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

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May 21, 2010

Abstract

Under Medicare Part D, people choose prescription drug insurance from many alternatives offered by private insurers. We examine enrollees' actions in 2006 and 2007 using panel data. The non-poor 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 as much as average or better, suggesting that real-world mechanisms help overcome cognitive limitations. The poor population also improved and increasingly utilized their continuous open enrollment to reduce their costs. Market evolution and consumer learning likely explain these gains.

Keywords: Medicare Part D, Consumer Choice, Learning.

JEL Codes: D01, D8, H51, I10, I11, I18.

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*We thank Kosali Simon for generously sharing data, and V. Kerry Smith for comments on an early version of the manuscript. We also thank seminar audiences at Keio University, McCombs' conference on "Innovation in Health Care Delivery Systems," and the 8th Invitational Choice Symposium.

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Abstract

Under Medicare Part D, people choose prescription drug insurance from many alternatives offered by private insurers. We examine enrollees' actions in 2006 and 2007 using panel data. The non-poor 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 as much as average or better, suggesting that real-world mechanisms help overcome cognitive limitations. The poor population also improved and increasingly utilized their continuous open enrollment to reduce their costs. Market evolution and consumer learning likely explain these gains.

\The new Medicare Part D prescription drug insurance market illustrates that leaving a large block of uniformed 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 threshhold. In 2006, these thresholds for the standard plan design were 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 in a high-stakes environment 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

[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.

of plans available to consumers, which ranged across regions from 27 to 52 plans available in 2006 and 45 to 66 available in 2007.[4]

In this article we present the first evidence of how consumers' actual choices in Medicare Part D evolve over time. To achieve this, we employ 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 misweight 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 ameliorates 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 their choices over time in terms of reducing overspending, which is defined 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, throughout the article we separately analyze those who did not receive federal low-income subsidies, which we refer to as the non-poor population, and those who did receive those subsidies, referred to as the poor population.

[5] Choi, Laibson, and Madrian (2009) present experimental evidence that 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.

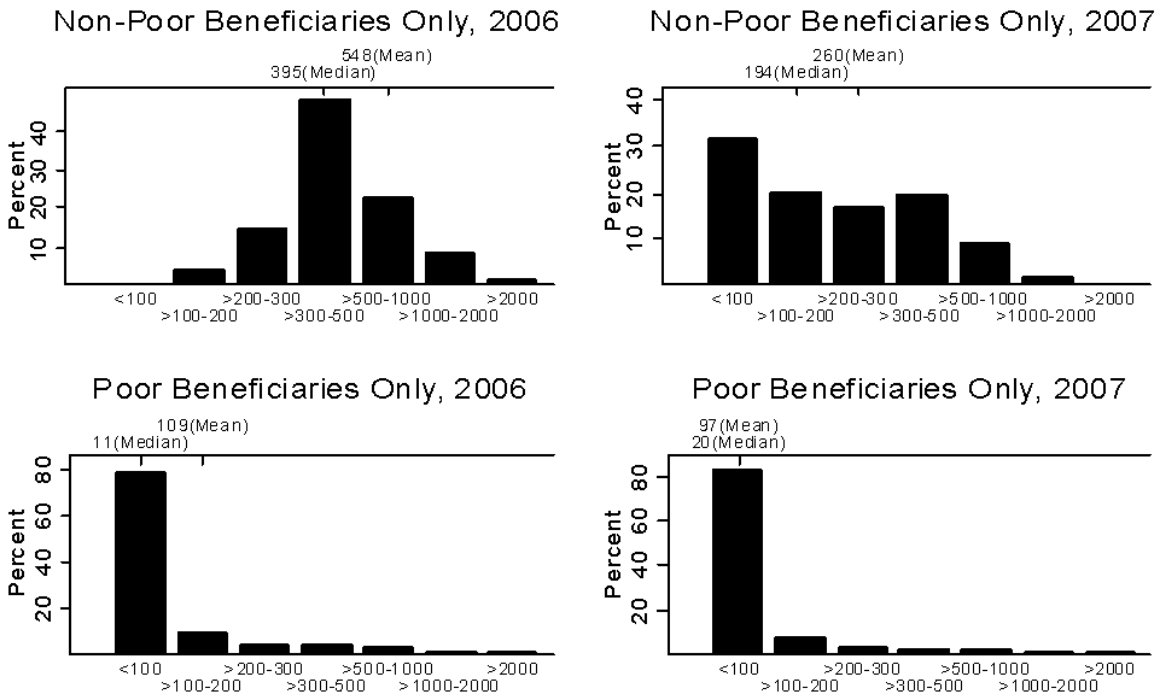
Among the non-poor population, we find consistent evidence of large improvements, with average reductions in overspending of 40-54% in one year. In addition to these large average effects, we find substantial heterogeneity in these improvements. The greatest improvements were achieved by those who overspent 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 our data do not permit us to directly observe the choice process, 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. Finally, even ignoring the effects of the late-enrollment penalty, we find that only a small share of our enrolled non-poor population would have achieved lower costs without insurance.

Using data described below, Figure 1 provides descriptive results for the changes in overspending from 2006 to 2007 that hold up to more rigorous analysis. [7] The two upper panels of Figure 1 depict the distribution of potential savings for non-poor 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

[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 and Income



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. We explore the causes of this change in detail in this article.

The bottom panels of Figure 1 indicate somewhat different patterns for poor beneficiaries who received federal low-income subsidies. This population's distributions are heavily concentrated around the least expensive option, and they remain stable across both years, although the mean overspending declined by $12 even among this population. Poor beneficiaries receive large subsidies for premiums, making a set of "benchmark" plans available to them at $0 premium, and these plans

have very small copayments. Furthermore, this population has continuous, rather than annual, open enrollment, and if they do not actively choose a plan, they are randomly assigned to one of the benchmark plans. Despite these features that by design limit the financial exposure for the poor, equity concerns have been raised about Part D, due in part to fear that lack of sophistication may cause Part D's design to be particularly deleterious for the poor population, e.g., McFadden (2006). These concerns motivate our analysis of the poor population in this article. As with the non-poor population, for the poor beneficiaries we find the greatest improvements among those who overspent most in 2006, and this is not due to changes in health. Furthermore, we find that the prevalence of those who switched plans within the year grew from 2006, with nearly 13% switching plans within 2007, and on average they reduced their costs by doing so.

In the remainder of the article we further explore these descriptive findings and their underlying causes. The article is organized as follows. Section 2 describes our data. Section 3 evaluates how potential savings evolve between 2006 and 2007 for non-poor beneficiaries without federal subsidies. We also analyze the decision to switch plans in 2007 and if these actions were responsible for the observed improvements. This section concludes with a subsection that evaluates 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 4 repeats the main analysis but for those receiving federal low income subsidies. Section 5 evaluates the participation decision, i.e., whether our enrolled population would have achieved lower costs without insurance, and we conclude in Section 6.

2 Data

To describe our data we first compare the features of the plans included in our sample with the universe of plans available in the US. Next, we summarize how we generated each consumer's spending in each plan available to them in each year. 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.

Data from the Centers for Medicare and Medicaid Services (CMS), CVS Caremark (a pharmacy benefits manager, henceforth "the PBM"), and ancillary sources were used to generate the cost of each plan to each patient in both 2006 and 2007. The PBM provided us with a unique, 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, gender, age and detailed measures of health status. Our study sample included 224,803 who were enrolled in stand-alone Prescription Drug Plans (PDPs) provided or administered by the PBM in 2006 and 2007.[8]

From this sample we exclude those who were not included in the data for all of 2006 and 2007, i.e., we analyze a balanced panel throughout this article. We also excluded those who switched plans within the year throughout the article with the exception of one analysis of within-year switching

[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 identify the individual's costs for prescription drugs and prescription drug insurance for those plans. Consequently, we restrict the analysis to PDPs and their enrollees.

itself by the poor population, described below in Section 4. Because we evaluate the poor and non-poor populations separately, we also exclude those who gained or lost the subsidy from 2006 to 2007, but we include those who moved between specific subsidy levels during our study period.[9] Thus the data underlying Figure 1, for example, excludes those who switched plans within the year or who switched subsidy status because that would have moved them between the top half and lower half of the figure. This leaves us with a sample of 178,449 (71,399 non-poor and 107,050 poor) for our most basic regression models.[10]

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.[11] This includes 9 different PDPs in 2006 and 18 in 2007, where only about 55% of the sample was enrolled in the Silverscript plans.[12] 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

[9] One implication of this is that any observed changes for the non-subsidy population cannot be explained by the fact that some of them may have newly acquired the subsidy in 2007, because such individuals are excluded from our analysis.

[10] The descriptive analyses have slightly higher numbers due to a few observations missing some data, e.g., Figure 1 includes 72,366 non-poor individuals in 2006.

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

[12] 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 population selection criteria. We restricted our analysis to those for whom we could observe all of the individual's claims for both 2006 and 2007. For example, the initial PDP open enrollment extended well into 2006, but it was not feasible for us to generate accurate annual spending amounts for those whom we observe only part of the year.

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	

range of all PDPs available, as shown in Table 1. The means for 2006 indicate that our study 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 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 at enrollment 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. If in fact the bias toward such plans exists,

then our sample includes those who should have left the PBM's plans but did not because of their favorable but harmful bias toward generic doughnut hole coverage. Because those who did not exhibit such bias and actually left were excluded from our sample, our results will underestimate the improvements because these changes in plan design increased the percent of our study sample making mistakes between 2006 and 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.

For each PDP available to each person 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 "not enrolling" as one of the options that individuals may choose from (although the implications of our results do not depend on the inclusion of this option), and we consider the enrollment choice directly in Section 5. Appendix A details how these calculations were implemented. For the main analyses 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.[13]

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

[13] 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 3.5 we present results under the alternative extreme assumption of perfectly inelastic demand for drugs, as reported in some of our predecessors' articles.

only their current consumption, ignoring the possibility of future changes in their plan choices. 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 analyses 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.[14] 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. In contrast, Tchernis, Normand, Pakes, Gaccione, and Newhouse (2006) present 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 choices from this *ex ante* perspective. However, we compare the cross-sectional overspending results for 2007 from both the *ex post* and the myopic *ex ante* approaches in Section 3.5, and we find no notable differences between them.

[14] 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.

3 Improvements among the Non-Poor Population

In this section we analyze the changes in overspending from 2006 to 2007 among the non-poor population who did not receive federal low-income subsidies. We find that the mean difference between non-subsidized consumers' 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 beneficiaries rather than due to changes in health. Consumers that realize the largest gains are those who switch plans, but even those who do not switch plans reduced their spending, likely through learning that affected behavior in other ways. Furthermore, we find evidence that consumers were forward-looking in their switching decisions, with higher probabilities of switching out of their 2006 plans between 2006 and 2007 if their 2006 plans became more expensive in 2007 relative to the available alternatives.

3.1 Sizable Average Reductions in Overspending and Substantial Heterogeneity

We begin by estimating regressions of overspending with individual fixed effects. Specifically, we estimate

$$O_{it} = \beta d07_t + \Gamma H_{it} + \xi_i + u_{it}, \tag{1}$$

where the dependent variable O_{it} denotes the overspending of beneficiary i in year t, $d07_t$ is a dummy variable that takes the value 1 if $t = 2007$, and the vector H_{it} contains indicators for

within-person changes in health.[15] In addition, in our composite error term we allow for time invariant, individual specific, unobserved heterogeneity ξ_i, and an idiosyncratic error u_{it}.

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. In the first model we do not control for changes in health, but in the second model we do. In the third and fourth models, we analyze a subset of consumers with stable health and control for any small, remaining observed changes in health. 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 have a change in any of the ten individual conditions that we include (listed in the previous footnote). While results show that overspending in OOP costs averaged $546 in the regression sample in 2006, in the most basic model this was reduced by almost $300, i.e., a reduction of 54%, in 2007.

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 non-poor 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).

[15] These health measures are defined by the Ingenix Pharmacy Risk Groups (PRGs) and calculated risk scores, which are used 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. We also 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, diabetes and osteoporosis. We also include controls for Alzheimer's disease because of its link with cognitive ability.

Table 2. Overspending of Non-Poor Beneficiaries: Individual Fixed Effects Models

	Health Controls		*Stable Health Only*	
	No	*Yes*	*Inclusive Definition*	*Narrower Definition*
Year 2007	-296.27	-298.55	-266.21	-255.74
	[3.888] ***	[4.128] ***	[6.922] ***	[9.264]
Observations	142,798	142,798	60,298	30,494
R-squared	0.075	0.077	0.047	0.048
Mean Overspending in 2006	546.4	546.4	514.9	504.2
Within-person change in Overspending				
5th Percentile	-1,136.0	-1,136.0	-1,043.0	-989.6
10th Percentile	-765.8	-765.8	-681.3	-642.3
25th Percentile	-409.4	-409.4	-381.5	-364.8
50th Percentile	-236.9	-236.9	-210.6	-189.1
75th Percentile	-44.2	-44.2	-39.0	-38.8
90th Percentile	98.5	98.5	76.8	72.7
95th Percentile	234.9	234.9	187.9	147

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

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 3 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.

3.2 Improvements Vary with Observed Individual Characteristics

Our results thus far point to market dynamics and potential learning as the driving forces behind the improvement in Medicare Pard D plan choices as the market evolved and beneficiaries gained experience. The large improvements shown by our panel data do not support claims of persistent consumer irrationality, at least for senior citizens, in an important but complex market. In this section we provide further evidence that elders reduce their overspending in response to previous overspending, i.e., money incentives dominate the effect of changes in health status (unexpected events or private information), or aging (decay of learning abilities). Furthermore, we do not find 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, and in fact the oldest consumers improved by the most. Although our data preclude us from examining this directly, these results suggest that social networks, children and other relatives, medical personnel, and other organizations and decision support tools that help these patients all assist these potentially vulnerable populations. In sum, this section indicates that poor choices appear to be transient rather than persistent, that beneficiaries' desires to reduce prior high levels of overspending prompts them to do so successfully, and that various real-world mechanisms appear to provide support to those with cognitive limitations. To obtain these results, we estimate

$$O_{it} = \beta d07_t + \Gamma H_{it} + \beta_3 Z_i * d07_t + \xi_i + u_{it}, \tag{2}$$

where Z_i includes a vector of time-invariant, observed characteristics for individual i, and the remaining variables are as in equation (1). By interacting Z_i with the 2007 indicator, in these models we allow the 2007 effects 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 both years for each of the 10 individual indications), and

sex. The coefficients from these interaction terms will indicate whether the rate of improvement depend on cognitive ability, from the interactions with age and Alzheimer's disease, or with the amount or type of medications taken, from the interactions with the health measures. These results will also provide evidence about the equity of Part D's reliance on consumers' ability to choose by testing whether certain populations, such as males, improved by substantially less than others. In a second version of the model, we also allow the 2007 effects to vary with the extent of their 2006 overspending (less than $100, $100-$200, $200-$300, $300-$500, $500-$1,000, $1,000-$2,000, more than $2,000). This provides a test of whether overspending persisted or whether it promoted greater improvement, even conditional on changes in health.

Table 3 presents the within-person changes in overspending from 2006 to 2007. The magnitude of the improvement varies inversely with the coefficients, with more negative numbers indicating greater reductions in overspending from 2006 to 2007. The first column allows the 2007 effect to vary with health, age, sex while the second and third columns also allow it to vary with the level of the 2006 overspending. The first two columns include all of our sample's non-poor beneficiaries, while the third column is limited to the subset with stable health.[16]

The results show that the change in overspending varies substantially with these observed characteristics. Improvements were greater for those with worse health, with $39 greater reduction in overspending for each unit increase in the risk score. Similarly, those taking medications for cholesterol, anticoagulation, or osteoporosis had larger decreases in overspending. Although those with some of the other conditions actually improved by less than average, in general these health status effects dissipate when we also allow the 2007 effect to vary with 2006 overspending, as in the second and third columns. In those more comprehensive models, however, we find evidence that males improved by $28-49 less than females.

[16] In unreported but very similar results we also estimated these models without any health controls.

Table 3. Non-Poor Beneficiaries 2006-2007 Reduction in Overspending by Individuals' Observed Characteristics: Individual Fixed Effects Models

	All Non-Poor Beneficiaries		*Subset with Stable Health Only*
2006-2007 Improvement Allowed to Vary with:	*Health, Age and Sex*	*Plus 2006 Overspending*	*Plus 2006 Overspending*
2007	-32.49 [10.413] ***	292.99 [19.569] ***	282.69 [28.789] ***
*2007*Overspending Level in 2006 was ($)*			
less than 100		*Reference Category*	*Reference Category*
between 100 and 200		-164.18 [17.299] ***	-156.26 [22.329] ***
between 200 and 300		-254.23 [21.186] ***	-225.49 [37.154] ***
between 300 and 500		-407.95 [16.945] ***	-386.87 [21.834] ***
between 500 and 1000		-632.96 [16.936] ***	-595.89 [22.137] ***
between 1,000 and 2,000		-1302.01 [17.961] ***	-1270.18 [24.871] ***
more than 2000		-3186.15 [207.496] ***	-2464.99 [433.494] ***
*2007*Age in 2006*			
Age 65-69	*Reference Category*	*Reference Category*	*Reference Category*
Age 70-74	-33.57 [11.518] ***	-19.7 [9.937] **	-26.3 [5.997] ***
Age 75-79	-70.11 [14.354] ***	-46.8 [13.242] ***	-52.13 [23.644] **
Age 80-84	-104.93 [14.685] ***	-76.48 [13.778] ***	-67.64 [26.476] **
Age 85 up	-109.49 [9.809] ***	-93.37 [8.283] ***	-93.27 [8.347] ***
2007*Male	13.22 [11.676]	27.85 [10.398] ***	49.17 [19.879] **
2007*Risk Score in 2006	-39.09 [3.997] ***	-2.36 [3.028]	-0.73 [3.779]
*2007*Took medication in both 2006 and 2007 for*			
Hypertension	21.69 [10.347] **	13.1 [9.835]	12.46 [14.950]
Cholesterol and other cardiovascular	-74.2 [10.641] ***	-16.25 [10.047]	-36.75 [19.306] *
Pain	32.97 [11.740] ***	9.53 [10.429]	15.96 [9.458] *
Mental health	13.27 [12.447]	25.43 [10.883] **	11.9 [12.495]
Antibiotics	7.58 [8.896]	-0.53 [7.628]	-2.26 [9.783]
Anticoagulants	-52.13 [11.128] ***	-13.17 [9.461]	-29.66 [17.473] *
Thyroid	-5.11 [9.013]	9.21 [7.601]	-1.61 [11.668]
Diabetes	-9.4 [12.878]	-0.32 [9.964]	-27.43 [16.525] *
Osteoporosis	-15.17 [9.200] *	-21 [7.200] ***	-48.9 [11.038] ***
Alzheimer's	-3.53 [17.387]	-5.22 [13.294]	-38.87 [21.363]
Change in Risk Score	6.05 [5.601]	14.21 [5.169] ***	66.63 [39.107] *
Change in takes medication for			
Hypertension	-26.32 [12.439] **	-25.86 [10.639] **	-13.84 [11.742]
Cholesterol and other cardiovascular	15.2 [18.395]	11.64 [17.133]	-12.79 [13.337]
Pain	-14.38 [6.223] **	-10.53 [5.259] **	-5.09 [6.076]
Mental health	-8.29 [12.937]	-7.24 [11.603]	23.54 [11.475] **
Antibiotics	-10.09 [8.062]	-9.23 [7.555]	-35.91 [19.450] *
Anticoagulants	-35.79 [13.799] ***	-31.02 [11.748] ***	-9.42 [17.618]
Thyroid	20.07 [12.831]	11.8 [10.182]	-0.19 [21.052]
Diabetes	-26.02 [40.398]	-42.03 [37.714]	-8.03 [39.292]
Osteoporosis	-18.64 [12.912]	-13.96 [10.758]	-16.01 [19.094]
Alzheimer's	-16.17 [19.469]	-51.42 [16.577] ***	-50.96 [28.521] *
Mean individual fixed effect	555.93 [13.832] ***	524.04 [11.951] ***	318.49 [115.902] ***
Observations	142,798	142,798	60,298
R-squared	0.094	0.23	0.126

NOTE: All models include individual fixed effects. These estimates are restricted to those who did not receive a federal subsidy in either 2006 or 2007. We assume a demand elasticity of -0.54. Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

These results also show that newly acquiring a medical condition in 2007 led to significant reductions in overspending.[17] Beneficiaries who began treatment for hypertension, pain, or anticoagulants reduced their 2007 overspending by $26, $14, and $36 more than average, respectively. The second model also shows significantly larger reductions for those who commenced taking medications for Alzheimer's disease in 2007, with reductions in overspending of $51. These results are consistent with the evidence from Tchernis et al. (2006) that patients have private information regarding the predictable evolution of their health status when enrolling in a particular Medicare plan. Had these patients chosen plans with meager coverage for these conditions, their overspending would have increased more than average, rather than decreased. These decreases suggest that uncertainty about when they would acquire these conditions likely led them to overspend in 2006, when they did not acquire the condition, but their forward-looking choice caused them to lower their overspending more in 2007 when they acquired the condition. This interpretation is bolstered by the observation that these results hold up in the second model, in which the change in overspending is also allowed to vary with the 2006 overspending level.

The differences in improvements by age are robust to all three specifications: older consumers reduced their overspending more than younger, with the reductions of the oldest approximately $100 greater than those of the youngest. This, in conjunction with the results showing that those who took medication for Alzheimer's in both years or who commenced medication for it in 2007 improved by at least as much or more than average, indicates that the role of individual cognitive ability in actual, important decisions may be complex. We do not adopt the unlikely interpretation that age and illness does not reduce cognitive ability. Furthermore, because these are conditional on the magnitude of the change due to the 2006 overspending, the simple interpretation that older and sicker consumers have more overspending to reduce does not apply. Rather, these

[17] We rely on the results in the first two columns, because those for the stable health population in the third column are identified off of individuals whose overall change in risk score was close to zero, indicating that increases due to newly acquired conditions were offset by stopping taking medication for some other condition(s).

results point to the role of various other support mechanisms in helping consumers with limited cognition learn and make decisions. For example, children or other family members may be more involved in plan choice and medication choice as seniors age. Alternatively, these consumers may receive greater assistance by health care providers, public health initiatives, or other private sector decision support tools.

Because we are analyzing a large database of prescription drug claims and plan choices, we lack the more detailed data necessary to observe these various support mechanisms directly. Additional research should seek to incorporate information about the actual decision making process and who was involved in conjunction with an empirical analysis of actual decisions. Such research would be useful for understanding the role of individual cognition not only in Part D, but in other environments such as retirement planning, where surveys show cognitive limitations by older populations but it remains unknown how older populations' investment decisions are actually made, and by whom.

The last two columns of Table 3 report another compelling set of results. 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. These results point to the essential role of considering the dynamic aspects of consumers' choices to analyze consumers' ability to choose more generally, and to evaluate the success of Part D specifically.

What explains this improvement from 2006 to 2007? For some consumers, the cheapest options may have become more expensive, resulting in lower overspending even apart from active engagement in searching for cheaper alternatives or learning about the coverage of their current plan. 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 actively seeking to reduce their overspending. For some, this may have involved learning about the formulary of their plans and substituting their previous drugs for similar ones covered by the formulary. For others, these actions may have led to switching to plans better suited for them. We consider these issues in the next subsection.

3.3 Sources of Improvement

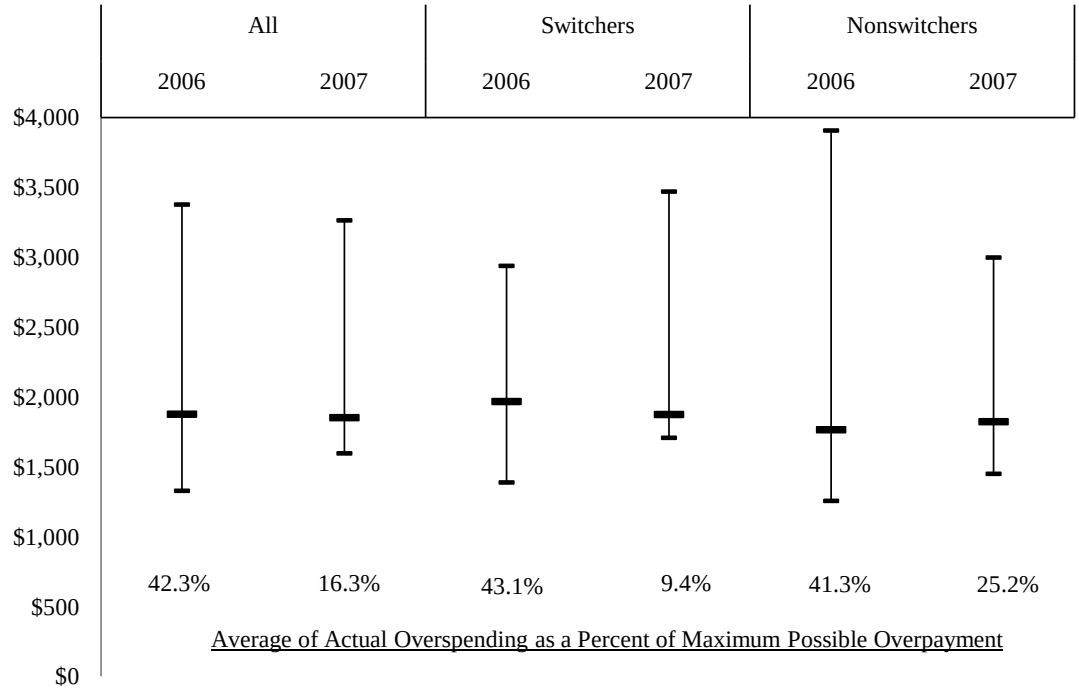
We now consider whether the gains we observed were due either to learning that led to switching to more appropriate plans or to learning that led to lower costs within a given plan. For example, enrollees may have become more familiar with how to navigate their formularies or may have better understood and anticipated the doughnut hole. We find evidence that improvements resulted from both types of learning, though the gains from switching appear substantially larger.

Figure 2 illustrates that the reductions in overspending are due to a variety of reasons, but switching is the predominant one among the non-poor population. In this figure, each person's chosen plan is compared to the full range of plans available to him, rather than simply comparing it with the cheapest option available as in our previously-reported analyses.[18] In the figure, the vertical lines represent the range of options, with markers at the bottom and top indicating the cheapest and most expensive option available, averaged across non-poor beneficiaries. Within that range is a heavier marker indicating the enrollee's total spending under the chosen plan, again averaged across the non-poor.[19] Below these visual representations of the distribution of plans available, we report the average ratio of the actual overspending to the maximum possible

[18] As before, we continue to include no insurance as one of the options in the choice set.

[19] We also examined the median values of all three to eliminate the influence of extreme values of the maximum cost options, but the results were very similar with one exception we mention below.

Figure 2. Average Values for the Actual, Minimum and Maximum Cost Options, Non-Poor Beneficiaries Only



overspending, i.e., the denominator is what they would have overspent if they had chosen the most expensive plan.[20]

We present these results for each year for the entire non-poor sample, and separately for those who switched plans from 2006 to 2007 and those who did not. As with our comparison of the actual and cheapest plan, in this broader context we find evidence of large improvements from 2006 to 2007. Overall, the average non-poor person dropped from overspending 42% of the maximum amount to 16% of the maximum amount from 2006 to 2007, equivalent to a 62% reduction.

Those who switched plans realized the largest improvements, where their actual spending fell from 2006 to 2007 and the cost of their minimum and maximum cost options both rose. We

[20] The values in the percentages do not perfectly match up with the visual representation in the graph because of differences in the average ratio and the ratio of the averages.

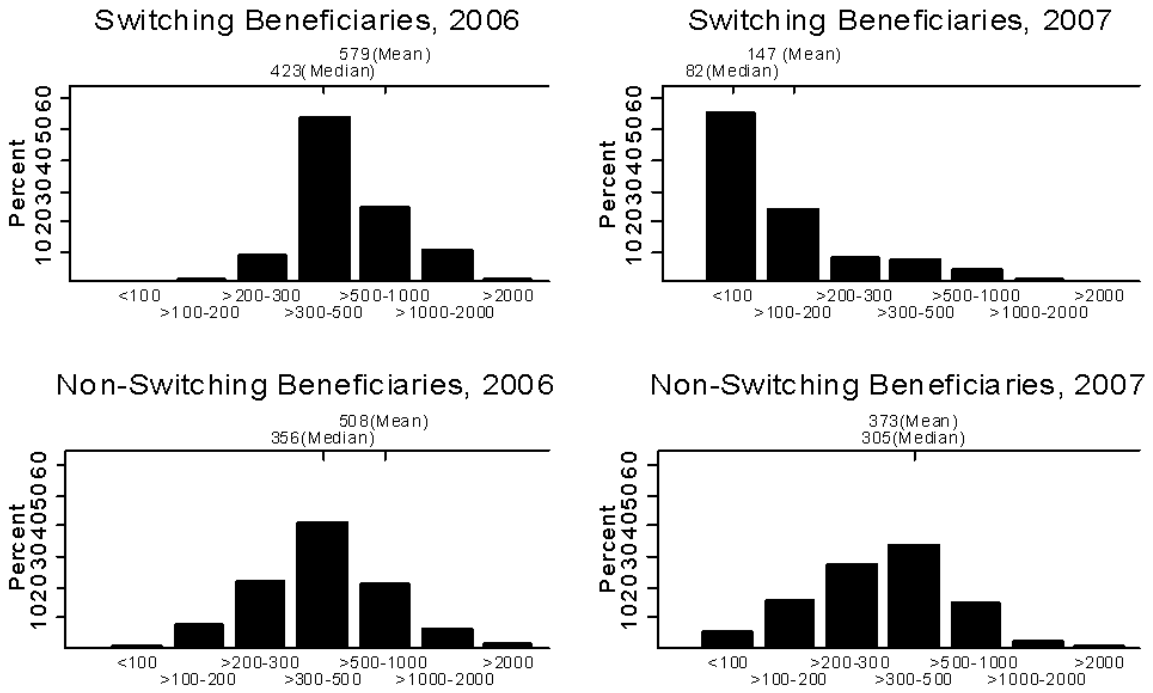
also find notable gains by those who did not switch plans, but the figure reveals that all of these improvements were due to higher costs of the minimum-cost options.[21]

These higher costs of the minimum-cost plan come from three potential sources–secular changes, plan redesign, and consumer learning. Some of this increase is due to secular changes, such as increases in brand name drug prices or the mandated increases in the initial coverage limits, and cannot explain why overspending fell because they also affected the chosen plan. Some may have been due to changes in plan design of the cheapest plans, although the effects of plan design are limited by our inclusion of no insurance as an option in the choice set. As we show below in Section 5, no insurance was the cheapest option for slightly more non-poor beneficiaries in 2007 than in 2006. Nevertheless, for those who had a plan as the cheapest option available, the characteristics of the minimum plans worsened in some ways, such as higher deductibles, premiums, less formulary coverage and no brand doughnut hole coverage, but it improved in others including fewer prior authorization restrictions and greater prevalence of generic doughnut hole coverage.

However, the underlying data also point out that even these gains were due to active learning by individuals: among non-switchers their gross spending (plan plus patient pay) on prescription drugs (excluding insurance premiums) increased substantially, but their out-of-pocket costs did not because a greater share was paid by the plans. Specifically, the share of gross drug spending paid by the individual fell by 7 percentage points, on average. Because the minimum cost options had different formularies (or in the case of no insurance, no coverage at all), this increase in gross spending drove up the cost to the patient of the available alternatives, including the minimum cost options. Thus, the improvements for nonswitchers can also be ascribed to learning, but learning about how to tailor their drug consumption to a particular formulary design.

[21] The average maximum cost option of nonswitchers in 2006 is inflated by a few large values, with a mean of $3,907 but a median of $1,830. When we evaluate the median of the maximum cost alternative instead, we see that this also increased substantially from 2006 to a value of $2,315 in 2007.

Figure 3. Overspending by Year and Switching, Non-Poor Only



This increase in gross spending explains the increase in the minimum cost option for those who switched as well. This change indicates that switchers were aware not only of their new plans' characteristics that affect all consumers equally, such as premiums and deductibles, but also about their formularies, which has individual-specific effects. Such information about the formularies is made available to consumer through the web-based "plan finders," including those offered by CMS as well as those offered by private organizations.

Figure 3 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 tale 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 3.4.

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,

$$O_{it} = \beta_1 d07_t + \beta_2 S07_i * d07_t + \Gamma H_{it} + \xi_i + u_{it}, \tag{3}$$

where $S07$ is a dummy denoting that the beneficiary switched plans in 2007, and the rest of the variables are defined as in equation (1). In the second model, we include the $S07_i * d07_t$ interaction term with the full model estimated in equation (2).

As reported in Table 4, the results conditional on individual heterogeneity are similar to the changes in the unconditional means shown in Figure 3. Non-switchers reduced their overspending from 2006 to 2007 by $137 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 remains above $230. Thus, switching was a primary source of improvement among the non-poor population.

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. Non-Poor Beneficiaries 2006-2007 Reduction in Overspending by Switching and Other Observed Characteristics: Individual Fixed Effects Models

	All Non-Poor Beneficiaries		*Subset with Stable Health Only*
2006-2007 Improvement Allowed to Vary with:	*Switching Plans*	*Plus Other Characteristics*	*Plus Other Characteristics*
2007	-137.1 [7.651] ***	288.20 [19.610] ***	274.20 [27.802] ***
2007*Switched plans	-298.6 [8.252] ***	-232.17 [7.420] ***	-233.40 [13.331] ***
*2007*Overspending Level in 2006 was ($)*			
less than 100		*Reference Category*	*Reference Category*
between 100 and 200		-175.91 [17.361] ***	-168.97 [20.846] ***
between 200 and 300		-223.28 [21.460] ***	-196.04 [37.073] ***
between 300 and 500		-314.00 [17.129] ***	-290.34 [21.002] ***
between 500 and 1000		-549.38 [17.273] ***	-516.51 [21.515] ***
between 1,000 and 2,000		-1199.77 [18.630] ***	-1175.81 [25.286] ***
more than 2000		-3115.84 [208.787] ***	-2391.73 [436.248] ***
*2007*Age in 2006*			
Age 65-69		*Reference Category*	*Reference Category*
Age 70-74		3.11 [10.034]	0.95 [5.938]
Age 75-79		5.53 [14.117]	4.32 [25.881]
Age 80-84		-1.40 [14.990]	15.61 [29.309]
Age 85 up		-0.43 [9.336]	6.25 [11.161]
2007*Male		-2.80 [9.886]	16.48 [18.385]
2007*Risk Score in 2006		-0.51 [3.005]	0.71 [3.801]
*2007*Took medication in both 2006 and 2007 for*			
Hypertension		14.47 [9.813]	16.09 [15.045]
Cholesterol and other cardiovascular		-13.84 [10.001]	-37.64 [19.281] *
Pain		9.50 [10.357]	15.91 [9.178] *
Mental health		16.97 [10.825]	5.29 [12.676]
Antibiotics		-5.19 [7.581]	-6.08 [9.794]
Anticoagulants		-14.59 [9.399]	-29.52 [17.378] *
Thyroid		0.79 [7.553]	-7.63 [11.613]
Diabetes		5.94 [9.840]	-18.33 [16.039]
Osteoporosis		-22.79 [7.093] ***	-53.88 [10.974] ***
Alzheimer's		-15.79 [13.140]	-42.24 [21.101] **
Change in Risk Score	22.47 [6.416] ***	15.61 [5.170] ***	69.81 [39.124] *
Change in takes medication for			
Hypertension	-9.10 [12.515]	-24.15 [10.564] **	-8.07 [11.249]
Cholesterol and other cardiovascular	27.67 [18.229]	8.02 [17.113]	-14.55 [12.530]
Pain	-18.52 [6.253] ***	-13.54 [5.211] ***	-7.38 [5.962]
Mental health	-24.81 [12.777] *	-24.31 [11.662] **	-1.01 [11.519]
Antibiotics	-9.11 [7.970]	-8.84 [7.517]	-35.43 [19.395] *
Anticoagulants	-31.30 [13.908] **	-28.37 [11.671] **	-8.32 [16.890]
Thyroid	4.98 [12.542]	9.57 [9.781]	-2.82 [20.609]
Diabetes	-36.89 [40.806]	-41.62 [37.456]	2.03 [37.836]
Osteoporosis	-6.84 [12.613]	-12.69 [10.588]	-15.48 [18.381]
Alzheimer's	-44.21 [19.895] **	-52.64 [16.336] ***	-46.43 [26.477] *
Mean individual fixed effect	472.37 [14.294] ***	523.47 [11.850] ***	307.69 [115.912] ***
Observations	142,798	142,798	60,298
R-squared	0.096	0.239	0.133

NOTE: All models include individual fixed effects. These estimates are restricted to those who did not receive a federal subsidy in either 2006 or 2007. We assume a demand elasticity of -0.54. 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, pain, anticoagulation and Alzheimer's remains even conditional on switching. This suggests that people had private information about their future need for these drugs but also faced some uncertainty about when they would need them. If they had full information about timing, then they would have switched in 2007 and the net effect on the change in overspending would have been ambiguous. Instead, these results further support our earlier interpretation that in 2006, individuals chose a slightly more expensive plan that more generously covered drugs that they thought they might use, relative to cheaper alternatives, and when they actually began to use these medications in 2007 their overspending fell relative to 2006. Finally, the results suggest that differences in switching fully explain the differences observed by age and sex. We analyze the switching decision directly in the next subsection.

3.4 The Switching Decision

In this subsection we analyze the decision to switch plans in 2007 conditional on observed individual characteristics. The results indicate that individuals' decisions to switch plans incorporated both forward-looking and private information. More importantly, the probability of switching increased sharply with the amount of overspending in 2006, and these increases begin even at levels of 2006 overspending of $200. To achieve this, we estimate the probit model

$$S07_i = \beta_0 + \beta_1 d07_t + \beta_2 Z_i + \Gamma H_{it} + u_{it}, \tag{4}$$

where H_{it} is the change in health status, as above, which in this model provides insight about the use of forward-looking private information in individuals' 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 sheds light on 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 5 presents the marginal effects from these probit models for all non-poor beneficiaries and for the subset in stable health. As suggested by 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. 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 private 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

Table 5. Switching Decisions of Non-Poor Beneficiaries

	All Non-Poor Beneficiaries	*Subset with Stable Health*
Overspending Level in 2006 was		
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]
2006-2007 Change in risk score	0.01 [0.001] ***	0.03 [0.016]
2006-2007 Change in whether they take 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	71,391	30,144

NOTE: These estimates are restricted to those who did not receive a federal subsidy in either 2006 or 2007 and did not switch plans within the year. Robust standard errors in brackets. *** p<0.01, **p<0.05, * p<0.1.

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 decisionmaking, then we would expect to find no significant relationships between switching and changes in health.

One bias that is commonly cited among the behavioral literature is the effect of inertia. The results by 2006 overspending category show that the probability of switching plans jumps up 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: among the non-poor population, overspending as small as $25 per month resulted in a 50 percentage point increase in an individual's likelihood of switching. This result indicates that plans compete vigorously to attract and retain consumers by designing cost-lowering products.

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.

3.5 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. Second, we compare the 2007 cross sectional results using both our primary *ex post* approach as well as an alternative *ex ante* approach.

3.5.1 Assuming perfectly inelastic demand for prescription drugs. All of the preceding results allow for a quantity response to the prices of drugs on 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 6 reports select coefficients from models identical to 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 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. These results also indicate that switching plans reduced overspending, and these results are even larger than the large reductions observed

Table 6. Select Results for Non-Poor Beneficiaries Assuming Perfectly Inelastic Demand for Prescription Drugs

Panel A. Results from models identical to those in Table 2.

Health Controls:	*No*			*Yes*		
Year 2007	-361.29	[4.709]	***	-368.91	[4.989]	***
Observations	142,798			142,798		
R-squared	0.076			0.081		

Panel B. Results from models identical to those in Table 3.

2006-2007 Improvement Allowed to Vary with:	*Health, Age and Sex*			*Plus 2006 Overspending*		
2007	1.36	[13.327]		462.86	[29.789]	***
*2007*Overspending Level in 2006 was ($)*						
less than 100				*Reference Category*		
between 100 and 200				-230.58	[28.127]	***
between 200 and 300				-339.55	[30.291]	***
between 300 and 500				-584.37	[27.394]	***
between 500 and 1000				-970.23	[27.467]	***
between 1,000 and 2,000				-1969.5	[28.806]	***
more than 2000				-4290.11	[238.896]	***
*2007*Age in 2006*						
Age 65-69	*Reference Category*			*Reference Category*		
Age 70-74	-37.6	[15.050]	**	-16.23	[12.669]	
Age 75-79	-82.53	[17.737]	***	-45.48	[15.875]	***
Age 80-84	-124.0	[17.341]	***	-79.04	[15.554]	***
Age 85 up	-123.62	[13.023]	***	-96.08	[10.631]	***
2007*Male	4.94	[13.530]		24.81	[11.740]	**
Observations	142,798			142,798		
R-squared	0.106			0.293		

Panel C. Results from Models Identical to those in Table 4.

2006-2007 Improvement Allowed to Vary with:	*Switching Plans*			*Plus Other Characteristics*		
2007	-158.49	[8.862]	***	456.97	[30.091]	***
2007*Switched plans	-389.14	[9.873]	***	-285.97	[8.852]	***
*2007*Overspending Level in 2006 was ($)*						
less than 100				*Reference Category*		
between 100 and 200				-245.03	[28.480]	***
between 200 and 300				-301.44	[30.768]	***
between 300 and 500				-468.65	[27.854]	***
between 500 and 1000				-867.28	[28.033]	***
between 1,000 and 2,000				-1843.57	[29.632]	***
more than 2000				-4203.5	[240.387]	***
*2007*Age in 2006*						
Age 65-69				*Reference Category*		
Age 70-74				11.87	[12.781]	
Age 75-79				18.98	[16.817]	
Age 80-84				13.43	[16.803]	
Age 85 up				18.4	[11.780]	
2007*Male				-12.95	[11.244]	
Observations	142,798			142,798		
R-squared	0.103			0.303		

NOTE: All models include individual fixed effects. Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Table 7. Comparing 2007 Overspending Using *Ex Ante* and *Ex Post* Prescription Drug Claims, Non-Poor Beneficiaries

	Assuming elasticity = -0.54		Assuming Perfectly Inelastic	
	Ex Post	*Ex Ante*	*Ex Post*	*Ex Ante*
Mean	259.27	308.32	441.5	487.27
Median	194.09	209.14	306	311.31
5th Percentile	0.00	0.00	18.71	33.17
10th Percentile	5.13	17.14	62.37	72.06
25th Percentile	70.70	87.19	154.61	164.2
75th Percentile	342.86	355.32	551.83	571.97
90th Percentile	522.55	546.92	962.44	997.21
95th Percentile	693.53	725.59	1275.77	1321.64

NOTE: The *ex ante* estimates generate the total spending in each available plan in 2007 using the claims filled by the person in 2006. The *ex post* estimates use the claims filled by the person in 2007. Both use the plans' premiums and formularies for 2007. Analysis is limited to non-poor beneficiaries who did not change plans within either of the plan years but may have switched between years.

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.

3.5.2 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 adopt the extreme opposite approach and 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 to comparing the cross-sectional results for 2007 from these two alternative assumptions about consumers' information sets.

The results in Table 7 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, and this is true under both assumptions about the elasticity of demand. 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. Two 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.[22] 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 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.

4 Improvements Among the Poor Population

McFadden (2006) expressed particular concern about the current design of Part D on the wellbeing of vulnerable populations such as the poor. We capitalize on the ability to observe each individual's subsidy level with certainty in our data to provide evidence that alleviates this concern. In this section, we replicate the analysis above but for the poor population.

In Table 8 we report results from Equation 1 for poor beneficiaries, except that we also include a vector of indicator variables to control for within-person changes in the particular subsidy level. Similar to the descriptive results in Figure 1, the results indicate that the mean overspending by this population was relatively low in 2006 but was lowered by $21-25, or 18% of the mean 2006 overspending, in 2007 according to the results for the full sample. Among those with stable

[22] 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.

Table 8. Overspending of Poor Beneficiaries: Individual Fixed Effects Models

	Health Controls		*Stable Health Only*	
	No	*Yes*	*Inclusive Definition*	*Narrower Definition*
Year 2007	-21.09	-24.65	-10.25	-9.2
	[3.151] ***	[3.021] ***	[3.092] ***	[4.527]
Observations	214,100	214,100	79,266	42,168
R-squared	0.001	0.002	0.001	0.000
Mean Overspending in 2006	133.7	133.7	94.6	80.6
Within-person change in Overspending				
5th Percentile	-392.6	-392.6	-283.1	-225.6
10th Percentile	-204.0	-204.0	-135.9	-105.4
25th Percentile	-27.9	-27.9	-6.6	-2.1
50th Percentile	3.0	3.0	1.5	0.0
75th Percentile	33.7	33.7	24.5	17.6
90th Percentile	127.0	127.0	81.5	58.8
95th Percentile	273.3	273.3	180.3	138.1

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

health, the magnitudes are approximately half of those but still statistically significant. As with the non-poor, the changes from 2006 to 2007 varied across individuals, although the absolute magnitudes of these differences are smaller among the poor population.

In Table 9 we report results from the models estimated by Equation 2 for the poor population, again controlling for within-person changes in subsidy level. As with the non-poor, the reductions monotonically increased with the level of the 2006 overspending. Comparing with Table 4, however, suggests that for any given level of overspending, these reductions appear smaller for poor than the non-poor.[23]

Additional results in Table 9 show no differences in the amount of improvement from 2006 to 2007 across age or their use of medications for Alzheimer's disease. This indicates that poor patients likely to have cognitive limitations improved as much on average as other poor patients. Patients with several of the common conditions improved by less than average, with statistically significant differences (in the second column) for hypertension, pain and anticoagulants. Finally,

[23] Because relatively few of the poor had overspending above $1000, we collapsed the highest category to include all those with spending above $500.

Table 9. Poor Beneficiaries' 2006-2007 Reduction in Overspending by Individuals' Observed Characteristics: Individual Fixed Effects Models

	All Poor Beneficiaries		*Subset with Stable Health Only*
2006-2007 Improvement Allowed to Vary with:	*Health, Age and Sex*	*Plus 2006 Overspending*	*Plus 2006 Overspending*
2007	-7.38 [9.257]	-7.59 [8.972]	-14.86 [17.775]
*2007*Overspending Level in 2006 was ($)*			
less than 100		*Reference Category*	*Reference Category*
between 100 and 200		-85.33 [3.436] ***	-80.83 [7.175] ***
between 200 and 300		-158.99 [6.280] ***	-163.03 [11.711] ***
between 300 and 500		-259.46 [9.072] ***	-261.31 [19.898] ***
more than 500		-934.77 [68.852] ***	-794.35 [93.047] ***
*2007*Age in 2006*			
Age 65-69	*Reference Category*	*Reference Category*	*Reference Category*
Age 70-74	-13.32 [8.193]	-8.58 [7.879]	-2.03 [8.916]
Age 75-79	4.26 [7.775]	9.11 [7.565]	8.69 [11.372]
Age 80-84	-7.02 [7.707]	1.76 [7.440]	11.05 [6.076] *
Age 85 up	-0.33 [10.036]	12.16 [9.625]	14.54 [6.676] **
2007*Male	12.81 [8.459]	9.88 [8.425]	-1.44 [6.701]
2007*Risk Score in 2006	-7.21 [4.536]	2.12 [4.386]	17.61 [19.675]
*2007*Took medication in both 2006 and 2007 for*			
Hypertension	19.76 [8.843] **	23.30 [8.673] ***	-4.71 [25.771]
Cholesterol and other cardiovascular	9.22 [8.476]	10.55 [8.302]	-2.82 [20.940]
Pain	6.68 [8.625]	20.98 [8.388] **	13.42 [13.987]
Mental health	3.12 [15.098]	1.93 [14.949]	-35.22 [50.770]
Antibiotics	-12.60 [7.589] *	6.84 [7.715]	-21.92 [20.000]
Anticoagulants	11.26 [9.288]	7.06 [8.935]	-2.76 [19.961]
Thyroid	16.60 [7.026] **	14.19 [6.802] **	4.06 [16.057]
Diabetes	3.80 [13.986]	-6.34 [13.695]	-38.19 [49.132]
Osteoporosis	-7.90 [9.444]	-0.72 [9.357]	-34.15 [28.822]
Alzheimer's	17.50 [25.705]	-2.85 [26.019]	-59.57 [52.631]
Change in Risk Score	7.75 [3.288] **	8.80 [3.259] ***	30.99 [26.515]
Change in takes medication for			
Hypertension	-4.17 [12.943]	-4.97 [12.716]	-14.95 [7.835] *
Cholesterol and other cardiovascular	1.15 [10.356]	-3.27 [10.185]	3.85 [14.544]
Pain	25.74 [7.976] ***	19.99 [8.081] **	8.59 [3.118] ***
Mental health	-41.98 [17.041] **	-42.62 [16.885] **	-57.06 [41.307]
Antibiotics	0.92 [5.842]	-1.31 [5.783]	1.41 [3.814]
Anticoagulants	5.52 [10.775]	5.82 [10.378]	-21.80 [20.509]
Thyroid	-41.46 [58.720]	-40.79 [58.238]	-19.32 [22.146]
Diabetes	4.37 [10.210]	8.72 [9.583]	12.03 [23.169]
Osteoporosis	-10.21 [18.323]	-15.01 [18.089]	-30.46 [15.679] *
Alzheimer's	-17.70 [11.236]	-8.61 [10.648]	24.05 [64.217]
Mean individual fixed effect	103.06 [24.425] ***	88.21 [23.665] ***	-17.27 [108.915]
Observations	214,100	214,100	79,266
R-squared	0.002	0.037	0.052

NOTE: All models include individual fixed effects. These estimates are restricted to those who did not receive a federal subsidy in either 2006 or 2007. We assume a demand elasticity of -0.54. Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Table 10. Poor Beneficiaries' Savings from Switching Plans During the Year

	2006	2007
Percent of poor sample who switched within the year	6.8	12.8
Reduction in overspending due to within-year switching		
Mean ($)	104.5	131.7
Median ($)	51.0	9.7

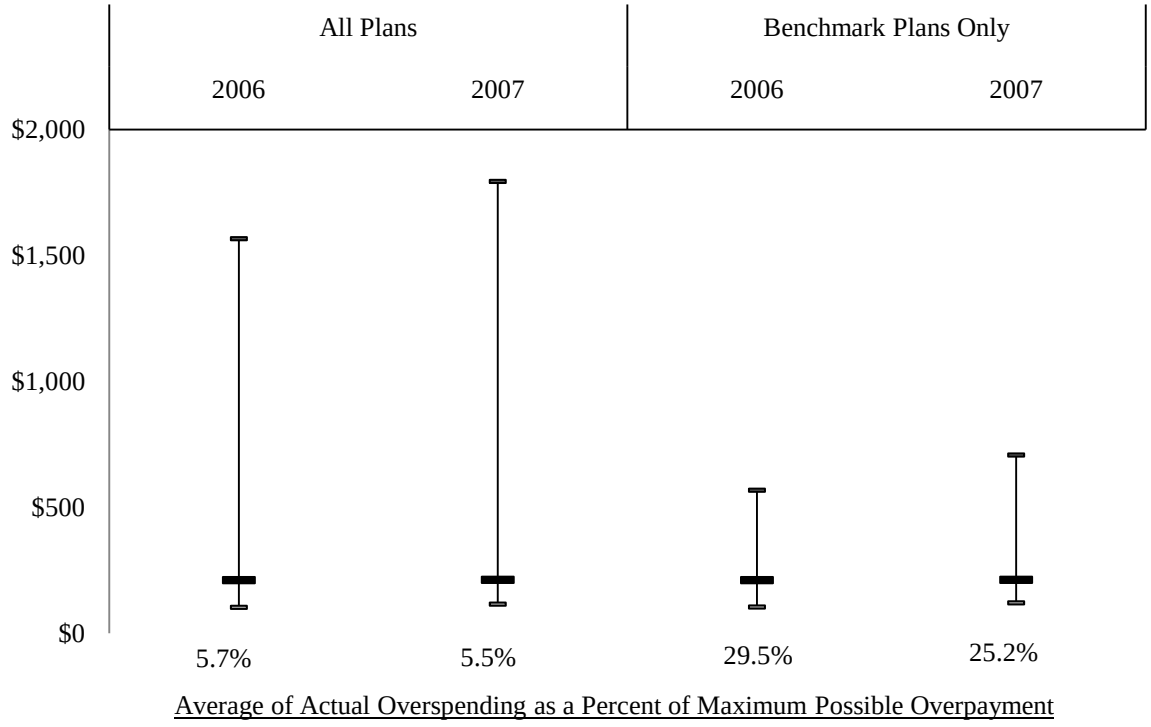
the improvements did not significantly differ by sex. Given that most of the poor population does not actively choose plans but rather is autoenrolled into benchmark plans, this lack of differences by age and sex is consistent with the results for the non-poor, for whom the observed differences for the non-poor population were driven by differences in the likelihood of switching plans.

All of the previous analyses exclude those who switched plans within the year. However because the poor have continuous open enrollment, we can also analyze their decisions to switch within the year. In Table 10 we report the share of the poor population who switched within the year, and how much they saved by doing so, relative to if they had remained in their initial plan for the entire year. The prevalence of within-year switching increased notably, from 6.8% in 2006 up to 12.8% in 2007. This switching led to mean savings exceeding $100 in both years, although the median savings was relatively small in 2007.

Interestingly, all of these individuals switched from one benchmark plan to another. This occurred because patients' costs vary even among the benchmark plans due to differences in formulary design. This is shown in Figure 4, which is analogous to Figure 2 but reports the extent of variation in poor patients' costs across all plans and, in the right half, across benchmark plans only. In both years, the poor populations' benchmark plans varied, with a $464 difference between the average cheapest and average most expensive plan in 2006 and a $588 difference in 2007.[24]

[24] As above, this figure also excludes those who switched within the year.

Figure 4. Average Values for the Actual, Minimum and Maximum Cost Options, Non-Poor Beneficiaries Only



Together the results in Table 10 and Figure 4 indicate that even when given a heavily subsidized, passive, default option, poor beneficiaries actively sought out alternatives and successfully lowered their costs by doing so, and this switching and improvement was greater in 2007. This is likely in response to both the greater variation in costs of benchmark plans in 2007, providing greater financial incentive to search and switch, as well as greater experience with Part D and greater provision of information about available alternatives.

Table 11. Who Would Have Been Better Off Without Insurance?

	Percent of beneficiaries for whom no insurance is	
	One of the minimum-cost options	*The only minimum-cost option*
Non-poor		
2006	10.2%	9.8%
2007	11.4%	11.2%
Both years	7.0%	7.0%
Poor		
2006	6.1%	0.0%
2007	5.7%	0.0%
Both years	3.6%	0.0%

5 The Option of Not Enrolling

Early criticism of Part D emphasized that irrational fears regarding the late-enrollment penalty could cause a substantial share of elders to wrongly choose to enroll.[25] Specifically, McFadden (2006) reported that 23.5 percent of those who intended to enroll would have been better off delaying.[26] At the same time, critics also point to the fact that approximately 10 percent of the eligible population remains without prescription drug coverage as a failure predestined by the policy's lack of a mandate (Heiss et al. (2006)). Because our sample is composed of only those who chose to enroll, we can address the former concern but not the latter.

In Table 11 we report the share of enrollees for whom no insurance is either one of the *ex post* minimum cost options or the only minimum cost option, separately for the non-poor and the poor populations. In 2006, no insurance was one of the cost-minimizing options for 10.2% of those not receiving subsidies, rising slightly to 11.4% in 2007. However, only 7% of this sample would have had lower costs in both years without insurance, suggesting that uncertainty, rather than mistakes that persist over time, explains why consumers chose to enroll.

[25] The penalty stipulates that an individual's premiums increase 1% for each month's delay past the initial eligibility.

[26] The 19.4 percent reported in the text of that article is not conditional on intended enrollment as reported in Table 8 of McFadden (2006).

For subsidy recipients, 6.1% had no insurance as one of the cost minimizing options in 2006.[27] In 2007 the percentage of subsidy recipients for whom not enrolling is one of the minimum cost options decreases to 5.7%, with less than 4% having lower costs in both years without insurance.

The true difference between our estimates and those in McFadden (2006) are even greater than what we report here, because we have not attempted to incorporate the late-enrollment penalty as he did. Doing so would cause some individuals on the margin to be worse off by remaining uninsured. The large gap between our estimates and McFadden (2006) may likely result from our use of actual choices during Part D compared to his use of surveys to elicit people's intended choices prior to Part D's launch. Finally, our analysis considers only cost minimization and excludes risk. Because the risk without insurance is always at least as large as that with insurance, incorporating this aspect into consumers' choices would make this already small number of those who "mistakenly" enroll even smaller.

6 Conclusions

We analyzed a number of decisions made by 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, among the non-poor population we found evidence that consumer choices of insurance plans, measured by overspending, improved substantially even in only one year, and that poor choices were transient. 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 depended on their financial incentives, indicating that plans must design products that lower consumers' costs to attract them and that plans cannot rely on inertia of existing enrollees. We also found evidence of improvement from

[27] Not enrolling was never their only cost minimizing option because the subsidies make costs identical between enrolling in a generously subsidized plan and not enrolling, even for low or zero consumption levels.

learning even among those who did not switch plans. Our analysis of the poor population also showed average improvements, and as in the non-poor population, improvements among those likely to have cognitive limitations were at least as large as those of the population overall even conditional on a number of other factors.

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. We found some *prima facie* evidence that uncertainty may be important in the context of the enrollment decision, with a share of those better off without insurance in one year were better off with coverage in the other year. Likewise, we found some evidence that consumers purchased more expensive plans that offered more generous coverage of conditions they were likely to acquire, resulting in above-average reductions in overspending in the year that they actually acquired the condition(s).

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)). In addition to considering these changes from the first to second years of the program, our approach differs from its predecessors by incorporating individual fixed effects and detailed measures of consumers' health.

The neoclassical framework to modeling consumer choices allows the market process to be dynamic: rational but uninformed, inexperienced consumers can make poor choices relative to an informed benchmark, but choices improve as consumers acquire information and experience and incorporate it into their decisions. In Part D, market experience and market evolution appear to sharply diminish the overspending that occurred among non-poor Part D beneficiaries in their initial choices in 2006. Such individual learning between the open enrollment in 2005 (for 2006) to the open enrollment in 2006 (for 2007) could result from consumers' experiences itself as well as learning from others, e.g., through social interactions among senior citizens, or from the help of younger, less cognitively-impaired family members or health care providers.

Learning has also been facilitated by the dissemination of information, plan ratings, user-friendly websites, and software applications of pharmacy chains and other institutions that ease the choice process of senior citizens. However, these consumer friendly learning tools did not appear 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.[28] Last but not least, some learning in this market appears to be driven by individuals' acquiring information on the effectiveness of different drugs to treat a given illness and the differences in insurance coverage among these alternative medications, which determines the eventual cost of prescriptions under each plan.[29]

[28] 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.

[29] For additional evidence about learning, social interactions, and health care plan choices see Sorensen (2006); about learning and health care insurance ratings see Sorensen and Jin (2006); and about learning drug effectiveness see Crawford and Shum (2005).

Our results thus question the wisdom of aggressive interventions in this recently created market such as reducing the number of plans available, or requiring greater standardization of plans to facilitate their comparison. Such recommendations rely on results of cross-section analyses that preclude the possibility of consumers improving their choices over time under Part D's current design.

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.[30] By providing an analysis of a large individual panel database in an economically-meaningful environment, we contribute to this debate by focusing on the potential learning effects from past choices, therefore shifting the attention from the static *how well do consumers choose* to the more dynamic *how much do they improve their choices over time*. Thus, we contemplate the possibility that consumers learn either individually, with the help of new institutions that facilitate the processing of information, or through the market process.

[30] 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.[31]

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.[32] 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.[33] 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.

[31] 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.

[32] 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 to estimate the impacts of specific formulary designs on consumption patterns in a more precise way.

[33] 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.[34] 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.[35;36] 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 0.70, with a median difference of $0 and a mean difference of $107 (with the average simulated costs being higher). The simulated costs were greater than the actual costs for 47% of the sample.[37] 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

[34] CMS began reporting such prices for a subset of NDCs for the 2009 data but does not plan to release them for earlier years.

[35] 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.

[36] 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.

[37] For non-poor patients (without subsidies), the median is $0, the mean is $146, and simulated costs exceeds actual costs for 56% of them.

costs were determined by the usual and customary price, which is what the pharmacy would have charged a cash-paying customer.