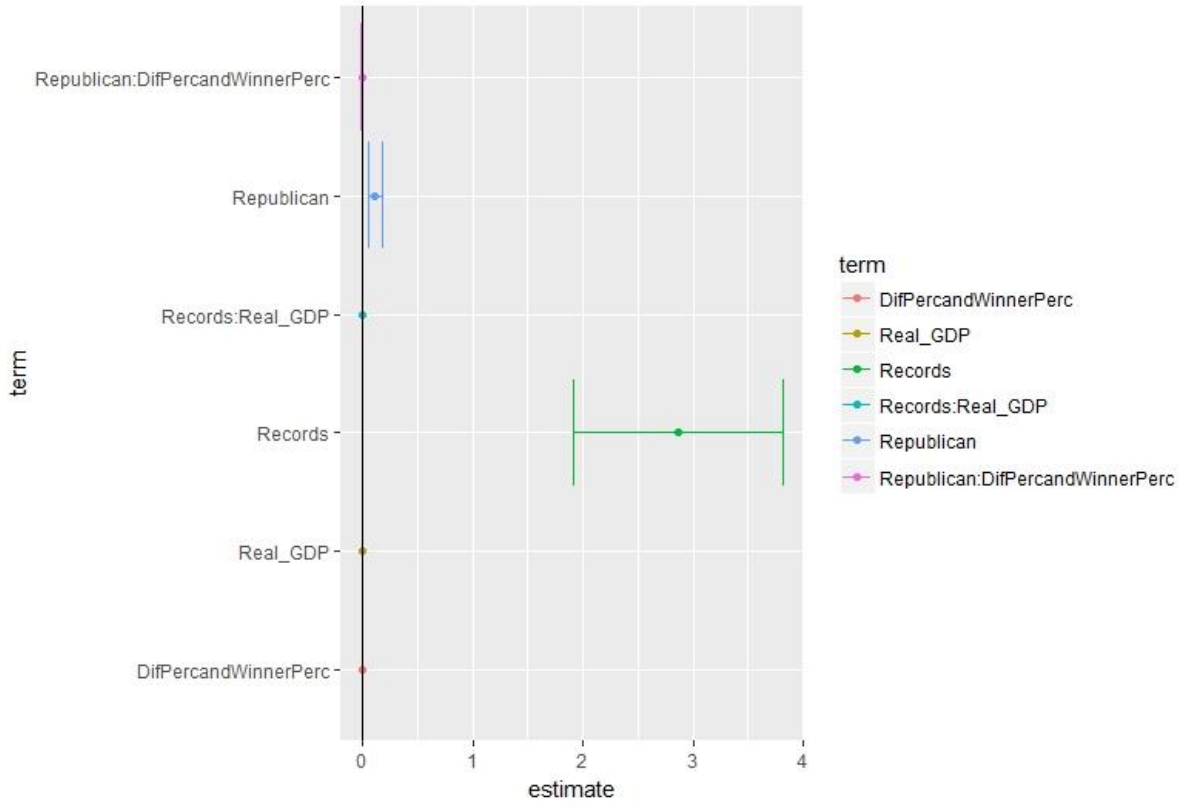

Figure 3.3: Coefficient Plot of the Records of Contributions to a Candidate

Discussion

The models presented here provide support for the hypotheses and predict that contributions from PhRMA to candidates of state offices influences the rate of adoption of PBM legislation in the states from 2000 and 2013. Even more, support is found for the importance of partisanship and for the candidate winning the election to enact a favorable policy for PhRMA. Nevertheless, this study suffers from several limitations that question the validity of the claims.

First, Type 1 censoring is occurring in these models since states have continued to adopt PBM regulations after the observed period. This chapter takes advantage of the ICPSR State Legislative Election Returns which have collected data up to 2010. State adoptions of PBM regulations are included up to 2013 to incorporate the influence of elected officials from the data that were still in office at this time. This concern is ameliorated by the fact that censoring time is statistically independent of the event time.

Second, campaign contributions could have been given with other policies in mind that influence the pharmaceutical supply chain. This chapter responds to the simultaneity bias concern by focusing on Republican candidates. The reason for this is that the ACA was the largest healthcare policy during this study, was drafted by Democrats, and was supported by PhRMA. This would suggest that campaign contributions to Democrats are unlikely to be targeted at PBM policies compared to the ACA, especially since state-level politicians faced the decision of whether to expand Medicaid under the ACA and it was estimated that the ACA would lead to a 33% increase to the market value of the pharmaceutical industry (Japsen 2013). A major Republican-led policy in this timeframe was the Medicare Modernization Act of 2003 by George W. Bush. Like the ACA, campaign contributions made towards Republicans could have been targeted at influencing the Medicare Modernization Act, however, this represents a smaller portion of the data than ACA lobbying. More importantly, the lobbying of the Medicare Modernization Act occurred in Washington D.C. instead of at the state-level.

Third, this chapter focuses on the adoption of very broad PBM policies that are considered as long as they limit the actions of PBMs in the pharmaceutical supply chain. Therefore, the hazard of adopting PBM legislation does not distinguish between the scope or effectiveness of these regulations. Furthermore, the extent in which the states can fully enforce each of these regulations is variable. Also, with the transparency regulations, if pharmaceutical manufacturers are unaware of these regulations in a state then they might not take advantage of

the opportunity to request information from PBMs. The ability of states to maintain these regulations is also an area of interest that is not examined here. Legal battles over these regulations could negate their impact and the resources in which states use to safeguard against legal troubles could also be part of the interest group story.

Finally, there are reasons to expect that other interest groups influence the rate of state adoptions. For instance, pharmacies also can gain from the regulation of PBMs and the National Community Pharmacists Association (NCPA) has called for more oversight over the businesses of PBMs. The NCPA is not analyzed in this chapter as its interest group efforts do not rely on campaign contributions but instead take advantage of grassroots mobilization efforts of community pharmacies. Thus, while this analysis suggests that PhRMA has contributed to the spread of PBM regulations across the states, it may only be a part of the story.

Future research could focus on the individual level of candidates instead of aggregating to states. This could be done with an ordinal logistic regression with the dependent variable representing legislative action on a PBM related bill. The highest order being Sponsorship of the bill, the next being a Yea vote, then Absent from the vote, and the lowest being a Nay vote. Campaign contributions from PhRMA to candidates could then be compared to the legislative decisions of those candidates.

CHAPTER 4

STATE TRANSPARENCY LAWS ON MEDICAID REIMBURSEMENTS TO PHARMACIES

MAC Transparency Legislation

Each PBM chooses products for their MAC lists using a variety of criteria to derive prices. Some of the factors considered include availability of the product, the number of manufacturers for that product, if the product is defined as an innovator drug by the FDA, and the price differences between the brand name and generic alternatives (NCPA 2012). Absent of state regulations, there is no industry standardization for either the inclusion of drugs on MAC lists or the methodology for determining the maximum price. Because of this lack of transparency, critics fear that PBMs take advantage of their MAC lists to produce substantial revenues (NCPA 2012). These revenues can be gained by using a low MAC price list while reimbursing pharmacies and a high price list when charging state Medicaid programs. Neither plan sponsors nor contracted pharmacies have any transparency into the MAC process—again, in the absence of state regulations. So far, 20 states have passed MAC legislation that is designed to improve the transparency of PBM pricing and standardize the selection process of prescription drugs on MAC lists. These state laws set up appeal processes for pharmacies to dispute MAC price billing with PBMs, require that MAC lists are made available to pharmacies, and require PBMs to reveal the methods and sources used to determine MAC prices (Arkansas Act 1194 2013; Kansas S.B. 103 2016). I argue that if PBMs are acting as imperfect agents, as was suggested in Chapter 2, then legislation that increases MAC list transparency would lead to a reduction in the practice of spread pricing. This is because, in situations where the principal cannot directly observe or infer the agent's activities, the agent might not act in the principal's interests. MAC transparency gives state Medicaid agencies insight into the MAC lists, which should result in the PBMs acting in the interests of Medicaid agencies. As was discussed in Chapter 1, spread pricing is when the PBM charges plan-sponsors a higher price for a drug than the PBM pays the dispensing pharmacy. In the context of this chapter, the plan-sponsors (the principals) are the state Medicaid agencies.

Empirical Strategy

Data

As was done in Chapter 2, weekly drug cost data are obtained from the National Average Drug Acquisition Cost (NADAC) provided by the Centers for Medicare and Medicaid Services. This information reflects the costs that pharmacies incur from acquiring drugs and spans from 2013-2018. In addition, the Centers for Medicare and Medicaid Services reports quarterly data on what state Medicaid agencies pay to cover outpatient drugs through their State Drug Utilization database. This database includes states, national drug codes, the number of prescriptions reimbursed, and the dollars reimbursed by states. By merging these datasets together, this chapter evaluates the difference between what a state is being charged through reimbursements and the average invoice prices pharmacies pay to acquire those drugs. Only generic drugs or brand name drugs with generic alternatives are included in the final dataset, as these reflect the types of drugs that could be included on MAC lists. Data are also collected on dates in which states have passed MAC transparency legislation and is added to the dataset.

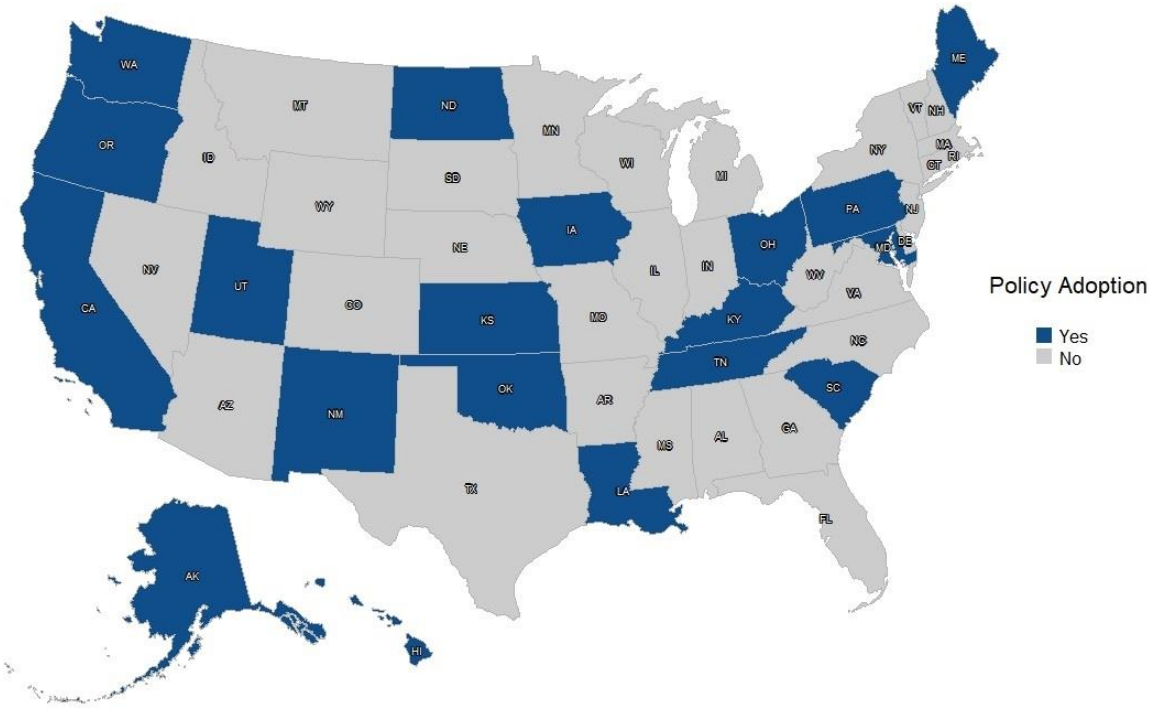

Figure 4.1 MAC Transparency Adoption by State, 2013-2018

Table 4.1: States with MAC Transparency Legislation

State	Date	Legislation
Arkansas	12-Apr-13	Act 1194
California	13-Jul-15	A.B. 627
Hawaii	2-Jul-15	H.B. 252
Iowa	14-Mar-14	HF 2297
Kansas	23-Mar-16	S.B. 103
Kentucky	22-Mar-13	S.B. 107
Louisiana	1-Aug-14	S.B. 410
Maine	11-Apr-16	L.D. 1150
Maryland	5-May-14	S.B. 952
New Mexico	5-Mar-14	H.B. 126
North Dakota	12-Apr-13	H.B. 1363
Ohio	30-Jun-15	H.B. 64
Oklahoma	12-May-14	H.B. 2100
Oregon	1-Jul-13	H.B. 2123
Pennsylvania	22-Nov-16	H.B. 946
Tennessee	1-Jan-15	H.B. 1554
Texas	14-Jun-13	S.B. 1106
South Carolina	2-May-16	S. 849
Utah	31-Mar-14	H.B. 113
Washington	3-Apr-14	SB 6137

The combined dataset for this chapter contains drugs identified by their National Drug Codes (NDCs), the National Average Drug Acquisition Cost (NADAC) which is what the pharmacy is invoiced for a drug, the total reimbursement that the state Medicaid agency paid for that drug, the number of reimbursements for that drug, the state in which the reimbursement took place, the date, and a binary variable that equals 1 if the transaction occurred after a MAC transparency legislation has been enacted in that state and 0 otherwise.

Outcome Variable

State Medicaid programs do not purchase prescription drugs directly from manufacturers. Instead, they reimburse pharmacies that fill prescriptions for Medicaid enrollees. The reimbursement that the pharmacy receives is based on the dispensing fees, the ingredient cost of the drug, and any cost sharing from the beneficiary (Dolan & Tian 2020). I refer to the difference between what is paid by the state and the invoice cost to the pharmacy as the ‘markup’ in this

chapter. In the absence of spread pricing, this markup reflects the dispensing fee for filling the prescription, with part of the markup going to the pharmacy and part to the PBM. The PBM ultimately decides how to divvy this markup, and according to agency theory, reducing the information asymmetry between the agent and the principal will increase the likelihood that the agent will act in accordance with the principal. This means, with PBMs contracting on behalf of state Medicaid programs, they will be less likely to drive up this markup when operating under transparency regulations. Correspondingly, a reduction in the markup translates to savings for state Medicaid programs and ultimately taxpayers. Although the spread is only a part of this markup and cannot be directly measured, I argue that changes in the size of the markup in response to the introduction of MAC transparency legislation is reflecting changes to the spread—as that is the part of the markup where information asymmetry gives the PBM an advantage. Remember, the reimbursement to the pharmacy equals dispensing fees plus ingredient costs plus cost sharing with a PBM. Adding transparency to how the PBM operates should affect the cost sharing part of this equation. To calculate the markup, I first divide the total amount of reimbursements paid by a state Medicaid program by the total number of units of the reported drug. This amount represents the per unit reimbursements for a drug at a given point in time. I then take the difference between the per unit reimbursement and the per unit NADAC for the drug to calculate the markup. Thus, the markup represents the per unit difference between what the state Medicaid program is reimbursing for a drug and the cost the pharmacy paid to acquire that drug.

Difference-in-Differences

The association between state MAC transparency legislation and the markup experienced by the states is estimated through a difference-in-differences design, an approach that involves comparing mean changes in a treatment group before and after a policy change with mean changes in a comparison group with no policy change, which permits the investigator to subtract out the unobserved changes in outcomes (French & Heagerty 2008; Walker 2010; Dimick & Ryan 2014; Raifman et al. 2017). A linear regression difference-in-differences model is estimated with a binary indicator for exposure to MAC transparency policies, year, fixed effects for states and drugs, and an interaction term between linear year and states exposed MAC transparency policies. Linear models are estimated due to the use of a continuous outcome

variable and the unbiased estimation of linear models with fixed effects analysis (Green 2004; Raifman et al. 2017). Controlling for each state with a fixed effects approach means that the analysis only captures relative changes in reimbursement markups in each state, preventing differing baseline rates of markups from affecting the analysis. Furthermore, controlling for each state also controls for time-invariant state characteristics such as differences in state Medicaid programs, pharmacies, and MAC lists that could otherwise confound the analysis. The same logic holds for controlling for each of the 25,163 drugs which can differ greatly in their costs per unit and underlying characteristics in the pharmaceutical supply chain. Due to the very large number of fixed effects, in order to identify the model, I randomly sample 500 unique drugs and run the analysis with the observations that include these sampled drugs (this reduces the dataset from roughly 20 million observations to about half a million observations for each iteration). In order to reduce bias, I construct confidence intervals drawn from 1,000 bootstrapped standard errors. This means that I resample 500 unique drugs from the data (replacing the drugs from each previous sample) and run my model 1,000 times to create a range of plausible values for the estimates (Efron & Tibshirani 1986; Gonçalves & White 2005).

The association between MAC transparency legislation and markup is estimated by examining the interaction between the exposed-unexposed and pre-post variables (Dimick & Ryan 2014). If MAC transparency legislation is associated with a reduction in markup (a beneficial change), then the difference-in-differences estimate (the interaction term) will be negative. An increase to the markup will result in a positive difference-in-differences estimate. While, in contrast, if there is no significant relationship between MAC transparency legislation and markup, then the difference-in-differences estimate will equal 0 (Dimick & Ryan 2014). Hence, I hypothesize that passage of MAC transparency legislation will, on average, have a negative effect on the size of the markup experienced by state Medicaid agencies.

Results

Table 4.2 presents the net change in the markup experienced by state Medicaid programs after implementation of MAC transparency legislation in the states with that legislation relative to states without MAC transparency legislation. MAC transparency legislation is associated with a statistically significant reduction in the markup. The difference-in-differences estimate (did) reveals that the mean change in markup from before MAC legislation to after is -$0.2221 per

unit. The average number of units reimbursed per state, per year, is 810,494,471. Thus, the did estimator can be interpreted as an average savings of $180,010,822 (-0.2221*810,494,471) for a state in a given year. However, the confidence interval is wide and suggests that this average savings can be between $13,292,109 and $346,648,485. Indeed, there is massive variation across the states in terms of Medicaid spending on prescription drugs. In 2018, the state with the lowest total amount reimbursed was Delaware ($17 million) with the highest being California ($9 billion). The median state, in terms of total amount reimbursed, was Alabama ($877 million).

Table 4.2: Changes in Markup

Predictor	Estimate	Bootstrapped 95% CI
did	-0.2221***	-0.4277 to -0.0164
Exposure	0.0448	
Year	0.1220	
Constant	-0.0244	
F Statistic	58.98***	

Note: N= 437,885. *** = p < 0.001, ** = p < 0.01, * = p < 0.05. Fixed effects are omitted for readability.

The intercept in a difference-in-difference design represents the mean outcome for the control group at the baseline (before any state passed MAC transparency legislation). Substantively, a negative coefficient means that states that never passed a MAC transparency legislation started with less markup than those that eventually passed the legislation; however, this value did not reach statistical significance in the bootstrapped confidence interval. Year signifies the expected mean change in outcome among the control states from baseline to post-intervention. The lack of statistical significance on Year suggests that the passage of time is not explaining the change in markup. Exposure represents the baseline differences between the intervention and control group, which also does not reach statistical significance.

Discussion

This chapter evaluates changes in the markup of reimbursement rates in states before and after MAC transparency legislation was enacted and finds evidence that these regulations are effective in reducing the markup in reimbursements from state Medicaid programs and save states millions of dollars. These findings substantiate the value of categorizing PBMs and plan-

sponsors as undergoing a principal-agent relationship. Whereas Chapter 2 suggests that PBMs use their information advantage to maximize rebates, this chapter finds evidence that directly reducing the information advantage of PBMs through the passage of MAC transparency legislation leads to millions of dollars saved by state Medicaid programs and ultimately taxpayers.

Limitations should be considered while interpreting these results. The markup is shared by both PBMs and pharmacies, but this analysis only focuses on PBMs. This is effectively the dispensing fee, and since the PBM determines how the markup is split, changes to the markup are assumed to be changes in the spread that the PBM receives. However, the pharmacy could be paid below the NADAC. In this instance, the entire markup is captured by the PBM and the pharmacy's margin is negative. I am unable to unpack how the markup is split and therefore rely on the assumption that since MAC transparency legislation specifically targets the information advantage of PBMs, changes to the markup associated with passage of this legislation are due to changes in the behavior of PBMs.

I also want to caution the reader from assuming that MAC transparency legislation alone solves the problem of spread pricing. For example, Arkansas passed MAC transparency legislation in 2012 while Ohio did the same in 2015. In 2018, pharmacists in Arkansas received losses on an estimated 60% of the generic prescriptions filled for Medicaid managed care patients (Balick, 2018). According to Scott Pace, executive vice president and CEO of the Arkansas Pharmacists Association, "Pharmacists were being faced with a choice of losing money on a prescription…or turning the patient away." Pharmacists allege that this is the result of Arkansas Blue Cross Blue Shield relying on CVS Caremark's PBM. Similarly, Ohio pharmacists also noticed reimbursement cuts from their Medicaid managed care program. The Ohio Pharmacists Association blamed CVS Caremark for dramatically decreasing Medicaid reimbursements to pharmacies and the state of Ohio is calling for a "transparent pass-through pricing model" for contracts starting in 2019 (Baxter, 2018). Under these new contracts, PBMs will charge insurance companies the exact amount for the prescriptions and dispensing fees at pharmacies and will profit purely off administrative service fees. Additionally, a drug cost report in Ohio showed that the PBMs OptumRx and CVS Caremark billed $224 million more for Medicaid drugs than they paid pharmacies in 2018 (Candisky 2020).

An important point to make here is that this research should not come off as inherently anti-PBM. Following agency theory, the problems presented in this dissertation stem from information asymmetry and can be ameliorated with more oversight. PBMs provide a multitude of functions that are vital to the United States healthcare system. The term 'pharmaceutical industry' entails a variety of different functions: manufacturing pharmaceuticals, packaging pharmaceuticals, dispensing pharmaceuticals, and managing the pharmacy benefit plans of employees and employers (Rentmeester & Garis 2008). No single entity in this industry should be entirely to blame for healthcare costs in the United States. The purpose of this dissertation is to add clarity to the least regulated component of the pharmaceutical industry and to try and explain and evaluate related state-level interventions into health policy.

APPENDIX A

HETEROGENEITY ACROSS DRUGS

Chapter 2 relies on NADAC per unit as the outcome variable while Chapter 4 uses NADAC per unit in the calculation of the outcome the variable. I present a visualization of the heterogeneity in this variable across the variety of drugs to explain why I use fixed effects in both chapters for drugs. NADAC per unit varies substantially across the types of drugs included in these models so random effects for drugs are not feasible.

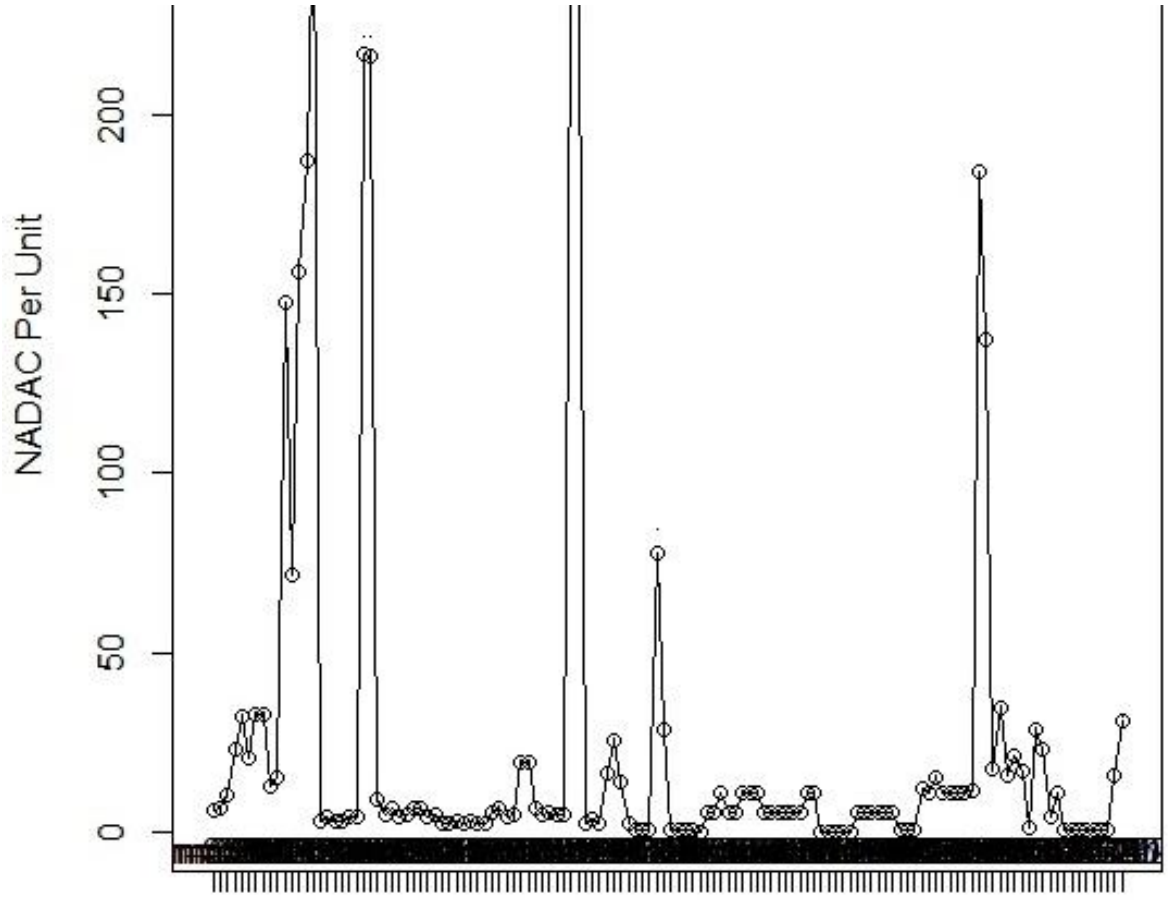

Figure A.1: Heterogeneity Across Drugs

APPENDIX B

ASSUMPTIONS FOR CHAPTER 3

I use a Cox proportional hazards model in Chapter 3, so I present the cumulative hazard rate and a test of the residuals for proportional hazards.

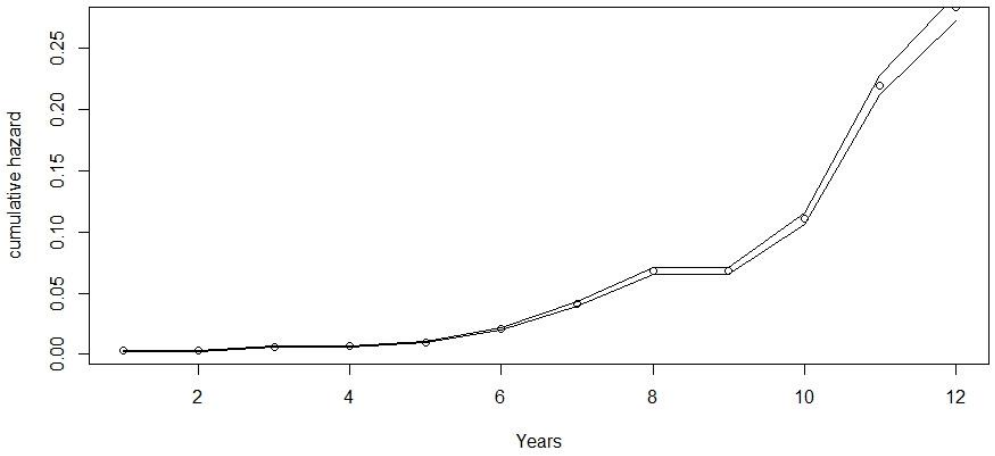

Figure B.1: Cumulative Hazard Rate

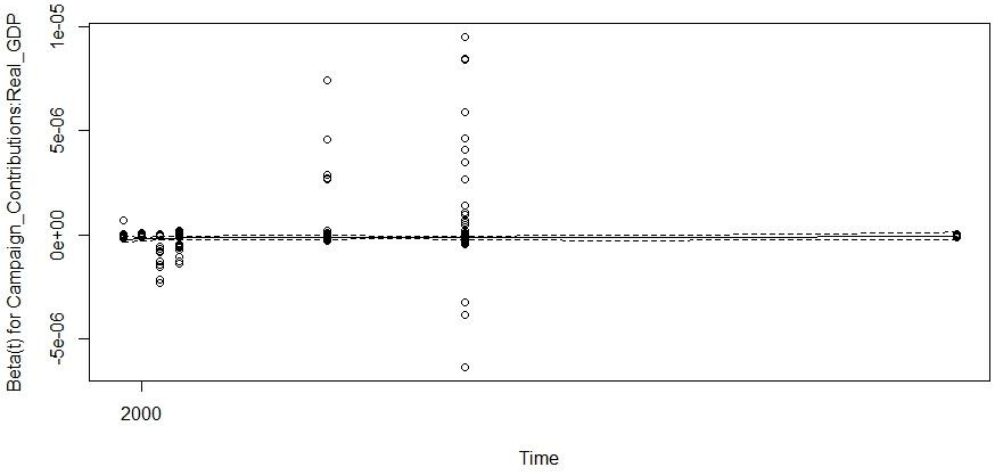

Figure B.2: Testing the Proportional Hazards Assumption

APPENDIX C

FULL MODELS

Table C.1: Table 2.1 Full Results

	Estimate	Std. Error	P-value
(Intercept)	-27.4363	0.5313	0
Express_Formulary	1.1268	0.0662	0
CVS_Formulary	7.8714	0.0977	0
Optum_Formulary	1.9802	0.0813	0
All_Formulary	-4.8476	0.0829	0
Date	0.0015	0	0
ADVAIR 250-50 DISKUS	0.6526	0.2821	0.021
ADVAIR 500-50 DISKUS	4.1188	0.2821	0
ADVAIR HFA 115-21 MCG INHALER	19.0751	0.2833	0
ADVAIR HFA 230-21 MCG INHALER	28.3768	0.2833	0
ADVAIR HFA 45-21 MCG INHALER	16.8343	0.2833	0
ALVESCO 160 MCG INHALER	33.2449	0.3573	0
ALVESCO 80 MCG INHALER	33.2635	0.3573	0
ASMANEX HFA 100 MCG INHALER	6.8336	0.4184	0
ASMANEX HFA 200 MCG INHALER	8.7973	0.4466	0
ASMANEX TWISTHALER 110 MCG #30	142.7635	0.3453	0
ASMANEX TWISTHALER 220 MCG #14	69.0826	0.4186	0
ASMANEX TWISTHALER 220 MCG #30	151.9656	0.3231	0
ASMANEX TWISTHALER 220 MCG #60	182.3969	0.3453	0
ASMANEX TWISTHALR 220 MCG #120	262.3991	0.3453	0
ATACAND 16 MG TABLET	5.8452	0.3021	0
ATACAND 32 MG TABLET	6.8698	0.31	0
ATACAND 4 MG TABLET	6.0885	0.428	0
ATACAND 8 MG TABLET	6.1336	0.44	0
ATACAND HCT 16-12.5 MG TAB	7.1735	0.44	0
ATACAND HCT 32-12.5 MG TAB	7.2495	0.44	0
AUVI-Q 0.15 MG AUTO-INJECTOR	214.1058	0.3813	0
AUVI-Q 0.3 MG AUTO-INJECTOR	213.8343	0.3813	0
BECONASE AQ 0.042% SPRAY	11.4364	0.3664	0
BENICAR 20 MG TABLET	1.4522	0.2532	0
BENICAR 40 MG TABLET	3.3321	0.2532	0
BENICAR 5 MG TABLET	0.5474	0.3457	0.113
BENICAR HCT 20-12.5 MG TABLET	1.4331	0.2868	0

Table C.1 – Continued

BENICAR HCT 40-12.5 MG TABLET	3.3178	0.2868	0
BENICAR HCT 40-25 MG TABLET	3.3088	0.2868	0
BREO ELLIPTA 100-25 MCG INH	3.8655	0.2943	0
BREO ELLIPTA 200-25 MCG INH	2.5368	0.3515	0
CANDESARTAN-HYDROCHLOROTHIAZIDE 16-12.5 MG TB	-3.6033	0.2471	0
CANDESARTAN-HYDROCHLOROTHIAZIDE 32-12.5 MG TB	-3.704	0.2475	0
CANDESARTAN-HYDROCHLOROTHIAZIDE 32-25 MG TAB	-2.9705	0.2569	0
CANDESARTAN CILEXETIL 16 MG TB	-4.115	0.2438	0
CANDESARTAN CILEXETIL 32 MG TB	-3.3767	0.2444	0
CANDESARTAN CILEXETIL 4 MG TAB	-3.9597	0.2683	0
CANDESARTAN CILEXETIL 8 MG TAB	-4.0475	0.2562	0
DIOVAN 160 MG TABLET	5.9136	0.3247	0
DIOVAN 320 MG TABLET	7.3358	0.3234	0
DIOVAN 40 MG TABLET	4.9488	0.3531	0
DIOVAN 80 MG TABLET	5.5287	0.3234	0
DULERA 100 MCG/5 MCG INHALER	14.9092	0.2898	0
DULERA 200 MCG/5 MCG INHALER	14.8086	0.2863	0
DYMISTA NASAL SPRAY	4.4752	0.3462	0
EDARBI 40 MG TABLET	5.405	0.3108	0
EDARBI 80 MG TABLET	5.82	0.3072	0
EDARBYCLOR 40-12.5 MG TABLET	5.5401	0.3132	0
EDARBYCLOR 40-25 MG TABLET	5.5268	0.313	0
EPIPEN 2-PAK 0.3 MG AUTO-INJCT	231.3836	0.3459	0
EPIPEN JR 2-PAK 0.15 MG INJCTR	228.4638	0.3481	0
FLOVENT 100 MCG DISKUS	-2.9922	0.342	0
FLOVENT 250 MCG DISKUS	-2.1296	0.342	0
FLOVENT 50 MCG DISKUS	-3.0994	0.342	0
FLOVENT HFA 110 MCG INHALER	11.0258	0.342	0
FLOVENT HFA 220 MCG INHALER	20.0315	0.342	0
FLOVENT HFA 44 MCG INHALER	8.3498	0.342	0
FLUNISOLIDE 0.025% SPRAY	-4.1613	0.2916	0
FLUTICASONE PROP 0.005% OINT	-2.9374	0.2388	0
FLUTICASONE PROP 0.05% CREAM	-2.9932	0.2263	0
FLUTICASONE PROP 50 MCG SPRAY	-3.0679	0.2388	0
GLUMETZA ER 1,000 MG TABLET	78.8368	0.376	0
GLUMETZA ER 500 MG TABLET	30.1878	0.3554	0
IRBESARTAN-HYDROCHLOROTHIAZIDE 150-12.5 MG TB	-4.6547	0.2188	0
IRBESARTAN-HYDROCHLOROTHIAZIDE 300-12.5 MG TB	-4.5312	0.2188	0

Table C.1 – Continued

IRBESARTAN 150 MG TABLET	-3.1952	0.2183	0
IRBESARTAN 300 MG TABLET	-3.0609	0.2188	0
IRBESARTAN 75 MG TABLET	-3.2255	0.2208	0
JANUMET 50-1,000 MG TABLET	2.0779	0.2643	0
JANUMET 50-500 MG TABLET	2.0635	0.2643	0
JANUMET XR 100-1,000 MG TABLET	7.564	0.2643	0
JANUMET XR 50-1,000 MG TABLET	2.0814	0.2643	0
JANUMET XR 50-500 MG TABLET	2.0362	0.2643	0
JANUVIA 100 MG TABLET	7.6191	0.2419	0
JANUVIA 25 MG TABLET	7.6174	0.2643	0
JANUVIA 50 MG TABLET	7.5826	0.2643	0
JENTADUETO 2.5 MG-1,000 MG TAB	-0.7829	0.2827	0.0056
JENTADUETO 2.5 MG-500 MG TAB	-0.8349	0.2827	0.0031
JENTADUETO 2.5 MG-850 MG TAB	-0.8129	0.2827	0.004
KAZANO 12.5-1,000 MG TABLET	8.0497	0.3664	0
KAZANO 12.5-500 MG TABLET	8.0532	0.3702	0
KOMBIGLYZE XR 2.5-1,000 MG TAB	5.995	0.3092	0
KOMBIGLYZE XR 5-1,000 MG TAB	11.4639	0.3112	0
KOMBIGLYZE XR 5-500 MG TABLET	11.4622	0.3103	0
LOSARTAN-HYDROCHLOROTHIAZIDE 100-12.5 MG TAB	-3.3217	0.2184	0
LOSARTAN-HYDROCHLOROTHIAZIDE 50-12.5 MG TAB	-3.3374	0.2176	0
METFORMIN HCL 1,000 MG TABLET	-3.3759	0.2149	0
METFORMIN HCL 500 MG TABLET	-3.39	0.2143	0
METFORMIN HCL 850 MG TABLET	-3.3543	0.2152	0
MICARDIS 20 MG TABLET	5.3528	0.3545	0
MICARDIS 40 MG TABLET	5.3651	0.3545	0
MICARDIS 80 MG TABLET	5.3734	0.3545	0
MICARDIS HCT 40-12.5 MG TABLET	5.4167	0.3545	0
MICARDIS HCT 80-12.5 MG TABLET	5.3602	0.3545	0
MICARDIS HCT 80-25 MG TABLET	5.379	0.3545	0
MOMETASONE FUROATE 0.1% CREAM	-0.5153	0.2372	0.0298
MOMETASONE FUROATE 0.1% OINT	-0.5042	0.2353	0.0322
MOMETASONE FUROATE 0.1% SOLN	-0.5893	0.2338	0.0117
NASONEX 50 MCG NASAL SPRAY	9.2241	0.3451	0
NESINA 25 MG TABLET	13.4329	0.3664	0
OMNARIS 50 MCG NASAL SPRAY	16.1107	0.3537	0
ONGLYZA 2.5 MG TABLET	11.4541	0.2701	0
ONGLYZA 5 MG TABLET	11.3085	0.2521	0
OSENI 25-15 MG TABLET	13.394	0.3664	0
OSENI 25-30 MG TABLET	13.4304	0.3664	0

Table C.1 – Continued

OSENI 25-45 MG TABLET	13.7306	0.4089	0
PULMICORT 180 MCG FLEXHALER	180.3951	0.3457	0
PULMICORT 90 MCG FLEXHALER	133.689	0.3457	0
QNASL 80 MCG NASAL SPRAY	18.1158	0.3562	0
QNASL CHILDREN'S 40 MCG SPRAY	34.2891	0.4133	0
QVAR 40 MCG ORAL INHALER	11.9781	0.31	0
QVAR 80 MCG ORAL INHALER	17.2923	0.31	0
RHINOCORT AQUA NASAL SPRAY	19.7233	0.4197	0
RIOMET 500 MG/5 ML SOLUTION	2.6925	0.3187	0
SYMBICORT 160-4.5 MCG INHALER	26.4606	0.2883	0
SYMBICORT 80-4.5 MCG INHALER	21.0586	0.2883	0
TEVETEN HCT 600-12.5 MG TAB	7.6314	0.4933	0
TRADJENTA 5 MG TABLET	4.6118	0.2599	0
VALSARTAN-HYDROCHLOROTHIAZIDE 160-12.5 MG TAB	-3.1431	0.2227	0
VALSARTAN-HYDROCHLOROTHIAZIDE 160-25 MG TAB	-3.11	0.2226	0
VALSARTAN-HYDROCHLOROTHIAZIDE 320-12.5 MG TAB	-3.1226	0.2236	0
VALSARTAN-HYDROCHLOROTHIAZIDE 320-25 MG TAB	-3.1142	0.2236	0
VALSARTAN 160 MG TABLET	-3.239	0.2251	0
VALSARTAN 40 MG TABLET	-3.3101	0.2289	0
VALSARTAN 80 MG TABLET	-3.2705	0.2253	0
VERAMYST 27.5 MCG NASAL SPRAY	16.6382	0.3557	0
ZETONNA 37 MCG NASAL SPRAY	31.891	0.3537	0

Table C.2: Table 2.2 Full Results

	Estimate	Std. Error	P-value
(Intercept)	-32.485	1.2961	0
Express_Formulary	0.4265	0.1137	0.0002
CVS_Formulary	10.1695	0.2125	0
Optum_Formulary	0.0013	0.1343	0.9922
Date	0.0017	0.0001	0
ADVAIR 250-50 DISKUS	0.7401	0.2856	0.0096
ADVAIR 500-50 DISKUS	4.2063	0.2856	0
ADVAIR HFA 115-21 MCG INHALER	18.337	0.2865	0
ADVAIR HFA 230-21 MCG INHALER	27.6387	0.2865	0
ADVAIR HFA 45-21 MCG INHALER	16.0962	0.2865	0
ALVESCO 160 MCG INHALER	29.9204	0.3571	0
ALVESCO 80 MCG INHALER	29.9389	0.3571	0
ASMANEX HFA 100 MCG INHALER	6.7087	0.4236	0

Table C.2 – Continued

ASMANEX HFA 200 MCG INHALER	9.0127	0.4522	0
ASMANEX TWISTHALER 110 MCG #30	141.8077	0.3491	0
ASMANEX TWISTHALER 220 MCG #14	66.9647	0.4222	0
ASMANEX TWISTHALER 220 MCG #30	150.7799	0.3265	0
ASMANEX TWISTHALER 220 MCG #60	181.4411	0.3491	0
ASMANEX TWISTHALR 220 MCG #120	261.4433	0.3491	0
ATACAND 16 MG TABLET	1.144	0.2948	0.0001
ATACAND 32 MG TABLET	2.1818	0.3032	0
ATACAND 4 MG TABLET	1.336	0.4254	0.0017
ATACAND 8 MG TABLET	1.373	0.4377	0.0017
ATACAND HCT 16-12.5 MG TAB	2.4128	0.4377	0
ATACAND HCT 32-12.5 MG TAB	2.4889	0.4377	0
AUVI-Q 0.15 MG AUTO-INJECTOR	211.9862	0.3843	0
AUVI-Q 0.3 MG AUTO-INJECTOR	211.7146	0.3843	0
BECONASE AQ 0.042% SPRAY	6.7521	0.3619	0
BENICAR 20 MG TABLET	-0.5387	0.254	0.0339
BENICAR 40 MG TABLET	1.3412	0.254	0
BENICAR 5 MG TABLET	-1.4474	0.3483	0
BENICAR HCT 20-12.5 MG TABLET	-0.5617	0.2883	0.0514
BENICAR HCT 40-12.5 MG TABLET	1.3229	0.2883	0
BENICAR HCT 40-25 MG TABLET	1.314	0.2883	0
BREO ELLIPTA 100-25 MCG INH	2.3312	0.2967	0
BREO ELLIPTA 200-25 MCG INH	1.6536	0.3555	0
CANDESARTAN-HYDROCHLOROTHIAZIDE 16-12.5 MG TB	-3.7066	0.2502	0
CANDESARTAN-HYDROCHLOROTHIAZIDE 32-12.5 MG TB	-3.8105	0.2505	0
CANDESARTAN-HYDROCHLOROTHIAZIDE 32-25 MG TAB	-3.1253	0.26	0
CANDESARTAN CILEXETIL 16 MG TB	-4.2682	0.2468	0
CANDESARTAN CILEXETIL 32 MG TB	-3.5332	0.2474	0
CANDESARTAN CILEXETIL 4 MG TAB	-4.059	0.2717	0
CANDESARTAN CILEXETIL 8 MG TAB	-4.2038	0.2593	0
DIOVAN 160 MG TABLET	4.497	0.3278	0
DIOVAN 320 MG TABLET	5.9076	0.3265	0
DIOVAN 40 MG TABLET	3.2664	0.3563	0
DIOVAN 80 MG TABLET	4.1005	0.3265	0
DULERA 100 MCG/5 MCG INHALER	13.9056	0.2928	0
DULERA 200 MCG/5 MCG INHALER	13.8647	0.2894	0
DYMISTA NASAL SPRAY	3.5798	0.3502	0
EDARBI 40 MG TABLET	3.2824	0.3125	0
EDARBI 80 MG TABLET	3.7114	0.3088	0

Table C.2 – Continued

EDARBYCLOR 40-12.5 MG TABLET	3.412	0.315	0
EDARBYCLOR 40-25 MG TABLET	3.4095	0.3147	0
EPIPEN 2-PAK 0.3 MG AUTO-INJCT	230.411	0.3498	0
EPIPEN JR 2-PAK 0.15 MG INJCTR	228.0316	0.3523	0
FLOVENT 100 MCG DISKUS	-3.4402	0.3461	0
FLOVENT 250 MCG DISKUS	-2.5776	0.3461	0
FLOVENT 50 MCG DISKUS	-3.5474	0.3461	0
FLOVENT HFA 110 MCG INHALER	10.5777	0.3461	0
FLOVENT HFA 220 MCG INHALER	19.5835	0.3461	0
FLOVENT HFA 44 MCG INHALER	7.9018	0.3461	0
FLUNISOLIDE 0.025% SPRAY	-3.8631	0.2951	0
FLUTICASONE PROP 0.005% OINT	-4.9367	0.2392	0
FLUTICASONE PROP 0.05% CREAM	-4.9881	0.2265	0
FLUTICASONE PROP 50 MCG SPRAY	-5.0483	0.2393	0
GLUMETZA ER 1,000 MG TABLET	75.8224	0.377	0
GLUMETZA ER 500 MG TABLET	26.9763	0.3555	0
IRBESARTAN-HYDROCHLOROTHIAZIDE 150-12.5 MG TB	-5.4316	0.2211	0
IRBESARTAN-HYDROCHLOROTHIAZIDE 300-12.5 MG TB	-5.3123	0.2211	0
IRBESARTAN 150 MG TABLET	-5.1899	0.2183	0
IRBESARTAN 300 MG TABLET	-5.0616	0.2188	0
IRBESARTAN 75 MG TABLET	-5.2193	0.2209	0
JANUMET 50-1,000 MG TABLET	0.083	0.2653	0.7543
JANUMET 50-500 MG TABLET	0.0686	0.2653	0.7959
JANUMET XR 100-1,000 MG TABLET	5.5692	0.2653	0
JANUMET XR 50-1,000 MG TABLET	0.0865	0.2653	0.7444
JANUMET XR 50-500 MG TABLET	0.0413	0.2653	0.8762
JANUVIA 100 MG TABLET	5.6321	0.2424	0
JANUVIA 25 MG TABLET	5.6226	0.2653	0
JANUVIA 50 MG TABLET	5.5878	0.2653	0
JENTADUETO 2.5 MG-1,000 MG TAB	-0.5951	0.2862	0.0376
JENTADUETO 2.5 MG-500 MG TAB	-0.6471	0.2862	0.0238
JENTADUETO 2.5 MG-850 MG TAB	-0.625	0.2862	0.029
KAZANO 12.5-1,000 MG TABLET	3.3654	0.3619	0
KAZANO 12.5-500 MG TABLET	3.3751	0.3659	0
KOMBIGLYZE XR 2.5-1,000 MG TAB	4.3919	0.3118	0
KOMBIGLYZE XR 5-1,000 MG TAB	9.9473	0.314	0
KOMBIGLYZE XR 5-500 MG TABLET	9.9065	0.313	0
LOSARTAN-HYDROCHLOROTHIAZIDE 100-12.5 MG TAB	-5.3108	0.2184	0
LOSARTAN-HYDROCHLOROTHIAZIDE 50-12.5 MG TAB	-5.3298	0.2176	0

Table C.2 – Continued

METFORMIN HCL 1,000 MG TABLET	-5.3707	0.2148	0
METFORMIN HCL 500 MG TABLET	-5.3846	0.2142	0
METFORMIN HCL 850 MG TABLET	-5.3518	0.2151	0
MICARDIS 20 MG TABLET	2.1992	0.3547	0
MICARDIS 40 MG TABLET	2.2115	0.3547	0
MICARDIS 80 MG TABLET	2.2198	0.3547	0
MICARDIS HCT 40-12.5 MG TABLET	2.2631	0.3547	0
MICARDIS HCT 80-12.5 MG TABLET	2.2066	0.3547	0
MICARDIS HCT 80-25 MG TABLET	2.2253	0.3547	0
MOMETASONE FUROATE 0.1% CREAM	-0.9769	0.24	0
MOMETASONE FUROATE 0.1% OINT	-0.96	0.2381	0.0001
MOMETASONE FUROATE 0.1% SOLN	-1.0295	0.2365	0
NASONEX 50 MCG NASAL SPRAY	7.2047	0.3477	0
NESINA 25 MG TABLET	8.7486	0.3619	0
OMNARIS 50 MCG NASAL SPRAY	13.9809	0.3562	0
ONGLYZA 2.5 MG TABLET	9.9133	0.2721	0
ONGLYZA 5 MG TABLET	9.8827	0.2541	0
OSENI 25-15 MG TABLET	8.7097	0.3619	0
OSENI 25-30 MG TABLET	8.7461	0.3619	0
OSENI 25-45 MG TABLET	9.0993	0.4062	0
PULMICORT 180 MCG FLEXHALER	178.4003	0.3483	0
PULMICORT 90 MCG FLEXHALER	131.6941	0.3483	0
QNASL 80 MCG NASAL SPRAY	16.581	0.3596	0
QNASL CHILDREN'S 40 MCG SPRAY	33.5134	0.4182	0
QVAR 40 MCG ORAL INHALER	10.2652	0.3125	0
QVAR 80 MCG ORAL INHALER	15.5795	0.3125	0
RHINOCORT AQUA NASAL SPRAY	14.985	0.4169	0
RIOMET 500 MG/5 ML SOLUTION	-0.417	0.3182	0.1899
SYMBICORT 160-4.5 MCG INHALER	25.3072	0.2912	0
SYMBICORT 80-4.5 MCG INHALER	19.9052	0.2912	0
TEVETEN HCT 600-12.5 MG TAB	2.8502	0.4925	0
TRADJENTA 5 MG TABLET	4.7997	0.263	0
VALSARTAN-HYDROCHLOROTHIAZIDE 160-12.5 MG TAB	-5.1406	0.2228	0
VALSARTAN-HYDROCHLOROTHIAZIDE 160-25 MG TAB	-5.1062	0.2227	0
VALSARTAN-HYDROCHLOROTHIAZIDE 320-12.5 MG TAB	-5.1105	0.2237	0
VALSARTAN-HYDROCHLOROTHIAZIDE 320-25 MG TAB	-5.1012	0.2238	0
VALSARTAN 160 MG TABLET	-5.1419	0.2255	0
VALSARTAN 40 MG TABLET	-5.217	0.2294	0
VALSARTAN 80 MG TABLET	-5.1723	0.2257	0

Table C.2 – Continued

VERAMYST 27.5 MCG NASAL SPRAY	14.063	0.3573	0
ZETONNA 37 MCG NASAL SPRAY	29.7613	0.3562	0

Table C.3: Table 4.2 Full Results for the First Iteration

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	-244.339	48.8546	-5	0
R1	447.7488	80.4789	5.56	0
Year	0.122	0.0242	5.03	0
did	-0.2221	0.0399	-5.56	0
factor(State)AL	-1.3359	0.3472	-3.85	0.0001
factor(State)AR	-1.221	0.3779	-3.23	0.0012
factor(State)AZ	-1.2925	0.3398	-3.8	0.0001
factor(State)CA	-1.5223	0.3227	-4.72	0
factor(State)CO	-1.4378	0.3441	-4.18	0
factor(State)CT	-1.2516	0.3461	-3.62	0.0003
factor(State)DC	-1.7523	0.3622	-4.84	0
factor(State)DE	-1.8528	0.3912	-4.74	0
factor(State)FL	-1.4072	0.3186	-4.42	0
factor(State)GA	-1.3864	0.3189	-4.35	0
factor(State)HI	11.8795	0.3855	30.81	0
factor(State)IA	-1.59	0.3698	-4.3	0
factor(State)ID	-1.3427	0.3776	-3.56	0.0004
factor(State)IL	-1.4904	0.3167	-4.71	0
factor(State)IN	-1.1956	0.325	-3.68	0.0002
factor(State)KS	-1.1875	0.3672	-3.23	0.0012
factor(State)KY	-1.2977	0.3509	-3.7	0.0002
factor(State)LA	-1.4337	0.3423	-4.19	0
factor(State)MA	-1.4399	0.3213	-4.48	0
factor(State)MD	-1.8796	0.3444	-5.46	0
factor(State)ME	-1.2595	0.3848	-3.27	0.0011
factor(State)MI	-1.5876	0.3186	-4.98	0
factor(State)MN	-1.3886	0.3206	-4.33	0
factor(State)MO	-0.9619	0.3357	-2.87	0.0042
factor(State)MS	-1.0216	0.3321	-3.08	0.0021
factor(State)MT	-1.3442	0.3807	-3.53	0.0004
factor(State)NC	-1.4066	0.3359	-4.19	0
factor(State)ND	-1.293	0.4309	-3	0.0027
factor(State)NE	-1.8897	0.3677	-5.14	0
factor(State)NH	-1.6493	0.3954	-4.17	0

Table C.3 –Continued

factor(State)NJ	-1.7842	0.3226	-5.53	0
factor(State)NM	-1.3077	0.3774	-3.47	0.0005
factor(State)NV	-1.5605	0.3327	-4.69	0
factor(State)NY	-0.1536	0.3095	-0.5	0.6196
factor(State)OH	-1.7875	0.3263	-5.48	0
factor(State)OK	-1.3857	0.3725	-3.72	0.0002
factor(State)OR	-1.6102	0.3582	-4.5	0
factor(State)PA	-1.575	0.3231	-4.88	0
factor(State)RI	-1.4737	0.3758	-3.92	0.0001
factor(State)SC	-1.2838	0.3389	-3.79	0.0002
factor(State)SD	-1.3514	0.4381	-3.08	0.002
factor(State)TN	-1.4616	0.3559	-4.11	0
factor(State)TX	-1.6053	0.3424	-4.69	0
factor(State)UT	-1.2822	0.374	-3.43	0.0006
factor(State)VA	-0.9189	0.3228	-2.85	0.0044
factor(State)VT	-1.063	0.3918	-2.71	0.0067
factor(State)WA	-2.0034	0.3445	-5.82	0
factor(State)WI	-0.8043	0.3388	-2.37	0.0176
factor(State)WV	-1.5676	0.3312	-4.73	0
factor(State)WY	-1.2524	0.4541	-2.76	0.0058
factor(NDC)10267083501	-1.146	6.4858	-0.18	0.8598
factor(NDC)10702006606	-0.7586	6.4872	-0.12	0.9069
factor(NDC)10702007701	0.0682	2.921	0.02	0.9814
factor(NDC)10702010001	-0.2088	0.6511	-0.32	0.7484
factor(NDC)10702020101	-0.2524	0.9622	-0.26	0.7931
factor(NDC)113016626	-0.2343	0.7538	-0.31	0.7559
factor(NDC)113048478	-0.5339	1.2303	-0.43	0.6643
factor(NDC)113089726	-0.2184	0.7369	-0.3	0.767
factor(NDC)115148361	0.9357	0.6652	1.41	0.1596
factor(NDC)115148801	0.3598	0.8309	0.43	0.665
factor(NDC)115148901	0.1469	0.7648	0.19	0.8477
factor(NDC)115169003	-0.1135	0.9609	-0.12	0.906
factor(NDC)115442201	-0.2878	0.6867	-0.42	0.6752
factor(NDC)13107003134	-0.0155	0.4376	-0.04	0.9717
factor(NDC)13107004405	-0.1326	0.5341	-0.25	0.8039
factor(NDC)13107008405	-0.4019	1.2277	-0.33	0.7434
factor(NDC)13107014305	-0.0667	0.7263	-0.09	0.9268
factor(NDC)13107015505	0.0993	0.6838	0.15	0.8846
factor(NDC)13107015705	0.0463	0.7335	0.06	0.9496
factor(NDC)135022602	-0.5133	1.4671	-0.35	0.7264
factor(NDC)135051101	-0.3944	9.1672	-0.04	0.9657

Table C.3 –Continued

factor(NDC)13668003905	0.2061	0.4802	0.43	0.6678
factor(NDC)13668008830	0.8258	0.6585	1.25	0.2098
factor(NDC)13668021890	2.6657	0.5679	4.69	0
factor(NDC)13668040910	-0.1287	0.4518	-0.28	0.7757
factor(NDC)13668044205	0.2951	1.15	0.26	0.7975
factor(NDC)13668048750	-0.1663	0.8035	-0.21	0.8361
factor(NDC)13811071430	-0.9894	0.7911	-1.25	0.211
factor(NDC)143319001	0.1335	6.4862	0.02	0.9836
factor(NDC)143973901	3.5502	0.6016	5.9	0
factor(NDC)143988650	-0.1861	1.0623	-0.18	0.8609
factor(NDC)16103034711	-0.1106	0.84	-0.13	0.8953
factor(NDC)16252053608	2.3839	1.558	1.53	0.126
factor(NDC)16252054733	0.0551	0.9974	0.06	0.9559
factor(NDC)16714034204	0.1089	0.686	0.16	0.8739
factor(NDC)16714045201	-0.2625	0.4788	-0.55	0.5835
factor(NDC)16714050102	-0.0102	0.5241	-0.02	0.9845
factor(NDC)16714050502	-0.233	0.5374	-0.43	0.6646
factor(NDC)16714053111	0.5738	0.4871	1.18	0.2387
factor(NDC)16714069501	-0.1537	0.4601	-0.33	0.7384
factor(NDC)16714071801	4.8747	2.134	2.28	0.0224
factor(NDC)16714075901	0.6416	1.4302	0.45	0.6537
factor(NDC)16729014901	-0.0777	0.5082	-0.15	0.8784
factor(NDC)16729021516	-0.0812	1.6451	-0.05	0.9606
factor(NDC)16729037501	-0.2084	2.1335	-0.1	0.9222
factor(NDC)168001631	-0.4313	0.5898	-0.73	0.4647
factor(NDC)168020230	-0.3631	0.4949	-0.73	0.4631
factor(NDC)168021560	-0.1889	1.221	-0.15	0.8771
factor(NDC)172731046	0.0383	0.7835	0.05	0.961
factor(NDC)173093356	0.7124	2.4211	0.29	0.7686
factor(NDC)17478020919	1.4119	0.7347	1.92	0.0546
factor(NDC)17478071410	0.7677	0.4479	1.71	0.0865
factor(NDC)17478076206	0.4298	0.6158	0.7	0.4852
factor(NDC)185002210	0.007	2.3941	0	0.9977
factor(NDC)185004710	-0.6023	2.3939	-0.25	0.8014
factor(NDC)185014501	-0.0686	0.5501	-0.12	0.9007
factor(NDC)186504031	-0.4968	0.5201	-0.96	0.3395
factor(NDC)224185281	0.1527	11.22	0.01	0.9891
factor(NDC)228285511	0.4508	0.4951	0.91	0.3626
factor(NDC)228289150	0.5574	0.7889	0.71	0.4799
factor(NDC)228306211	-0.0589	0.5747	-0.1	0.9184
factor(NDC)228308406	-0.1212	0.6181	-0.2	0.8446

Table C.3 –Continued

factor(NDC)228348211	0.3041	0.5536	0.55	0.5828
factor(NDC)23155064609	-0.0068	2.0814	0	0.9974
factor(NDC)2323930	-1.2087	0.8916	-1.36	0.1752
factor(NDC)24208058559	48.4936	6.4854	7.48	0
factor(NDC)24208060105	-0.3778	0.641	-0.59	0.5556
factor(NDC)24338013213	-0.4527	1.722	-0.26	0.7926
factor(NDC)24385001121	0.6386	2.7485	0.23	0.8163
factor(NDC)24385003936	0.348	3.4817	0.1	0.9204
factor(NDC)24385035926	-0.5005	0.5801	-0.86	0.3882
factor(NDC)24385059471	3.7817	0.7796	4.85	0
factor(NDC)245018115	0.0216	0.8623	0.03	0.98
factor(NDC)24658016271	1.6863	9.1644	0.18	0.854
factor(NDC)24658031201	0.7791	2.088	0.37	0.709
factor(NDC)27241001603	-0.0268	0.6437	-0.04	0.9668
factor(NDC)27808008602	1.4873	0.6342	2.35	0.019
factor(NDC)281032630	-0.188	1.2583	-0.15	0.8812
factor(NDC)29300011405	0.0332	0.4765	0.07	0.9444
factor(NDC)29300011805	-0.5453	6.4858	-0.08	0.933
factor(NDC)29300024110	-0.5263	0.7338	-0.72	0.4732
factor(NDC)31722020930	-0.0505	0.4763	-0.11	0.9156
factor(NDC)31722032801	0.0793	4.4148	0.02	0.9857
factor(NDC)31722045903	1.2842	1.7408	0.74	0.4607
factor(NDC)31722056924	-0.2083	0.6103	-0.34	0.7329
factor(NDC)31722057330	1.7774	0.8896	2	0.0457
factor(NDC)31722058160	0.1226	0.6807	0.18	0.8571
factor(NDC)31722072830	-0.1572	0.4958	-0.32	0.7511
factor(NDC)31722073830	-0.1319	1.1565	-0.11	0.9092
factor(NDC)33342004507	-0.3055	2.5352	-0.12	0.9041
factor(NDC)33342011007	-0.0055	0.5821	-0.01	0.9924
factor(NDC)33342012307	0.9222	0.7152	1.29	0.1972
factor(NDC)36800082529	-0.2149	2.7865	-0.08	0.9385
factor(NDC)37205028078	0.0066	2.033	0	0.9974
factor(NDC)37205029272	0.1478	2.134	0.07	0.9448
factor(NDC)37205083766	0.0615	2.2526	0.03	0.9782
factor(NDC)378002301	-0.1513	0.5648	-0.27	0.7888
factor(NDC)378004701	-0.2571	0.5057	-0.51	0.6111
factor(NDC)378005301	-0.1391	0.7136	-0.19	0.8454
factor(NDC)378014105	-0.0013	1.9067	0	0.9994
factor(NDC)378014805	0.5998	1.2586	0.48	0.6337
factor(NDC)378034201	-0.3761	0.787	-0.48	0.6327
factor(NDC)378036010	-1.5405	3.8657	-0.4	0.6903

Table C.3 –Continued

factor(NDC)378061601	-0.4641	0.6575	-0.71	0.4803
factor(NDC)378111005	-0.076	0.5736	-0.13	0.8946
factor(NDC)378117591	0.0685	0.5008	0.14	0.8911
factor(NDC)378135505	0.012	0.6946	0.02	0.9863
factor(NDC)378157591	0.3479	1.1414	0.3	0.7605
factor(NDC)378191077	-0.1951	1.7129	-0.11	0.9093
factor(NDC)378207310	-0.0278	0.5571	-0.05	0.9603
factor(NDC)378253710	-0.2939	0.517	-0.57	0.5697
factor(NDC)378300377	-0.6214	5.2995	-0.12	0.9067
factor(NDC)378414101	0.868	2.9192	0.3	0.7662
factor(NDC)378456177	-0.3077	0.6459	-0.48	0.6338
factor(NDC)378521077	-0.1802	0.5159	-0.35	0.7269
factor(NDC)378543877	2.1399	9.165	0.23	0.8154
factor(NDC)378548510	-0.3851	1.5133	-0.25	0.7991
factor(NDC)378557505	-0.849	6.4857	-0.13	0.8959
factor(NDC)378604328	0.1345	0.7697	0.17	0.8613
factor(NDC)378610505	0.2906	5.3008	0.05	0.9563
factor(NDC)378611301	-0.1555	0.9881	-0.16	0.875
factor(NDC)378709801	0.2858	0.6395	0.45	0.655
factor(NDC)378715005	0.4174	0.884	0.47	0.6368
factor(NDC)378815877	-0.6017	1.4456	-0.42	0.6773
factor(NDC)406012423	3.4059	1.6874	2.02	0.0436
factor(NDC)406012501	-0.2065	0.4735	-0.44	0.6627
factor(NDC)406012523	7.3889	2.0821	3.55	0.0004
factor(NDC)42292001401	21.72	6.4869	3.35	0.0008
factor(NDC)42292001420	0.1484	6.4873	0.02	0.9817
factor(NDC)42543049701	-0.2191	0.9391	-0.23	0.8156
factor(NDC)42571013252	-0.3461	1.4896	-0.23	0.8163
factor(NDC)42806005801	0.1226	1.1794	0.1	0.9172
factor(NDC)43386053006	0.049	0.5621	0.09	0.9305
factor(NDC)43478024320	-0.8207	0.4975	-1.65	0.099
factor(NDC)43478027115	-1.2882	3.865	-0.33	0.7389
factor(NDC)43547034050	-0.2146	0.4844	-0.44	0.6577
factor(NDC)43547034811	-0.0407	0.524	-0.08	0.9381
factor(NDC)43547035311	-0.1887	0.4669	-0.4	0.6861
factor(NDC)43598044770	0.1434	0.5846	0.25	0.8062
factor(NDC)44183020816	0.1637	4.1125	0.04	0.9682
factor(NDC)45802010501	0.023	1.2304	0.02	0.9851
factor(NDC)45802011222	0.2567	0.4361	0.59	0.5561
factor(NDC)45802021001	-2.811	0.7135	-3.94	0.0001
factor(NDC)45802026337	-0.0406	0.4637	-0.09	0.9302

Table C.3 –Continued

factor(NDC)45802036235	-0.8671	0.9194	-0.94	0.3456
factor(NDC)45963030309	-0.3342	2.3436	-0.14	0.8866
factor(NDC)45963055930	0.9552	0.5306	1.8	0.0718
factor(NDC)45963056808	0.6641	5.3012	0.13	0.9003
factor(NDC)45963063404	0.0074	0.5265	0.01	0.9888
factor(NDC)46672005310	-0.2013	0.531	-0.38	0.7047
factor(NDC)472037145	0.0595	0.6091	0.1	0.9221
factor(NDC)472127094	-0.2666	0.6063	-0.44	0.6602
factor(NDC)472178310	1.6026	1.5133	1.06	0.2896
factor(NDC)47335066868	8.1871	1.8699	4.38	0
factor(NDC)47335076083	-0.8376	5.2994	-0.16	0.8744
factor(NDC)47781019601	-0.1118	0.507	-0.22	0.8254
factor(NDC)47781033530	1.4863	0.7607	1.95	0.0507
factor(NDC)49348022934	-0.6828	0.5584	-1.22	0.2215
factor(NDC)49348093044	-0.3564	0.7745	-0.46	0.6454
factor(NDC)49348095434	-1.0927	1.1214	-0.97	0.3299
factor(NDC)49483033110	-0.0415	1.1546	-0.04	0.9713
factor(NDC)49702020218	-0.1015	0.9095	-0.11	0.9111
factor(NDC)49884000910	-0.2656	1.078	-0.25	0.8054
factor(NDC)49884002710	0.0186	0.5827	0.03	0.9745
factor(NDC)49884003401	-0.289	0.569	-0.51	0.6115
factor(NDC)49884032055	1.1842	0.8965	1.32	0.1865
factor(NDC)49884094601	-0.1025	0.9707	-0.11	0.9159
factor(NDC)49908015030	-0.5024	4.7964	-0.1	0.9166
factor(NDC)50111039403	-0.0092	0.7802	-0.01	0.9906
factor(NDC)50111039803	-0.0905	0.6336	-0.14	0.8865
factor(NDC)50268040111	-0.0226	9.165	0	0.998
factor(NDC)50268060015	2.1952	4.1138	0.53	0.5936
factor(NDC)50383024116	-0.2504	0.4411	-0.57	0.5703
factor(NDC)50419040703	-0.3048	0.8911	-0.34	0.7323
factor(NDC)50458059050	0.1235	0.5589	0.22	0.8251
factor(NDC)50474059766	-1.1087	0.4623	-2.4	0.0165
factor(NDC)50742015601	-0.1252	0.8608	-0.15	0.8844
factor(NDC)50742020801	0.4776	3.6576	0.13	0.8961
factor(NDC)50742061510	-0.0113	0.8538	-0.01	0.9894
factor(NDC)51079005101	3.7054	1.3126	2.82	0.0048
factor(NDC)51079010519	-0.9988	3.4817	-0.29	0.7742
factor(NDC)51079014220	-0.742	6.4854	-0.11	0.9089
factor(NDC)51079029420	1.0517	0.8091	1.3	0.1937
factor(NDC)51079030020	5.3917	1.0234	5.27	0
factor(NDC)51079037901	0.9387	9.164	0.1	0.9184

Table C.3 –Continued

factor(NDC)51079054220	154.6355	1.0314	149.93	0
factor(NDC)51293082101	-0.3404	0.9063	-0.38	0.7072
factor(NDC)51645070601	-0.3403	0.8296	-0.41	0.6817
factor(NDC)51660012312	-0.9281	2.1344	-0.43	0.6637
factor(NDC)51660035230	-0.3117	1.1218	-0.28	0.7811
factor(NDC)51660072469	0.0192	0.6724	0.03	0.9772
factor(NDC)51672125303	-0.1247	0.4842	-0.26	0.7967
factor(NDC)51672126103	-0.697	4.2558	-0.16	0.8699
factor(NDC)51672129402	-0.1527	2.081	-0.07	0.9415
factor(NDC)51672129602	-3.7614	11.2202	-0.34	0.7374
factor(NDC)51672130601	-0.4214	0.6341	-0.66	0.5063
factor(NDC)51672209208	-0.1068	0.4421	-0.24	0.8092
factor(NDC)51672302009	1.1695	0.7437	1.57	0.1159
factor(NDC)51672405204	-0.8012	1.5448	-0.52	0.604
factor(NDC)517281025	1.0509	9.164	0.11	0.9087
factor(NDC)51845030	-0.2218	0.6522	-0.34	0.7338
factor(NDC)51862022901	-0.1291	0.5967	-0.22	0.8287
factor(NDC)51862058201	1.6971	0.8206	2.07	0.0386
factor(NDC)51991064390	0.0238	3.0751	0.01	0.9938
factor(NDC)51991070890	0.7261	2.6699	0.27	0.7857
factor(NDC)51991070990	0.5453	2.0176	0.27	0.787
factor(NDC)51991075033	0.5744	1.4104	0.41	0.6839
factor(NDC)51991077233	0.678	0.6828	0.99	0.3207
factor(NDC)5250002	-0.8691	3.4023	-0.26	0.7984
factor(NDC)5250023	-0.1763	1.9876	-0.09	0.9293
factor(NDC)52544069530	-1.7186	7.9386	-0.22	0.8286
factor(NDC)527134101	-0.2067	0.4913	-0.42	0.6739
factor(NDC)527139701	0.1411	0.8349	0.17	0.8658
factor(NDC)527142562	-1.0055	9.164	-0.11	0.9126
factor(NDC)53489055101	0.0189	0.5857	0.03	0.9743
factor(NDC)536100059	-0.2926	0.6583	-0.44	0.6567
factor(NDC)536102206	0.0813	2.2524	0.04	0.9712
factor(NDC)536102637	-0.3529	1.8122	-0.19	0.8456
factor(NDC)536113428	-0.2091	1.3122	-0.16	0.8734
factor(NDC)536359701	-0.2002	0.9115	-0.22	0.8262
factor(NDC)536439135	-0.5696	7.9383	-0.07	0.9428
factor(NDC)536515026	-0.1332	0.7708	-0.17	0.8628
factor(NDC)536570098	-0.0965	0.7074	-0.14	0.8915
factor(NDC)53746010110	-0.0815	0.5833	-0.14	0.8889
factor(NDC)53746010910	-0.0025	4.4155	0	0.9995
factor(NDC)53746017801	-0.2666	0.4388	-0.61	0.5435

Table C.3 –Continued

factor(NDC)53746046400	-0.4141	1.5136	-0.27	0.7844
factor(NDC)53746054405	-0.1677	0.8029	-0.21	0.8346
factor(NDC)54008813	-0.5479	1.9457	-0.28	0.7783
factor(NDC)54040441	-0.0459	6.0058	-0.01	0.9939
factor(NDC)54092025490	-0.1405	2.081	-0.07	0.9462
factor(NDC)54092038301	4.7552	0.4484	10.61	0
factor(NDC)54329446	-0.259	0.4921	-0.53	0.5987
factor(NDC)54350049	-0.2424	0.491	-0.49	0.6216
factor(NDC)54372144	-0.084	3.4805	-0.02	0.9807
factor(NDC)54458086210	-0.3989	0.7516	-0.53	0.5956
factor(NDC)54838013570	-0.4901	1.2217	-0.4	0.6883
factor(NDC)55111014330	0.2234	7.9386	0.03	0.9776
factor(NDC)55111015030	-0.4938	0.5806	-0.85	0.3951
factor(NDC)55111015905	0.1188	0.4561	0.26	0.7945
factor(NDC)55111018601	0.1735	0.4882	0.36	0.7223
factor(NDC)55111025860	0.4995	0.4475	1.12	0.2643
factor(NDC)55111026581	2.3283	0.5509	4.23	0
factor(NDC)55111035710	0.4773	0.8119	0.59	0.5566
factor(NDC)55111052701	2.8033	0.5645	4.97	0
factor(NDC)55111053201	-0.2742	0.444	-0.62	0.5368
factor(NDC)55111054990	-0.0279	1.6219	-0.02	0.9863
factor(NDC)55150011720	4.317	4.2548	1.01	0.3103
factor(NDC)55390012101	58.7642	2.2106	26.58	0
factor(NDC)55390031010	3.6967	2.2743	1.63	0.1041
factor(NDC)555015802	-0.0528	0.5991	-0.09	0.9298
factor(NDC)555087402	-0.17	0.6286	-0.27	0.7868
factor(NDC)555095202	-0.1802	0.5785	-0.31	0.7555
factor(NDC)555904979	-0.5637	2.4759	-0.23	0.8199
factor(NDC)56016970	-0.3049	0.6985	-0.44	0.6625
factor(NDC)56017670	-0.4887	0.8576	-0.57	0.5688
factor(NDC)57237007530	-0.0375	0.505	-0.07	0.9408
factor(NDC)57237011001	-0.6171	0.7861	-0.78	0.4325
factor(NDC)57237016290	-1.6217	1.8698	-0.87	0.3858
factor(NDC)57664064108	-0.1087	0.5575	-0.19	0.8454
factor(NDC)57664064988	-0.6587	0.5904	-1.12	0.2646
factor(NDC)58657013390	0.3376	5.6197	0.06	0.9521
factor(NDC)58657016112	-1.2294	3.1327	-0.39	0.6947
factor(NDC)591065801	-0.2233	0.5457	-0.41	0.6824
factor(NDC)591252005	-0.1414	0.7596	-0.19	0.8523
factor(NDC)591329315	0.822	1.1487	0.72	0.4742
factor(NDC)591352511	6.0677	1.7707	3.43	0.0006

Table C.3 –Continued

factor(NDC)591377619	0.2969	1.8689	0.16	0.8738
factor(NDC)591396401	4.8961	0.6107	8.02	0
factor(NDC)591410301	-0.0325	0.8749	-0.04	0.9704
factor(NDC)591578701	-0.1349	0.5518	-0.24	0.8068
factor(NDC)59746017706	4.5698	0.5724	7.98	0
factor(NDC)59746032430	0.1462	0.4497	0.33	0.7451
factor(NDC)59746033430	0.0502	1.2209	0.04	0.9672
factor(NDC)59746044890	-0.0688	2.5673	-0.03	0.9786
factor(NDC)59746067134	0.1428	2.9201	0.05	0.961
factor(NDC)59762152002	2.2717	0.5927	3.83	0.0001
factor(NDC)59762308001	0.9737	0.5433	1.79	0.0731
factor(NDC)59762374401	1.4594	0.4492	3.25	0.0012
factor(NDC)59762453802	-3.435	0.4346	-7.9	0
factor(NDC)59762490004	-0.1335	0.4807	-0.28	0.7812
factor(NDC)60258015816	-0.1089	2.4758	-0.04	0.9649
factor(NDC)603021021	-0.1912	0.6786	-0.28	0.7782
factor(NDC)603085758	-0.41	0.6046	-0.68	0.4976
factor(NDC)603153458	-0.3094	0.6867	-0.45	0.6522
factor(NDC)603211060	0.4286	9.1644	0.05	0.9627
factor(NDC)603294821	-0.1767	0.5747	-0.31	0.7585
factor(NDC)603294928	-0.1296	0.541	-0.24	0.8106
factor(NDC)603333021	-0.6672	3.7567	-0.18	0.859
factor(NDC)603388702	0.0965	1.6613	0.06	0.9537
factor(NDC)603389002	0.0491	2.7864	0.02	0.9859
factor(NDC)603424721	0.1948	0.5705	0.34	0.7328
factor(NDC)603516521	-0.1606	0.5584	-0.29	0.7736
factor(NDC)603533921	0.0511	0.562	0.09	0.9275
factor(NDC)603533928	-0.0529	0.5257	-0.1	0.9199
factor(NDC)603548332	-0.1927	0.5226	-0.37	0.7124
factor(NDC)60505006603	-1.1086	9.1641	-0.12	0.9037
factor(NDC)60505018601	-0.5511	2.7864	-0.2	0.8432
factor(NDC)60505074401	-0.2095	15.8635	-0.01	0.9895
factor(NDC)60505100301	0.8551	0.5864	1.46	0.1448
factor(NDC)60505283303	0.434	1.0612	0.41	0.6826
factor(NDC)60687014511	8.146	0.7815	10.42	0
factor(NDC)60758086615	-1.1529	9.1641	-0.13	0.8999
factor(NDC)61314035401	12.6214	15.8632	0.8	0.4262
factor(NDC)61314063136	0.4088	0.4535	0.9	0.3673
factor(NDC)61442011201	0.2703	0.4541	0.6	0.5517
factor(NDC)62011001702	-0.0343	1.0681	-0.03	0.9744
factor(NDC)62011029201	-1.0753	1.3164	-0.82	0.414

Table C.3 –Continued

factor(NDC)62011033201	-0.5531	3.0756	-0.18	0.8573
factor(NDC)62037059805	0.021	0.5253	0.04	0.9681
factor(NDC)62037069890	0.1363	0.6578	0.21	0.8359
factor(NDC)62107002636	-0.4773	0.9793	-0.49	0.626
factor(NDC)62107004810	0.5632	11.2202	0.05	0.96
factor(NDC)62175089046	-0.0211	0.5511	-0.04	0.9694
factor(NDC)62332002990	-0.6183	3.0754	-0.2	0.8407
factor(NDC)62332007660	0.1452	1.0835	0.13	0.8934
factor(NDC)62332008290	-0.0369	1.061	-0.03	0.9722
factor(NDC)62332010230	0.7702	0.7906	0.97	0.33
factor(NDC)62332011491	-0.051	1.846	-0.03	0.978
factor(NDC)62756016081	-0.1081	1.5076	-0.07	0.9428
factor(NDC)62756018788	-1.0429	4.7973	-0.22	0.8279
factor(NDC)62756035664	1.6904	0.475	3.56	0.0004
factor(NDC)63044015001	-0.3665	0.5353	-0.68	0.4935
factor(NDC)63304031330	1.3753	1.5446	0.89	0.3732
factor(NDC)63304044890	-0.1832	2.4758	-0.07	0.941
factor(NDC)63304055301	0.1609	1.2213	0.13	0.8952
factor(NDC)63304062310	-0.0455	0.5182	-0.09	0.93
factor(NDC)63304082890	0.3325	0.6032	0.55	0.5815
factor(NDC)63323034020	3.9908	3.6573	1.09	0.2752
factor(NDC)63459010101	-0.5522	3.9835	-0.14	0.8898
factor(NDC)63739007310	7.5466	0.7349	10.27	0
factor(NDC)63739044310	3.6337	1.2692	2.86	0.0042
factor(NDC)63824000861	-0.1699	1.0152	-0.17	0.8671
factor(NDC)63868013230	0.0026	1.2975	0	0.9984
factor(NDC)63868033860	-0.09	3.7569	-0.02	0.9809
factor(NDC)64125090605	-0.2669	0.7122	-0.37	0.7079
factor(NDC)64376013201	0.9781	0.7194	1.36	0.174
factor(NDC)64380073508	-0.1362	0.7232	-0.19	0.8506
factor(NDC)64380076304	0.3303	0.8971	0.37	0.7128
factor(NDC)64679010102	-0.1054	1.7043	-0.06	0.9507
factor(NDC)64679043304	0.3303	1.0645	0.31	0.7563
factor(NDC)64679051602	0.322	0.7704	0.42	0.676
factor(NDC)64679073702	0.4366	0.8352	0.52	0.6012
factor(NDC)64679090601	0.1986	1.4562	0.14	0.8915
factor(NDC)64679090603	0.1829	1.0798	0.17	0.8655
factor(NDC)64980016201	-0.1148	0.7871	-0.15	0.884
factor(NDC)64980037603	0.3887	0.6168	0.63	0.5286
factor(NDC)65042915	0.005	0.8269	0.01	0.9952
factor(NDC)65162005711	-0.0367	2.7864	-0.01	0.9895

Table C.3 –Continued

factor(NDC)65162023709	-0.3574	1.0023	-0.36	0.7214
factor(NDC)65162052210	-0.0277	0.5162	-0.05	0.9571
factor(NDC)65162067684	0.0785	0.8243	0.1	0.9242
factor(NDC)65597010590	-0.4032	3.2596	-0.12	0.9016
factor(NDC)65862004201	-0.8163	2.2971	-0.36	0.7223
factor(NDC)65862012005	0.5967	4.2561	0.14	0.8885
factor(NDC)65862017699	-0.0721	0.594	-0.12	0.9033
factor(NDC)65862019499	0.0271	0.4895	0.06	0.9558
factor(NDC)65862020290	-0.1102	0.4402	-0.25	0.8023
factor(NDC)65862032699	0.0356	2.4203	0.01	0.9883
factor(NDC)65862042001	-0.1506	0.4767	-0.32	0.7521
factor(NDC)65862047601	-0.0412	0.6113	-0.07	0.9463
factor(NDC)65862052730	0.045	0.4687	0.1	0.9235
factor(NDC)65862086230	-0.8978	2.4764	-0.36	0.7169
factor(NDC)65862092127	0.11	0.7051	0.16	0.876
factor(NDC)66993016502	-0.2552	0.4633	-0.55	0.5818
factor(NDC)66993046530	1.6335	0.5944	2.75	0.006
factor(NDC)66993082230	-2.187	5.6196	-0.39	0.6972
factor(NDC)66993093570	-0.1633	0.5432	-0.3	0.7637
factor(NDC)67001624	0.0274	11.2201	0	0.9981
factor(NDC)67253020111	-0.1644	0.5542	-0.3	0.7668
factor(NDC)67457014630	1.1931	7.1023	0.17	0.8666
factor(NDC)67877010501	0.0986	0.4594	0.21	0.8301
factor(NDC)67877013005	-0.9823	7.1028	-0.14	0.89
factor(NDC)68001016208	0.0148	0.4907	0.03	0.976
factor(NDC)68001020400	-0.1025	0.5771	-0.18	0.859
factor(NDC)68001024716	33.7878	6.4856	5.21	0
factor(NDC)68001025001	4.2294	3.7572	1.13	0.2603
factor(NDC)68025008190	-0.4042	6.4853	-0.06	0.9503
factor(NDC)68047025201	-0.0102	1.8026	-0.01	0.9955
factor(NDC)68084038011	17.1308	9.164	1.87	0.0616
factor(NDC)68084044401	-0.0299	6.4874	0	0.9963
factor(NDC)68084048111	75.982	15.8637	4.79	0
factor(NDC)68084065901	39.0996	2.9215	13.38	0
factor(NDC)68084078311	-0.326	3.2596	-0.1	0.9203
factor(NDC)68084079711	-0.7954	4.1129	-0.19	0.8467
factor(NDC)68084088211	-0.2119	9.165	-0.02	0.9816
factor(NDC)68180011402	0.0061	0.4932	0.01	0.9901
factor(NDC)68180012909	0.6796	0.6435	1.06	0.291
factor(NDC)68180019506	-0.5342	3.7571	-0.14	0.8869
factor(NDC)68180026501	-0.3074	1.7226	-0.18	0.8584

Table C.3 –Continued

factor(NDC)68180028501	0.1907	2.3191	0.08	0.9345
factor(NDC)68180033107	0.2178	0.4564	0.48	0.6332
factor(NDC)68180036009	0.0816	0.5195	0.16	0.8753
factor(NDC)68180048102	-0.1332	0.528	-0.25	0.8009
factor(NDC)68180048702	-0.1173	0.4622	-0.25	0.7996
factor(NDC)68180051401	0.0017	0.4545	0	0.9971
factor(NDC)68180059701	0.0662	1.0102	0.07	0.9477
factor(NDC)68180065907	-0.0563	0.535	-0.11	0.9161
factor(NDC)68180067711	0.4464	1.2901	0.35	0.7293
factor(NDC)68180075501	0.1029	0.8638	0.12	0.9052
factor(NDC)68180082813	-0.3232	1.6534	-0.2	0.845
factor(NDC)68180084613	-0.0723	0.5437	-0.13	0.8943
factor(NDC)68308014501	-0.2994	0.5903	-0.51	0.612
factor(NDC)68382001014	-0.2072	0.4463	-0.46	0.6425
factor(NDC)68382004001	-0.113	0.4432	-0.25	0.7988
factor(NDC)68382004201	-0.3917	0.5571	-0.7	0.482
factor(NDC)68382005801	-0.0357	0.5344	-0.07	0.9468
factor(NDC)68382012316	-0.1539	0.4761	-0.32	0.7465
factor(NDC)68382013716	-0.1602	0.4765	-0.34	0.7368
factor(NDC)68382076214	0.5608	0.4809	1.17	0.2436
factor(NDC)68382080510	-0.2012	0.7431	-0.27	0.7866
factor(NDC)68382090701	0.6096	1.6871	0.36	0.7178
factor(NDC)68462013135	-0.3174	0.8442	-0.38	0.7069
factor(NDC)68462017905	-0.0442	0.6092	-0.07	0.9421
factor(NDC)68462022517	0.0478	0.4662	0.1	0.9183
factor(NDC)68462022901	-0.1612	0.476	-0.34	0.7349
factor(NDC)68462027501	-0.0649	0.4986	-0.13	0.8964
factor(NDC)68462029112	19.2697	0.8374	23.01	0
factor(NDC)68462034001	0.4283	2.6695	0.16	0.8725
factor(NDC)68462058201	0.1758	1.1493	0.15	0.8784
factor(NDC)68462065629	-0.6661	0.8164	-0.82	0.4146
factor(NDC)68645022254	0.0475	1.0299	0.05	0.9632
factor(NDC)68645025254	0.5053	11.2206	0.05	0.9641
factor(NDC)68645048170	0.1252	0.5758	0.22	0.8279
factor(NDC)68682010910	-0.0811	0.5832	-0.14	0.8894
factor(NDC)69097082312	-0.0672	0.5979	-0.11	0.9106
factor(NDC)69097083715	-0.1738	0.5268	-0.33	0.7415
factor(NDC)69097083805	-0.1696	0.5537	-0.31	0.7593
factor(NDC)69238148901	-0.0524	1.5714	-0.03	0.9734
factor(NDC)69238156401	0.2001	4.5934	0.04	0.9653
factor(NDC)69367015504	0.0318	3.133	0.01	0.9919

Table C.3 –Continued

factor(NDC)69367016204	0.0258	0.6921	0.04	0.9702
factor(NDC)69367016304	0.1518	0.6343	0.24	0.8109
factor(NDC)69452012820	-0.0791	1.2791	-0.06	0.9507
factor(NDC)69452014420	-0.3769	0.6532	-0.58	0.564
factor(NDC)69543013650	-0.1431	0.5376	-0.27	0.7901
factor(NDC)69543038030	-0.044	1.3316	-0.03	0.9736
factor(NDC)70000020701	-0.367	9.1645	-0.04	0.9681
factor(NDC)70069013101	0.8487	0.6253	1.36	0.1747
factor(NDC)703005101	4.346	1.7596	2.47	0.0135
factor(NDC)70710106601	0.6415	4.1121	0.16	0.876
factor(NDC)71093011204	-0.152	0.7833	-0.19	0.8462
factor(NDC)713063415	-0.1443	0.5048	-0.29	0.775
factor(NDC)713066815	-1.4603	0.6235	-2.34	0.0192
factor(NDC)71717010250	-0.1788	2.152	-0.08	0.9338
factor(NDC)72205000599	0.6516	11.221	0.06	0.9537
factor(NDC)74780419	-1.5498	1.4403	-1.08	0.2819
factor(NDC)76282023710	-0.302	2.1167	-0.14	0.8865
factor(NDC)76439012010	-0.5231	2.4754	-0.21	0.8326
factor(NDC)76439020690	0.7275	5.0292	0.14	0.885
factor(NDC)76439025216	-0.2223	0.5968	-0.37	0.7096
factor(NDC)781100801	0.1967	0.5998	0.33	0.743
factor(NDC)781100805	0.1169	0.614	0.19	0.849
factor(NDC)781139601	-0.1466	0.4993	-0.29	0.7691
factor(NDC)781178905	-0.0702	0.6329	-0.11	0.9117
factor(NDC)781202001	-0.2479	0.5221	-0.47	0.6349
factor(NDC)781278501	-0.2748	2.3199	-0.12	0.9057
factor(NDC)781405815	-0.2646	0.5588	-0.47	0.6358
factor(NDC)781504301	0.2664	1.4007	0.19	0.8491
factor(NDC)781506801	-0.1565	1.1875	-0.13	0.8951
factor(NDC)781537105	-0.2474	0.5246	-0.47	0.6372
factor(NDC)781555531	-0.0323	0.5187	-0.06	0.9503
factor(NDC)781556701	-0.1336	0.857	-0.16	0.8761
factor(NDC)781558436	-0.1104	0.5867	-0.19	0.8508
factor(NDC)781570192	-0.2862	0.7328	-0.39	0.6961
factor(NDC)781599401	0.0455	0.7396	0.06	0.9509
factor(NDC)781635587	0.9297	0.6424	1.45	0.1479
factor(NDC)832030110	-0.0444	1.3159	-0.03	0.9731
factor(NDC)832091015	-0.3626	0.9366	-0.39	0.6987
factor(NDC)832107130	0.3371	4.255	0.08	0.9369
factor(NDC)832112035	0.1857	0.8442	0.22	0.8259
factor(NDC)85171801	0.1435	9.1642	0.02	0.9875

Table C.3 –Continued

factor(NDC)904201959	-0.2412	1.4348	-0.17	0.8665
factor(NDC)904530760	-0.2734	0.5494	-0.5	0.6188
factor(NDC)904581852	-0.1424	1.8808	-0.08	0.9396
factor(NDC)904625549	-0.0167	1.4618	-0.01	0.9909
factor(NDC)904635561	-1.0788	9.164	-0.12	0.9063
factor(NDC)904636061	10.8567	2.7866	3.9	0.0001
factor(NDC)904637661	1.3761	1.5311	0.9	0.3688
factor(NDC)904645461	-0.5654	3.26	-0.17	0.8623
factor(NDC)904791451	-0.3093	1.2397	-0.25	0.803
factor(NDC)904791540	-0.3426	0.5555	-0.62	0.5374
factor(NDC)93001298	-0.1098	0.4759	-0.23	0.8175
factor(NDC)93022056	-0.2245	0.7215	-0.31	0.7556
factor(NDC)93035010	-0.1366	0.7113	-0.19	0.8477
factor(NDC)93078256	-0.2452	0.584	-0.42	0.6746
factor(NDC)93084030	-0.251	0.5771	-0.43	0.6637
factor(NDC)93100501	-0.2317	0.582	-0.4	0.6905
factor(NDC)93101501	-0.0363	0.5648	-0.06	0.9488
factor(NDC)93113556	-1.0846	2.017	-0.54	0.5908
factor(NDC)93226801	-0.206	0.4984	-0.41	0.6794
factor(NDC)93412774	-0.3716	0.4957	-0.75	0.4535
factor(NDC)93423601	-0.4164	0.68	-0.61	0.5403
factor(NDC)93474250	0.0647	2.1335	0.03	0.9758
factor(NDC)93552856	6.8738	0.9674	7.11	0
factor(NDC)93727398	0.1253	0.7168	0.17	0.8612
factor(NDC)93732701	0.1344	6.4872	0.02	0.9835
factor(NDC)93754010	-0.0077	1.0392	-0.01	0.9941
factor(NDC)95300001	0.235	1.4252	0.16	0.869

REFERENCES

Abelson, R. (2018, October 10). CVS Health and Aetna $69 Billion Merger Is Approved With Conditions. *The New York Times*. Retrieved from https://www.nytimes.com/2018/10/10/health/cvs-aetna-merger.html

Adams, M. B. (1994). Agency theory and the internal audit. *Managerial auditing journal*.

ALEC (2007). Resolution Opposing Government Mandated Disclosure of Proprietary, Trade Secret Information Retrieved from https://www.alec.org/model-policy/resolution opposing-government-mandated-disclosure-of-proprietary-trade-secret-information/

Almashat, S. (2014, June). Pharmaceutical Lobby Reigns Supreme in Washington. Retrieved April 29, 2017, from http://www.citizen.org/our-work/health-and-safety/health-letter-pharmaceutical-lobby-reigns-supreme-washington

American Legislative Exchange Council (2011). Conference Sponsors, conference brochure on file with CMD, August 11, 2011

Assistant Secretary for Planning and Evaluation. "Report to the President: Prescription Drug Coverage, Spending, Utilization, and Prices.": 2000.

Balcerzak, A. (2017, April 21). PhRMA shows biggest spike in lobbying spending in first quarter of President Trump. Retrieved April 29, 2017, from https://www.opensecrets.org/news/2017/04/phrma-shows-biggest-spike-in-lobbying-spending-in-first-quarter-of-president-trump/

Balick, R. (2018, July). Pharmacists fume over slashed Medicaid reimbursement rates. Retrieved from https://www.pharmacytoday.org/article/S1042-0991(18)30947-2/fulltext/S1042-0991(18)30947-2/fulltext

Balla, S. J. (2001). Interstate professional associations and the diffusion of policy innovations. *American Politics Research*, *29*(3), 221-245.

Barrett, L. L. (2005). Prescription Drug Use Among Midlife and Older Americans. AARP, 1-32.

Baumgartner, F. R., Berry, J. M., Hojnacki, M., Kimball, D. C., & Leech, B. L. (2006). The structure of policy conflict. In *annual meetings of the Midwest Political Science Association, Chicago*

Baumgartner, F. R., De Boef, S. L., & Boydstun, A. E. (2008). *The decline of the death penalty and the discovery of innocence*. Cambridge University Press.

Baumgartner, F. R., Berry, J. M., Hojnacki, M., Leech, B. L., & Kimball, D. C. (2009). *Lobbying and policy change: Who wins, who loses, and why*. University of Chicago Press.

Baxter, A. (2018, August 16). Ohio Medicaid ends contracts with CVS Caremark, Optum. Retrieved from https://www.healthexec.com/topics/policy/ohio-medicaid-ends-contracts-cvs-caremark-optum

Berry, F. S., & Berry, W. D. (1990). State lottery adoptions as policy innovations: An event history analysis. *American political science review*, *84*(2), 395-415.

Berry, F. S. (1994). Sizing up state policy innovation research. *Policy Studies Journal*, *22*(3), 442-456.

BRIEF OF PHARMACEUTICAL RESEARCH AND MANUFACTURERS OF AMERICA (PhRMA) AS AMICUS CURIAE IN SUPPORT OF PETITIONERS (2010). Retrieved April 29, 2017, from www.americanbar.org/content/dam/aba/publishing/preview/publiced_preview_briefs_pdfs_09_10_09_1273_PetitionerAmCuPhRMA.pdf

Bulik, B. S. (2017, April 10). PhRMA and PCMA fire up another tit-for-tat spat over new drug pricing ad campaign. Retrieved April 29, 2017, from http://www.fiercepharma.com/marketing/phrma-and-pcma-s-fire-up-another-tit-for-tat-spat-over-new-ad-campaign

Candisky, C. (2020, February 26). State task force tackling high prescription drug costs. Retrieved from https://www.dispatch.com/news/20200226/state-task-force-tackling-high-prescription-drug-costs

Clifton, E. (2012, March 12). Double Agent's Obamacare Sabotage. Retrieved April 29, 2017, from http://www.theinvestigativefund.org/investigations/politicsandgovernment/1951/double_agent%E2%80%99s_obamacare_sabotage/

"CMS Discusses Details of New "National Average Drug Acquisition Cost" Survey." Health Industry Washington Watch. March 31, 2016. Accessed August 31, 2017. https://www.healthindustrywashingtonwatch.com/2011/08/articles/other-health-policy-developments/other-hhs-developments/cms-discusses-details-of-new-national-average-drug-acquisition-cost-survey/.

CNBC Transcript: Mylan CEO Heather Bresch Sits Down with CNBC's Brian Sullivan Today on "Squawk Box". (2016, August 25). Retrieved February 13, 2017, from http://www.cnbc.com/2016/08/25/first-on-cnbc-cnbc-transcript-mylan-ceo-heather-bresch-sits-down-with-cnbcs-brian-sullivan-today-on-squawk-box.html

Collins, Susan M., and Claire McCaskill. (2016, December). "Sudden Price Spikes in Off-Patent Prescription Drugs: The Monopoly Business Model that Harms Patients, Taxpayers, and the U.S. Health Care System". *Special Committee on Aging: United States Senate*. 3.

Cong. Rec. H1449 (March 1, 2017) (statement of Rep. Dave Loebsack)

Cong. Rec. H1449 (March 1, 2017) (statement of Rep Doug Collins)

Crumer, A. M. (2011). Comparison between Weibull and Cox proportional hazards models.

Data.Medicaid.gov. Retrieved from https://data.medicaid.gov/browse?category=State Drug Utilization&limitTo=datasets

De Bruycker, I. (2017). Framing and advocacy: a research agenda for interest group studies. *Journal of European Public Policy*, *24*(5), 775-787.

Demko, P., Robertson, D., Shafer, J., Nossel, S., & Pesek, W. (2018, September 17). Feds approve Cigna-Express Scripts mega-merger. *Politico*. Retrieved from https://www.politico.com/story/2018/09/17/cigna-express-scripts-merger-775364

Dickerson, B. E., Calamunci, A. J., Butler, A. L., and Waid, N. H. (2016). PBMs and Drug Pricing: Congress and Major U.S. Employers Start to Unravel the Hidden Pricing Mechanisms of PBMs. Retrieved March 22, 2017, from http://www.lexology.com/library/detail.aspx?g=2ae6941d-65a0-4ce1-a7ad-b2031f9a4764

DiJulio, B., Firth, J., & Brodie, M., Kaiser Health Tracking Poll: June 2015. Retrieved February 13, 2017, from http://kff.org/health-costs/poll-finding/kaiser-health-tracking poll-june-2015/

Dimick, J. B., & Ryan, A. M. (2014). Methods for evaluating changes in health care policy: the difference-in-differences approach. *Jama*, *312*(22), 2401-2402.

Dolan, R., & Tian, M. (2020, January 23). Pricing and Payment for Medicaid Prescription Drugs - Issue Brief. Retrieved from https://www.kff.org/report-section/pricing-and-payment-for-medicaid-prescription-drugs-issue-brief/#endnote_link_446009-3

Druckman, J. N. (2004). Political preference formation: Competition, deliberation, and the (ir) relevance of framing effects. *American Political Science Review*, *98*(4), 671-686.

Drug prices are the wrong target, PhRMA CEO Steve Ubl says. (2016, April 30). Retrieved February 13, 2017, from http://www.modernhealthcare.com/article/20160430/MAGAZINE/304309954

Eban, K., & October, F. (2013). Painful prescription. *Fortune*.

Efron, B., & Tibshirani, R. (1986). Bootstrap methods for standard errors, confidence intervals, and other measures of statistical accuracy. *Statistical science*, 54-75.

Entman, R. (1991). Framing US Coverage of International News: Contrast in naratives of the KAL and Iran Air Incident.(online) Dostupno na:< http://jclass. umd. edu/classes/cpsp222.

Federal Trade Commission. (2005). Pharmacy Benefit Managers: Ownership of Mail-Order Pharmacies.

Fein, P. A. (2016, September 14). EpiPen, Channel Economics, and the Great PBM Rebate Debate. Retrieved February 13, 2017, from http://www.drugchannels.net/2016/09/epipen-channel-economics-and-great-pbm.html

French, B., & Heagerty, P. J. (2008). Analysis of longitudinal data to evaluate a policy change. *Statistics in medicine*, *27*(24), 5005-5025.

Freudenheim, M., and R. Pear. 2003. More Disclosure for Drug Plans: Legislation May Alter the Ways of Benefit Managers. *New York Times*, July 19.

Fritz, S. (2002, December 10). Billions in drugmaker rebates diverted. *St.Petersburg Times*. Retrieved March 22, 2017, http://pharmacybenefitconsultants.com/company-news/billions-in-drugmaker-rebates-diverted/

Garis, R. I., & Syed, F. (2003). "Spread Pricing in the Prescription Benefit." *Creighton University School of Pharmacy and Health Professions*

Garis, R. I., & Clark, B. E. (2004). The spread: pilot study of an undocumented source of pharmacy benefit manager revenue. *Journal of the American Pharmacists Association*, *44*(1), 15-21.

Garis, R. I., Clark, B. E., Siracuse, M. V., & Makoid, M. C. (2004). Examining the value of pharmacy benefit management companies. *American Journal of Health-System Pharmacy*, *61*(1), 81-85.

Garrett, A. D., & Garis, R. (2007). Leveling the playing field in the pharmacy benefit management industry. *Val. UL Rev.*, *42*, 33.

Gerber, B. J., & Teske, P. (2000). Regulatory policymaking in the American states: A review of theories and evidence. *Political Research Quarterly*, *53*(4), 849-886.

Goldberg, R. "Drug Costs Driven by Rebates," *Center for Medicine in the Public Interest*, http://bionj.org/wp-content/uploads/2015/11/drug-costs-driven-by-rebates.pdf.

Gonçalves, S., & White, H. (2005). Bootstrap standard error estimates for linear regression. *Journal of the American Statistical Association*, *100*(471), 970-979.

Greene, W. (2004). The behaviour of the maximum likelihood estimator of limited dependent variable models in the presence of fixed effects. *The Econometrics Journal*, *7*(1), 98-119.

Green, K. (2008). *Regulation of pharmacy benefit managers: An economic analysis of regulation and litigation as agents of health care change*.

Haider-Markel, D. P. (2001). Policy diffusion as a geographical expansion of the scope of political conflict: Same-sex marriage bans in the 1990s. *State Politics & Policy Quarterly*, *1*(1), 5-26.

Hale, K. (2011). *How Information Matters : Networks and Public Policy Innovation*. Washington D.C.: Georgetown University Press.

Herman, B. (2017, January 22). The next drug pricing target: pharmacy benefit managers. Retrieved February 13, 2017, from https://www.axios.com/the-next-drug-pricing-target-pharmacy-benefit-managers-2197628433.html

Herrick, D. (2017). How to Make New Drugs More Affordable. *NATIONAL CENTER FOR POLICY ANALYSIS*, (203).

Hua, X., Carvalho, N., Tew, M., Huang, E. S., Herman, W. H., & Clarke, P. (2016). Expenditures and prices of antihyperglycemic medications in the United States: 2002-2013. *Jama*, *315*(13), 1400-1402.

Industry and FDA Overview on GDUFA. (2015, September 29). Joint Regulatory Conference. http://www.fda.gov/downloads/ForIndustry/UserFees/GenericDrugUserFees/UCM470981.pdf

Japsen, B. (2013, May 25). Obamacare Will Bring Drug Industry $35 Billion In Profits. Retrieved from https://www.forbes.com/sites/brucejapsen/2013/05/25/obamacare-will bring-drug-industry-35-billion-in-profits/#61c677334a59

Jones, B. S., & Branton, R. P. (2005). Beyond logit and probit: Cox duration models of single, repeating, and competing events for state policy adoption. *State Politics & Policy Quarterly*, *5*(4), 420-443.

Kantor, E. D., Rehm, C. D., Haas, J. S., Chan, A. T., & Giovannucci, E. L. (2015). Trends in prescription drug use among adults in the United States from 1999-2012. *Jama*, *314*(17), 1818-1830.

Kile, B. (2005). Networks, interest groups and the diffusion of state policy.

Klarner, Carl, Berry, William D., Carsey, Thomas M., Jewell, Malcolm, Niemi, Richard, Powell, Lynda, and Snyder, James. State Legislative Election Returns (1967-2010). *Ann Arbor, MI: Inter-university Consortium for Political and Social Research* [distributor], 2013-01-11. https://doi.org/10.3886/ICPSR34297.v1

Klüver, H., Mahoney, C., & Opper, M. (2015). Framing in context: how interest groups employ framing to lobby the European Commission. *Journal of European Public Policy*, *22*(4), 481-498.

Kreling, D. H. (2000, August). Cost Control for Prescription Drug Programs: Pharmacy Benefit Manager PBM Efforts, Effects, and Implications. In *Department of Health and Human Services Conference on Pharmaceutical Pricing Practices, Utilization, and Costs*.

Krulwich, A. S. (1995). The response to health care reform by the pharmaceutical industry. *Food & Drug LJ*, *50*, 1.

Langenfeld, J., & Maness, R. (2003). The Cost of PBM "Self-Dealing" Under a Medicare Prescription Drug Benefit. *LECG, LLC, Loyola University Chicago Law School: Chicago.*

Lowery, D., Gray, V., & Monogan, J. (2008). The construction of interest communities: distinguishing bottom-up and top-down models. *The Journal of Politics, 70*(4), 1160-1176.

Lowi, T. J. The End of Liberalism: The Second Republic of the United States. 1979. *Chapter Five*.

Mintrom, M. (1997). Policy entrepreneurs and the diffusion of innovation. *American journal of political science*, 738-770.

Moore, R. T., & Giovinazzo, C. T. (2011). The distortion gap: policymaking under federalism and interest group capture. *Publius: The Journal of Federalism, 42*(2), 189-210.

Mukherjee, S. (2016, September 21). Mylan's CEO Tells Congress the EpiPen Price Hike Was 'Fair'. Retrieved February 13, 2017, from http://fortune.com/2016/09/21/mylan-ceo-epipen-price-hike/

"NADAC (National Average Drug Acquisition Cost)." Centers for Medicare and Medicaid Services. Accessed August 31, 2017. https://data.medicaid.gov/Drug-Pricing-and-Payment/NADAC-National-Average-Drug-Acquisition-Cost-/a4y5-998d/data.

NCPA Offers Help as Senate Committee Mulls PBMs' Role in Rising Prescription Drug Prices. (2017, January 23). Retrieved February 13, 2017, from http://www.ncpanet.org/newsroom/news-releases/2017/01/23/ncpa-offers-help-as-senate-committee-mulls-pbms%27-role-in-rising-prescription-drug-prices

NCPA to Congress: Scrutinize PBM Corporations as Part of Drug Cost Review. (2016). Retrieved March 22, 2017, from http://www.ncpanet.org/newsroom/news-releases/2016/02/04/ncpa-to-congress-scrutinize-pbm-corporations-as-part-of-drug-cost-review.

Obama, B. (2016). United States health care reform: progress to date and next steps. *Jama, 316*(5), 525-532.

Olson, M. (2009). *The Logic of Collective Action: Public Goods and the Theory of Groups, Second Printing with a New Preface and Appendix* (Vol. 124). Harvard University Press.

PhRMA Share the Savings. (2017, April 6). Retrieved April 29, 2017, from http://www.phrma.org/press-release/phrma-launches-new-share-the-savings-campaign-to-urge-payers-to-share-negotiated-discounts-with-patients

PhRMA v. Walsh: The Supreme Court's First Word in the Latest Conflict Between States and Drug Companies Over the Price of Prescriptions. (n.d.). Retrieved April 29, 2017, from http://corporate.findlaw.com/law-library/phrma-v-walsh-the-supreme-court-s-first-word-in-the-latest.html

PhRMA Statement on House PBM Transparency Bills. (2019, October 29). Retrieved from https://www.phrma.org/Press-Release/PhRMA-Statement-on-House-PBM-Transparency-Bills

Popken, B. (2016, November 02). Soaring insulin prices send families into sticker shock. Retrieved February 12, 2017, from http://www.nbcnews.com/business/consumer/insulin-new-epipen-families-facing-sticker-shock-over-400-percent-n667536

Potters, J., & Sloof, R. (1996). Interest groups: A survey of empirical models that try to assess their influence. *European journal of political economy, 12*(3), 403-442.

Raifman, J., Moscoe, E., Austin, S. B., & McConnell, M. (2017). Difference-in-differences analysis of the association between state same-sex marriage policies and adolescent suicide attempts. *JAMA pediatrics*, *171*(4), 350-356.

Ramsey, L. (2016, August 22). The price of an EpiPen has skyrocketed more than 500% since 2009 - and senators are asking for answers. Retrieved February 12, 2017, from http://www.businessinsider.com/epipen-price-increases-about-500-percent-2016-8

Rau, J. (2005, March 28) Industry Aims to Defeat Discount Drug Initiatives. Retrieved from https://www.latimes.com/archives/la-xpm-2005-mar-28-me-drugs28-story.html

Rentmeester, C. A., & Garis, R. I. (2008). Rebates and spreads: pharmacy benefit management practices and corporate citizenship. *Journal of Health Politics, Policy and Law*, *33*(5), 943-963.

Rogers, E. M., & Shoemaker, F. (1983). Diffusion of innovation: A cross-cultural approach. New York.

Rogers, E. M. (2003). Diffusion of innovations (5th ed.). New York, NY: Free Press.

Sabatier, P. A., & Jenkins-Smith, H. (1993). Policy change and learning: An advocacy coalition framework. *Boulder: Westview*.

Sagonowsky, E. (2017, February 09). PBMs counter pharma's pricing blame with proposals to cut $100B in drug costs. Retrieved April 29, 2017, from http://www.fiercepharma.com/pharma/pbms-look-to-defend-themselves-amid-new-drug-pricing-scrutiny

Scapens, R. W. (1991). *Management accounting: a review of contemporary developments*. Macmillan International Higher Education.

Shipan, C. R., & Volden, C. (2006). Bottom-up Federalism: the diffusion of antismoking policies from US cities to states. *American journal of political science*, *50*(4), 825-843

Shipan, C. R., & Volden, C. (2012). Policy diffusion: Seven lessons for scholars and practitioners. *Public Administration Review*, *72*(6), 788-796.

Shulman, S. R. (1998). Pharmacy Benefit Management Companies (PBMs). *Pharmacoeconomics*, *14*(1), 49-56.

Swanson, J., & Weissert, W. G. (2018). Case managers for high-risk, high-cost patients as agents and street-level bureaucrats. *Medical Care Research and Review*, *75*(5), 527-561.

The Center for Responsive Politics. Retrieved from https://www.opensecrets.org/lobby/clientsum.php?id=D000000504&year=2016

US General Accounting Office. (1995). Pharmacy Benefit Managers: Early Results on Ventures with Drug Manufacturers, GAO/HEHS-96-45.Washington, DC: US Gov.

Vera-Hernandez, M. (2003). Structural estimation of a principal-agent model: moral hazard in medical insurance. *RAND Journal of Economics*, 670-693.

Weissert, C. S., & Weissert, W. G. (2012). *Governing health: The politics of health policy*. JHU Press.

Wooldridge, J. M. (2010). *Econometric analysis of cross section and panel data*. MIT press.

Zirkelbach, R. (2019, March 20). *The PBM story you haven't heard: Hidden fees quadrupled in two years.* Retrieved from https://catalyst.phrma.org/the-pbm-story-you-havent-heard-hidden-fees-quadrupled-in-two-years

BIOGRAPHICAL SKETCH

Randy P. Propper received a Bachelor of Arts in Political Science from Flagler College in 2015. In 2015, Randy accepted an assistantship in the Political Science PhD program at Florida State University where he specialized in Public Policy and American Government and received a Master of Science in Political Science from Florida State University in 2018. His primary research interest is in Health Policy, particularly state-level regulations of the pharmaceutical supply chain.