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ABSTRACT

We explore choice inconsistency over time within the Medicare Part D Prescription Drug Program. Using the full universe of Part D claims data, we revisit our earlier work on partial data to replicate our results showing large "foregone savings" among Part D enrollees. We also document that this foregone savings increases over time during the first four years of the Part D program. We then develop a rich dynamic structural framework that allows us to mathematically decompose the "foregone welfare" from inconsistent plan choices into components due to demand side factors, supply side factors, and changes in preferences over time. We find that the welfare cost of choice inconsistencies increases over time. Most importantly, we find that there is little improvement in the ability of consumers to choose plans over time; we identify and estimate little learning at either the individual or cohort level over the years of our analysis. Inertia does reduce welfare, but even in a world with no inertia we estimate that substantial welfare losses would remain. We conclude that the increased choice inconsistencies over time are driven by changes on the supply side that are not offset both because of inertia and because non-inertial consumers still make inconsistent choices.

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The past five years has seen a sea change in the way that publicly provided health insurance benefits are delivered to the U.S. population. From the introduction of the Medicare and Medicaid programs in 1965, expansions in public health insurance entitlements came through the extension of these monopoly government-run insurance plans. But beginning with the introduction of the Medicare Part D Prescription drug program in 2006, and continuing through the exchanges that are at the center of the Affordable Care Act that was passed in 2010, the U.S. has been moving to a different model: insurance exchanges where the publicly insured choose from a host of subsidized private insurance options.

This privatization of the delivery of public insurance raises a host of interesting policy and research questions. Primary among these is the ability of individuals to make consistent choices across a potentially large array of choices with meaningful differences. In Abaluck and Gruber (2011), we explored this issue in the context of the Part D program. We considered in particular whether elders appeared to be properly weighing the premium and out of pocket spending implications of their plan choices. We concluded that they were not, with the typical elder able to save about 30 percent on their drug spending through a more appropriate choice of plan. A recent paper by Ketcham et al. (2012) argues that these choice inconsistencies are largely initial errors made by those newly enrolling in Part D and that they are mostly corrected through plan switching from 2006 to 2007.

Both of these papers suffer, however, from very incomplete data. The data used in Abaluck and Gruber come from a sample of roughly one-third of all prescription drug transactions in the U.S., leaving them unable to address spending done by individuals outside of this sample. The data used by Ketcham et al. is a complete sample of prescriptions, but only for a limited set of plans, and in particular a set of plans which does not much vary in its coverage of the “donut hole” range where high spending seniors were exposed to the full cost of their drug spending.

In this paper we revisit both the initial plan choice of seniors and their plan switching decisions using the most comprehensive data that can be used to explore the Part D plan: the full universe of Part D claims data recently made available by the Centers for Medicare and Medicaid Services (CMS). These data have information on the full set of prescription drug claims under Part D for every senior enrolled in the program, as well as information on the characteristics of the plans that they chose.

To do so, we consider for each elder two aspects of their available set of plan choices: premiums and expected out of pocket costs. Premiums are available by plan, and expected out of pocket costs are computed for each senior for each plan available by creating a "calculator" that enables us to run seniors predicted drug spending through each plan's cost sharing parameters.[1] Using these improved data, we continue to find that seniors are making inconsistent plan choices in the first year of Part D (2006). We find a similar level of foregone savings and overweighting of premiums relative to expected out of pocket costs as in our previous work. However, in contrast to Ketcham et al., we find that choices do *not* improve over time in aggregate. Rather, foregone savings grows over time, and is much larger by 2009 than it was at the start of the Part D program in 2006.[2]

Our main methodological innovation relative to previous work is to develop a rich dynamic structural framework in which to study plan choices over time. This framework allows us to mathematically decompose the "foregone welfare" from inconsistent plan choices into components due

1 As described below, we do so for alternative models of predicted drug spending and find that the results are very similar for each.

2 Two studies written in parallel with ours also use the new CMS Part D data to examine the optimality of Part D plan choice. Heiss et al. (2012) finds significant "overspending" in Part D using these data, replicating the earlier work of AG. Heiss et al. do not emphasize changes over time; they find that by some measures choices improve over time and by others they get worse. A second study by Jonathan Ketchem, Claudio Lucarelli, and Christopher argues that more experienced consumers are more likely to switch plans and save money conditional on switching. Neither article puts their findings in a welfare analytic framework that allows them to incorporate the impacts of variance or plan quality. And neither decomposes their findings into supply and demand side factors in order to understand why the quality of chosen plans is changing relative to the best available plan. Ketcham et al. in particular focuses on the determinants of switching behavior; our analysis suggests that inertia accounts for only 1/3 of foregone welfare.

to demand side factors, supply side factors, and changes in preferences over time. On the demand side, we can use data on choices by movers and stayers, as well as by new cohorts over time, to separately identify the effects of inertia, learning from experience, and calendar year or "cohort" learning effects on the quality of choices. On the supply side, we can use the structural parameters of our model to decompose the total supply effect into factors such as the change in premiums, the change in out of pocket costs, and the set of plan choices available.

Overall, we find that the welfare cost of choice inconsistencies increases over time. These net changes reflect a number of moving pieces and different factors appear to be driving the changes in different years. But the key general conclusion of our analysis is that there is little improvement in the ability of consumers to choose plans over time; we identify and estimate little learning at either the individual or cohort level over the years of our analysis. Inertia does reduce welfare, but even in a world with no inertia we estimate that substantial welfare losses would remain. We conclude that the increased choice inconsistencies over time are driven by changes on the supply side that are not offset both because of inertia and because non-inertial consumers still make inconsistent choices.

Our paper proceeds as follows. In Part I, we review the Medicare Part D program and related previous literature. In Part II, we discuss at length the new CMS Part D data. Part III presents the basic facts on plan choice and plan switching. Part IV describes our empirical strategy for more rigorously modeling choice inconsistencies as well as the reasons for changes in welfare over time, and Part V presents the results of our analysis. Part VI concludes.

Part I: Background[3]

The Medicare Part D Program

[3] This section draws heavily on Abaluck and Gruber (2011).

Medicare, which provides universal health insurance coverage to those over age 65 and to those on the disability insurance program, did not include coverage of outpatient prescription drugs when it was established in 1965; this coverage was added through the Part D program that passed in 2003 and became active in 2006. The most noticeable innovation of the Part D plan is that this new Medicare benefit is not delivered by the government, but rather by private insurers under contract with the government. Beneficiaries can choose from three types of private insurance plans coverage of their drug expenditures. The first is stand-alone plans called Medicare Prescription Drug Plans (PDP) (a plan that just offers prescription drug benefits). In 2006, there were 1429 total PDPs offered throughout the nation, with most states offering about forty PDPs (Gruber, 2009). The majority of PDPs are offered by a dozen national or near national companies.

The second alternative is Medicare Advantage (MA) plans, plans that provide all Medicare benefits, including prescription drugs, such as HMO, PPO, or Private FFS plans. There were 1314 total plans nationally in 2006 (Gold, 2006). Finally, beneficiaries could retain their current employer/union plan, as long as coverage is "creditable" or at least as generous (i.e. actuarially equivalent) as the standard Part D plan, for which they would receive a subsidy from the government.

Under Part D, recipients are entitled to basic coverage of prescription drugs by a plan with a structure actuarially equivalent to a standard plan. In 2006 the standard plan offered the following coverage: none of the first $250 in drug costs each year; 75 percent of costs for the next $2,250 of drug spending (up to $2,500 total); 0 percent of costs for the next $3,600 of drug spending (up to $5,100 total, the "donut hole"); and 95 percent of costs above $5,100 of drug spending (McClellan, 2006). Over 90 percent of beneficiaries in 2006, however, were not enrolled in the standard benefit design, but rather are in plans with low or no deductibles, flat payments for covered drugs following a tiered system, or some form of coverage in the donut hole (McClellan, 2006). The main requirement for plans

is that they must have equal or greater actuarial value than the standard benefit.[4] The government also placed restrictions on the structure of the formularies that plans could use to determine which prescription medications they would ensure. Overall, Part D sponsors have great flexibility in terms of plan design.

Enrollment in Part D plans was voluntary for Medicare eligible citizens, although Medicare recipients not signing up by May 15, 2006 were subject to a financial penalty if they eventually joined the program (to mitigate adverse selection in the choice of joining the program). One group, however, was automatically enrolled: low income elders who had been receiving their prescription drug coverage through state Medicaid programs (the "dual eligibles"). These dual eligibles were enrolled in Part D plans by default if they did not choose one on their own. The Part D plans for dual eligibles could charge copayments of only $1 for generics/$3 for name brand drugs for those below the poverty line, and only $2 for generics/$5 for name brand drugs for those above the poverty line, with free coverage above the out of pocket threshold of $3600.[5]

Despite reluctance voiced before the legislation passed, there was enormous interest from insurers in participating in the Part D program. By November 2006, 3,032 plans were being offered to potential Part D enrollees. Every county in the nation had at least 27 plans available; the typical county had 48 plans, while some counties featured more than 70 choices, primarily due to high number of MA plans.[6]

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[4] Cover Memo for Medicare Part D Benefit Parameters: Annual Adjustments for Standard Benefit in 2007 (CMS)

[5] In addition, two other groups receive substantial subsidies – those found eligible for Low Income Subsidy (LIS) or for Partial Subsidy by the SSA. To qualify for LIS, beneficiaries must have income less than 135 percent of poverty and resources less than $7,500/individual or $12,000 couple. This group received benefits comparable to the dual eligibles with incomes above 100 percent of poverty. To qualify for Partial Subsidy, beneficiaries must have income at 135 percent-150 percent of poverty and resources less than $11,500/individual or $23,000/couple. This group can enroll in plans with a $50 deductible, a 15 percent copayment up to the out of pocket threshold, and $2/$5 copayments above that point. In addition, premiums are fully paid by the government up to 135 percent of poverty, and then partially subsidized up to 150 percent of poverty.

[6] Details on number of plans in a median county obtained from Prescription Drug Plan Formulary and Pharmacy Network Files for 2006, provided by CMS.

Enrollment in the new Part D program was initially fraught with problems, but in the following months the federal government was able to iron out many of the problems that had arisen during the initial transition. As of June 2006, there were 10.4 million people enrolled in stand-alone PDP plans, 5.5 million people enrolled in MA plans and about 6 million dual eligibles.[7] Yet 73 percent of people over 65 felt that the Medicare prescription drug benefit was too complicated, while 91 percent of pharmacists and 92 percent of doctors expressed this concern. When asked if they agree with the statement "Medicare should select a handful of plans that meet certain standards so seniors have an easier time choosing," 60 percent of seniors answered "Yes."[8]

Despite these reservations, there were no signs of diminished plan choice in subsequent years. The number of PDPs increased by about 30 percent in 2007, from 1,429 to 1,875 and remained at this level in 2008.[9] By 2012, there were 1603 PDPs available.

Issues of Elder Choice in Part D

Standard economic theory would suggest that Medicare beneficiaries are better off choosing from a wide variety of plans that meet their needs, rather than constraining them to a limited set of choices being made by the government. But, as reviewed in detail in Iyengar and Kamenica (2006), and summarized in AG, there are a large number of behavioral economics models which suggest that in fact agents may be better off with more restrictive choice sets. Other recent literature has shown that the nature of how choices are presented can have important impacts on choice. And work by Agarwal et al. (2007) shows that issues may be magnified for the elderly.

[7] Enrollment data (rounded) taken from CMS, State Enrollment Data spreadsheet at http://www.cms.hhs.gov/PrescriptionDrugCovGenIn/02_EnrollmentData.asp#TopOfPage. Enrollment numbers also available at http://www.kff.org/medicare/upload/7453.pdf.
[8] Kaiser Family Foundation and Harvard School of Public Health (2006).
[9] Hoadley et al. (2006). Data on 2008 plans taken from CMS 2008 PDP Landscape Source (v. 09.25.07) available at http://www.cms.hhs.gov/prescriptiondrugcovgenin/.

Several previous papers have addressed issues of choices under Part D. The first is a set is summarized in Heiss et. al. (2006) and Winter et. al. (2006). These researchers surveyed a set of elders about their plans for enrolling in Part D programs, and evaluate whether enrollment intentions in the plan were "rational" given the penalties for delay. They find that, for most potential enrollees, the decision over whether to enroll seems to be made rationally. But they find that, faced with a hypothetical choice of plans, only about 36 percent of enrollees choose the cost-minimizing plan, and they do not place much value on the insurance aspects of more comprehensive plans. Lucarelli, Prince and Simon (2008) uses aggregate data on plan market shares to conduct a study of how plan features impact demand and to undertake a welfare analysis of choice restrictions. They estimate sizeable welfare losses from limiting the option set facing seniors. But they do so in a framework which assumes that seniors are choosing optimally so that by definition restricting the choice set can only be harmful. Kling et al. (2012) examine how providing people with information about the relative costs of each of the available plans in 2007 computed using their 2006 claims impacts their choices. They find that individuals who receive this intervention are more likely to switch plans, and more likely to end up with lower predicted and realized costs.

Most relevant for the current paper is our previous paper (AG) and the work of Ketcham et al. (KLMR, 2011). In AG, we use data from Wolters Kluwer (WK), the largest "switch" operator in the prescription drug market that collects the electronic claims from pharmacies and pass them on to the Pharmacy Benefit Managers (PBMs) and insurance companies that will pay the claims. On average, the claims captured by the WK system represent almost 31 percent of all 3rd party prescription claims filled in the U.S. An advantage of such data over even the CMS data used in this paper is that there is information on elders both in 2005, before the introduction of the Part D program, and 2006, after its introduction. Some disadvantages are the sizeable rate of attrition from the data (about one-third of the sample per year), which potentially arises from individuals using pharmacies outside of the WK

network, and the fact that we must reverse engineer some plan identities using data on out pocket costs. We endeavor to address this shortcoming in a number of ways and show that the findings are robust to the alternatives. We use this WK data, along with plan information from CMS, to model the premiums and expected out of pocket costs facing individuals as they choose across Prescription Drug Plans (PDPs).

Our earlier paper has several key findings. First, we show that only about 12 percent of elders choose the cost minimizing plan (the plan which minimizes the sum of premiums plus expected out of pocket costs), and that the average elder could save about 30 percent by choosing the cost minimizing plan. Second, we estimate plan choice models that document three key choice inconsistencies: individuals consistently weight premiums much more highly than out of pocket costs in making their plan choices; even conditioning on own out of pocket costs, individuals place large weight on plan financial characteristics in making their plan decisions; and individuals appear to ignore the variance in expected out of pocket spending across plans. We conclude with a partial equilibrium welfare analysis which implies that welfare would have been 27 percent higher if patients had all chosen rationally.

KLMR extend this analysis to examine both initial plan enrollment decisions and plan switching decisions. They highlight the fact that a number of studies document the amelioration of choice biases through repeated market interactions. To study this issue, they turn to data from CVS Caremark, a Pharmacy Benefit Manager (PBM) for a number of PDPs (9 in 2006 and 18 in 2007). They are therefore able to follow individuals who stay within that set of PDPs, although not individuals who leave that set through switching. Moreover, their limited set of plans do not include any plans with donut hole coverage (which AG highlight as a major source of choice inconsistency) so that they may as a result understate inconsistencies; they attempt to address this point in their analysis.

KLMR find large choice inconsistencies in 2006, with most individuals in their sample choosing plans that were significantly more expensive than the cost minimizing option; indeed, they find even

fewer enrollees choosing the cost minimizing option and larger potential cost savings on average than AG. But they find that these inconsistencies are substantially reduced by plan switching in 2007, with the median amount of "Foregone Savings" relative to the cost minimizing choice falling by more than $200, and the number of individuals foregoing savings by less than $100 rises from zero to one-third of the sample. They find that most of this reduction comes from switchers moving to more cost effective plans, but their estimated switching rate of 54% is much higher than is reported in virtually every other health insurance study.[10]

Part II: Data

The main source of data for our analysis is the newly released universe of claims for Medicare Part D enrollees. These claims are linked to encrypted plan IDs which are linked to a plan characteristics file containing information on premiums, deductibles, and donut hole coverage. Information on plan formularies is inferred from copayment costs and from public use files on formulary characteristics.

Construction of Out of Pocket Cost Variables

The total enrollee costs of Part D can be decomposed into premiums, which are known for certain at the time of plan choice, and the distribution of out of pocket costs given the information available at the time when plans are chosen. Our focus is on estimating the distribution of costs given all of the information potentially available to individuals at the time when they make their choice. However, we only observe realized out of pocket costs for the plan in which an individual is enrolled. We therefore assume that the set of claims is fixed and would remain constant had the individual in question chosen a different plan; that is, we assume no moral hazard. This assumption allows us to use the calculator to determine what each individual's realized costs would be for each plan in their choice

[10] The classic reference on this topic is Neipp and Zeckhauser (1985), who estimate an annual switching rate among health insurance plans of 3% in the mid-1980s.

set. Given typical estimates of the elasticity of prescription drug utilization in the range of 0.2 to 0.5, and considering that this would only impact our results to the extent that individuals have sufficient foresight to take into account future utilization effects in their plan choices, this is a fairly innocuous assumption, as shown in Appendix A to Abaluck and Gruber (2008).

We consider two alternative models of out of pocket costs: the first is a "realized cost" model in which we construct out of pocket costs using the claims incurred by individuals during that year. This amounts to assuming that individuals chose their Part D plans with perfect foresight as to what their claims would be, which is clearly not fully accurate. The second model we consider is a "rational expectations" model in which we compute expected spending in that year based on either prior year claims or claims in the first month of enrollment. We use this model in our regression analysis because it allows us to quantify in a natural way the riskiness of alternative plans. In AG, we show that our main conclusions regarding choice inconsistencies are not sensitive to the choice of model, and are further robust to allowing consumers to have private information so that they know more than we would predict using the previous year's claims but have less than perfect foresight. We do find evidence that consumers possess some private information about future out of pocket costs, but not enough to fundamentally change our welfare calculations using the rational expectations model.

Another issue that must be addressed is that we observe only a single realization of out of pocket costs for each individual, so we do not observe the variance in spending across choices. We construct this variance in our rational expectation measure based on the distribution of realized costs among individuals who look ex ante identical. In AG, we defined 1000 cells based on deciles of total expenditure, days supply of branded drugs and days supply of generic drugs in the prior year and called individuals ex ante identical if they were in the same cell. Because we do not observe prior year spending in 2006, in our main specifications we define 10 cells based on expenditures in the first month of enrollment and construct the distribution of realized costs among individuals who enrolled in the

same month and were in the same cell. We show in Appendix Table 1 that our results do not depend on whether we use the 10 cell or 1000 model in 2007 when both models are feasible. This is consistent with our findings in AG, in which the variance measures did not much impact plan choice, and our basic findings based on means were not much impacted by conditioning on the variance of spending across plans as well.

Sample Selection

Our sample begins with a 20 percent sample of all Medicare Part D beneficiaries in 2006, 2007, 2008 and 2009. This includes 7,213,755 beneficiaries. We then drop all beneficiaries with employer coverage or who are eligible to receive low income subsidies, which leaves 2,620,441 beneficiaries. From this number, we construct two samples for analysis. The first, which we refer to as the "Full Sample", includes a 10 percent sample of our data in all years (we use only 10 percent because this is computationally more convenient and more than adequate for statistical significance in all of our analysis). The second, which we refer to as the "Panel Sample", restricts to a 10 percent sample of beneficiaries who are present in 2006, 2007, 2008 and 2009**.** The basic facts we outline below are reported using the "full sample". Our structural model is estimated using the full sample (new enrollees entering in each year help identify several parameters); we report the results using the panel sample so that changes over time are not confounded by individuals entering and leaving the sample. In the primary sample considered in the text, we also restrict to individuals who were enrolled in a Part D plan for the full year. This restriction makes costs more comparable across years (since more consumers enrolled late in 2006). We show in Appendix Table 2 that the basic trends we observe in foregone welfare over time are not sensitive to this restriction.

Part III: Plan Choices and Switching: The Facts

We begin our analysis by presenting the basic facts on plan choice in Figure 1. For each individual in the data, we estimate the total cost of enrolling in each PDP plan in their county, adding both premiums and expected out of pocket costs. We then estimate the difference in total costs between the plan chosen by that individual and the lowest cost plan in their county, which we call "foregone savings".[11] Figure 1 conducts this exercise using the perfect foresight model of expectations, while Figure 2 reports the results with our rational expectations model.

As Figure 1 shows, fewer than 20% percent of individuals choose the lowest cost plan in their choice set in 2006. On average, individuals could save 25-32 percent of their total Part D spending by choosing the lowest cost plan rather than the plan they chose. We find that half of beneficiaries could have saved more than $330 by enrolling in a different plan. These findings are very similar to those in AG, although they appear smaller than for KLMR for 2006, where mean foregone savings is $550.

Figure 2 replicates Figure 1 using our "ex ante" predicted cost measure. Potential savings are smaller according to this measure (as one would expect, since this measure mechanically reduces the variation in out of pocket cost across plans) but nonetheless remain substantial with more than half having foregone savings of $230 or more.

Unlike KLMR, however, the CMS data show that the share of individuals making cost minimizing choices does not improve over time. We further find that an ever-falling share of individuals choose the cost minimizing plan. On net, we find that 16 percent of individuals in 2006, 11 percent in 2007, 14 percent in 2008 and just 3 percent in 2009 chose the low-cost plan according to our predicted costs measure.

One reason consumers might not choose the cost minimizing plan is because they are willing to pay more for plans with better risk protection. To deal with this issue, we use an "efficient frontier" measure developed in AG: we ask what cost savings are possible if consumers are restricted to choosing

[11] This corresponds to KLMR's concept of "overspending".

a plan with weakly better risk protection, as measured by a weakly lower variance of costs. The results from this efficient frontier measure are summarized in Table 1. We report these results using our predicted cost measure because the variance of costs as a measure of risk only makes sense in that model (in the perfect foresight model, there is no uncertainty and thus no risk). Because we are restricting the set of plans to which one can move to save money, efficient frontier savings are smaller but most beneficiaries could still have saved several hundred dollars in all years without sacrificing risk protection.

Once again we find no tendency for choices to improve over time; if anything, there is a trend in the opposite direction. This is a striking difference: KLMR find that foregone savings fell by almost $300 on average from 2006-2007. In contrast, we find that foregone savings fell only slightly in that year using one measure (perfect foresight), and rose using our other two measures. For all measures, forgone savings then rises significantly in 2008 and 2009.

Table 1 also reports foregone savings and the efficient frontier measure as a percentage of total costs. The change in this measure overtime is confounded by the fact that better choices reduce both the numerator (foregone savings) and denominator (realized costs). Nonetheless, the magnitude gives a sense of the stakes involved, between 9 percent and 22 percent of total costs depending on the specification. It is therefore clear that choices did not materially improve over the first three years of the Part D program, and clearly worsened substantially in 2008 and 2009.

Part IV: Modeling Plan Choice and Switching

Restrictions on Preferences

To move from foregone savings to a more comprehensive welfare metric, we consider a structural model of plan choice. We begin by specifying a CARA utility model with a normally distributed cost distribution:

$$U(C) = -\exp\big(-\gamma(W - C)\big) \text{ where } C \sim N(\mu, \sigma^2) \quad (1)$$

We show in our earlier paper that this specification leads to a conditional logit model of plan choice where the utility of individual *i* from choosing plan *j* in year *t* is given by:

$$u_{ijt} = \pi_{jt}\beta_{0it} + \mu^*_{ijt}\beta_{1it} + \sigma^2_{ijt}\beta_{2it} + \boldsymbol{x_{jt}\gamma_{it}} + \boldsymbol{\xi_{b(j)t}} + \xi_{ij=C_{ij}(t-1)}(x_i) + \epsilon_{ijt} \quad (2)$$

In this equation, π_{jt} gives the annual premium of plan *j*, μ^*_{ijt} gives expected out of pocket costs, σ^2_{ijt} gives the variance of costs, $\boldsymbol{x_{jt}}$ represents any financial plan characteristics which impact choice, $\boldsymbol{\xi_{b(j)t}}$ represents brand fixed effects, $\xi_{ij=C_{ij}(t-1)}$ is a dummy variable which is 1 if and only if plan j was chosen by consumer i during the previous year, and ϵ_{ijt} are i.i.d. type I extreme value random variables. We allow the inertia dummy to depend on plan characteristics x_i in two ways: first, the dummy is interacted with the change in characteristics of the previously chosen plan and second, the dummy is interacted with the change in characteristics of the minimum cost plan.

The financial plan characteristics include the deductible of the plan; a dummy for whether the plan covers all donut hole expenditures; a dummy for whether the plan covers generic expenditures in the donut hole only; and a cost-sharing index. The cost sharing index is calculated for each plan as the average percentage of expenditures covered by the plan between the deductible and the donut hole. This variable differs from expected out of pocket costs in that it has the same value for everyone in the sample for each plan, and because it is not directly impacted by whether plans have deductibles or donut hole coverage. To control for other aspects of plan quality, we include a full set of brand dummies. This will capture the many features of plans that are common within brand, such as consumer support and pharmacy access.

In AG, the structural coefficients β, γ and δ were treated as constants in the primary specifications (in robustness checks, we allowed for observed and unobserved heterogeneity), and the inertial dummy ξ was omitted because we examined only a single year of data. Here we will examine explicitly the forces that cause these coefficients to evolve over time. We also show the base results for

2006 as well to assess whether the use of improved data impacts our econometric findings in the earlier work.

Identification is a natural concern in this context. All of the plan characteristics included in our model may be endogenous due to unobserved demand factors, and they may be biased by correlation with unobserved plan characteristics. To address this concern, we observe and include in our model all of the publicly available information that might be used by individuals to make their choices. We also control for a full set of brand dummies, so that we are only comparing choices of plans with different cost-sharing structure within a given insurer.

Even with these fixed effects, it is possible that premiums are endogenous because they are set based on brand-state specific assessments of demand conditions. If premiums are higher in regions where insurers anticipate more demand for their particular plan (relative to other plans offered by the same insurer), our estimate of the coefficient on premiums will be biased towards zero since individuals will appear to be less averse to higher premiums. To the extent that these factors make high premiums appear less undesirable than they actually are, our conclusion that premiums are overweighted relative to out of pocket costs would be strengthened, as would our estimates of the welfare loss due to consumer mistakes.

Including brand dummies also raises a normative question regarding whether these reflect additional value that consumers receive from plans. One way of interpreting these coefficients is to say: "Consumers ultimately only care about financial characteristics. However, they are willing to pay several thousand dollars to enroll in a plan from brand A rather than brand B because they are boundedly rational and unable to directly evaluate the financial consequences but trust brand A more." In this world, given that we (the econometrician) *can* directly evaluate the financial consequences, brand dummies should *not* count in the normative welfare function. They are redundant given the available information. Alternatively, one might interpret the brand dummies as capturing some omitted feature

of brands which consumers do value, such as familiarity with the logistics of plans from an earlier experience with a given brand. In this case, brand dummies *should* count normatively in our appraisal of plans. We consider both possibilities in our analysis below. In our baseline model, we do not count brand dummies in the normative welfare function but we do include a quality rating (which summarizes features such as customer service) whose normative weight is recovered by an OLS regression of the brand dummies on the quality variable (that is, we assume that $\boldsymbol{\xi_{b(j)t} = q_{b(j)t}\delta + v_{jt}}$ where only the $\boldsymbol{q_{b(j)t}\delta}$ term counts in the normative welfare function). In an alternative model, we do count brand dummies as part of normative welfare.

The model laid out above suggests three natural restrictions on preferences which extend the efficient frontier concept to the discrete choice setting.

Restriction 1: $\boldsymbol{\beta_0 = \beta_1}$

This restriction states that the coefficient on premiums should equal the coefficient on expected out of pocket costs. Controlling for the risk characteristics of plans, individuals should be willing to pay exactly one dollar in additional premiums for coverage which reduces expected out of pocket costs by one dollar. If this restriction fails to hold, individuals are not choosing on the efficient frontier: they could switch to alternative plans with comparable risk characteristics but lower total costs.[12]

Restriction 2: $\boldsymbol{\gamma = 0}$

This restriction states that financial plan characteristics other than premiums, expected out of pocket costs and the variance of out of pocket costs do not impact choices. Individuals should not care about deductibles, donut hole coverage or copays *per se*; they should only care about these factors to

[12] Of course, this condition will not hold if expected out of pocket costs suffer from measurement error and premiums do not. To address this concern in our previous paper, we used our perfect foresight measure of expected out of pocket spending, instrumented by our rational expectations measure, which is a function only of the category of previous year spending (tantamount to instrumenting by previous year spending category times plan dummy). In this paper we simply estimate the reduced form of that equation, which is the same as IV due to a first stage coefficient of roughly 1.

the extent that they impact the distribution of out of pocket costs. Once we control for this distribution, these factors should be redundant.

Restriction 3: $\beta_2 < 0$

This restriction states that individuals should be risk averse.

While these restrictions follow naturally from utility maximization with full information and standard preferences, the model from which they are derived makes several important functional form assumptions: we assume that the distribution of out of pocket costs can be summarized by its mean and variance, that indirect utility is a linear function of this mean and variance, and that the errors are i.i.d. type I extreme value. In Appendix Table 3, we show that the restrictions assumed in the previous section still hold even when these functional forms assumptions are weakened. Of course, it is always possible to write down preferences that would violate the above restrictions, but these restrictions are generally compatible with commonly used expected utility functions given the observed cost distributions.

Appendix D of AG shows how to evaluate welfare in conditional logit models when positive and normative utility functions coincide. Unlike the money metric of foregone savings, the welfare metric we compute takes into account risk aversion, and plan quality. That is, for each plan, we compute:

$$W_{ijt} = \frac{1}{\beta_{0it}}(\beta_{0it}(\pi_{jt} + \mu^*_{ijt}) + \sigma^2_{ijt}\beta_{2it} + \boldsymbol{q_{b(j)t}\delta_{it}}) \quad (3)$$

This is the welfare measure taking into account total costs, risk protection, and plan quality variables and scaling by the marginal utility of income so that it is expressed in a money-metric. Let $W^*_{it} = \max_j W_{ijt}$, welfare for the best plan. We define foregone welfare for individual *i* at time *t* in plan *j* as:

$$\mathrm{FW_{it}} = \Delta W_{it} = W_{ijt} - W^*_{it} \quad (4)$$

This is the welfare analogue of our foregone savings measure.

Modeling the Dynamics of Foregone Welfare

Conceptually, changes in foregone welfare can be driven by demand side factors (i.e. changes in how people choose), supply side factors (i.e. changes in the choice set), changes in the underlying claims (which determine the welfare consequences of choosing a given plan) or changes in the normative parameters (i.e. how consumers value risk protection and plan quality ratings).

We can further decompose the demand side factors into three effects, which we label inertia, individual learning, and cohort learning. Inertia is the tendency of consumers to remain in the same plan regardless of changes in the plan choice environment. Learning is the tendency for consumers to reduce foregone welfare conditional on choosing a new plan as they gain experience in the market, individually or collectively. Individual learning concerns whether individuals with experience in the market do a better job conditional on choosing a new plan than individuals with less experience, while cohort learning reflects "calendar year" effects – given a fixed choice set, do we see improvements in the ability of each cohort of individuals to choose over time (controlling for their individual experience in the market).

It is important to note that given our definition, individuals could save money by switching plans in every year but this is not necessarily evidence of learning; that is, learning is not just the complement of inertia. If, for example, all consumers switched whenever foregone welfare exceeded $400 and chose plans with foregone welfare of $300 conditional on switching, this would suggest that they saved money by switching and it would suggest that inertia is making consumers worse off (assuming that inertial consumers would choose as well as switchers were they to switch). It would *not* suggest that consumers who switched plans were learning – because in every year their behavior is the same – they switch plans and choose plans averaging $300 in foregone welfare if their current plan becomes sufficiently unsuitable. It *would* be evidence of learning if either a) Consumers with more experience in the market systematically chose better plans so switchers did better than new enrollees (individual learning), or b)

Controlling for choice set differences, consumers in 2007 chose systematically better than consumers in 2006 (cohort learning).

Even if there is no change in consumers' ability to choose over time from a given choice set, supply side factors may lead to changes in foregone welfare if the choice set becomes more "dangerous"; for example, suppliers may learn to better conceal costs and otherwise take advantage of consumers' biases. We can decompose the supply-side factors into those driven by choice set changes and those driven by plan characteristics. Choice set changes include changes in which plans are available in different years, which we separate into the impact of plans exiting and entering. We further decompose changes in plan characteristics into changes in plan premiums and changes in plan characteristics which impact out of pocket costs.

Formally, we can define each of these effects in terms of changes in the parameters of our structural model (equation 1). Above, we allowed the structural coefficients β, γ, δ and ξ to vary flexibly from year-to-year for each individual. We will now place additional structure on this variation. Let $\boldsymbol{\beta_{it}} = \boldsymbol{\alpha_{1t}^{\beta}} + \boldsymbol{\alpha_{2}^{\beta}} E_{it}$, $\boldsymbol{\gamma_{it}} = \boldsymbol{\alpha_{1t}^{\gamma}} + \boldsymbol{\alpha_{2}^{\gamma}} E_{it}$ and $\boldsymbol{\delta_{it}} = \boldsymbol{\alpha_{1t}^{\delta}} + \boldsymbol{\alpha_{2}^{\delta}} E_{it}$ where E_{it} denotes individual i's years of experience in the market in calendar year t. Cohort learning can then be identified with changes in the $\boldsymbol{\alpha_1}$ coefficients or brand fixed effects, individual learning with changes in the $\boldsymbol{\alpha_2}$ coefficients, and inertia with the inertial dummy ξ. Supply-side changes can be straightforwardly equated with changes in π_{jt}, μ_{ijt}^{*}, σ_{ijt}^{2}, and $\boldsymbol{x_{jt}}$ and $\boldsymbol{q_{b(j)t}}$ over time.[13] Out of pocket costs in a given year are a function both of an individual's claims and of the characteristics of the plan in which they are enrolled. To separately identify the impact of changes in plan characteristics *holding fixed* an individual's claims data, we use our calculator to simulate how out of pocket costs would have changed if the characteristics of plans changed from year *t* to year *t+1* but the underlying claims remained fixed

[13] Note that conditional on the inclusion of brand-fixed effects, changes in the quality variable impact the normative utility function but not the positive utility function in our baseline specification.

at their year *t* level. The changes in welfare we attribute to the supply side all hold fixed these underlying claims.

We will consider decomposing the change in welfare over time for the panel sample so that all individuals are present in all years; this is not substantively important but it simplifies the exposition. Individuals not in this sample – such as beneficiaries who appear for the first time in 2007 – will nonetheless be of use in identifying the structural parameters as we describe below. The change in foregone welfare from year *t* to year *t+1* is given by:

$$\Delta \mathrm{FW}_{\mathrm{it}} = \Delta_t^t W_{ittt}^{t,e(i,t),I(i,t)} - \Delta_{t-1}^{t-1} W_{i(t-1)(t-1)(t-1)}^{t-1,e(i,t-1),I(i,t-1)} \tag{5}$$

where $e(i,t)$ denotes the experience of individual *i* in year *t* and $I(i,t)$ denotes the inertial dummy of individual *i* in year *t* (i.e. $I(i,t) = 1$ provided *i* was enrolled in a plan in the previous year which is still present in year *t*).[14] We can decompose this into supply side, demand side, underlying changes in claims and normative terms.

$$\begin{aligned}
\mathrm{S}_{\mathrm{it}} &= \Delta_{t-1}^{t-1} W_{ittt}^{t-1,e(i,t-1),I(i,t-1)} - \Delta_{t-1}^{t-1} W_{i(t-1)(t-1)(t-1)}^{t-1,e(i,t-1),I(i,t-1)} \\
\mathrm{D}_{\mathrm{it}} &= \Delta_{t-1}^{t-1} W_{ittt}^{t,e(i,t),I(i,t)} - \Delta_{t-1}^{t-1} W_{ittt}^{t-1,e(i,t-1),I(i,t-1)} \\
\mathrm{C}_{\mathrm{it}} &= \Delta_{t}^{t-1} W_{ittt}^{t,e(i,t-1),I(i,t-1)} - \Delta_{t-1}^{t-1} W_{ittt}^{t-1,e(i,t-1),I(i,t-1)} \\
\mathrm{N}_{\mathrm{it}} &= \Delta_{t}^{t} W_{ittt}^{t,e(i,t),I(i,t)} - \Delta_{t}^{t-1} W_{ittt}^{t,e(i,t),I(i,t)} \\
\Delta \mathrm{FW}_{\mathrm{it}} &= \mathrm{S}_{\mathrm{it}} + D_{it} + C_{it} + N_{it}
\end{aligned} \tag{6}$$

The supply side change in welfare – S_{it} – describes how welfare changes due to changes in premiums (the 2nd subscript), change in plan characteristics (the 3rd subscript) and change in the choice set itself (the 4th subscript). The demand side change in welfare asks how welfare changes due to changes in the cohort learning (the 1st superscript), individual learning (the 2nd superscript), and inertia (the 3rd

[14] Note that $I(i,t)$ differs from $I(i,t-1)$ in two ways: first, the plan to which inertia applies may differ if the beneficiary switched plans (in 2007 inertia would apply to the plan chosen in 2006 while in 2008 inertia would apply to the plan chosen in 2007). Second, the weight attached to that plan may differ if the tendency to choose the same plan as in the previous year changes from year to year.

superscript), holding fixed claims and plan characteristics at the pre-period level. The "claims" change in welfare describes how welfare changes due to changes in the underlying claims observed. This term is not completely independent of supply side effects – it may for example be driven by utilization responses to changes in plan characteristics. Nonetheless, we find it useful to separate out the changes in welfare due to changes in plan characteristics which impact premiums and out of pocket costs for a fixed set of claims and changes in the observed claims. The normative change in welfare - N_{it} – asks how welfare changes due to the fact that preferences may change overtime (e.g. individuals may become more risk averse or the revealed preference value placed on plan quality may change). In our results below we suppress this term and use the 2006 preferences as our benchmark for evaluating welfare in all years.

We can further decompose the demand side effect into the welfare impacts of cohort learning, inertia and individual learning.

$$\begin{aligned}
\mathrm{CL_{it}} &= \Delta^{t-1} W_{ittt}^{t,e(i,t),I(i,t)} - \Delta^{t-1} W_{ittt}^{t-1,e(i,t),I(i,t)} \\
\mathrm{I_{it}} &= \Delta^{t-1} W_{ittt}^{t-1,e(i,t),I(i,t)} - \Delta^{t-1} W_{ittt}^{t-1,e(i,t),I(i,t-1)} \\
\mathrm{IL_{it}} &= \Delta^{t-1} W_{ittt}^{t-1,e(i,t),I(i,t-1)} - \Delta^{t-1} W_{ittt}^{t-1,e(i,t-1),I(i,t-1)} \\
\mathrm{D_{it}} &= \mathrm{CL_{it}} + \mathrm{I_{it}} + \mathrm{IL_{it}}
\end{aligned} \tag{7}$$

Each of cohort learning (CL_{it}), inertia (I_{it}) and individual learning (IL_{it}) is defined by holding fixed the other two factors (as well as the supply side factors).

Finally, we can decompose supply-side welfare effects into the change in welfare induced by changes in premiums (the "Premium" term), changes in out of pocket costs and plan characteristics for a fixed set of claims (the "OOP" term) and changes in the choice set itself (the "Plan" term). In our results below, we separate the plan term into the impact of plan exit (plans present in year *t-1* leaving the choice set in year *t*) and plan entry (plans present in year *t* but not in year *t-1*).

$$
\begin{aligned}
\text{Plan}_{\text{it}} &= \Delta^{t-1}\text{W}_{\text{ittt}}^{\text{t-1,e(i,t-1),I(i,t-1)}} - \Delta^{t-1}\text{W}_{\text{itt(t-1)}}^{\text{t-1,e(i,t-1),I(i,t-1)}} \\
\text{OOP}_{\text{it}} &= \Delta^{t-1}\text{W}_{\text{itt(t-1)}}^{\text{t-1,e(i,t-1),I(i,t-1)}} - \Delta^{t-1}\text{W}_{\text{it(t-1)(t-1)}}^{\text{t-1,e(i,t-1),I(i,t-1)}} \\
\text{Premium}_{\text{it}} &= \Delta^{t-1}\text{W}_{\text{it(t-1)(t-1)}}^{\text{t-1,e(i,t-1),I(i,t-1)}} - \Delta^{t-1}\text{W}_{\text{i(t-1)(t-1)(t-1)}}^{\text{t-1,e(i,t-1),I(i,t-1)}} \\
\text{S}_{\text{it}} &= \text{Plan}_{\text{it}} + \text{Claim}_{\text{it}} + \text{OOP}_{\text{it}} + \text{Prem}_{\text{it}}
\end{aligned}
\tag{8}
$$

Once again, each of these welfare effects is can be thought of conceptually as the change in welfare implied by the structural model when only that characteristic is changed and all other characteristics are held constant.

In order to estimate each of the above effects, we need to identify the associated coefficients in the structural model. We now discuss the intuition for the identification of each of these effects.

Consider first "individual learning" effects, $\boldsymbol{\alpha_2}$. Individual learning is identified by comparing the choices of returning consumers *conditional on choosing a new plan* with the choices of new consumers in a given year. A confounding factor is that returning consumers who choose a new plan may be a selected sample of the broader pool of returning consumers – in other words, those consumers who choose to switch might do so in part because they are better at choosing plans. To control for this, we also attempt to identify individual learning by comparing the choices of new beneficiaries and "forced switchers", consumers whose choice in the prior year is no longer available meaning they had no choice but to choose a new plan. This solution is not perfect, however, as "forced switchers" are not randomly chosen: consumers who choose plans in year *t-1* which are no longer available in year *t* tend to perform worse than average in year *t-1*. The comparison between new beneficiaries and active switchers should provide an upper bound on the learning effect (because active switchers are better than average choosers) and the comparison between new beneficiaries and forced switchers should provide a lower bound on the learning effect (because forced switchers are worse than average choosers).

Consider next inertia, the $\xi_{ij=C_{ij}(t-1)}$ dummies. These are identified by comparing the choices of switchers and non-switchers using the structural model. More precisely, given the estimated

premium elasticity for switchers, the inertia dummy tells us what equivalent premium subsidy would make beneficiaries equally likely to remain in the same plan if there were no inertia present. The welfare impact of inertia depends in turn on whether non-switchers would have been better off had they actively chosen a plan. This is not necessarily the case even if they are not already enrolled in the best plan: the choice set might become "more dangerous" and active choices might lead them to choose even more poorly than if they just remained in the same plan. We can assess whether they would be made better off by switching by assuming that had they switched, they would have chosen as well as switchers (either active or forced).

Consider finally the "cohort learning" effects, $\boldsymbol{\alpha_1}$. Cohort learning is the impact of market experience on consumers' ability to choose controlling for any direct individual experience with the market. Some channels for this type of learning might be a greater abundance of tools which help consumers choose better or increasing knowledge on the part of healthcare providers such as pharmacists and doctors who consumers turn to for advice. These effects can be identified by comparing beneficiaries in different years with the same amount of experience: for example, new beneficiaries in 2006 and 2007 or beneficiaries with a single year of experience in 2007 and 2008. In the estimates we report here, the model uses both sources of variation to identify cohort learning.

Identification of the supply side factors is straightforward. Given the estimated structural parameters, we can use the model to simulate how choices (and ultimately welfare) differ when premiums, out of pocket costs or the available plans change.[15] Intuitively, one can think of the supply-side estimates as analogous to the usual "area under the demand curve" welfare measures. If premiums of Plan A increase by $100, welfare does not fall by $100 because consumers can substitute towards alternative plans: the amount by which welfare falls depends on the degree of substitution via the price elasticity.

[15] As noted above, this involves using our plan calculator tool to compute how out of pocket costs would change counterfactually were the underlying claims held fixed.

Part V: Structural Results

We begin by reporting the estimated coefficients in the structural model. Table 2 reports our baseline specification as described above, while Table 3 presents a specification where the coefficients in 2007, 2008 and 2009 are identified using only the choices of forced switchers.

The first column shows our results for 2006, the year studied in AG. The coefficients are the structural coefficients in a conditional logit model and not marginal effects. They can be roughly interpreted as the impact of a one unit increase in the variable of interest on the probability that a plan is chosen; a premium coefficient of -0.79 implies that a $100 increase in premiums decreases the probability that a plan is chosen by 79 percent (this interpretation holds exactly for plans which are a negligible share of overall market share).

We find that even with this improved data, there is a sizeable gap between the estimated premium and out of pocket cost coefficients, with the former being more than *four times* the latter. We also find that there are significant coefficients on several plan characteristics: the deductible, donut hole coverage variables and formulary variables all matter even after controlling for out of pocket cost variables. The magnitude of these coefficients is substantial: we observe that, *controlling for out of pocket cost consequences*, individuals are willing to pay almost $400 to obtain donut hole coverage (the ratio of the donut hole coefficient to the premium coefficient).

The coefficient on the variance is insignificant in most specifications, and even where significant it is close to zero in magnitude: foregone welfare changes by less than $6 relative to a world where the variance coefficient is identically zero. As we saw in our efficient frontier analysis, we cannot rationalize consumers' foregone savings as arising because consumers prefer plans with superior risk protection.

As noted above, these choice inconsistencies do not simply reflect the restrictions we place through the CARA model. Even in models which considerably loosened these assumptions we would

still not expect to see these rejections of consistency. Appendix Table 3 carries out simulations where we assume that consumers maximize expected utility given CARA or CRRA utility, the empirically estimated distribution of costs, and different levels of risk aversion. We then take the simulated choices and estimate our conditional logit model as if the simulated choices were the true choices observed in the data. In these simulations, the coefficients on plan characteristics are several orders of magnitude smaller despite the fact that the (simulated) choices used to estimate the model are generated using the empirical distribution of costs and CARA or CRRA utility as opposed to a linear indirect utility function with normally distributed costs. This suggests that the significant coefficients we find in the data are not due to the linearization or normality assumptions we make in our theoretical model, but rather due to the fact that consumers attach special weight to these characteristics beyond their personalized out of pocket cost consequences.

The remaining columns show comparable results for 2007, 2008 and 2009. We observe that the premium and out of pocket cost coefficients move closer together. The specifications in Table 2 include a flexible set of interactions between the inertia dummy and plan characteristics both in the present year and in the previous year. These interactions allow the decision of whether to switch to depend flexibly both on the current year choice set and specifically on changes to the plan in which the consumer was previously enrolled. With these interactions included, the reported coefficients are identified only by the choices of switchers *conditional on switching.* The fact that the premium-OOP coefficient gap narrows in later years relative to 2006 reflects the fact that these coefficients are identified only by the 10 percent of individuals who switched plans.

Despite the fact that we are focusing on switchers, however, the premium and out of pocket cost coefficients remain significantly different. Moreover, the other choice inconsistencies persist: other plan characteristics are highly significant and the variance term is insignificant or small in magnitude. The inertia term is extremely large in magnitude, reflecting the fact that the vast majority of consumers

remain in the same plan they chose in the previous year. The inertia term can be interpreted to mean that consumers are 500-700% more likely to choose a plan if it is the plan they chose last year; comparing the inertia term to the premium coefficient, we find that consumers are willing to give up more than $600 worth of premiums to remain in the same plan.

When we identify the coefficients using only the choices of forced switchers, we obtain higher coefficients on premiums and out of pocket costs in 2007, but the sizeable gap between the two remains, and the significance of the coefficients on other plan characteristics are somewhat larger (note that forced switchers only exist from 2007 onward because they are defined as Part D enrollees whose choice in the previous year was discontinued). The forced switchers results for 2008 and 2009 are very similar to the full set of results. The similarities between the choices of switchers and forced switchers suggests that it is not unreasonable to use the observed choices of switchers to model how inertial consumers would choose were they forced to switch.

Welfare Implications

We next use this structural model to move from the results for foregone savings presented above to a welfare metric which includes not only expected spending but also risk protection and plan quality based on the revealed preference weights estimated by the model.

Table 4 shows the results of this welfare analysis. For comparison purposes, the first two rows replicate in the panel sample our earlier results using the predicted spending measure, with large and rising foregone savings, even relative to plans with similar or lower variance (Table 1 reports the analogous results in the full sample). The third row shows the welfare equivalent in our baseline model, which supports the inferences drawn from our efficient frontier measure: foregone welfare increases over time, rising from about $154 in 2006 to $254 in 2009. This occurs despite the fact that mean

expenditures in our final sample are lower in 2009 than in 2006 ($2150 in 2006 compared to $2100 in 2009). We see a similar pattern if we allow brand dummies to enter the normative utility function.

In fact, allowing brand dummies to matter for welfare increases foregone welfare. This is a counterintuitive result: one might expect that allowing brand fixed effects to matter for normative welfare would reduce foregone welfare because it would help to rationalize the observed patterns of choices across brands. This does not occur because we are in a second best world where other mistakes reverse the usual logic. To gain some intuition, it is helpful to imagine a world where there is a single best plan and all consumers have a 10% chance of choosing the best plan and a 90% chance of choosing randomly from amongst 40 or so other plans in their choice set. Adding brand fixed effects makes the best plan look even better from a normative standpoint (a disproportionate share choose it given the fact that people otherwise choose randomly) but this increases foregone welfare since most people do not choose the best plan.[16]

The remaining two rows in Table 4 show the contribution of inertia to foregone welfare from 2007 onwards. We find that the contribution of inertia is very small in 2007 either with or without counting the brand dummies in the normative model. That is, in 2007 those who stayed behind in the same plan rather than switching were not much worse off than those who switched. In 2008 and 2009 in the base model, the inertia estimates become more sizeable, but still remain less than half as large as the total foregone welfare. In the model allowing for normative brand dummies, the role of inertia is even smaller, and indeed is *negative* in 2009. That is, in 2009, those who didn't switch plans had smaller foregone welfare than those who did. This is striking evidence that, in general, switching only sometimes improved and never fully offset the choice inconsistencies among Part D consumers.

[16] An alternative normative assumption would be to allow each individual to have fully-flexible preferences over brands (as opposed to estimating a single brand fixed effect and allowing that to matter for welfare). This model *by assumption* would rationalize any choices across brands meaning that the only possible mistakes would be within brand (e.g. choosing the wrong United plan). The above result suggests that the observed choices cannot be explained by systematic factors valued equally by all individuals which vary across plans.

Structural Decomposition

In this section, we attempt to understand the factors driving changes in welfare over time. To make the changes over time more transparent, we eliminate the normative terms and the claims term in the decomposition above and evaluate welfare in all years using 2006 claims as well as the risk preferences and quality ratings estimated in 2006. This restriction has little impact on the results but it makes more transparent the degree to which supply and demand side factors are impacting welfare. Overall, we find that supply side factors predominate, and that increasing premiums combined with consumer inertia and the exit of the most generous plans over time lead foregone welfare to increase.

The first panel in Table 5 shows the level of foregone welfare in the previous year, and the second row shows the change due to supply and demand factors holding fixed 2006 claims. The remainder of the table shows the contribution of each supply and demand side factor to the overall change in welfare.

Our results suggest that demand-side measures were relatively unimportant, particularly in 2008 and 2009. Individual learning, inertia and cohort learning all led welfare to change relatively little over time. The small amount of individual learning suggests that switchers are doing little better than new entrants to the program. The change in inertia does raise foregone welfare in each year, although the magnitude is quite small by 2009. The results for cohort learning are mixed, ranging from small positive to small negative. Thus, as highlighted above, the problem here is not simply inertia; it is that even those who switch do not remove choice inconsistencies when they do so.

Despite the fact that the premium-OOP cost gap narrows in later years in our structural model, we find that the quality of these simulated choices does not improve. This is because the over-responsiveness to plan characteristics remains. Our model even suggests that narrowing the premium-OOP cost coefficient gap can reduce welfare in the 2nd best world where plan characteristics are

overweighted given their individualized out of pocket cost consequences. This is the same phenomena noted earlier which led to including brand fixed effects in the normative model to increase foregone welfare. If overweighting premiums were the *only* mistake individuals made, then weighting out of pocket costs more appropriately would have to increase welfare. But because consumers also tend to overweight plan characteristics which provide some out of pocket coverage, it is actually better for them to overweight premiums relative to out of pocket costs than to weight the two equally assuming nothing else is done to correct the fact that they overweight certain plan characteristics. That is, if consumers are placing too much weight on donut hole coverage given their own expected out of pocket costs, then *also* placing too much weight on premiums relative to out of pocket costs can offset that inconsistency.

Table 5 suggests that supply side changes substantially reduced foregone welfare over time, although the pattern of supply side factors changes year by year. From 2006-2007, there is a reduction in foregone welfare from premiums; that is, the premiums of chosen plans fell relative to the best available plan. On the other hand, the foregone welfare from out of pocket costs rose considerably; that is, the out of pocket costs of chosen plans rose relative to the best available plan. Finally, there was a large decline in foregone welfare through plan exit. From 2007-2008, the pattern on premiums and out of pocket costs is the opposite, while the effects of plan exit are much smaller. From 2008-2009, foregone welfare rises both from higher premiums of the chosen plan (relative to the highest welfare plan) and from higher out of pocket costs; this is offset by a substantial reduction in foregone welfare from the exit of desirable plans that are typically not chosen.

In each of these cases, we are unable to distinguish from Table 5 whether the effects are due to changes in the chosen plan or changes in the best foregone plan. To address this, in Table 6 we present the same supply side decomposition but for absolute, not foregone, welfare. Absolute welfare is normalized to 0 for a plan with zero premiums, zero out of pocket costs, mean risk aversion and mean quality rating; dollar equivalent welfare is then computed for each plan relative to this normalized plan.

In this case more negative numbers mean a larger reduction in welfare. We see that absolute welfare is falling over time – consumers are being made worse off. The demand side impacts are identical to those for foregone welfare because changes in demand impact only the chosen plan, not the best available plan. The supply side effects are different because supply side changes impact both the chosen plan (which would impact both absolute and foregone welfare) and the best available plan (which only impacts foregone welfare).

The absolute welfare results add some nuance to the foregone welfare results. From 2006-2007, we find that there is a reduction in absolute welfare due to all three of premiums, out of pocket costs, and plan exit. This contrasts with foregone welfare where changes in plan generosity reduced foregone welfare (i.e. led to fewer mistakes). Together, this implies that from 2006-2007, existing plans became less generous which made consumers worse off but also reduced foregone welfare because the reduction in generosity was even larger for the best plans. In 2007-2008 and 2008-2009, once again premium increases and plan exit reduce absolute welfare, but increased coverage of out of pocket costs raise welfare. Thus, we find that over time in the Part D program there was an exit of the most generous plans, with a shift towards higher premiums and more generous coverage among plans that remain in the program. More generous coverage tended to increase foregone welfare because unchosen plans increased their coverage even more, and the exit of generous plans tended to reduce foregone welfare since unchosen plans were even more likely to exit. Taken together, these supply side changes served to reduce absolute welfare and increase foregone welfare.

Tables 7 replicates the results in Table 5 with normative brand dummies. The stylized facts noted on the demand side persist. Likewise, in both cases, supply side changes are predominantly responsible for the increase in foregone welfare over time.

Part VI: Conclusion

The bold experiment with consumer choice across health insurance plans embodied in the Medicare Part D program provides an excellent opportunity to assess how consumers perform in choosing insurance plans. We find that, using the best available data, consumers are very inconsistent in their choices, overweighting premiums relative to out of pocket costs, weighting plan characteristics above and beyond the effect on that consumer, and ignoring variance in coverage across plans. Moreover, we find that these choice inconsistencies persist over time, and that the foregone welfare from choosing inconsistently rises during the first four years of the Part D program.

This increase in foregone welfare occurs primarily through supply side changes. The set of plans available to consumers were changing over time in a way which heightened the disadvantages of choosing poorly. And this was not offset by factors on the demand side. Most consumers remain inertial, passively allowing the changes in the supply side to impact them. Most strikingly, even those consumers who are not inertial continue to choose inconsistently, so even the limited amount of switching that takes place does not do much to offset the welfare losses. Ultimately, we conclude that there was little learning at both the individual and cohort levels over time within the Part D program.

A shortcoming of our analysis is that we do not endogenize the supply side: we document how the supply side changed over time but we do not examine the factors driving these changes in equilibrium. If the model developed here were supplemented by a model of competition between firms for behavioral consumers, we could simulate how policy changes such as providing additional information to consumers or new rules governing the types of benefits firms may offer might impact the premium setting and entry and exit of firms and thereby consumer welfare. Such a model should take into account both the fact that more informed consumers could exacerbate adverse selection (Handel, 2011) and the fact that more information could intensify price competition by eliminating the artificial differentiation which arises from consumer confusion.

Table 1: Realized Overspending, Predicted Overspending, and Efficient Frontier Overspending

	2006	2007	2008	2009
Foregone Savings PF ($)	302	294	313	381
Foregone Savings PF (%)	29%	25%	28%	32%
Foregone Savings Pred ($)	193	199	256	340
Foregone Savings Pred (%)	13%	15%	18%	26%
Efficient Frontier Pred ($)	139	160	210	274
Efficient Frontier Pred (%)	9%	12%	15%	22%
# of Beneficiaries	49901	124384	124368	102427

Notes: Table shows various measures of choice quality from 2006 through 2009, both in absolute terms and as a percentage of total costs (computed as the sum of premiums paid and out of pocket costs) in the "Full Sample" described in the text (as opposed to the full panel). "Foregone Savings PF" gives our "perfect foresight" measure: realized total costs relative to the plan which minimizes realized total costs (ex post). "Foregone Savings Pred" compares predicted costs in the chosen plan to predicted costs in the costs minimizing plan, where predicted costs are computed as average costs among all individual in the same decile of costs in January of that year. "Efficient Frontier Pred" gives the same measure, but compares the chosen plan only with plans which have weakly lower variance (computed as the variance in simulated out of pocket costs for that plan among 200 beneficiaries in the same decile of January expenditure). The number of beneficiaries is lower in 2006 because we restrict to beneficiaries enrolled for the entire year and this restriction excludes a larger share of the sample in 2006 when open enrollment stretched from January to June.

Table 2: Conditional Logit Model Coefficients with Brand Fixed Effects

Brand Dummies	2006	2007	2008	2009
Premium	-0.79***	-0.84***	-1.03***	-0.98***
(hundreds)	(0.04)	(0.09)	(0.07)	(0.07)
OOP	-0.19***	-0.57***	-0.37***	-0.51***
(hundreds)	(0.03)	(0.08)	(0.08)	(0.08)
Variance	1.03	3.45	-6.63	-14.1**
(times 10^6)	(5.65)	(4.06)	(6.63)	(6.29)
Inertia	X	5.33***	7.05***	6.58***
		(0.35)	(0.17)	(0.31)
Deductible	-1.19***	-0.36***	-0.94***	-0.45***
(hundreds)	(0.05)	(0.06)	(0.06)	(0.05)
Full Donut Hole Coverage	3.00***	4.57***	X	X
	(0.34)	(0.73)		
Generic Coverage	0.97***	1.34***	2.25***	2.76***
	(0.13)	(0.13)	(0.20)	(0.21)
Cost Sharing	-10.25***	0.63	-2.66***	-0.75
	(0.69)	(0.74)	(0.84)	(0.78)
Number of top 100 on form	0.08***	0.41***	0.26***	0.05
	(0.02)	(0.07)	(0.07)	(0.03)
Quality Rating	0.65***	0.15***	0.63***	0.58***
	(0.04)	(0.04)	(0.08)	(0.02)

Notes: Table shows conditional logit results from estimating the model given in equation (2) by maximum likelihood. The coefficients reported are the parameters of the utility function, not marginal effects. Standard errors are in parentheses. In addition to the coefficients reported here, all specifications include brand fixed effects, separate coefficients for active and forced switchers (only those for active switchers are reported), interactions between all the reported coefficients and experience variables, and interactions between the inertia coefficient and (demeaned) values of the plan characteristics for the minimum cost plan, deciles of expenditure in the previous year, as well as the characteristics of the chosen plan in the previous year. These interactions between the inertia term allow the decision of whether or not to switch to vary flexibly as a function of plan characteristics. In later years, separate inertia dummies are included for the plan one was enrolled in during each preceding year. Premiums, out of pocket cost and deductibles are in hundreds of dollars and the variance term is in millions. The cost sharing variable is computed as the average value of covered expenditures divided by total drug expenditures for individuals in the choice set. The average quality variable is a normalized version of the "average rating" index provided by CMS. It is offset to indicate that we recover it from an auxiliary regression of estimated brand fixed effects on the quality rating variable. The risk index is twice the coefficient on the variance divided by the coefficient on premiums scaled by 100. In the model in the text, this value equals one million times the coefficient of absolute risk aversion.

*** indicates significance at the 1 percent level

** indicates significance at the 5 percent level

Table 3: Conditional Logit Model Coefficients with Brand Fixed Effects and Forced Switchers

Brand Dummies and Forced Switchers	2007	2008	2009
Premium	-2.1***	-1.07***	-1.09***
(hundreds)	(0.22)	(0.21)	(0.13)
OOP	-1.21***	-0.41**	-0.39**
(hundreds)	(0.41)	(0.17)	(0.17)
Variance	-8.94**	-1.06	-5.28
(times 10^6)	(4.47)	(1.08)	(7.78)
Inertia	5.21***	7.43***	7.13***
	(0.37)	(0.21)	(0.31)
Deductible	-1.11***	-1.1***	-0.84***
(hundreds)	(0.20)	(0.18)	(0.23)
Full Donut Hole Coverage	7.64***	x	x
	(1.86)		
Generic Coverage	6.21***	1.61***	3.03***
	(0.64)	(0.52)	(0.45)
Cost Sharing	-7.01***	-3.06	-2.89
	(1.83)	(1.73)	(2.33)
Number of top 100 on form	-1.01***	0.22	0.16**
	(0.12)	(0.32)	(0.08)
Quality Rating	0.15***	0.61***	0.56***
	(0.03)	(0.06)	(0.03)

Notes: Table shows conditional logit results from estimating the model given in equation (2) by maximum likelihood. This Table differs from Table 2 in that we report the coefficients on each variable interacted with whether you were a forced switcher (meaning that the plan in which you were enrolled the previous year is no longer available). The coefficients reported are the parameters of the utility function, not marginal effects. Standard errors are in parentheses. In addition to the coefficients reported here, all specifications include brand fixed effects, separate coefficients for active and forced switchers (only those for forced switchers are reported), interactions between all the reported coefficients and experience variables, and interactions between the inertia coefficient and (demeaned) values of the plan characteristics for the minimum cost plan, deciles of expenditure in the previous year, as well as the characteristics of the chosen plan in the previous year. These interactions between the inertia term allow the decision of whether or not to switch to vary flexibly as a function of plan characteristics. In later years, separate inertia dummies are included for the plan one was enrolled in during each preceding year. Premiums, out of pocket cost and deductibles are in hundreds of dollars and the variance term is in millions. The cost sharing variable is computed as the average value of covered expenditures divided by total drug expenditures for individuals in the choice set. The average quality variable is a normalized version of the "average rating" index provided by CMS. It is offset to indicate that we recover it from an auxiliary regression of estimated brand fixed effects on the quality rating variable. The risk index is twice the coefficient on the variance divided by the coefficient on premiums scaled by 100. In the model in the text, this value equals one million times the coefficient of absolute risk aversion.

*** indicates significance at the 1 percent level

** indicates significance at the 5 percent level

Table 4: Foregone Savings, Efficient Frontier Savings and Foregone Welfare

Foregone Welfare	*2006*	*2007*	*2008*	*2009*
Foregone Savings PF ($)	323	306	346	418
Efficient Frontier Pred ($)	264	193	256	347
Welfare	154	158	197	254
Welfare (Brand Dummies, Normative)	195	165	265	288
# of Beneficiaries	33308	33308	33308	33308
Inertia Welfare Loss		*2006-2007*	*2007-2008*	*2008-2009*
Baseline Model		17	72	59
Normative Brand Dummies		17	64	-13

Notes: First panel shows various measures of choice quality from 2006 through 2009. The first two rows replicate the corresponding rows of Table 1 in our "Full Panel" (beneficiaries who appear in the data for a full year in all years from 2006-2009) and all subsequent rows report results in the "Full Panel" sample. "Welfare" reports our welfare adjusted measure, computed as total costs plus the dollar equivalent value of risk protection and quality ratings estimated in our logit model with brand fixed effects as described in equation (3). "Welfare (Brand Dummies, Normative") also includes the dollar-equivalent value of the brand fixed effects in the welfare calculation. The second panel uses the model to simulate the impact of inertia on welfare relative to a world with no inertia in which inertial consumers choose from among all plans given the estimated structural coefficients identified primarily from the choices of switchers. As noted in the text, the model is estimated on the "Full Sample" but the results are reported in the "Full Panel". The reported value is the welfare loss in a world with inertia relative to a world with no inertia (so a negative number implies a welfare gain from inertia).

Table 5: Structural Decomposition

	2007	2008	2009
Year t-1 Foregone Welfare	154	158	197
Change due to supply + demand	16	85	63
Demand	23	5	-15
Individual Learning	-4	-3	-2
Inertia	17	8	2
Cohort Learning	10	0	-15
Supply	-7	80	77
Premiums	-27	104	42
OOP	127	-56	80
Plans (exit)	-115	-6	-71
Plans (entry)	8	38	26

Notes: Table reports the results of the welfare decomposition exercise described in equations (3)-(8). As noted in the text, the model is estimated on the "Full Sample" but the results are reported in a randomly chosen subset of the "Full Panel" with 5,266 beneficiaries per year (the remaining Full Panel beneficiaries after the model is estimated on a 10% sample of the Full Sample). The first row is identical to the third row of Table 4 and reports foregone welfare from the previous year. The next row reports the sum of the changes due to supply and demand. The first row of the "Demand" and "Supply" panels gives the sum of the changes due to each of their respective components. The "Inertia" term represents the change in welfare due to the *change* in inertia between years which differs from the exercise in Table 4 where we report the impact of inertia relative to a world with no inertia.

Table 6: Structural Decomposition: Absolute Welfare

	2007	2008	2009
Year t-1 Absolute Welfare	-1347	-1344	-1374
Change due to supply + demand	-162	-82	-80
Demand	-23	-5	15
Individual Learning	4	3	2
Inertia	-17	-8	-2
Cohort Learning	-10	0	15
Supply	-139	-77	-95
Premiums	-17	-41	-80
OOP	-24	-45	145
Plans (exit)	-98	6	-152
Plans (entry)	0	4	-7

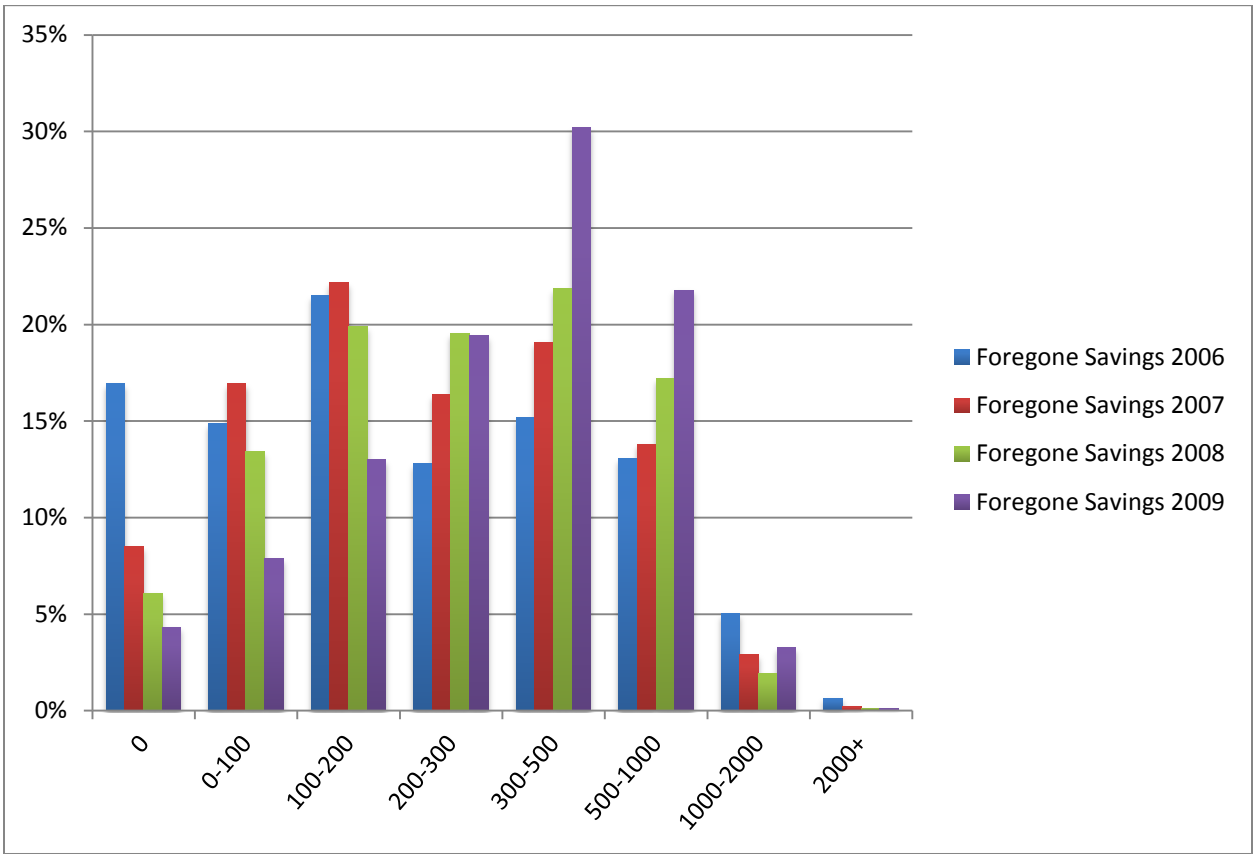
Notes: Table reports the results of the welfare decomposition exercise described in equations (3)-(8) using absolute welfare rather than foregone welfare. As noted in the text, the model is estimated on the "Full Sample" but the results are reported in a randomly chosen subset of the "Full Panel" with 5,266 beneficiaries per year (the remaining Full Panel beneficiaries after the model is estimated on a 10% sample of the Full Sample). The first row reports absolute welfare from the previous year. The next row reports the sum of the changes due to supply and demand. The first row of the "Demand" and "Supply" panels gives the sum of the changes due to each of their respective components. The "Inertia" term represents the change in welfare due to the *change* in inertia between years which differs from the exercise in Table 4 where we report the impact of inertia relative to a world with no inertia.

Table 7: Structural Decomposition: Normative Brand Dummies

	2007	2008	2009
Year t-1 Foregone Welfare	195	165	265
Change due to supply + demand	16	64	34
Demand	23	7	-2
Individual Learning	-4	-2	0
Inertia	17	7	-1
Cohort Learning	-1	-5	-14
Supply	-8	56	35
Premiums	-27	104	53
OOP	127	-56	43
Plans (exit)	-115	-6	-70
Plans (entry)	8	14	10

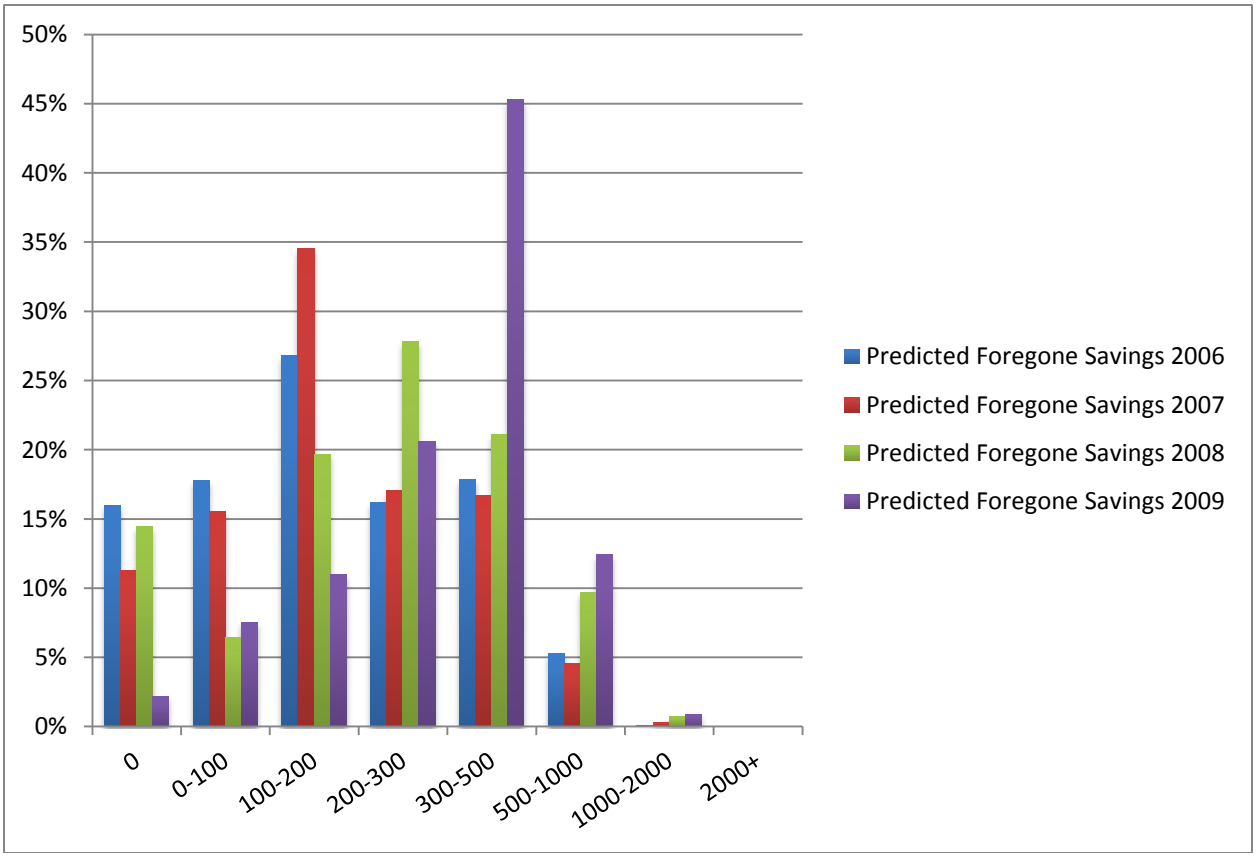
Notes: Table reports the results of the welfare decomposition exercise described in equations (3)-(8). Table 7 differs from Table 5 in that all welfare evaluations use a normative model in which the dollar-equivalent of brand fixed effects is included. As noted in the text, the model is estimated on the "Full Sample" but the results are reported in the "Full Panel". The first reports foregone welfare from the previous year. The next row reports the sum of the changes due to supply and demand. The first row of the "Demand" and "Supply" panels gives the sum of the changes due to each of their respective components. The "Inertia" term represents the change in welfare due to the *change* in inertia between years which differs from the exercise in Table 4 where we report the impact of inertia relative to a world with no inertia.

Figure 1: Perfect Foresight Foregone Savings



Notes: Figure 1 shows the distribution of foregone savings per year in the Full Sample using our perfect foresight measure; in other words, this gives the different in realized costs between the chosen plan and the plan that would ex post have minimized realized costs (computed as the sum of total premiums and out of pocket costs). The x-axis gives dollars of foregone savings, the y-axis the fraction of the total population in that bin.

Figure 2: Rational Expectations Predicted Foregone Savings



Notes: Figure 2 shows the distribution of foregone savings per year in the Full Sample using our predicted cost measure; in other words, this gives the difference in predicted costs between the chosen plan and the plan that would have minimized ex ante predicted costs (computed as the sum of total premiums and predicted out of pocket costs). As described in the text, predicted out of pocket costs are computed as the average among 400 beneficiaries in the same decile of January expenditures. The x-axis gives dollars of foregone savings, the y-axis the fraction of the total population in that bin.

Appendix Table 1: 1000 Cell Model vs. Just January Model

	January (2007)	1000 Cell (2007)
Foregone Savings PF ($)	306	306
Foregone Savings PF (%)	25%	25%
Foregone Savings Pred ($)	193	195
Foregone Savings Pred (%)	16%	16%
Efficient Frontier Pred ($)	152	153
Efficient Frontier Pred (%)	12%	12%
# of Beneficiaries	5275	5275

Notes: Table replicates the corresponding rows of Table 1 in the text in the final sample for which reports are resulted in the structural model. In this sample, we compare the predicted savings measures computed by conditioning on decile of January expenditures with a model in which we assign each individual to one of 1000 cells based on deciles of prior year expenditures and days supply of branded and generic drugs (as in AG). The latter model is not feasible in 2006 since we do not observe prior year data but it is feasible in 2007.

Appendix Table 2: Realized Overspending, Predicted Overspending, and Efficient Frontier Overspending in Full Year Sample

	2006	2007	2008	2009
Foregone Savings PF ($)	244	264	284	340
Foregone Savings PF (%)	25%	25%	28%	31%
Foregone Savings Pred ($)	193	184	219	297
Foregone Savings Pred (%)	17%	15%	18%	22%
Efficient Frontier Pred ($)	162	148	165	236
Efficient Frontier Pred (%)	14%	12%	13%	18%
# of Beneficiaries	151262	187745	192707	171124

Notes: Table shows various measures of choice quality from 2006 through 2009, both in absolute terms and as a percentage of total costs (computed as the sum of premiums paid and out of pocket costs) in the "Full Sample" described in the text using all enrollees from January-June. "Foregone Savings PF" gives our "perfect foresight" measure: realized total costs relative to the plan which minimizes realized total costs (ex post). "Foregone Savings Pred" compares predicted costs in the chosen plan to predicted costs in the costs minimizing plan, where predicted costs are computed as average costs among all individual in the same decile of costs in the first month in which they were enrolled. "Efficient Frontier Pred" gives the same measure, but compares the chosen plan only with plans which have weakly lower variance (computed as the variance in simulated out of pocket costs for that plan among 200 beneficiaries in the same decile of expenditure in the first month of enrollment).

Appendix Table 3: CRRA vs. CARA Estimates

	CRRA (wealth = 17000)			CARA		
	1	3	10	0	0.0003	0.0005
Premium	-5.39***	-5.1***	-3.4***	-5.3***	-4.77***	-3.88***
(hundreds)	(0.04)	(0.00)	(0.00)	(0.00)	(0.03)	(0.02)
OOP Cost	-5.36***	-4.9***	-2.8***	-5.3***	-4.52***	-3.38***
(hundreds)	(0.04)	(0.00)	(0.00)	(0.00)	(0.03)	(0.03)
Variance	-1.90***	-6.30***	-20.00***	-2.60***	-9.24***	-16.28***
(times 10^6)	(0.15)	(0.10)	(0.20)	(0.20)	(0.14)	(0.19)
Deductible	0.01***	0.03***	0.08***	0.01***	0.04***	0.07***
(hundreds $)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Donut Hole	0.01	0.05***	-0.1	0.0	0.0	0.04***
(hundreds $)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Generic Donut Hole	0.01	0.03***	0.05***	0.01	0.02**	0.05***
(hundreds $)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)

Notes: Table excerpted from Appendix Table 1 in Abaluck and Gruber (2009). The table shows the results of estimating the model using simulated choices assuming the utility function and risk parameter listed in a given column. Each column shows coefficients from a single regression. The coefficients reported are the parameters of the utility function, not marginal effects. Standard errors are in parentheses. The sample differs slightly from that in Table 1 because individuals with greater than 17000 in total costs for any plan are dropped. All simulated choices are based on the cost distribution generated from the realized costs of 200 individuals in the same decile of 2005 total costs, decile of 2005 total days supply of branded drugs and decile of 2005 days supply of generic drugs. The first three columns compute expected utility using a CRRA utility function with wealth of 17000 and the indicated coefficient of relative risk aversion, assuming that individuals select the choice which maximizes expected utility. The final three columns compute expected utility using a CARA utility function with the indicated coefficient of absolute risk aversion.

*** indicates significance at the 1 percent level

** indicates significance at the 5 percent level

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