Sinking, Swimming, or Learning to Swim in Medicare Part D*

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Abstract

Under Medicare Part D, people choose prescription drug insurance offered by many private insurers. We examine non-poor enrollees' actions in 2006 and 2007 using panel data. This population substantially reduced overspending from 2006 to 2007, with the greatest improvements by those who switched plans and who overspent the most in 2006. The oldest consumers and those with Alzheimer's improved by more than average, suggesting that real-world mechanisms help overcome cognitive limitations. These gains are due to the intertwined decisions of both individual enrollees and plan providers. Consumers incorporate forward-looking information about their health and about their current plans' performance.

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Abstract

Under Medicare Part D, people choose prescription drug insurance offered by many private insurers. We examine non-poor enrollees' actions in 2006 and 2007 using panel data. This population substantially reduced overspending from 2006 to 2007, with the greatest improvements by those who switched plans and who overspent the most in 2006. The oldest consumers and those with Alzheimer's improved by more than average, suggesting that real-world mechanisms help overcome cognitive limitations. These gains are due to the intertwined decisions of both individual enrollees and plan providers. Consumers incorporate forward-looking information about their health and about their current plans' performance.

"The new Medicare Part D prescription drug insurance market illustrates that leaving a large block of uninformed consumers to 'sink or swim', and relying on their self-interest to achieve satisfactory outcomes, can be unrealistic."

Nobel Laureate Daniel McFadden

2006 Presidential Address to the American Economic Association

1 Introduction

Four years after its launch, Medicare Part D stands at a remarkable crossroads of the current political and academic debates. Beginning in 2006, Part D expanded Medicare beneficiaries' access to prescription drug coverage by allowing them to choose among competing private insurance plans. The philosophy underlying this approach adopts the perspective that private competition within a regulated framework would strike the appropriate balance between cost control and providing value to consumers. Within Part D, costs are controlled through private insurers negotiating prices with pharmaceutical manufacturers in conjunction with demand-side cost sharing such as copays and the "doughnut hole."[1] At the same time, competition for enrollees would incentivize insurers to design plans that were attractive to individuals. To limit adverse selection and encourage participation, the program provided large subsidies even to non-poor beneficiaries and penalties for those who did not enroll when they became initially eligible.[2]

Although many of the widely-publicized opinions of the program were initially pessimistic, the growing evidence from research on Part D is largely positive, with high participation, expanded prescription drug use, lower out-of-pocket prices for drugs, high consumer satisfaction, and total

[1] Consumers who do not receive federal low-income subsidies enter the "doughnut hole" and pay 100% of drug costs out of pocket once the total drug spending exceeds a threshold, and they exit it once their spending reaches another threshold. In 2006, these thresholds for the standard plan design were $2,250 and $5,100, respectively.

[2] Beneficiaries could avoid this penalty by immediately enrolling in a Part D plan, a Medicare Advantage plan, or an employer-sponsored plan meeting the creditable coverage criteria, which require the plan to have an actuarial value meeting or exceeding the regulated standard plan.

program costs below projections.[3] The most contentious remaining aspect of Part D is whether its reliance on competition between many private insurers is too complex for beneficiaries to navigate despite the program's regulation and subsidies.

Part D is an important context to study consumer choice due to the large number of lives and dollars involved. It offers an environment rich for testing theories of individual conduct that will inform policy in health care as well as other markets. Because of the age and prevalence of illness of the Medicare population, these consumers may have limited cognitive abilities. This may be compounded by the fact that prescription drug insurance plans are multiattribute, with some attributes uniform across individuals, such as premiums and deductibles, as well as individual-specific attributes due to plans' use of formularies and consumers' heterogeneous prescription drug consumption. Finally, because this was a newly-created market, all eligible beneficiaries confronted these complex choices for the first time in January, 2006. This last feature is econometrically attractive because analyzing data that include 2006 overcomes the initial condition problem raised by Heckman (1981), allowing researchers to separate the effects of aging from the effects of experience.

Behavioral economists have reported a number of biases in consumer decision making, such as inertia and confusion, particularly when cognition is limited by age, illness, or limited attention, e.g., Lusardi, Mitchell, and Curto (2009), Agarwal, Driscoll, Gabaix, and Laibson (2009). These contributions have raised a number of academic questions about how to best model and predict human decision making. They also evoke calls for a number of regulatory reforms, such as stronger consumer protection rules and simplification of credit cards, mortgages, retirement plans and health insurance contracts. In Part D specifically, many observers have called for a reduction in the number of plans available to consumers, which ranged across regions from 27 to 52 plans available in 2006

[3] Thus, for instance, although Heiss, McFadden, and Winter (2006) initially questioned whether a government run program could have more effectively controlled for the cost of drugs, they later concluded —see Heiss, McFadden, and Winter (2007)— that Part D has been a tactical success that has induced high enrollment levels, ensured competition among private insurance sponsors, and kept drug prices and rates of consumer deception low.

and 45 to 66 available in 2007.[4] In fact, regulatory changes will limit the number of options that insurers can make available to consumers in 2011 Hoadley, Cubanski, Hargrave, Summer, and Neuman (2010).

In this article we present the first evidence of how consumers' actual plan choices in Medicare Part D evolve over time. To achieve this, we analyze a large, comprehensive dataset that reports every individuals' chosen and available plans, prescription drug use and spending, and other characteristics in 2006 and 2007. Two existing articles also rely on large data sets, both finding that consumers inappropriately weight various attributes of the plans, causing them to choose less than optimally. In the first, Heiss et al. (2007) conclude that enrollees' choices can be best understood as myopic, relying on static expectations and using only current drug expenditures. They find that beneficiaries appear to be rational in their decisions about whether to participate in Part D, but less so in their plan choices conditional on participation.

In the second article, Abaluck and Gruber (2009) conclude that enrollees show inconsistencies with optimizing behavior because they overweight some features of the plan, such as plan premiums and doughnut hole coverage, while neglecting others. They thus conclude that elders fail to make choices consistent with optimization under full information. Bolstering the conclusions of Abaluck and Gruber, Kling, Mullainathan, Shafir, Vermeulen, and Wrobel (2009) conclude that older adults suffer from serious misperceptions of prices and other features of Part D plans. According to their evidence, misperception results in them choosing prescription plans that are substantially more expensive than available alternatives. One implication is that greater choice and

[4] Liebman and Zeckhauser (2008) perhaps best summarize the mistrust in consumers' ability to choose: "health insurance is too complicated a product for most consumers to purchase intelligently," they state, concluding that, "[i]t is unlikely that most individuals will make sensible decisions when confronted with these choices." Based on these premises they suggest that either a public agency or some private company should mediate consumers' health insurance purchases. Similarly, Hoadley (2008) surveys a panel of medical experts to call for a standardization of plan benefits and formularies to make them easier to compare as well as reducing the number of plans available. Hanoch, Rice, Cummings, and Wood (2009) reached the same conclusion after analyzing the experimental evidence of 192 subjects (half of whom were age 65 or older) who performed hypothetical enrollment decisions. Duggan, Healy, and Scott-Morton (2008), Goldman and Joyce (2008), Joyce, Goldman, Vogt, Sun, and Jena (2009) and Heiss, McFadden, and Winter (2009) are notable exceptions to the opinion of the majority of researchers in this area.

competition harms rather than improves welfare because plans can flourish by promoting confusion rather than by designing products that meet fully-informed, unbiased consumers' preferences.

These prior articles analyzed only 2006 and did not consider how consumers' actions changed over time. Yet in contrast to the often cross-sectional and typically laboratory-based evidence of common biases in consumer choice, summarized in DellaVigna (2009), other work suggests that markets and market experience ameliorate those biases, e.g., List (2003), List (2004), List (2006), and List and Millimet (2008).[5] Considering the dynamic aspects of consumer choice is important to evaluate Part D given the large degree of heterogeneity across consumers and plans as well as the related but distinct facts that this was a new market and that consumers had no previous experience in it. Furthermore, using detailed, individual-level panel data of actual choices in a complex, high stakes context will add to economists' understanding of consumer choice more broadly.

Our primary focus in this article is on whether consumers improved over time in terms of reducing overspending. We define overspending as the consumers' out-of-pocket (OOP) costs for insurance and prescription drugs above the cost of the cheapest *ex post* alternative, where the choice set includes no insurance and other Part D plans. Analyzing changes in this aspect of choice alone is insightful given the high persistence in an individual's drug spending over time,[6] and our use of panel data to eliminate the effects of individual-specific time invariant risk aversion, among other things. Due to differences in Part D's design across income levels, in this article we exclusively focus on those who did not receive federal low-income subsidies in either year.

We find consistent evidence of large improvements, with average reductions in overspending of 40-54% in one year. In addition to these large average effects, we find substantial heterogeneity,

[5] Choi, Laibson, and Madrian (2009) present experimental evidence that individuals pay more attention to some attributes than others when presented with multiattribute financial contracts. In contrast to financial contracts, beneficiaries of Part D may revise their enrollment and choice decisions on a regular basis. We are not aware of any existing evidence, experimental or otherwise, about whether such biases persist over time.

[6] See Pauly and Zeng (2004) for one recent example of this widely-documented fact for the Medicare population.

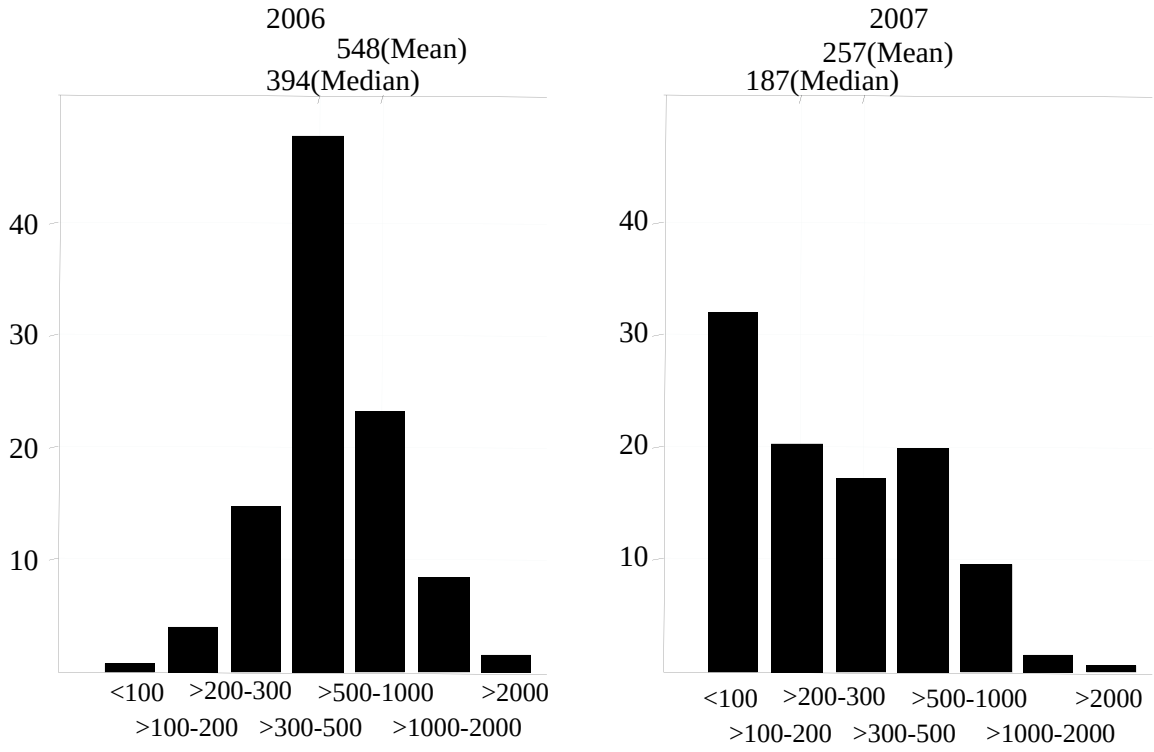
with 80% of the study population improving from 2006 to 2007. The greatest improvements were achieved by those who overspent most in 2006, and this cannot be explained by changes in health. Interestingly, the improvements were greatest among those age 85 and above, and those with Alzheimer's improved by about as much as the average consumer. Although we cannot observe the choice process itself, these two results suggest that populations with greater prevalence of cognitive limitations are helped by markets and other real-world features, including family members, health care providers and other private organizations, and publicly- and privately-provided decision support tools such as online plan finders.

Switching plans was a primary source of improvement, but we also find evidence of learning resulting in other sources improvement. Our analysis of switching decisions reveals that consumers respond to financial incentives and incorporate both forward-looking information about future changes in their own health as well as changes in the relative costs of their current plans.

Using data described below, Figure 1 provides descriptive results for the changes in overspending from 2006 to 2007. [7] The two panels of Figure 1 depict the distribution of potential savings for individuals that do not receive any federal low-income subsidy for premiums and copayments. During the initial year of the program most beneficiaries overpaid between $300 and $500 dollars. The distribution of potential savings has a long right tail, with a few beneficiaries overpaying by more than $1,000. This results in the mean overspending, $548 dollars, being almost 40% larger than the median overspending of $395 dollars. More important, however, is the contrast between the two top panels of this figure. In 2007, just one year into the program, the distribution shifts left, with substantially more beneficiaries closer to the cost-minimizing choice. Both mean and median potential savings in 2006 are cut in half in 2007, i.e., $260 and $194, respectively.

[7] This analysis does not control for additional sources of heterogeneity such as medical conditions, age, or others. The empirical analysis of the rest of the article adds all those variables to show that results summarized in Figure 1 are robust to health status, age, and private information regarding own's health status changes. All variables are defined in later sections of the article.

Figure 1. Overspending by Year



In the remainder of the article we further explore these descriptive results and their underlying causes. The article is organized as follows. Section 2 describes our data and how the key variables are defined. Section **??** evaluates how overspending changed between 2006 and 2007 overall, as well as heterogeneity in those changes across our sample. Section 4 reports how the changes vary with observed individual characteristics, such as initial overspending, age, sex, and levels and changes in health. In Section 5 we analyze the importance of various potential sources of improvement, including switching to better-matched plans, changing plan design, and tailoring drug consumption to fit the chosen plan's coverage. Section 7 follows that with an analysis of the robustness of our results to assuming perfectly inelastic demand for drugs (rather than an elasticity of -0.54 used in our main results), and, for the 2007 cross-section we evaluate plan choice based on past rather than on future drug consumption. Section **??** evaluates the participation decision,

i.e., whether our enrolled population would have achieved lower costs without insurance, and we conclude in Section 8.

2 Data

To describe our data we first compare the features of the plans included in our sample with the universe of Part D plans available in the US. Next, we summarize how we generated each consumer's spending in each plan available to them in each year. With these estimates, we construct overspending, the key measure of plan choice in our analysis. Finally, we discuss the use of *ex ante* versus *ex post* drug consumption to evaluate improvements in overspending.

In addition to observing two years under Part D for each individual, another attractive feature of our data set is that it allows us to compute each consumers' OOP costs of the total drug bundle consumed by each beneficiary under their actual plan, which we observe with certainty, and under each alternative available in their geographical market, as well as their OOP premiums for each plan. Together these features allow us to eliminate biases due to unobserved individual heterogeneity and minimize those due to measurement error.

2.1 Study Sample

Data from the Centers for Medicare and Medicaid Services (CMS), CVS Caremark (a pharmacy benefits manager, hereafter "the PBM"), and ancillary sources were used to estimate the cost of each plan to each patient in both 2006 and 2007. The PBM provided us with a large data set of its enrollees, for whom we observe their chosen plan with certainty, the universe of their claims, whether and which subsidy level they received, and their gender, age and detailed measures of health status, described below. The sample for this article

Our study sample included 75,592 individuals who were enrolled in stand-alone Prescription Drug Plans (PDPs) provided or administered by the PBM for all of 2006 and 2007 and who did not receive a federal low income subsidy in either year.[8] This sample excludes those who switched plans within the year, which this non-subsidy population could do if they moved between regions. Because our analysis required both years of data, we also cannot examine the decisions of those who switched into or out of the set of plans offered by the PBM. This eliminated 5,314 individuals (or 6.6% of those enrolled in the PDP's plans for all of 2006) who switched out of the PBMs plans from 2006 to 2007.

A crucial feature of our data is that we observe individuals enrolled in PDPs that the PBM sells directly, under the Silverscript brand, and those in PDPs administered by the PBM but sold under different names. These administrative agreements between insurers and the PBM are rarely known to individuals and are likely to be unrelated to any important individual enrollee characteristics. As a result, our study sample incorporates not only those who chose a Silverscript plan but also those who in essence were randomly assigned to be administered by the PBM.[9] This includes 9 different PDPs in 2006 and 18 in 2007, where only about 55% of the sample was enrolled in the Silverscript plans.[10] Similar to all available plans, those in our sample vary greatly in their enrollment sizes. In both years the characteristics of our study plans cover much of the range of all PDPs available, as shown in Table 1. The means for 2006 indicate that our study

[8] We have data on an even larger number of individuals in Medicare Advantage plans. However, those plans' premiums include both drug coverage and coverage for other types of health care, so that it is not possible to isolate the individual's costs for prescription drugs and prescription drug insurance under those plans. Consequently, we restrict the analysis to PDPs and their enrollees. Similarly, we have data on those who were enrolled for only part of 2006 because the initial PDP open enrollment extended into May of that year, but it is not feasible to generate accurate annual spending amounts for them, which is required to evaluate within-person changes accurately.

[9] Additionally, the PBM is prohibited from participating in designing of these other plans or negotiating prices for them; they may only administer the claims.

[10] This change in plan composition does not introduce any bias because individuals in the 9 plans that appear only in 2007 were excluded from our analysis because we could not observe their 2006 costs, unless they switched from insurance administered by the PBM from 2006 into one of these 9 plans in 2007. The number of individuals in the sample are well below the enrollment reported by CMS for these plans because of errors in the CMS enrollment data as well as our study sample selection criteria.

Table 1. Part D Plan Characteristics

	Plans in Study Sample			All Plans		
	Mean	5th Pct.	95th Pct.	Mean	5th Pct.	95th Pct.
2006						
Deductible	95.248	0	250	101.63	0	250
Annual Premium	355.55	296.04	400.56	311.07	83.16	571.32
Number of the Top 100 Drugs						
On the Formulary	94.416	92	98	95.58	78	100
Requiring Prior Authorization	5.75	5	7	7.89	1	13
"Doughnut hole" coverage for generics	0.00	0	0	0.03	0.0	0.0
"Doughnut hole" coverage for brands	0.00	0	0	0.03	0.0	0.0
Enhanced plan	0.00	0	0	0.17	0.0	1.0
Observations		99			1,347	
2007						
Deductible	66.38	0	265	115.19	0	265
Annual Premium	305.36	184.8	450	329.93	147.6	579.6
Number of the Top 100 Drugs						
On the Formulary	88.38	87	91	93.33	80	97
Requiring Prior Authorization	3.59	1	5	1.05	0	3
"Doughnut hole" coverage for generics	0.10	0.0	1.0	0.07	0	1
"Doughnut hole" coverage for brands	0.00	0	0	0.02	0	0
Enhanced plan	0.12	0	1	0.21	0	0
Observations		271			1,638	

plans were, on average, slightly more generous in one aspect, lower deductibles, but a less generous on other dimensions such as higher premiums and lower formulary coverage, prior authorization requirements, doughnut hole coverage, and other enhancements. In 2007, relative to all plans, our study plans became more generous in some aspects with lower premiums, lower deductibles, and more widespread provision of doughnut hole coverage for generics. At the same time, our study plans became less generous in formulary coverage and in prior authorization restrictions. The net effect of these changes is ambiguous and heterogeneous, varying with individuals' levels and types of prescription drug utilization.

The fact that our sample does not include any plans with doughnut hole coverage in 2006 may raise concerns about the generalizability of our results. For example, Abaluck and Gruber (2009) argue that an important reason why beneficiaries make mistakes in their enrollment decisions is their biased preference for expensive plans that include doughnut hole coverage. Table 1 shows that both the prevalence of generic doughnut hole coverage in our 2007 plans and the growth

in the prevalence of those plans exceed those nationwide. Because we analyze the within-person changes from 2006 to 2007, this change in the design of the plans in our sample, coupled with the bias reported by Abaluck and Gruber, would cause us to underestimate the true size of the improvements. The reason is that our analysis is conditional on remaining in the PBM's plans for both years. Because these plans added generic doughnut hole coverage more than other plans, our sample would include a disproportionate number of people who should have left these plans but did not because of their self-defeating preferences for such coverage. Likewise, our sample definition excludes those who did not exhibit such bias and actually left plans that added this coverage in 2007. Furthermore, the CMS data indicate that nationwide enrollment in plans with doughnut hole coverage for brand name drugs fell sharply in 2007. If biases for these plans existed in 2006 and were as large as reported by Abaluck and Gruber (2009), then those consumers, who are omitted from our analysis because none of our study plans offered brand doughnut hole coverage in 2006, also likely experienced large improvements over time as these supply-side changes prevented them from acting on their biases.

2.2 Estimating Overspending, Out of Pocket Costs, and Gross Costs

We use data from CMS in conjunction with the PBM data that indicate where each person lives to provide the characteristics of each plan available in each person's region in each year. These characteristics include premiums, deductibles, doughnut hole coverage, and formularies, which indicate what the beneficiaries' costs would be for every possible drug. For each person in each available plan in each year, we calculate the total OOP costs, which is defined as the sum of the OOP prescription drug costs and the plan premiums, net of any federal premium subsidies. Throughout the article, we consider "no insurance" as one of the options that individuals may choose from, although results from analysis that exclude this option yield the same insights and implications. Appendix A details how these calculations were implemented. For the main analysis

presented in this article we assume a price elasticity of demand for prescription drugs of -0.54 to allow the total amount of drugs consumed by a beneficiary to vary under different marginal drug prices.[11]

With these values, we determine how the individuals' costs of the actual, chosen plan compare to all of the available alternatives. Our primary focus is on how the chosen plan compares to the person's cheapest alternative, where we refer to the difference in OOP costs between the two as "overspending". To determine how the chosen plan compares with the full distribution of plans, and not only the cheapest plan, we also calculate the chosen plan's percentile ranking in each person's distribution of available options, as well as the cost of the minimum and maximum cost options.

Through this process, we are also able to calculate two other measures for each person under each available alternative. The first is the person's non-premium OOP costs, i.e., the cost to the individual for prescription drugs alone. The second is gross spending on prescription drugs, i.e., the total amount spent by the person and the insurance plan on prescription drugs, excluding insurance premiums. In the main results we present, we allow the consumption bundle to vary with the average price in each plan, so that both the non-premium OOP costs and the gross spending vary across plans for each person. To check the sensitivity of the results to our elasticity assumption, we alternatively assumed perfectly inelastic demand, holding constant both of these cost measures across all plans at the level reported in our PBM data itself.

[11] This is the drug price arc-elasticity estimate obtained by Shea, Terza, Stuart, and Briesacher (2007). This is the most elastic estimate among those available for drug consumption by the elderly, just above that of -0.4 assumed by Pauly (2004) and just above the range $[-0.44, -0.22]$ estimated by Ketcham and Simon (2008). By using the most elastic demand estimate, we allow for the greatest changes in drug demand when consumers face different marginal charges under alternative insurance plans. In Section 7 we present results under the alternative extreme assumption of perfectly inelastic demand for drugs, as reported in some of our predecessors' articles.

2.3 *Ex Ante* and *Ex Post* Costs

One important decision in analyzing how consumers' choices change over time in a context with uncertainty is adopting a perspective on what information consumers use to make their decisions. Conceptually, consumers may rely on different levels of information with respect to uncertainty about future drug consumption. At one extreme, they may be fully myopic and utilize only their current consumption, ignoring the possibility of future changes when making choices about which plans to enroll in. At the other extreme, they may have perfect information and no uncertainty, anticipating precisely how future drug consumption will change and incorporating that into their choices of plans. Between those two are intermediate cases, in which consumers are aware of probabilities and expenses of various potential illnesses and purchase plans accordingly, but they do not know precisely whether or when they will acquire those illnesses.

While all three information sets are plausible, for both practical and conceptual reasons in the primary analysis reported here we adopt the fully-informed approach in which consumers' choices for a given year are evaluated based on their actual drug consumption in that same year.[12] We refer to this as the *ex post* approach, while we refer to the other extreme as the *ex ante* approach. Conceptually important in our context, the *ex ante* approach eliminates the potential for learning, as consumers may have changed their drug consumption as they learned the intricacies of PDPs. These assumptions are rejected by Tchernis, Normand, Pakes, Gaccione, and Newhouse (2006), which presents evidence consistent with consumers having private information regarding the evolution of their own health status. They find that consumers choose plans that are more generous for treatments that they might likely need in the near future. Practically speaking, we cannot rely on the *ex ante* benchmark to study within-person changes over time because we do not observe individuals' drug consumption in 2005, precluding us from using it to evaluate 2006

[12] This is the same approach taken by Fang, Keane, and Silverman (2008, §5) when comparing the *ex post* total medical expenditures under basic Medicare (parts A and B) with and without Medigap supplemental insurance.

choices. However, we compare the cross-sectional overspending results for 2007 from both the *ex post* and the myopic *ex ante* approaches in Section 7, and we find no notable differences between them.

2.4 Additional variables

The data provide several additional types of variables. First, the prescription drug claims are used to determine the health status, and changes in health status over time, for each person. Specifically, these health measures are defined by the Ingenix Pharmacy Risk Groups (PRGs) and calculated risk scores. The risk scores are used by insurers to predict individuals' prescription drug expenditure based on their claims history and demographics. In our sample, the risk score has a mean of 5.1 and a standard deviation of 3.8. To give a sense of scale, taking medications for Alzheimer's increases the risk score by 2.8, while taking hypertension medications increases it by 1.4. The PRGs are a vector of 126 indicator variables for whether drugs were consumed for specific clinical indications. These indicators do not vary with the quantity or cost of drugs taken for a condition, but rather they simply indicate whether the individual took any drugs for each of conditions. From these, we generated dummy variables indicating which of the 15 most common PRGs in our sample in 2006 were taken by each individual. These fall into 9 illness categories that we include as dummy regressors in the second column. They are, from more to less frequently observed: hypertension, cholesterol and other cardiovascular, pain, mental health, antibiotics, anticoagulants, thyroid conditions, diabetes and osteoporosis. We also include controls for Alzheimer's disease because of its link with cognitive ability.

Second, the PBM data to permit us to identify which individuals switched plans, which plans they switched to, which they switched from, and the amount of overspending they would have incurred had they stayed in the same plan. We observe this directly from the enrollment files provided by the PBM. While this eliminates any uncertainty about the each person's actual, chosen

plan, it also limits us to studying only those who were enrolled for both years in the set of plans offered or administered by the PBM.

Third, the CMS data provide details about how each plans' design changed over time as well as which plans exited and entered each region. While changes in a plan's premiums affect all consumers equally, changes in other plan attributes, such as deductibles, doughnut hole coverage, and formulary design such as copays for specific drugs, have heterogeneous effects. Thus, to understand the implications of these changes for each individual, we use these details in conjunction with the individual's prescription drug claims.

3 Within-Person Changes in Overspending, 2006-2007

We begin by estimating first difference regressions of overspending,

$$\Delta O_i = \beta_i + \Gamma \Delta H_i + u_i, \tag{1}$$

where the dependent variable ΔO_{it} denotes the within-person change in overspending for individual i conditional on ΔH_{it}, which is a vector of variables for the within-person changes in the measures of health, specified above, and u_i is an idiosyncratic error.

The main coefficient of interest is β, which is interpreted as the average within-person change in overspending. In Table 2 we present results from four models to determine whether the results can be explained by changes in health. The first model does not control for changes in health, i.e., we exclude ΔH_{it}, but the second model does. In the third and fourth models, we analyze only the subset of consumers with stable health, which we define in two alternate ways. In the third column, we define people in stable health if their total "risk score" changed by less than 0.5. In the fourth column, we further required that they did not change for any of the ten individual conditions that

Table 2. First Difference Models of Within-Person Change in Overspending 2006-2007

	Health Controls		*Stable Health Only*	
	No	*Yes*	*Inclusive Definition*	*Narrower Definition*
Intercept	-295.8	-298.15	-265.96	-254.66
	[3.887] ***	[4.128] ***	[6.925] ***	[9.265]
Observations	71,498	142,798	30,183	15,268
Mean Overspending in 2006	546.18	546.18	514.83	503.58
Within-person change in Overspending				
5th Percentile	-1,137.7	-1,137.7	-1,044.4	-989.6
10th Percentile	-766.4	-766.4	-681.3	-641.8
25th Percentile	-409.3	-409.3	-381.3	-364.6
50th Percentile	-236.3	-236.3	-210.3	-189
75th Percentile	-43.6	-43.6	-38.2	-38.2
90th Percentile	99.3	99.3	77.8	72.7
95th Percentile	236.6	236.6	189.2	148.6

NOTE: Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

we include. In the most basic model, average overspending was reduced in 2007 by almost $300, i.e., a reduction of 54% of the average overspending of $546 in the regression sample in 2006.

To show the degree of heterogeneity, for the sample included in each regression model we also report various points in the distribution of the unadjusted within-person change. The bottom half of the table shows the heterogeneity in these improvements. More than 80% of the sample decreased their overspending, ranging from a few dollars to amounts exceeding $1,000. At the other end of the spectrum, just under 20% overspent more in 2007 than in 2006, but the absolute value of their increases ($223) were only slightly over half of the average decreases experienced by the 80% who improved ($419).

The remaining columns of Table 2 indicate that these results are independent of changes in individual health, with similar means and distributions of improvements across all four columns. Because of concerns about changing health in explaining our results, in the remainder of Section **??** we continue to analyze both the full population and the subset of those in stable health. Given the similarity of results with our two definitions of stable health, we rely on the more inclusive one (in column three of Table 2) because of its larger sample size.

These results highlight the importance of analyzing how choices evolve over time, particularly in a new market, which itself was evolving to provide better information to consumers, and in which consumers have no prior experience. The (unconditional) mean overspending in 2006 by our regression sample was $546, with the mean overspending 36.3% percent of the total out of pocket costs. However, in 2007 overspending averaged 21% of total out of pocket costs, amounting to a 40% reduction in only one year. The results show that reductions in overspending are independent of changes in individual medical conditions but still vary substantially, suggesting that consumers may be learning at different speeds. In the next section, we analyze how 2006-2007 changes in overspending varied with other observable patient characteristics.

4 Differences in Improvement by Observed Individual Characteristics

To investigate what explains the substantial degree of heterogeneity in improvement, we begin by expanding the basic model used in the previous section to consider how the within-person changes vary by observed individual characteristics. Specifically, we estimate

$$\Delta O_i = \beta_i + \Gamma \Delta H_i + beta_2 Z_i + u_i, \tag{2}$$

where Z_i includes a vector of observed time-invariant characteristics for individual i , and the remaining variables are as in equation (1). By including Z_i, in these models we allow the within-person change in overspending to vary with observed individual characteristics, including age in 2006 (65-69, 70-74, 75-79, 80-84, and 85 and above), health (the 2006 risk score, and indicators for whether the person took medication in 2006 for each of the 10 individual indications), and sex. In general, these coefficients provide some evidence about the equity of Part D's current design, by indicating whether some groups improved less, or even worsened, from 2006 to 2007. For example, the coefficients on age and on the levels and changes in taking medications for Alzheimer's

disease provide evidence about whether populations where cognitive impairment was more prevalent improved less than others. In a second version of the model, we also include in Z_i a set of categorical variables for the extent of overspending in 2006 (less than \$100, \$100-\$200, \$200-\$300, \$300-\$500, \$500-\$1,000, \$1,000-\$2,000, more than \$2,000). This provides evidence about whether overspending in 2006 persisted through 2007, or whether those who overspent most in 2006 also improved most in 2007.

Table 3 presents the results from these first difference models. The first column allows the within-person change to vary with age, sex and levels and changes in health while the second and third columns also allow it to vary with the level of the 2006 overspending. The model in the third column also includes controls for the level and change in total drug consumption, defined as the gross amount spent on prescription drugs by the individual and the plan on the individual's behalf.

The results show that the change in overspending varies substantially with these observed characteristics. Improvements were greater for females and for those who were older, with those age 85 and above reducing overspending by \$83 to \$109 more than those age 65-69. The results also show that initiating medications for some of the most-common medical conditions in 2007 led to significant reductions in overspending. Results from the second column indicate that beneficiaries who began treatment for hypertension, anticoagulants, osteoporosis and Alzheimer's reduced their overspending from 2006 to 2007 by \$22, \$37, \$27 and \$50 more than average, respectively. Further, the within-person changes in overspending among those who were taking medication for Alzheimer's in 2006 did not significantly differ from those not taking these medications. This, in conjunction with the results by age and the results showing that those who initiated medication for Alzheimer's in 2007 improved by more than average indicates that the role of individual cognitive ability in actual, important decisions may be complex. In our context, these results likely point to the role of others in choosing plans for this population, although we cannot observe the choice process directly

Table 3. Within-Person Change in Overspending 2006-2007, by Observed Individual Characteristics

2006-2007 Change Allowed to Vary with:	*Age, Sex, Levels and Changes in Health*			*Plus 2006 Overspending*			*Plus Levels and Changes in Drug Consumption*		
Overspending Level in 2006 ($)									
less than 100				*Reference Category*			*Reference Category*		
between 100 and 200				-164.55	[21.266]	***	-128.31	[46.098]	***
between 200 and 300				-254.36	[24.627]	***	-221.49	[49.369]	***
between 300 and 500				-407.93	[21.013]	***	-376.38	[42.488]	***
between 500 and 1000				-632.35	[20.959]	***	-615.01	[29.741]	***
between 1,000 and 2,000				-1300.46	[21.811]	***	-1349.59	[56.913]	***
more than 2000				-3180.73	[205.334]	***	-3392.43	[185.195]	***
Age in 2006									
Age 65-69	*Reference Category*			*Reference Category*			*Reference Category*		
Age 70-74	-43.20	[10.543]	***	-26.85	[9.046]	***	-23.72	[10.411]	**
Age 75-79	-62.75	[16.323]	***	-38.16	[15.677]	**	-33.65	[18.875]	*
Age 80-84	-113.84	[9.333]	***	-86.64	[7.726]	***	-78.61	[12.713]	***
Age 85 up	-108.90	[8.669]	***	-93.36	[7.274]	***	-83.37	[14.308]	***
Male	13.69	[11.411]		26.79	[10.164]	***	28.15	[10.965]	**
Risk Score in 2006	-40.67	[4.321]	***	-1.14	[3.161]		-31.16	[32.799]	
Took medication in 2006 for									
Hypertension	23.14	[10.237]	**	10.63	[9.744]		10.44	[9.288]	
Cholesterol and other cardiovascular	-72.31	[11.837]	***	-22.26	[10.828]	**	-23.56	[11.272]	**
Pain	34.79	[11.122]	***	7.37	[9.910]		7.60	[10.190]	
Mental health	20.60	[13.153]		19.02	[11.388]	*	30.35	[15.658]	*
Antibiotics	9.94	[9.411]		-3.46	[8.108]		-2.73	[8.069]	
Anticoagulants	-44.19	[10.885]	***	-16.57	[9.101]	*	-19.29	[10.602]	*
Thyroid	0.47	[8.992]		11.33	[7.570]		21.20	[11.431]	*
Diabetes	-2.42	[13.515]		-1.57	[10.306]		16.54	[16.852]	
Osteoporosis	-13.35	[9.772]		-22.25	[7.633]	***	-31.44	[13.001]	**
Alzheimer's	17.70	[17.741]		-4.08	[13.442]		-13.86	[18.937]	
Change in Risk Score	5.30	[5.678]		14.71	[5.234]	***	-8.83	[23.906]	
Change in takes medication for									
Hypertension	-17.49	[13.376]		-22.49	[11.723]	*	-25.35	[11.541]	**
Cholesterol and other cardiovascular	-14.67	[18.356]		2.66	[17.117]		2.96	[17.669]	
Pain	1.32	[8.385]		-7.10	[7.387]		-7.50	[7.601]	
Mental health	1.08	[12.062]		2.97	[10.654]		17.34	[16.779]	
Antibiotics	-5.39	[8.506]		-11.00	[7.714]		-10.74	[7.558]	
Anticoagulants	-50.08	[15.037]	***	-37.00	[12.945]	***	-38.88	[13.690]	***
Thyroid	21.64	[13.154]	*	15.72	[10.375]		23.29	[13.117]	*
Diabetes	-27.59	[39.749]		-42.41	[37.147]		-35.06	[37.583]	
Osteoporosis	-27.00	[12.910]	**	-26.52	[10.555]	**	-37.62	[17.097]	**
Alzheimer's	-9.42	[19.961]		-49.81	[16.904]	***	-41.91	[17.594]	**
2006 Gross Drug Spending							0.04	[0.040]	
Change in Gross Drug Spending							0.04	[0.040]	
Intercept	-40.00	[9.800]	***	293.64	[23.585]	***	264.06	[44.513]	***
Observations	71,494			71,494			30,179		

NOTE: Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

with these data. These results persist in the third column, indicating that they are not simply reflecting levels or changes in total drug spending.

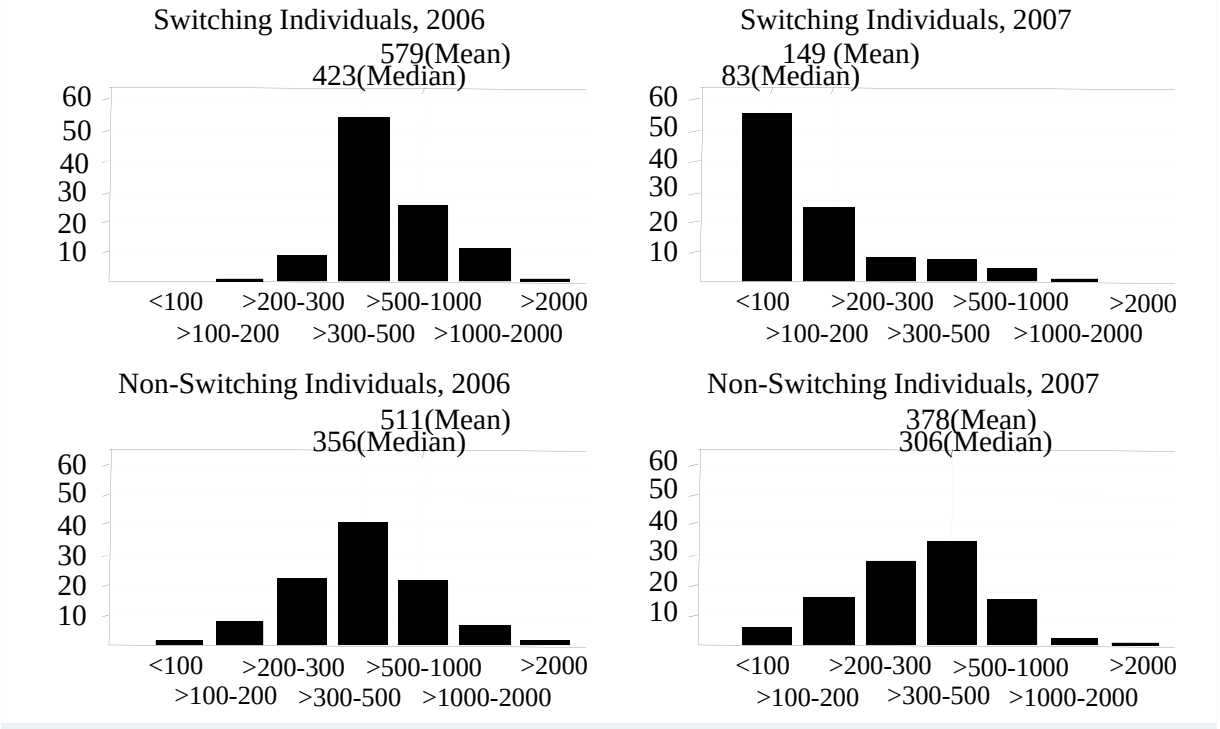
These results that improvements are greater among individuals' who initiated medication for a specific condition are consistent with the evidence from Tchernis et al. (2006) that patients incorporate some forward-looking information regarding the evolution of their health status when enrolling in a particular Medicare plan. Among the study sample, 94% took medications for at least one of these ten conditions. Given this high prevalence of these illnesses, our results suggest that consumers chose plans that provided generous coverage for these indications in 2006 even if they were not yet taking medications for them. If instead these individuals had chosen plans with meager coverage for these conditions, their overspending would have increased more than average, rather than decreased.

The last two columns of Table 3 show a final set of important differences in within-person changes in overspending. Relative to those with overspending below $100 in 2006, all other groups of beneficiaries reduced their excessive payments substantially more. These reductions increased monotonically with the size of the 2006 overspending, with those overspending by more than $2000 reducing their overspending by an average of $3200 to $3400 from 2006 to 2007. These results point to the importance of considering the dynamic aspects of consumers' choices when analyzing consumers' abilities to choose in general, and to evaluate the success of Part D specifically.

5 Sources of Improvement

In this section, we explore what explains the reductions in overspending from 2006 to 2007. Several potential sources of these improvements exist, including changes in plan design and the available plans, changes in health, learning about plans' specific formularies, and consumers' decisions to switch plans. For some individuals, their cost of their 2006 plans may have improved, relative those

Figure 2. Overspending by Year and Switching



that were cheaper for them in 2006, leading to reductions in overspending through changes in plan design and plan availability. For example, the Humana plan that covered 87% of those in plans with brand doughnut hole coverage in 2006 was the cheapest option for approximately 10% of the population (in Figure 3 of Abaluck and Gruber (2009)), but Humana did not offer this coverage in 2007. As suggested by our finding that the improvements were greatest among those who overspent most in 2006, the improvements may also result from consumers reducing their overspending by tailoring their consumption to their plans' formularies, or by switching to better-suited plans.

Figure 2 illustrates and compares the gains by switchers and non-switchers, with results analogous to Figure 1. The top two panels, which report the overspending by year for switchers, indicates that switching was a primary contributor to improvement: in 2006, the distribution of overspending has a thick right tail with a mean of $579. In 2007, however, those who switched

overspent by an average of $147, and the distribution becomes highly concentrated at the bottom end, with half of switchers overpaying by $82 or less in 2007. The two bottom panels of Figure 3 make evident that even non-switchers overpaid less in 2007 than in 2006. In 2007, beneficiaries that stayed in their 2006 plans reduced their mean overspending from $508 to $373. Finally, the figure indicates that those who chose to switch had higher overspending in 2006 than those who did not. We explore this issue more in detail in Section 6.

To further analyze the effects of switching, we estimate two models. The first is identical to equation (1) except that we also allow the change from 2006 to 2007 to vary with whether the person switched or not. The second is identical to equation (2),

$$\Delta O_i = \beta_i + \Gamma \Delta H_i + beta_2 Z_i + \beta_3 S07_i + u_i, \tag{3}$$

except that it includes an additional $S07$ term denoting that the beneficiary switched plans in 2007.

As reported in Table 4, the results conditional on individual characteristics are similar to the changes in the unconditional means shown in Figure 3. Non-switchers reduced their overspending from 2006 to 2007 by $136 on average, while switchers averaged an additional $299 reduction, for a total decrease of $436. As the results from the full models in second and third columns indicate, even when the change is allowed to vary with a number of other observed characteristics, the difference between switchers and non-switchers is $233. Thus, switching was a primary source of improvement.

A comparison of the results for the other variables interacted with 2007 in Tables 3 and 4 shows how switching moderates the other observed differences in the magnitude of the changes from 2006 to 2007. Interestingly, the large differences across the 2006 overspending level remain, indicating that these differences exist for reasons other than differences in the choice to switch

Table 4. Within-Person Change in Overspending 2006-2007, by Switching and Other Observed Individual Characteristics

	Full Sample		*Subset with Stable Health Only*
2006-2007 Change Allowed to Vary with:	*Switching Plans and Changes in Health*	*Plus Other Characteristics*	*Plus Other Characteristics*
Switched plans	-299.31 [8.242] ***	-232.84 [7.264] ***	-232.68 [12.816] ***
Overspending Level in 2006 ($)			
less than 100		*Reference Category*	*Reference Category*
between 100 and 200		-172.43 [21.199] ***	-217.80 [44.579] ***
between 200 and 300		-219.53 [24.751] ***	-244.69 [53.097] ***
between 300 and 500		-310.02 [21.089] ***	-339.17 [44.565] ***
between 500 and 1000		-544.49 [21.188] ***	-565.13 [44.623] ***
between 1,000 and 2,000		-1194.28 [22.341] ***	-1225.34 [46.275] ***
more than 2000		-3108.02 [206.701] ***	-2470.66 [428.845] ***
Age in 2006			
Age 65-69		*Reference Category*	*Reference Category*
Age 70-74		-3.36 [9.177]	-7.61 [6.901]
Age 75-79		16.87 [16.779]	31.22 [34.708]
Age 80-84		-11.49 [8.502]	-8.59 [10.112]
Age 85 up		-3.19 [8.208]	3.11 [9.522]
Male		-3.95 [9.674]	14.17 [17.706]
Risk Score in 2006		0.98 [3.142]	3.34 [4.290]
Took medication in 2006 for			
Hypertension		12.10 [9.719]	15.89 [15.608]
Cholesterol and other cardiovascular		-20.90 [10.783] *	-41.99 [19.877] **
Pain		3.59 [9.867]	0.62 [14.388]
Mental health		13.72 [11.334]	0.92 [13.672]
Antibiotics		-9.92 [8.058]	-13.37 [13.291]
Anticoagulants		-18.74 [9.053] **	-31.32 [18.201] *
Thyroid		2.09 [7.526]	-7.55 [11.593]
Diabetes		4.61 [10.176]	-23.09 [17.264]
Osteoporosis		-23.97 [7.534] ***	-56.69 [11.528] ***
Alzheimer's		-15.92 [13.319]	-44.42 [22.231] **
Change in Risk Score	22.54 [6.409] ***	16.25 [5.238] ***	72.24 [39.035] *
Change in takes medication for			
Hypertension	-9.67 [12.502]	-20.05 [11.657] *	-1.37 [12.326]
Cholesterol and other cardiovascular	27.18 [18.210]	-0.49 [17.098]	-34.34 [14.596] **
Pain	-19.08 [6.252] ***	-12.05 [7.355]	-7.73 [10.247]
Mental health	-26.50 [12.797] **	-17.35 [10.743]	-5.12 [16.350]
Antibiotics	-8.95 [7.961]	-13.64 [7.708] *	-41.91 [17.288] **
Anticoagulants	-28.97 [13.970] **	-35.17 [12.850] ***	-14.65 [22.395]
Thyroid	6.13 [12.535]	10.89 [10.022]	-4.31 [21.185]
Diabetes	-37.31 [40.774]	-39.91 [36.863]	-5.26 [40.122]
Osteoporosis	-6.70 [12.606]	-26.15 [10.376] **	-48.69 [20.443] **
Alzheimer's	-42.75 [19.897] **	-54.10 [16.677] ***	-56.90 [27.293] **
Intercept	-136.44 [7.642] ***	290.96 [23.499] ***	326.90 [48.454] ***
Observations	71,498	71,494	30,179

NOTE: Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

plans itself. Similarly, the larger reductions in overspending by those who initiated medication for hypertension, anticoagulation, osteoporosis and Alzheimer's remains even conditional on switching. Finally, the results suggest that differences in switching fully explain the differences observed by age and sex, which we evaluate explicitly in the next section.

We conducted two analyses to understand the sources of improvement among nonswitchers. First, we evaluated the extent of improvement due to changes in plan design and plan availability. To accomplish this, we simulated each person's 2007 spending on each plan available in 2007, using the plan attributes in 2007 in conjunction with the consumers' 2006 drug consumption. We then defined the within-person change in overspending as the difference between this value and the 2006 overspending, defined as before. This approach holds drug consumption constant at 2006 levels, so that any changes in overspending from 2006 to 2007 are due entirely to changes in the design of the individuals' actual plans and minimum-cost options. As before, we allow the spending to vary with the OOP cost of prescription drugs, although the results are virtually identical when we instead assumed perfectly inelastic demand for drugs.

We repeated the model reported in Table 4 column 1 using this approach and compared the magnitude of results of this model with those in Table 4 column 1. The results show that when only plan design and availability is allowed to change from 2006 to 2007, non-switchers reduced their overspending by $115, which is 85% of the total reductions shown in Table 4. Thus improvement in their own plans that they chose to remain with, relative to the plans that were cheaper for them in 2006, explains a large share of improvement among nonswitchers. The remaining 15% being due to changes in drug consumption not accounted for by changes in the measures of health included in the model. One source of such improvement would be consumers learning how to navigate their plans' formularies in ways that reduced their spending on their actual plan but not on their minimum-cost plans.

We also implemented a supplemental descriptive analysis to further understand the role of changes in health in improvement even among non-switchers. Initiating medication may reduce overspending if consumers chose more expensive plans that provided more generous coverage for conditions that they did not yet have. However, initiating medication may also alter drug consumption for existing conditions, such as by prompting a physician or pharmacist to conduct a medication review. To distinguish between the two, we analyzed within-person changes in overspending among the subset of patients that did not take any medication in 2006 and compared the changes of those who initiated medication with those who did not. Table 5 reports these results overall, and separately for those who did not switch plans and those who did switch. These results show that those who initiated new medications reduced their overspending by more than those who did not. In fact, among those who did not switch plans, those who remained healthy did not reduce their overspending in 2007, while overspending fell by $29 to $148 for those who initiated medication for 8 of the 10 illnesses. This suggests that consumers' 2006 choices included an element of insurance value against likely but yet unexperienced illnesses, reducing overspending even among the nonswitching population. Finally, the results in Table 5 also show that those who switched plans and initiated medication significantly reduced their overspending more than those who did not switch. This indicates that the newly-chosen plans provided better coverage for these future illnesses than their previous plans did.

6 The Switching Decision

To analyze individuals' decisions about whether to switch plans, achieve this, we estimate the probit model

$$S07_i = \beta_0 + \Gamma \Delta H_i + beta_1 Z_i + u_i, \tag{4}$$

Table 5. Mean Within-Person Changes in Overspending Among Those Not Taking Any Medications in 2006

	N	All	P Value vs Did Not Initiate	Non-Switching Individuals	Switching Individuals	P Value Switching vs Non
Full sample with no medication in 2006	2,964	-117.33	< 0.001	-21.85	-196.66	< 0.001
No medication in 2007	1,678	-96.28	--	-0.26	-170.57	< 0.001
Initiated medication in 2007 for						
Hypertension	547	-171.2	< 0.001	-56.4	-249.6	< 0.001
Cholesterol and other cardiovascular	287	-173.6	< 0.001	-54.6	-261.5	< 0.001
Pain	305	-139.7	< 0.001	-44.8	-237.7	0.007
Mental health	181	-178.7	< 0.001	-82.1	-255.2	< 0.001
Antibiotics	436	-157.8	< 0.001	-66.8	-242.4	< 0.001
Anticoagulants	139	-188.3	< 0.001	-28.9	-267.2	< 0.001
Thyroid	87	-119.8	0.45	54.1	-242.5	0.003
Diabetes	108	-140.9	0.07	19.8	-251.4	0.001
Osteoporosis	85	-228.8	< 0.001	-147.9	-268.6	< 0.001
Alzheimer's	57	-201.5	< 0.001	-85.8	-269.0	< 0.001

NOTE: P-Values are from one-tailed t-tests of whether the improvements of those who initiated medication > those who did not, or for whether the improvements of switching individuals > non-switching individuals.

where $DeltaH_i$ is the change in health status, as above, which in this model provides insight about individuals' use of information about future changes in health in their plan choices. As above, Z_i is a vector of time-invariant individual characteristics including health status and age in 2006, among others, as well as the category of the individual's overspending in 2006, which in this model provides insights about individuals' potential financial gains from searching for a new plan. Also within Z_i is a variable that indicates how the person's 2006 plan changed in 2007 relative to the alternatives, i.e., it is defined as the difference in the person's 2006 plan's percentile ranking in 2006 and 2007. By capturing how much worse the individual's 2006 plan would become in 2007 relative to the available alternatives, this variable also provides insights about whether people were forward looking in their plan choices or whether inertia causes consumers to remain in their plans despite those plans growing relatively worse over time.

Table 6 presents the marginal effects from these probit models for our full sample and for the subset in stable health. As suggested by the results in Table 4, the switching decisions differ with observed characteristics, with males 15 percentage points less likely than females, and the oldest group 39 percentage points more likely to have switched plans than those age 65-69.

Table 6. Average Marginal Effects from Probit Models of Switching

	Full Sample	*Subset with Stable Health*
Overspending Level in 2006 ($)		
less than 100	*Reference Category*	*Reference Category*
between 100 and 200	-0.08 [0.039] **	-0.12 [0.067] *
between 200 and 300	0.21 [0.032] ***	0.21 [0.057] ***
between 300 and 500	0.49 [0.029] ***	0.51 [0.051] ***
between 500 and 1000	0.50 [0.020] ***	0.49 [0.037] ***
between 1,000 and 2,000	0.48 [0.010] ***	0.49 [0.017] ***
more than 2000	0.43 [0.007] ***	0.45 [0.011] ***
Change in 2006 Plan's Percentile Ranking	0.79 [0.009] ***	0.85 [0.016] ***
Age in 2006		
Age 65-69	*Reference Category*	*Reference Category*
Age 70-74	0.12 [0.007] ***	0.14 [0.010] ***
Age 75-79	0.25 [0.006] ***	0.28 [0.009] ***
Age 80-84	0.33 [0.006] ***	0.36 [0.008] ***
Age 85 up	0.39 [0.005] ***	0.41 [0.008] ***
Male	-0.14 [0.005] ***	-0.15 [0.007] ***
Risk score in 2006	0.01 [0.001] ***	0.00 [0.002] *
Took medication in 2006 for		
Hypertension	-0.02 [0.006] ***	-0.01 [0.009]
Cholesterol and other cardiovascular	-0.03 [0.005] ***	-0.04 [0.008] ***
Pain	0.00 [0.006]	0.00 [0.011]
Mental health	-0.03 [0.006] ***	-0.03 [0.010] ***
Antibiotics	-0.04 [0.006] ***	-0.04 [0.009] ***
Anticoagulants	-0.04 [0.006] ***	-0.04 [0.010] ***
Thyroid	-0.06 [0.006] ***	-0.06 [0.009] ***
Diabetes	0.01 [0.006]	0.02 [0.011]
Osteoporosis	-0.02 [0.006] ***	-0.03 [0.010] ***
Alzheimer's	-0.06 [0.012] ***	-0.02 [0.021]
Change in Risk Score	0.01 [0.001] ***	0.03 [0.016]
Change in takes medication for		
Hypertension	0.00 [0.009]	0.03 [0.021]
Cholesterol and other cardiovascular	-0.02 [0.008] ***	-0.03 [0.024]
Pain	-0.01 [0.005] **	-0.01 [0.009]
Mental health	-0.10 [0.007] ***	-0.14 [0.018] ***
Antibiotics	-0.02 [0.005] ***	-0.02 [0.008] *
Anticoagulants	-0.01 [0.009]	-0.02 [0.024]
Thyroid	-0.04 [0.015] ***	-0.02 [0.030]
Diabetes	-0.01 [0.014]	0.04 [0.054]
Osteoporosis	0.00 [0.009]	0.00 [0.024]
Alzheimer's	-0.02 [0.014]	0.02 [0.060]
Observations	71,489	30,179

NOTE: Robust standard errors in brackets. *** p<0.01, **p<0.05, * p<0.1.

Because these results are conditional on health and the magnitude of overspending in 2006, they likely reflect differences in how the decision for 2007 was made, rather than differences in incentives or experience *per se*. The effects of the level of health status on switching also suggest that the re-enrollment decisions did not vary with experience, as captured by the number and types of conditions for which medications were taken. The probability of switching varied with the presence of a medical condition by 2 to 6 percentage points, with people with any of 8 individual conditions significantly less likely to switch plans. In contrast, greater prevalence of other illnesses captured by the risk score was associated with higher probability of switching, although those effects are small as well.

Individuals who acquire new conditions in 2007 are slightly less likely to switch plans. This supports our interpretation above of the analogous results in Tables 3 and 4, where those who initiate treatment improved by more than average—people relied on forward-looking information to choose a plan in 2006 in anticipation of these future needs. Because their 2006 choices already incorporated this information, they were less likely to switch between 2006 and 2007, and they improved by more than average by staying. Although these effects are generally small, they range up to 10 percentage points for mental health and five of the ten achieve significance of $p < 0.05$, as does the change in risk score, which summarizes health from all other conditions. If consumers did not anticipate their future illnesses and incorporate them into their decision making, then we would expect to find no significant relationships between switching and changes in health.

One bias that is commonly cited in the behavioral economics literature is inertia. The results by 2006 overspending category show that the probability of switching plans jumps quite significantly for those whom 2006 overspending was between \$200 and \$300 a year, and it doubles again at levels above \$300. Previous studies have documented poor choices during the first year of Part D, leading researchers to conclude that consumers could not choose well in this context and additional reform was needed, such as reducing the number of plans available. Due to these dynamic

aspects, our results indicate that the partial-equilibrium static approach underlying such proposed reforms are incomplete: overspending as small as $25 per month resulted in a 50 percentage point increase in an individual's likelihood of switching.

In addition to these results by overspending category showing that switching increases sharply even at the lower levels of overspending, we offer evidence about inertia by examining whether switching depends on how the person's 2006 plan changed in 2007. The large positive effect of this variable indicates that beneficiaries tend to move away from their previous choice if it would become more expensive in 2007 relative to the new offerings of other insurers, with an 8 percentage point increase in the likelihood of switching for each additional ten percentage points that the 2006 plan worsened in the distribution of options available in 2007. In addition to assuaging concerns that inertia is dominant in this market, this result indicates that consumers incorporate forward-looking information in their choice of plans.

7 Robustness of Results

In this section we consider whether the results we have reported are robust to alternative approaches. First, we replicate the analysis but adopt the assumption that demand for prescription drugs is perfectly inelastic, as in the results reported by Abaluck and Gruber (2009), rather than assuming an elasticity of -0.54 as in our main results. Second, we compare the 2007 cross sectional results using both our primary *ex post* approach as well as an alternative *ex ante* approach.

7.1 Assuming perfectly inelastic demand for prescription drugs

All of the preceding results allow for a quantity response to the prices of drugs under each plan. To test the sensitivity of the results to this assumption, we replicate many of the analysis assuming perfectly inelastic demand for drugs. Table 7 reports select coefficients from models identical to

Table 7. Select Results for Within-Person Changes in Overspending from Models Assuming Perfectly Inelastic Demand for Prescription Drugs

Panel A. Results from models identical to those in Table 2.						
Health Controls:	*No*			*Yes*		
Intercept	-360.54	[4.712]	***	-368.21	[4.991]	***
Observations	71,498			71,498		
Panel B. Results from models identical to those in Table 3.						
2006-2007 Improvement Allowed to Vary with:	*Age, Sex, Levels and Changes in Health*			*Plus 2006 Overspending*		
Overspending Level in 2006 ($)						
less than 100				*Reference Category*		
between 100 and 200				-144.05	[42.088]	***
between 200 and 300				-250.31	[43.406]	***
between 300 and 500				-495.49	[41.375]	***
between 500 and 1000				-880.02	[41.451]	***
between 1,000 and 2,000				-1875.95	[42.404]	***
more than 2000				-4169.78	[238.207]	***
Age in 2006						
Age 65-69	*Reference Category*			*Reference Category*		
Age 70-74	-50.20	[13.833]	***	-25.16	[11.621]	**
Age 75-79	-75.15	[18.765]	***	-36.93	[17.483]	**
Age 80-84	-133.86	[12.430]	***	-91.17	[10.000]	***
Age 85 up	-122.73	[11.653]	***	-96.40	[9.448]	***
Male	4.92	[13.300]		22.64	[11.546]	**
Intercept	376.40	[42.965]	***	-158.11	[8.859]	***
Observations	71,494			71,494		
Panel C. Results from Models Identical to those in Table 4.						
2006-2007 Improvement Allowed to Vary with:	*Switching Plans and Changes in Health*			*Plus Other Characteristics*		
Switched plans	-388.86	[9.870]	***	-286.22	[8.768]	***
Overspending Level in 2006 ($)						
less than 100				-153.74	[42.191]	***
between 100 and 200				-207.49	[43.591]	***
between 200 and 300				-375.13	[41.548]	***
between 300 and 500				-772.02	[41.713]	***
between 500 and 1000				-1745.42	[42.868]	***
between 1,000 and 2,000				-4080.40	[239.748]	***
more than 2000						
Age in 2006						
Age 65-69	*Reference Category*			*Reference Category*		
Age 70-74				3.70	[11.778]	
Age 75-79				30.70	[18.661]	*
Age 80-84				1.21	[10.870]	
Age 85 up				14.44	[10.512]	
Male				-15.14	[11.064]	
Intercept	-158.11	[8.859]	***	373.10	[43.028]	***
Observations						

NOTE: Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

those reported in Tables 2-4 but using this alternate elasticity assumption. As shown in Panel A, the mean 2007 effects indicate somewhat larger average improvements than under the assumption of somewhat elastic demand, with reductions of overspending exceeding $360 versus reductions in the comparable elastic results of approximately $300. As a percent of the mean 2006 overspending, this amounts to a 46% reduction, which is slightly below the 54% found for the elastic results. In terms of how the unconditional overspending as a share of total spending changed, the inelastic results indicate it fell by 36%, from means of 46% overspending in 2006 to 29% in 2007. Thus, the mean improvements are similar under both elasticity assumptions.

Panels B and C of Table 7 confirm that the key implications from Tables 3 and 4 are also robust to the elasticity assumption. As before, improvements increase monotonically with the size of the 2006 overspending, and here these differences are even greater. Similarly, the differences by sex and age group persist unconditional on switching (Panel B), but disappear conditional on switching (Panel C). This replicates the results in Tables 3 and 4. As before, switching plans reduced overspending, and these results are even larger than the large reductions observed under the assumption of elasticity of -0.54. Finally, the (unreported) results from probit models for switching yield marginal effects very similar to those reported in Table 5.

7.2 Ex Ante Versus Ex Post Cost Minimization

The preceding analysis all adopt an *ex post* approach by considering cost minimization based on the actual drug consumption, which occurred after the plan choice itself was made. To consider the sensitivity of these results to this assumption, here we instead assume that consumers' only relied on their 2006 drug consumption when making their enrollment choices for 2007. To do this, we generate the total *ex ante* 2007 spending by combining the patient OOP costs from their 2006 drugs, the plans' formularies and the costs of those drugs in 2007, and the plans' premiums in 2007. Because we lack information on individuals' 2005 drug claims, this analysis is limited

Table 8. Comparing 2007 Overspending Using *Ex Ante* and *Ex Post* Prescription Drug Claims

	Ex Post *Using 2007 Claims*	*Ex Ante* *Using 2006 Claims*
Mean	257.2	308.32
Median	186.78	209.14
5th Percentile	0.00	0.00
10th Percentile	2.87	17.14
25th Percentile	67.35	87.19
75th Percentile	342.37	355.32
90th Percentile	526.35	546.92
95th Percentile	697.64	725.59

NOTE: The *ex ante* approach defines the total spending in each available plan in 2007 using the claims filled by the person in 2006. The *ex post* approach uses the claims filled by the person in 2007. Both rely on the plans available and their attributes (e.g., premiums and formularies) in 2007 and their attributes in 2007.

to comparing the cross-sectional results for 2007 from these two alternative assumptions about consumers' information sets.

The results in Table 8 indicate a high degree of similarity between the two approaches, both in terms of the mean as well as at various other points in the distribution of 2007 overspending. Despite the similarity, choices appear closer to cost-minimization using the *ex post* rather than the *ex ante* approach. We find this result despite these descriptive statistics being unconditional on changes in health, where unanticipated *ex post* health shocks would cause choice to appear farther from the cheapest option under the *ex post* approach. Several reasons likely explain this potentially surprising result. First, the *ex ante* approach implicitly assumes perfectly inelastic demand under the actually chosen plan: the consumption bundle in 2007 is held to be identical to that in 2006 despite the fact that the person's formulary and out-of-pocket costs may have changed from 2006 to 2007.[13] Second, for similar reasons, it eliminates an important source of learning. If patients understood their formularies better in 2007 than 2006, their purchasing on their actual plan to become better tailored to their 2007 formulary, and this would occur without equally-large effects

[13] This is true even when we use the elasticity estimate of -0.54, because those adjustments are made only to the alternative non-chosen options in the cases where their prices differed from the actual, chosen plan.

for the minimum-cost options because they have different formularies. Using the 2006 claims as in the *ex ante* approach prevents the analysis from allowing for such learning. Third, as presented above, if consumers purchase plans with higher premiums that provide more generous coverage for medications they are likely to take in the future but are not currently, then such changes in health will reduce overspending. Holding drug consumption constant at the 2006 level excludes these gains as well.

8 Conclusions

We analyzed Medicare Part D plan choices of older consumers who faced a potentially dizzying array of options for a complex, multiattribute product. Despite these features raising the potential for widespread consumer confusion, we found evidence that consumer choices of insurance plans, measured by overspending, improved substantially even in only one year. Further, these improvements were greatest among those who overspent most in the first year. A substantial share of these improvements were due to consumers capitalizing on the heterogeneity of available alternatives and switching into a plan more appropriate for them. Consumers' decisions to switch plans were sensitive to changes in their current plan relative to the alternatives, indicating that plans must compete to retain enrollees and cannot rely on their inertia.

Specifically, we found that the mean difference between individuals' actual choices and their cheapest options fell by about $300 while the median difference fell by about $240. The reduction in overspending varies, with those with the highest overspending in 2006 realizing the greatest reduction in 2007. We find evidence that this reduction in overspending is due to changes by individuals as well as changes in the design and availability of plans. The largest improvements were achieved by those who switched plans, indicating active effort by enrollees or someone acting on their behalf. However, even those who did not switch plans improved on average, due largely from

changes in the design of their . Because we cannot observe the enrollment decision process itself with these data, we cannot determine whether the decision to remain was driven by these relative improvements, as the results from our estimates of the switching decision suggest, or whether such consumers passively received these gains that may not have been experienced by those in plans outside of our study sample. Additional research would provide a deeper understanding of the complex, dynamic relationships between supply-side changes in plan offerings and demand-side changes in enrollment decisions.

Our results provide no evidence that populations with greater prevalence of cognitive limitations, as indicated by taking medications for Alzheimer's disease or being age 85 or above, improved by less than average. In fact, the oldest consumers improved by the most, and those taking medications for Alzheimer's in both years improved by more than average. Although our data preclude us from examining the choice process directly, these results suggest that social networks, children and other relatives, medical personnel, and other organizations and decision support tools that help these patients assist these potentially vulnerable populations in choosing Part D plans. That is, various real-world mechanisms appear to provide support to those with cognitive limitations in ways that have been omitted from the existing survey- or laboratory-based research.

Omitted from our analysis are risk aversion and uncertainty, although our analysis accounts for them as long as their individual-specific effects are time-invariant. Subsequent work that incorporates their roles will indicate whether they explain the remaining amount of observed overspending. Our results provide some evidence that consumers purchased plans that provided insurance value against common but yet unexperienced medical illnesses, suggesting that such forward-looking information may be important in these markets.

While these data offer a number of strengths, they can provide insights about only a limited scope of choices related to Part D. First, because our data include only enrollees, we cannot analyze the participation decision itself, as done by Heiss et al. (2007). Second, we analyze the choice of

prescription drug insurance in isolation, where Medicare beneficiaries face a number of decisions about how to best acquire insurance for the full scope of health care. Thus, some individuals may improve in their choices in Part D plans, but not improve along these broader dimensions if, for example, improvements by Medicare Advantage plans that offer both prescription drug coverage and health insurance were greater yet from 2006 to 2007.[14]

Our results add to the accumulating evidence indicating that Medicare Part D represents a successful implementation of a market-based approach to deliver a large-scale entitlement program. In addition to the high enrollment found by Joyce et al. (2009), Duggan et al. (2008) report that Part D has reduced pharmaceutical prices, increased the utilization of prescription drugs, and reduced medical expenditure risk, all at a substantially lower cost for the government than initially expected. Furthermore, although Heiss et al. (2006) initially questioned whether a government run program could have more effectively controlled for the cost of drugs, they later concluded that Part D has been a tactical success that has induced high enrollment levels, ensured competition among private insurance sponsors, and kept drug prices and rates of consumer deception low (Heiss et al. (2007)).

One implication for Part D specifically is that cross-sectional analysis and subsequent policy recommendations based on new and evolving markets (Abaluck and Gruber (2009)) overlook the importance of experience and market responses in ameliorating biases in consumer choices (List (2003)). As Part D has developed, consumers had greater access to information through plan ratings, user-friendly websites, and software applications of pharmacy chains and other institutions to help people choose well-matching plans. However, these sources of information did not appear

[14]It is worth noting that given our focus on within-person improvements over time, overlooking outside options such as Medicare Advantage does not undermine applicability of our results on these broader decisions per se, as long as the individual's cost of those other options remains stable over time.

overnight when Medicare Part D was first implemented. Rather, the market for information itself grew in response to the new and greater demand for it.[15]

Both within and beyond health care, repeated evidence that choice overwhelms consumers and leads to poor matches between consumers and products will support policies such as strengthening consumer protection rules or requiring a simplification of credit cards, mortgages, or health insurance contracts. Alternatively, evidence that consumers can discern among multiple complex alternatives would indicate that policies that reduce barriers to entry and promote competition, freedom of choice, and the provision of heterogeneous products will enhance welfare, including an increase overall the value of health care spending. Unfortunately, the evidence supporting consumers' inabilities to choose their health insurance plans appropriately has been obtained using only cross-sectional data that often abstracts from the actual choice process.[16] By providing an analysis of a large individual panel database in an economically-meaningful environment, we contribute to this debate by focusing on the evolution of consumers' performance over time.

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[15] See `http://www.medicalnewstoday.com/articles/57318.php` for one example of a private sector initiative that was not available in 2005 for the 2006 open enrollment but was available in the fall of 2006 for the 2007 open enrollment period. The plan finder offered through CMS was also overhauled between the two periods to be more user-friendly.

[16] For instance, the work by Kling et al. (2009) cited above analyzes a few hundred telephone and mail interviews.

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APPENDIX

A Individual's Out-of-Pocket Costs for Each Available Plan and Year

For each person in each year, we computed counterfactual estimates of the total out-of-pocket (OOP) costs (the sum of plan premiums and OOP prescription drug costs) for all PDPs available in the person's market. The Geographic Locator File from CMS was used to determine which PDP region code a person resided at each point in time. We then used the CMS Plan Information file to determine which plans were available in each person's market.

To generate the OOP and gross prescription drug costs for each person in each available PDP, we used the PBM claims data, which include all claims paid by the PBM as well as all of the claims submitted but rejected. We combined these with the CMS formulary files. Across all plans we held constant whether the prescription was filled via mail service or retail, and for retail prescriptions we assumed that they were filled at a preferred network pharmacy.[17]

In the main estimates reported in the article, we allowed the consumption bundle to vary with the average price of the person's drugs in each plan. Starting from the amount consumed under the actual, chosen plan, we compute the amount of each drug consumed by applying the assumed arc-elasticity of -0.54 (from Shea et al. (2007) to the difference in prices of each drug under the different formularies.[18] We then multiply this adjusted quantity by the individual's average price of prescriptions in each plan and add the appropriate (subsidy-adjusted) premium for each plan.[19] This creates each plan's total OOP cost to each patient for each year, which we use to analyze how the chosen plan compares to the cheapest alternative and to the range of available options.

[17] This was essential because within a given plan, prices for a given drug can vary by pharmacy type (mail *vs.* retail) and whether the pharmacy is in the plan's network.

[18] Because we define each option's costs based only on the drugs that were purchased under the actual plan, we are not able to fully incorporate substitution patterns among drugs, which may perhaps led to measurement error. For example, assume that drugs A and B are perfect substitutes, and in the person's actual plan they pay \$10 for drug A, which they consume because the copay for drug B is \$30. If in an alternative plan drug A's copay is \$30 but drug B's is \$10, the individual's total drug consumption and total costs would have remained unchanged. Under the assumption of perfectly inelastic demand, we would estimate the person's expenditures to be \$20 higher per prescription under the alternative plan. Allowing for somewhat elastic demand incorporates some but not all of the demand response and thus gets closer to the true counterfactual drug spending. Unfortunately it is not feasible for us to estimate the impacts of specific formulary designs on consumption patterns in a more precise way.

[19] One unique characteristic of our data is that they identify which of the four federal low income subsidy (LIS) levels, if any, was received by each person in each year. This allowed us to adjust premiums appropriately by subtracting the premium support for that level of subsidy in that region from the plan's premium. The premium support for those between 100-150% of the federal poverty level (LIS level 4) is based on a sliding scale depending on the specific level of income. Because we could not observe this, we assumed the (unweighted) average, which is 62.5% of the region's full premium support. This population accounts only for approximately 3% of our study sample.

One challenge to researchers examining consumers' actual Part D plan choices is that the CMS formulary file does not provide all required information in cases where patients paid the full cost, as under the deductible or doughnut hole, or some fraction of it, as with coinsurance. Specifically, the formulary files do not provide the underlying prices of each drug in each available plan to which the coinsurance would be applied.[20] We relied on a range of data sources to provide these underlying prices. First, we used Wolters Kluwer Health Source LX claims data to generate an average price per unit (e.g., day's supply) for each of the Food and Drug Administration's National Drug Code (NDC) in each plan by quarter, region, and pharmacy type (retail or mail service). To do this, indicators in the Wolters Kluwer Health data were cleaned and used to generate these measures at the level of the PDP parent company. Individual plan identifiers are not available in these data, but the prices we need do not vary across plans within a parent organization, which we confirmed by examining "scraper" data from the Medicare Prescription Drug Plan finder website for 2006 as in Simon and Lucarelli (2006). These scraper data captured the price per unit for 400 common drugs for each plan in 2006.

Because the WKH data did not provide all of these underlying prices needed to estimate costs for each person in each available plan, we relied on the scraper data for most of the additional prices. Where needed, we multiplied the coinsurance rate by the average unit price from either of these two sources for the given NDC, quarter, region and pharmacy type.[21,22] To validate this approach of determining each person's total OOP spending in each available plan, we compared the total spending for the person's actual plan derived from this simulation method with that directly observed from the PBM data. The correlation coefficient between these was 0.77, with a median difference of $0 and a mean difference of $146 (with the average simulated costs being higher). The simulated costs were greater than the actual costs for 56% of the sample. This suggests that our method for estimating spending in counterfactual plans was highly accurate.

We also included not enrolling as a possible option to the choice set. One benefit of including this alternative is that it limits the extent to which any observed improvements in plan choice can be ascribed to exit or redesign of the lowest-cost plans. For this "no insurance" option, premiums were $0 and drug costs were determined by the usual and customary price, which is what the pharmacy would have charged a cash-paying customer.

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[20] CMS began reporting such prices for a subset of National Drug Codes (NDCs) for the 2009 data but does not plan to release them for earlier years.

[21] Where necessary, for a given NDC we imputed these values by relying first on adjacent quarters, then on adjacent regions, and moved farther away in geographic or temporal space. For mail service pharmacies, we also imputed from retail pharmacies in the same region and quarter.

[22] On average, only 10.5 percent of each person's total OOP spending for each plan relied on imputed prices. Of the imputed spending, 79.7% was imputed from the WKH data, 19.8% was imputed from the scraper data. The remaining 0.5% of the imputed spending (or five hundreths of 1% of the average total OOP spending) was imputed from the PBM data by dividing the price for the person's actual PBM plan by the average relative price for a given plan in the scraper data.