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THE WELFARE IMPACT OF REDUCING CHOICE IN MEDICARE PART D: A COMPARISON OF TWO REGULATION STRATEGIES*

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Motivated by widely publicized concerns that there are "too many" plans, we structurally estimate (and validate) an equilibrium model of the Medicare Part D market to study the welfare impacts of two feasible, similar-sized approaches for reducing choice. One reduces the maximum number of firm offerings regionally; the other removes plans providing donut hole coverage—consumers' most valued dimension. We find welfare losses are far smaller when coupled with elimination of a dimension of differentiation. We illustrate our findings' relevance under current health care reforms, and consider the merits of instead imposing ex ante competition for entry.

1. INTRODUCTION

The Medicare prescription drug program started in January 2006 and constitutes the largest expansion of Medicare benefits since 1965. There is an immediate need to understand the functioning of this program to better inform policy, as changes have already been implemented and are continually being debated. A much debated reform is the reduction in the number of plans. This is in response to the large number of Part D plans that have entered the market, which has been argued to create large search costs when the elderly make their drug insurance decisions. A series of studies (Perry et al., 2006; Cubanski, 2008; Rice and Cummings, 2010), advocates for a reduction of Part D plans. These findings indicate that there is considerable political pressure to limit the number of choices.

In the absence of search costs, limiting the number of products in a market with differentiated products could lead to softened price competition, decreased product variety, or both. In light of the challenges the U.S. government faces in regulating this market effectively and the regulations currently in place, this article studies the welfare impact of two easily implementable, and fundamentally different, approaches toward limiting the number of Part D plans: reducing the maximum number of plans each firm can offer per region and removing plans that offer a certain feature, namely, donut hole coverage. Both approaches would result in a similar-sized reduction in the number of plans (approximately 20%). However, the latter involves eliminating a dimension of plans' characteristics, the net consequences of which depend on consumers' valuation of that dimension versus firms' ability to soften competition by differentiating along it.

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We believe the comparison between these two ways to reduce choice is particularly relevant for several reasons in terms of providing valuable economic and policy-oriented insights. First, current regulations dictate that providers can offer no more than three plans in any given region. Recent law changes have attempted to limit the choice set further by discouraging seemingly redundant policies provided by a single firm and requiring firms to pull plans that have too few participants (Federal Register, 2010). Our first method of reducing choice follows the spirit of these changes by restricting firms to a maximum of two plans per region and imposing this limitation by eliminating the least popular plan for firms that were offering three. Second, legislation has already started to take effect to close the donut hole, or gap, in all Part D plans offered (The Patient Protection and Affordable Care Act, 2010; Shrank, 2011). Consumers currently can purchase plans that provide some gap coverage, but these plans are priced at a premium. The regulatory change does nothing to limit choice per se; however, it will eliminate firms' ability to differentiate along the gap coverage dimension. Our second method of reducing choice by removing gap covered plans both represents a fundamentally different alternative for reducing choice by a similar magnitude and illustrates the amount by which differentiation along gap coverage is able to soften competition. This latter aspect can help identify the importance of closing the gap, as it pertains to preserving competition in the face of fewer offerings. Finally, the impact of adding (or subtracting) a dimension of product differentiation on consumer welfare is theoretically ambiguous—it can both improve it by adding a characteristic valued by consumers or worsen it by softening competition (e.g., Lancaster, 1975; Dixit and Stiglitz, 1977; Hausman et al., 1994). Therefore, the effect of interventions to reduce plan choice is essentially an empirical question, which our analysis addresses for an important market and a particularly relevant dimension.

To execute our comparison, we first provide evidence on the relative utility (or disutility) that the elderly derive from plan design features such as premium, deductible, gap coverage, etc. By measuring how seniors value these plan characteristics, we can assess whether they view Part D plans as differentiated products. Then, using our demand- and supply-side estimates, we assess the effects on equilibrium premiums and welfare from limiting each firm to its two most popular plans per region (as opposed to the current three) and from removing plans that offer donut hole coverage. In our analysis, we assume consumers are aware of all products in the choice set. This approach allows us to measure, for each regulation strategy, the full *potential* welfare loss from reducing choice, i.e., those that would occur if we reduced choice despite consumers being fully informed. These losses may result from the elimination of plans that consumers value and/or from higher premiums due to reduced competition. Hence, rather than assuming search costs in the model, our approach allows us to bound how high search costs must be in order to justify reducing choice. Importantly, our analysis allows us to determine whether one approach is clearly superior to the other.

Our empirical strategy utilizes discrete choice methods pioneered by Berry (1994) and Berry et al. (1995) to recover structural estimates of parameters of the demand and cost functions for the differentiated prescription drug plans (PDPs). This method is especially appealing because it requires only aggregate data at the plan level, which are publicly available (e.g., plan market shares and characteristics).[2] The estimates from this procedure allow us to measure the value of plan characteristics to consumers, price elasticities of demand for each plan, and the consumer surplus created by the market. We combine our demand system with a Nash–Bertrand assumption to generate equilibrium premiums and quantities, where firms take into account the expected subsidy they receive from the government. We then back out firms' marginal costs and ultimately their producer surplus. The structural nature of the estimates allows us to conduct counterfactual policy experiments to see how prices and welfare would change if we made changes in program design.

Using this approach, we have several key findings. When plans covering the donut hole are removed, the average premiums for other "enhanced" plans rise by 1.6%, although average

[2] No individual-level data are available in the public domain linking individuals to their plan choices.

premiums for nonenhanced plans rise by only 0.2%.[3] We find that consumer surplus and producer surplus fall by about 5.75% and 2.76%, respectively. In addition, the number of seniors enrolled in any PDP drops by 2.9%. In this case, we find that most of the welfare loss comes from seniors substituting for a less valuable option or dropping PDP coverage in favor of the outside option. The premium effect concentrates mostly within the set of closest substitutes, i.e., the remaining enhanced plans.

On the other hand, when firms are limited to two plans in each region (as opposed to three),[4] we find more extreme results. In this case, the average premium rises by about 5.5% and enrollment in PDP plans drops by about 11.7%. Consumer surplus falls by 15.3% and producer surplus falls by 11.34%. In this case, most of the consumer welfare loss happens via premium increases.

The strong contrast in our measurements for these two counterfactuals highlights how differing methods for reducing the number of plans can have substantially different effects on equilibrium prices and welfare. Eliminating plans covering the gap and restricting firms to two plans per region reduces the number of plans by similar amounts: 18% and 21%, respectively. However, the former approach eliminates a key mode of product differentiation. This leaves the remaining plans, which are relatively similar in features, to compete primarily on price. In contrast, restricting firms to two plans per region still allows for all forms of product differentiation, which better enables firms to soften price competition. Although consumers do highly value gap coverage as a plan characteristic, our results strongly suggest that a mandated reduction in the number of plans will have the fewest consumer welfare losses if it is coupled with a restriction on plan features (ultimately restricting product differentiation).

Before discussing implications, we validate the performance of our model out of sample by assessing the impact of a recent major merger between two Part D insurers. We then compare predictions of our model with what actually occurred and find our model performs quite well.

The implications of our findings are several. First, they suggest that offering gap coverage serves as a significant means of differentiation that quite effectively softens price competition between plans. Along these lines, they also highlight the importance of coupling any reduction in plan offerings with a limitation on firms' ability to differentiate plans. In this market, preservation of price competition is important enough to warrant elimination of even a very highly valued product characteristic. Finally, we note that recent legislation has attempted to reduce choice largely along the lines of our first approach (reducing the cap per region per insurer from three to two plans). As our results show, this can lead to notable consumer welfare losses and higher prices, as a significantly smaller number of remaining plans can still differentiate themselves along the same number of dimensions. However, given this is the approach used to reduce the number of plans, our results illustrate the possible merits of concurrent legislation designed to fill the gap for the remaining plans. Filling the gap directly addresses the problem we identify, namely, price competition that is "too soft" among remaining plans due to differentiation along gap coverage, by equalizing all plans along this dimension.

In supplemental analysis, we consider a completely different method of reducing choice, where the government sets a cap on total plans for each region and firms compete to have their plans included in the choice set. Specifically, the plans with the ability to generate the most consumer surplus are granted access to the market. We find that this radically different means of reducing choice via a general cap with ex ante competition can actually increase consumer surplus although reducing the choice set, even absent any reduction in search costs.

Our work does not explicitly model adverse selection, dynamic pricing of firms exploiting switching costs, and the possibility of nonrational choices. These are all interesting avenues for

[3] Enhanced plans are plans that are actuarially more generous than the standard plan design for Part D and for which the government does not subsidize the extra premium associated with the enhancement. One kind of enhancement is to provide donut hole coverage.

[4] We assume the firms drop the plan with the lowest enrollment in 2006.

future research when individual level data become available to researchers. At various points in the article we provide insights about these limitations and their potential impact on our results.

The remainder of the article is organized as follows. Section 2 provides a description of the Medicare Part D market, and Section 3 provides a literature review. Section 4 details our empirical methods, and Section 5 describes the data. Section 6 presents our results, and Section 7 concludes.

2. DESCRIPTION OF THE MARKET

Medicare Part D was signed into law as part of the Medicare Prescription Drug, Improvement and Modernization Act (MMA) of 2003 and went into effect in January 2006. Unlike the Hospital Insurance (Part A) and the Supplemental Medical Insurance (Part B), the delivery of the new benefit is entirely through the private sector. Private companies can provide the new benefit as either stand-alone plans, called PDPs, or they can offer it together with Parts A and B as Medicare Advantage plans (MA-PDs).[5]

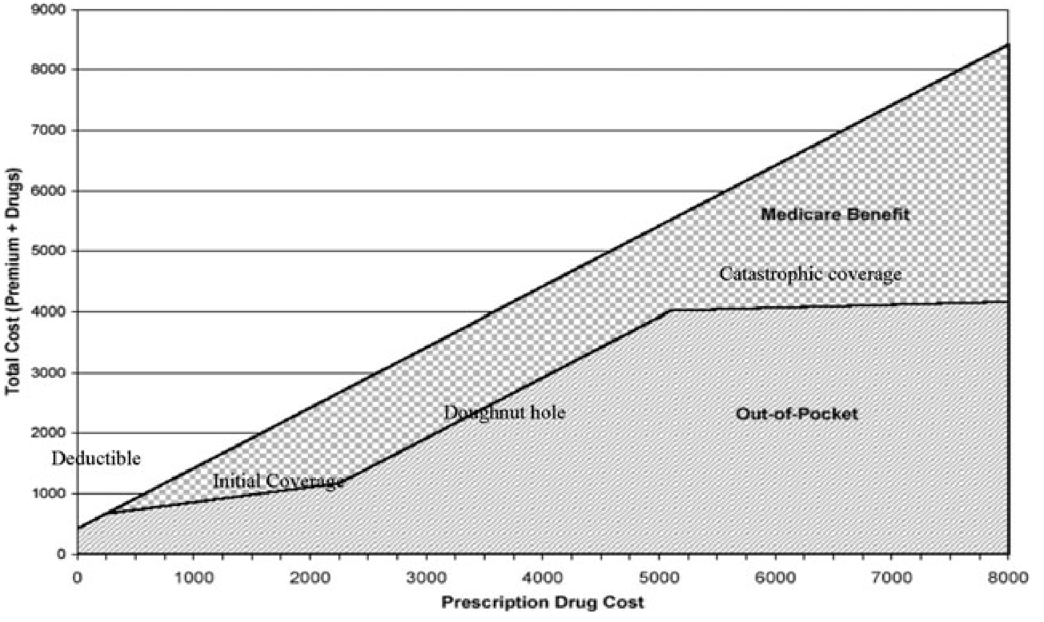
Our study focuses just on the PDP market, leaving MA-PDs as part of the outside option, for several reasons. First, given how fundamentally these options differ, it is reasonable to think that these are not close competing options for many people. It is likely that consumers first choose whether to be in Fee-for-Service (FFS) Medicare or MA, and then choose their drug plans within those confines. Second, prior studies on plan choice have all analyzed the PDP market as a separate market (e.g., Kling et al., 2008; Abaluck and Gruber, 2011) because consumers must be willing to forgo the entire Medicare FFS system in order to enroll in the MA form of drug coverage. Finally, it is also the case that prescription drug coverage cannot be priced separately from the other features of MA plans (on which data do not exist) in the MA-PD market.

Medicare beneficiaries can enroll in PDP plans by paying a 74.5% subsidized premium. Further price reductions happen according to income and dual Medicaid status. The first open enrollment took place from November 15, 2005, to May 15, 2006, during which time the beneficiaries could make decisions about participating in this market. PDP plans enrolled 16.5 million of the 22.5 million Part D enrollees in 2006. In subsequent years, open enrollment takes place from November 15 to December 31 of the previous year. In 2006, a total of 1,429 different insurance plans owned by approximately 70 different companies were available in 34 regions into which the country is divided.[6] In 2007, even more plans entered, with a new total of 1,875 plans across all regions, increasing the relevance of the debate about limiting the number of plans. For 2011, 1,109 plans are available (Hoadley et al., 2010), partly as a result of regulations limiting the number of plans offered by sponsors starting in 2011. Dual eligible beneficiaries (those eligible for Medicaid as well as Medicare) are automatically enrolled in certain low-cost plans, but allowed to switch to other plans.

Although MMA specifies a standard drug benefit, the law allows deviations from that design as long as the modified plans are actuarially equivalent to the standard benefit. To the extent that the plan is more generous in actuarial terms than the standard benefit, the additional premium associated with the extra coverage is not subsidized by Centers for Medicare and Medicaid Services (CMS). Most beneficiaries are locked in to their current plan for a full year, but are allowed to switch plans each open enrollment period at a premium that is community rated. An

[5] Before the enactment of MMA, private plans could also provide the benefits of Parts A and B of Medicare as Part C, later named Medicare+Choice. However, the benefits of Parts A and B have been delivered mainly through the traditional fee-for-service Medicare, with private plans accounting for 12% of the total Medicare enrollees in 2005 (Kaiser Family Foundation, 2006).

[6] The regions are composed of one or more states and were set by the government at the beginning of year 2005. The regions were established to meet the MMA requirement of having no fewer than 10 and no more than 50 regions in all, and to maximize the availability of plans to eligible individuals regardless of health status, with particular attention to rural areas. Most (25) PDP regions consist of one state, six consist of two states pooled together, one consists of three states, and one consists of seven states.



NOTE: The graph above shows how the insurance benefit translates prescription drug costs to total out-of-pocket costs for a beneficiary. The straight line is total cost (premium + drug costs) as a function of drug costs. Therefore, it has slope of 1 and intercept equal to the premium. The kinked line is out-of-pocket cost as a function of drug costs. The kinks represent points where Medicare coverage changes. The difference between these two lines is the Medicare benefit.
SOURCE: Authors depiction of standard plan details announced by CMS.

FIGURE 1

THE DESIGN OF PART D DRUG COVERAGE

exception is made for Medicaid–Medicare dual eligible enrollees, who are allowed to switch plans at any point in the year and who may have to pay a small premium to the extent that they switch into certain higher priced plans.

The standard drug benefit design specified in MMA for year 2006 comprises a deductible of $250 and three coverage zones where the fraction of the additional drug dollar covered by the insurer varies substantially. Figure 1 shows how out-of-pocket drug expenses vary with total drug spending in the different coverage zones of the plan. The straight line has slope equal to 1 and represents the total cost (beneficiary premium plus total drug cost). The kinked line shows the out-of-pocket costs as a function of total drug cost. The vertical distance is therefore the size of the Medicare benefit. After the deductible is exhausted, the elderly are covered 75% for the next $2,000 spent in total prescription drug expenditure (initial coverage zone, ICZ), 0% between $2,250 and $5,100 (so the next $2,850) of total drug expenditure, the donut hole zone, and 95% after the $5,100 threshold (catastrophic coverage zone). Thus, at the point that catastrophic coverage begins, the beneficiary has spent $3,600 out of pocket ($250 in zone 1, $500 in zone 2, and $2,850 in region 3).

The plans offered are differentiated along several dimensions, such as premium, deductibles, gap coverage, number of drugs in the formulary, copay sizes, etc. Insurance companies can deviate in plan design from the standard benefit described above and offer a variety of plans as long as they satisfy certain requirements.[7] For example, an insurer can offer plans with lower or no deductibles and higher coinsurance rates for the ICZ, or offer plans with tiered cost sharing

[7] These are (a) they should provide the same catastrophic coverage as the standard benefit (same cost sharing rule of 5% and same threshold of $3,600 in true out of pocket expenses), (b) the deductible should not be higher than the standard benefit's deductible of $250, (c) assure actuarial equivalency of (i) the value of total coverage (e.g., if they remove the deductible, the cost sharing in the initial coverage zone should be set higher than 25%), (ii) cannot increase

in the initial coverage level as long as the tiered structure is equivalent to the standard 25% coinsurance rate.[8] Private insurers have taken advantage of the ability to offer modified plans, and only 9% of the 2006 plans (containing 22% of PDP enrollees in 2006) followed the standard benefit design. The actuarially equivalent design (same deductible, different cost sharing) was adopted by 21% of plans containing 17.1% of enrollees, although the basic alternative design (smaller deductible with different cost sharing) was selected by 27% of plans containing 44.2% of PDP enrollees.

In addition to benefit designs that are identical or actuarially equivalent to the standard benefit, insurance companies can also offer enhanced plans. These plans become more generous than the standard benefit by including gap coverage, or lower deductible and lower cost sharing, or addition of non-Medicare covered drugs.[9] Gap coverage of generic and/or branded drugs in the donut hole was the enhancement that received the most attention because of the unpopularity of the donut hole in the first place. These enhancements were included in 43% of plans in 2006, containing 16.7% of PDP enrollees. Firms could design up to three benefit packages per region, as long as one of them was standard or actuarially equivalent to a standard plan (Hoadley et al., 2006).

Although we do not model selection in our article, we recognize that the community-rated nature of Medicare plans could lead to adverse selection. One way that the presence of selection could affect calculation of welfare in the Part D market is that insurers constrain the plan choices they make available to guard against selection, leading to reduced welfare. Lustig (2010) finds evidence of this in the case of the MA market prior to Part D. Room for selection in Part D is much less likely than in the MA market because plan rules have been created in such a way that selection incentives are minimized. For example, the risk corridors referred to in footnote 11 below were particularly narrow in our year of study, 2006. Other aspects of the design such as rules about covering all drugs in certain classes and government provision of 80% catastrophic reinsurance past the donut hole also act to minimize selection. Even though selection is limited in scope, we comment later in the article on ways our analysis may be affected if more selection occurs in the scenario of limiting insurers to two plans than in removing gap-covered plans.

To participate in the Part D PDP market, the insurance companies submit bids (separate bids for each region, even if they design just one plan to be offered nationally) stating their expected cost per beneficiary of providing the basic drug coverage. The expected cost is calculated with the understanding that CMS, and not the individual insurer, is responsible for 80% of drug costs that are incurred in the catastrophic zone.[10] This is required by MMA 2003, and is referred to as the reinsurance feature of Part D, which lessens fears of adverse selection among private insurers.[11] CMS also asks plans to separately inform them of the cost of covering an individual if CMS were to not provide this reinsurance, in order to assess the total amount by which CMS

the threshold at which the third coverage zone ends (the end of the donut hole), and (iii) cannot change the threshold at which the third coverage zone starts (start of the donut hole). These details are contained in the 2003 MMA. Also see Duggan et al. (2008) for a description of the Medicare Part D program.

[8] For example, a company cannot offer a plan with initial coverage limit higher than $2,250 (in 2006) that has a higher coinsurance rate above the deductible because this would violate condition (iii) in footnote 7.

[9] All plan formularies must include at least two drugs in each therapeutic category (see CMS, 2007, for details of categories) and must include substantially all drugs in six key therapeutic classes. Plans are also forbidden to design formularies that discriminate against those with costly medical conditions (Hoadley, 2005); there is no evidence of heavy auditing of these requirements, but the threat remains.

[10] This means that only 15% of the catastrophic cost will be paid by the insurance company, as the remaining 5% is the beneficiary's liability by the plan design.

[11] MMA also calls for "risk corridors" to further reduce adverse selection fears and incentives to cream skim. This means plans that have actual costs that exceeded their expected costs (after accounting for the reinsurance feature) by a sufficiently large amount may receive additional payments to compensate for those losses. In the same way, if plans make larger than expected profits due to actual costs being lower than the expected ones, the plans would have to return those extra profits to the government. For years 2006 and 2007, the plans will be responsible for all the profits and losses that are within a band of 2.5% from their expected costs. If the actual costs are bigger (smaller) than the expected costs by more than 2.5% but less than 5% the government will pay (receive) 75% of the amount in that range.

subsidizes the coverage. This reporting is also required by MMA to make sure that CMS's total subsidy to Part D (which includes the subsidy through reinsurance and the "direct subsidy" paid prospectively to the insurer) on average comes to 74.5% of the total cost of providing coverage.

As an example of the bidding process, suppose that there are three plans in the nation, coming in with bids (for reinsured coverage) of $93, $100, and $107 per month. Suppose that the value of reinsurance is 27% (the value assumed in a Congressional Budget Office (CBO) 2004 report); thus their total costs for nonreinsured coverage is $127.40, $136.99, and $146.58, calculated as the earlier cost divided by 1.27. In order for CMS to satisfy the rule that the average plan is subsidized 74.5% by them in the form of reinsurance and beneficiary premium protection, the beneficiary premium must be set at 0.255 * $136.99 = $34.93. In order for the premium of other plans to be set such that it equals the premium of the average plan plus or minus the difference between their and the average plan's reinsured bid (which amounts to $7), the other plan premiums will be set at $27.93 and $41.93 per month.

Ideally, our model of price competition would incorporate all aspects of the above mechanism in price calculations and formulation of firm strategies. However, we are unable to fully replicate this process because we lack data on key components, such as reinsurance payments and the size of enhancements for enhanced plans. Consequently, we postulate that firms submit their bids having in mind the premium the beneficiary will pay as a result of the bidding process, because consumers will make their enrollment decisions based on this premium and the characteristics of the plan. Implicit here is the assumption that firms do not submit bids to strategically alter the ultimate subsidy—an assumption we argue is reasonable in this case due to the large number of plans in each region and hence the very limited ability of one firm to notably alter the subsidy. In later years, firms' bids were incorporated proportional to enrollment, raising the possibility of such strategic bidding, but because we analyze the first year of the program these effects are absent in our supply-side model. Consequently, we believe a Bertrand game with differentiated products, as discussed in Section 5, will capture the relevant features of the game.

We conclude this section by detailing some particularly relevant, recent changes in U.S. health care law. In April 2010, CMS issued final rules on regulation #4085-F. These aim to reduce the extent to which insurers can offer multiple plans that are not substantively different from each other (as part of the three per insurer per region). This went into effect in 2010 for plans offered in 2011. If an insurer submits for approval a benefit structure that is not substantially different from other plans offered by the insurer, it will not be approved. CMS looks for differences in premiums, cost sharing, formulary structure, and benefits offered. When insurers merge, they have two years to reduce redundancies and come under the CMS rule. The aim of this change is to address what CMS believes is confusion caused by having too many plans that seem similar in the market (Federal Register, 2010).[12] Also, for the first time, CMS states that they may consider enrollment in the plan a criterion for whether they will approve the plan the next year. If a plan did not attract "enough" customers in the past, they may not get to offer it again next year.

Briefly, some relevant provisions of the Affordable Care Act of 2010 for Medicare Part D include the following. First, in 2010 a one-time tax exempt subsidy check of $250 was mailed out to those who hit the donut hole. Second, in 2011 a 50% discount on eligible brand name drugs when in the donut hole was implemented with the discounts to be provided by the drug

If the actual costs differ with the expected costs by more than 5% then the government will pay 80% of the amount beyond 5% in the case of losses and receive 80% of the amount beyond 5% in the case of profits.

[12] For example, on p. 19681, the Federal Register states: "some have suggested that a significant number of beneficiaries are confused by the array of choices and find it difficult to make enrollment decisions that are best for them. Moreover, experience has shown that organizations submitting bids under Part C and D to offer multiple plans have not consistently submitted plan benefit designs that were significantly different from each other, which can add to beneficiary confusion. In this rule, we finalize a number of proposals to the way we administer the Part C and D programs to promote beneficiaries making the best plan choice that suits their needs."

manufacturers. Third, from 2013 to 2020, the percentage covered by the government of branded drugs in the donut hole will increase from 0% in 2010 to 2.5% in 2013 and to 25% by 2020. The 50% discount for eligible branded drugs will be on top of that, so that the total percent reduction in price from the sticker price for those in the donut hole will be 75%; thus, the donut hole will be "closed" for branded drugs. The generic drug subsidy by the government will expand from 7% in 2011 to 75% by 2020. Finally, the spending amount that gets one into the donut hole will also increase incrementally (by approximately $10 per year between 2010 and 2020).

3. PREVIOUS LITERATURE

Many recent papers have studied several aspects of Medicare Part D in order to guide future policy. Lakdawalla and Sood (2007) propose and calibrate a dynamic model to study the welfare effects of Medicare Part D, focusing on pharmaceutical innovation. They find that public drug insurance can be welfare enhancing by lowering the static welfare loss coming from the monopoly power granted by patent protection and by encouraging innovation from pharmaceutical firms. Their study provides insights on a separate important policy issue, which is whether the government should be allowed to participate in price negotiations. They find that price negotiation by the government could slightly distort the monopoly price and decrease the deadweight loss from optimal monopoly pricing, and this would not have a negative effect on innovation as long as patent lengths are increased. Their result is consistent with the traditional "long and narrow" dynamic optimal patent. Heiss et al. (2006) surveyed seniors through WebTV devices to study consumers' perceptions and choices of Medicare Part D plans during the open enrollment period. They found that most seniors chose the optimal action of enrolling. This result was expected because, according to their calculations, enrolling in Medicare Part D was immediately beneficial for 81.7% of the population and intertemporally beneficial for 97.5%. With respect to their choice of plan, they found that consumers often chose cheaper plans when more expensive and comprehensive coverage was actuarially favorable.

Kling et al. (2008) conduct an experiment in which they recruit a sample of seniors from Wisconsin, find out their current list of medications taken, provide half with customized information, and compare their plan choices to the other half, which serve as a control group. They find that customized information (data on the prices of drugs under different plans and a recommendation of the cheapest plans for them, based on their current medications) leads the treatment group to select a plan that is cheaper by $104 a year for them in predicted terms than the control group. Whether we should expect this to be zero optimally depends on whether consumers value nonprice features like insurer reputation as well as whether customers should choose an insurance plan only based on current information. Domino et al. (2008) point out that about half of all seniors are likely to have medication experiences over the next 12 months that would have, in retrospect, made another plan appear cheaper than the one that is the cheapest based on current medications.

Other papers that report results of surveys that include seniors post-Part D are Neuman et al. (2007) and Levy and Weir (2007), both confirming that the overall percent of seniors who are uninsured for prescription drugs fell to around 10% in 2006.

Closest in spirit to our work is Town and Liu (2003), who estimate the welfare impact of Medicare Health Maintenance Organizations (HMOs) during the 1993–2000 period. They found big increases in consumer surplus due to the introduction of Medicare HMOs, and a sizable portion of that surplus in the last year of their study (45%) comes from making available prescription drugs to the elderly through these plans. They study the effect of counterfactuals such as what would happen to welfare if more plans were added to the markets and find increases in consumer surplus, stemming mostly from increased price competition. In Medicare HMO markets, whose geographical unit is a county, the number of options available to consumers was quite limited, with the most frequent market structure being monopoly. This article provided early evidence that broad prescription drug coverage for the elderly could be achieved through private managed care plans and that competition in Medicare HMO markets increased consumer welfare. Our work complements theirs by showing that competition enhances consumer surplus under a very different market structure, one with many more competitors. In addition, we show that product differentiation could play an important role when one considers mechanisms for limiting choices.

A primary motivation for our work comes from studies that document the prevailing desire among seniors and other interested parties to see reduced choice in the Part D market. A Kaiser Family Foundation–Harvard School of Public Health poll conducted during the open enrollment period in 2006[13] found that seniors favor simplification,[14] removing the donut hole,[15] and reducing the number of plans available.[16] Only 11% strongly favored keeping the program as is. Rice and Cummings (2010) proposes that CMS "acts as a broker to winnow down the number of choices so that beneficiaries face a small subset of those judged to be best on several dimensions," specifically limiting the number of choices that consumers would face to 10 per region, with 8 being national plans, and 2 being regional or state-only plans. CMS would select these plans from bids submitted by insurers (up to three bids each), so that the 10 choices selected would provide lower-cost, lower-coverage options as well as higher-cost, higher-coverage options. The study then goes on to describe the logistics of three cases where the government has acted as an agent for consumers in selecting the options they face: pension plans for state employees (New York and Ohio), Arizona's Medicaid program, and California's Medicaid hospital contracting.

Lab surveys also find seniors expressing preference for reduced choice. Reed et al. (2008) find that seniors report desiring fewer choices across several domains than younger adults, and that the gap is larger for health care domains (including drug plans). Mikels et al. (2009) find that seniors report lower willingness to pay for increasing the number of choices available for drug coverage plans than younger adults. Both findings are consistent with older adults experiencing decreased decision-making capacity and high search costs. Cubanski (2008) reports that 49% of seniors enrolled in Part D say in the Medicare Current Beneficiary Survey 2006 that there are "too many" drug plans to choose from. Although there are benefits from reduced cognitive loads/reduced search costs when seniors have fewer choices from which to choose their drug coverage, our article's counterfactual exercises quantify the potential welfare losses when certain reductions occur. These losses stem from reduced competition and the fact that eliminating choices risks some consumers losing their most preferred option.

4. EMPIRICAL METHOD

For our empirical analysis, we estimate the structural parameters of the demand and supply sides of the market. The approach follows that in previous literature such as Berry (1994), Berry et al. (1995), Bresnahan et al. (1997), Nevo (2001), Petrin (2002), and Town and Liu (2003).

4.1. *Demand Estimation.* For our demand-side analysis, we estimate demand(s) for differentiated PDPs using aggregate data following the seminal works of Berry (1994) and Berry et al. (1995), henceforth BLP. The approach is as follows. First, we write down an expression for the utility experienced by an individual from purchasing a given Medicare Part D plan as a function of plan characteristics, premium, and unobservables. Given this utility function, we next derive a formula (utilizing simulation) for the market share that should result for a given plan. Market shares represent the outcome of consumer decision making in the aggregate.

[13] Kaiser Family Foundation (2006).

[14] Fifty-one percent of seniors "strongly agree" that the design of part D is "too complicated."

[15] Forty-six percent "strongly favor" spending more government money to remove the coverage gap.

[16] Forty-four percent of seniors "strongly favor" reducing the number of plans.

Each individual is assumed to maximize her utility by choosing among the $J_t + 1$ alternatives for prescription drug coverage available to her in the following way:

$$\max_{\{0,\ldots,J_t\}} u_{ijt} = X'_{jt}\beta^X + \beta_i^{Enh} Enh_{jt} - \beta_i^p p_{jt} + \xi_{jt} + \varepsilon_{ijt}, \tag{1}$$

$$i = 1, \ldots, I \quad j = 0, \ldots, J_t \quad t = 1, \ldots, T,$$

where p_{jt} is the premium of plan j in market t, Enh_{jt} is a dummy variable indicating whether plan j is an enhanced plan, X'_{jt} is a vector of other observable plan characteristics (e.g., deductible), ξ_{jt} is an unobserved (by the econometrician) product characteristic, and ε_{ijt} is a random, idiosyncratic utility shock for individual i for plan j in market t from the distribution $F_\varepsilon(\varepsilon)$. We normalize the utility for the "outside option" ($j = 0$) to zero. The outside option is composed of choosing an MA-PD plan, choosing employer retirement coverage, or choosing not to enroll in any plan.

In the above framework, we allow for individual-specific marginal utilities for price and whether the plan was enhanced (as indicated by the i subscripts on the β's).[17] We follow the standard random coefficients approach by assuming these β parameters are independent draws from $F_\beta(\beta;\theta)$—a set of distributions characterized by θ. A key merit of this approach is that it allows for much more flexible substitution patterns (i.e., cross-price elasticities) and own-price elasticities than more restrictive models, such as the simple logit or nested logit.

Given this formulation for utility, we can derive a formula for each product j's market share in a given market t. Conceptually, this formula calculates the probability that a given individual draws a set of βs and εs such that the utility from choosing product j is at least as high as the utility of choosing any other product. Formally, this is

$$s_{jt}(X_t, p_t, \xi_t;\theta) = \int_{\{\beta_i,\varepsilon_{it} | u_{ijt} \geq u_{ij't} \forall j' \neq j\}} dF_\beta(\beta;\theta)\, dF_\varepsilon(\varepsilon). \tag{2}$$

If we assume that $F_\varepsilon(\varepsilon)$ has the type I extreme value distribution, we can integrate out this component of the above formula analytically, leaving us with

$$s_{jt}(X_t, p_t, \xi_t;\theta) = \int_\beta \frac{\exp\left(X'_{jt}\beta^X - \beta^p p_{jt} + \xi_{jt}\right)}{1 + \sum_{k=1}^{J_t} \exp\left(X'_{kt}\beta^X - \beta^p p_{kt} + \xi_{kt}\right)} dF_\beta(\beta;\theta). \tag{3}$$

A common approach to solving for the above analytical formula for market shares is to assume the βs are draws from independent normal distributions with $\theta = (\mu, \sigma)$, an assumption we make here as well. Unfortunately, this leaves us with no closed form formula for the analytical market shares. However, we can evaluate the above integral through simulation. Specifically, we can take ns[18] draws from the joint normal distribution $F_\beta(\beta;\theta)$ and simulate the

[17] We have estimated versions with more random coefficients, and the parameter values and hence the results from our counterfactual exercises are robust to changes in the number of random coefficients. We prefer the specification with these two random coefficients, as this provides more precise estimates and allows for heterogeneous responses to changes in premia, the strategic variable in our model of supply, and on plan enhancements, which provides more flexible substitution patterns than the nested logit model.

[18] In our estimation the number of simulation draws is 200.

integral using

$$s_{jt}\left(X_t, p_t, \xi_t; \theta\right) = \frac{1}{ns}\sum_{r=1}^{ns} \frac{\exp\left(X'_{jt}\beta^{X,r} - \beta^{p,r}p_{jt} + \xi_{jt}\right)}{1 + \sum\limits_{k=1}^{J_t} \exp\left(X'_{kt}\beta^{X,r} - \beta^{p,r}p_{kt} + \xi_{kt}\right)}. \tag{4}$$

Empirically, our objective is to get estimates for the underlying parameters of this problem, θ, which represent the mean and standard deviation for the distribution of consumer tastes. The typical BLP approach to solving for these parameters is to first isolate the implied product-level shocks (ξ_{jt}) by solving the system of equations

$$S_{jt} = s_{jt}\left(X_t, p_t, \xi_t; \theta\right), \tag{5}$$

where S_{jt} is the observed market share for product j in market t. This system is typically solved using a contraction mapping, and for each market t, it can be represented by the vector $\xi_t(\theta) = s^{-1}(S_t; \theta)$.

With the vector of shocks in hand, we can construct a Generalized Method of Moments (GMM) estimator in the usual way, using appropriately chosen instruments (z_{jt}). Specifically, let $h(z_{jt}, x_{jt})$ be a vector-valued function where we assume $E[\xi_{jt} * h(z_{jt}, x_{jt})] = 0$. Then, having solved for ξ_{jt} as a function of observed market shares and θ, we can create the sample analog of these moment conditions as

$$g\left(\xi\left(\theta\right)\right) = \frac{1}{T}\sum_{t=1}^{T}\sum_{j=1}^{J_t} \xi_{jt}\left(\theta\right) * h(z_{jt}, x_{jt}). \tag{6}$$

For a given weighting matrix W, the GMM estimator is $\widehat{\theta}$ that solves

$$\min_{\theta} Q\left(\theta\right) = \min_{\theta} g\left(\xi\left(\theta\right)\right)' W g(\xi\left(\theta\right)). \tag{7}$$

The above estimation procedure requires one to provide a starting value for θ, evaluate analytical market shares, use a contraction mapping to solve for $\xi_t(\theta)$, evaluate the GMM objective function, $Q(\theta)$, and, using an optimization routine, find the values of θ that minimize the GMM objective function.

To map the above estimation procedure into our framework, we must specify the instruments we will use to construct our moment conditions and ultimately $g(\xi)$. The primary reason we need to find instruments z_{jt} is the concern that price is endogenous in our model. That is, we fear price is correlated with the unobserved characteristic, ξ. To this end, we construct our instruments following the insights provided in Berry et al. (1995) and Bresnahan et al. (1997). Specifically, they illustrate first-order conditions (FOCs) for firms' pricing decisions and note that anything shifting these FOCs could serve as an instrument for price. They go on to note that characteristics of products in a similar group to product j (such as counts and sums of features) could be potential candidates, as these would tend to shift and/or rotate the demand curve for product j.[19] The key identifying assumption in using these instruments is that the unobserved characteristic is mean independent of the observed characteristics. The intuition behind our choice of instruments is that they proxy the degree of competition faced by a plan in the product space. We explicitly list our instruments below, after describing our data.

[19] See Bresnahan et al. (1997, p. S33) for a more detailed discussion of the merits of these types of instrument choices.

4.2. *Supply and Marginal Costs.* On the supply side, we assume firms partake in Bertrand–Nash competition. Specifically, each firm maximizes its profit:

$$\Pi_{ft} = M \sum_{j \in J_{ft}} (p_{jt} - mc_{jt} + subs_t) s_{jt}(X_t, p_t, \xi_t; \theta), \tag{9}$$

where M is market size and mc_{jt} is marginal cost for product j in market t and $subs_t$ is the subsidy. This leads to the following FOC:

$$s_{jt}(X_t, p_t, \xi_t; \theta) + \sum_{j \in J_{ft}} (p_{jt} - mc_{jt} + subs_t) \frac{\partial s_{jt}(X_t, p_t, \xi_t; \theta)}{\partial p_{jt}} = 0. \tag{10}$$

We can invert the system of FOCs to solve for marginal costs as follows:

$$mc = p - \Delta(p, X; \theta)^{-1} s(X, p, \xi; \theta), \tag{11}$$

where mc, p, and s are vectors of marginal costs, premia, and market shares, and $\Delta(p, X; \theta)$ is the appropriately defined matrix of own- and cross-price share derivatives (Petrin, 2002). Once we have estimates for the demand-side parameters, we can directly solve for marginal costs using the above equation and the simulation method described above for calculating market shares and $\Delta(.)$.

Using the estimated parameters of the utility function, we can calculate own- and cross-price elasticities for each product. Further, combining these demand-side estimates with our marginal cost estimates, we can calculate welfare measures and conduct counterfactuals for the choice sets. We describe these procedures, their outcomes, and the robustness of the results in Section 6.

5. DATA

This article uses data on enrollment and plan characteristics of stand-alone Part D plans offered during 2006. Using the first year of data for this analysis has two particular advantages. First, firms had less knowledge of regional demands for this product, reducing the likelihood that product characteristics are correlated with unobserved components of demand, making it less likely that the product characteristics in our model are endogenous. Second, as this is the first time consumers bought this product, there are no switching costs. For subsequent years, these could be relevant (Keating, 2007) and would be difficult to fully capture using aggregate data.

The CMS Landscape file contains basic characteristics of each plan (premium, deductible, coverage during the gap, number of top 100 drugs that are on the plan's formulary or not, etc.).[20] Enrollment data come from the CMS enrollment file for 2006, released in July 2006. This file shows the number of people enrolled in each of 1,415 plans on which we have data on all items needed (with enrollment numbers under 10 suppressed by CMS). Certain plans are designated low-income subsidy (LIS) eligible and were automatically assigned enrollees in the region who were previously qualifying for full Medicaid coverage. However, these plans are also the lowest cost options in the region by definition and thus enjoyed high enrollment from voluntary enrollees, too. Ignoring that a sizable part of beneficiaries are autoenrolled in the lower cost plans would make us overestimate the price sensitivity of consumers. Based on individual-level data from a national Pharmacy Benefits Manager, we are able to calculate the number of autoenrollees per plan, assuming the autoenrollment was random, as it is specified in

[20] This is available for download from [http://www.medicare.gov/medicarereform/map.asp] (access date May 2006).

TABLE 1
VARIABLE DEFINITIONS

Variable	Definition
Premium	Measured in dollars per month
Deductible	Measured in dollars per year (annual deductible)
Form_100	Measures the number of drugs, of the top 100 drugs taken by seniors, that are on the plans formulary
Auth_100	Measures the number of drugs, of the top 100 drugs for seniors, for which the plan requires prior authorization*
Under_20_100	Measures the number of drugs in the top 100 list that have copays of under $20 during the initial coverage zone of the plan
Gapgen	Means that the plan covers generics in the donut hole portion of the plan
Gapgenb	Means that the plan covers generics and brand name drugs in the donut hole portion of the plan

*Prior authorization is a utilization hurdle whereby the physician must call the plan for prior approval before prescribing that drug for the senior. The number of drugs with these requirements rising means less generous coverage.

the legislation. Knowing the number of auto enrollees for each LIS plan, we are able to rescale the market shares to include only those who made an active choice.

In using 2006 data, we capitalize on the advantages from studying a new market. However, a drawback to using early market data is that there may be systematic miscalculations on the part of consumers and producers. In the case of consumers, search costs are possible, but our approach is designed to assess potential welfare losses from alternative regulations when consumers are fully informed. In the case of producers, insurers likely examined plan design strategies because the signing of the MMA in 2003. As one example, they could engage in data collection by participating in the CMS drug discount card program from 2004 to 2006. There is still room for systematic intentional mispricing if firms follow predatory pricing policies the first year. This is a problem that our models cannot address and may exist in any setting when insurers perceive a change (such as when a new firm is contemplating entry or when donut hole provisions are known to phase in over future years), not just in the first year. In fact, the problems of dynamic pricing schemes may be less in the first year because each plan had presumably the same information set and incentives. In future years, dynamic pricing strategies may become more complex as plans differ in existing enrollment and take that into account when responding to new incentives.

Our data set consists of one observation for each of 1,429 plans (of which enrollment data are available for 1,415 plans, as the others enrolled fewer than 10) that were offered in the PDP market in 2006. Of these, we observe all the relevant variables for 1,251 plans. We provide variable definitions and summary statistics in Tables 1 and 2, respectively.

We conclude this section by listing the variables we use as instruments for price. When choosing our instruments, we utilize a very basic division of products into "enhanced" and

TABLE 2
SUMMARY STATISTICS

Variable	Mean	S.D.	Min	Max
Enrollment	9,462.9	23,560.58	10	327,541
Market share	0.015	0.029	0.000	0.245
Premium	38.46	12.25	4.91	73.17
Deductible	74.4	108.8	0	250
Form_100	93.21	6.78	75	100
Auth_100	9.64	9.38	0	44
Under_20_100	61.37	13.18	20	95
Gapgen	0.148	0.36	0	1
Gapgenb	0.025	0.15	0	1

NOTE: Sample size is 1,251 when limited to plans that report all the variables above.

TABLE 3
PARAMETER ESTIMATES OF DEMAND MODELS

	OLS Logit	IV Nested Logit	BLP	
			Mean	S.D.
Constant	−9.26***	−11.075***	−8.94***	
	(1.256)	(1.175)	(1.847)	
Premium	−0.12***	−0.13***	−0.13**	0.02
	(0.007)	(0.014)	(0.065)	(0.065)
Deductible	−0.005***	−0.002**	−0.004***	
	(0.0008)	(0.0009)	(0.001)	
Form_100	0.07***	0.110***	0.07***	
	(0.012)	(0.012)	(0.026)	
Auth_100	0.08***	0.062***	0.08***	
	(0.009)	(0.010)	(0.017)	
Under_20_100	0.002	−0.002	0.002	
	(0.004)	(0.003)	(0.004)	
Gapgen	0.03	0.029	0.04	
	(0.140)	(0.124)	(0.172)	
Gapgenb	4.07***	4.802***	4.12***	
	(0.396)	(0.572)	(0.979)	
Enhanced	−0.75***	0.246***	−0.75	0.27
	(0.171)	(0.089)	(0.534)	(2.279)
GMM Obj. Func.			67.95	

NOTE: All specifications include firm and region fixed effects. We denote *, **, and *** statistically significant at the 10%, 5%, and 1% level, respectively.

"not enhanced." Enhanced plans have added features such as gap coverage or zero deductible, whereas "not enhanced" plans are those that are actuarially equivalent to the basic plan. This basic division can help us better isolate the competitive circumstances for each plan, following the insights in Bresnahan et al. (1997) summarized in Section 4. Hence, for a given market, the instruments we utilize for the price of plan j in group g (enhanced vs. not enhanced) sold by firm f are as follows:

Count of plans in group g
Sum of premiums of other plans in group g (other plans means plan j is excluded)
Count of plans sold by firm f
Count of plans sold by firm f in group g
Sum of deductible of other plans in group g
Sum of form_100 of other plans in group g
Sum of auth_100 of other plans in group g
Sum of under_20_100 of other plans in group g
Sum of Gapgen of other plans in group g

6. RESULTS

6.1. *Economic Measures.* In the third column of Table 3, we present the parameter estimates for our random coefficients discrete choice model described in Section 4 (with region and firm fixed effects).[21] As noted in Section 4, we introduced two random coefficients, one on premium and the other on enhanced.

Using these estimates, we see that characteristics that should add value such as the number of top 100 drugs on the formulary, number of top 100 drugs with copay under $20, and branded

[21] We present results from the first stage regression of price on our instruments in the Appendix.

drugs being covered in the gap have mean β estimates that are positive and significant, which is consistent with them adding value. Higher deductibles and premiums reduce value as expected. These are all attributes that are easily observable and important in choosing an insurance plan. Prior authorization (Auth_100) has a counterintuitive sign that may be due to the fact that formularies that include better and more expensive drugs are more likely to require prior authorization.[22] It is also interesting to note that our estimates suggest seniors find little or no value from coverage of generics in the gap (in stark contrast to coverage of branded drugs).

To help illustrate the robustness of our estimates, we also include parameter estimates from two simpler versions of our model: logit and nested logit (with one nest—enhanced or not enhanced). The results for these models are in the first two columns, respectively, of Table 3. Comparing across models, we see a great deal of similarity in the estimates. For the nested logit specification the parameter on the Enhanced characteristic corresponds to the within nest correlation (Berry, 1994). Our qualitative findings are robust to the use of any of these three model specifications. Given the greater flexibility of the random coefficients model, this is the one on which we focus for our remaining analysis.

We begin our analysis by quantifying the value of the plan attributes to consumers, which is an important exercise given that the design of the plans is heavily influenced by policy. We find that consumers on average value a \$250 decrease in the annual deductible by approximately \$92 per year (250*(0.004/0.130)*12).[23] An extra top 100 drug added to the formulary is worth approximately \$6.50 on average. The coverage of branded drugs appears to be what seniors value the most, with an estimated annual value of \$380.

Using the estimates from our baseline model, we can calculate own- and cross-price elasticities for the different plans using the following formulas:

$$\eta_{jkt} = \frac{\partial s_{jt} p_{kt}}{\partial p_{kt} s_{jt}} = -\frac{p_{jt}}{s_{jt}} \int \alpha_i s_{ijt} (1 - s_{ijt})\, dF_\beta(\beta), \quad \text{if } j = k, \tag{12}$$

$$\eta_{jkt} = \frac{\partial s_{jt} p_{kt}}{\partial p_{kt} s_{jt}} = \frac{p_{kt}}{s_{jt}} \int \alpha_i s_{ijt} s_{ikt} dF_\beta(\beta), \quad \text{if } j \neq k. \tag{13}$$

The first formula is the own-price elasticity; the second is the cross-price elasticity for plans j and k. Given the large number of plans, we can only present a sample of our estimated elasticities. We are able to capture the intuitive result that enhanced plans are closer substitutes to each other than to nonenhanced plans. Table 4 shows a sample of our estimated elasticities for the players with the largest market shares.[24]

The elasticities in the table show that enhanced plans are closer substitutes to each other than nonenhanced plans and vice versa. Our estimates also allow us to calculate important welfare measures of this market. In particular, we can calculate producer and consumer surplus for the current market environment, and then recalculate and compare these measures in our counterfactuals. The formulas for these measures are as follows:

$$PS = \sum_t \sum_j (p_{jt} + subs_t - mc_{jt}) * M_t * s_{jt}, \tag{14}$$

[22] We thank Dan Miller for this insight.

[23] The coefficient on premium is the estimate for a household's marginal utility from money. Therefore, to determine the monetary value of a given characteristic, we must divide its coefficient by the coefficient on premium. Also, our data are monthly, requiring us to multiply by 12 to get annual estimates.

[24] The table containing all the plans is available upon request.

TABLE 4
AVERAGE PRICE ELASTICITIES

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. United AARP	−2.778	0.548	0.562	0.711	0.775	1.026	0.296	0.433	0.571	0.759	0.801	0.488	0.731
2. United MedAdvance	0.051	−3.568	0.060	0.077	0.084	0.106	0.029	0.046	0.061	0.083	0.089	0.054	0.081
3. Memberhealth Basic	0.159	0.180	−3.516	0.232	0.253	0.355	0.101	0.143	0.190	0.256	0.282	0.172	0.257
4. Memberhealth Choice	0.015	0.017	0.017	−4.508	0.025	0.042	0.010	0.013	0.018	0.026	0.029	0.017	0.026
5. Memberhealth Gold	0.011	0.013	0.013	0.017	−4.889	0.035	0.008	0.010	0.015	0.022	0.024	0.012	0.020
6. Humana Complete	0.072	0.084	0.085	0.119	0.146	−6.071	0.040	0.063	0.095	0.145	0.168	0.076	0.135
7. Humana Enhanced	0.172	0.190	0.190	0.232	0.266	0.331	−1.999	0.155	0.205	0.260	0.285	0.177	0.249
8. Unicare Rewards	0.076	0.086	0.088	0.111	0.121	0.150	0.045	−2.874	0.092	0.122	0.125	0.078	0.114
9. Unicare Plus	0.002	0.003	0.003	0.004	0.004	0.006	0.001	0.002	−3.781	0.004	0.005	0.002	0.004
10. Unicare Premium	0.002	0.002	0.002	0.003	0.003	0.005	0.001	0.001	0.002	−4.829	0.004	0.002	0.003
11. PacifiCare Comprehensive	0.006	0.007	0.007	0.009	0.011	0.019	0.004	0.005	0.008	0.011	−5.107	0.006	0.010
12. PacifiCare Saver	0.104	0.117	0.120	0.152	0.165	0.219	0.064	0.092	0.122	0.163	0.174	−3.208	0.159
13. PacifiCare Select	0.004	0.005	0.006	0.008	0.008	0.009	0.002	0.004	0.006	0.008	0.008	0.004	−4.691

TABLE 5
WELFARE AND POLICY EXPERIMENTS

	Baseline	Merger	Gap Plans Policy	Two Plan Maximum
Consumer surplus				
Surplus	1,980,343,388.68	1,945,955,388.24	1,866,531,012.44	1,676,575,822.91
Diff. from baseline		−1.73%	−5.75%	−15.34%
Diff. from baseline−premium fixed			−5.12%	−1.83%
Diff. from baseline−due to new eqm. premia			−0.63%	−13.51%
Producer surplus				
Surplus	1,277,592,635.18	1,292,299,536.11	1,242,258,114.46	1,132,617,178.45
Diff. from baseline		–1.15%	−2.76%	−11.34%
Diff. from baseline−premium fixed			−3.20%	−23.36%
Diff. from baseline−due to new eqm. premia			+0.43%	+12.02%
Enrollment	11,838,069	11,686,956	11,485,345	10,452,922
Premium effects				
Avg. nongap premium	36.20		36.49	
Avg. premium enhanced	39.60		40.23	
Avg. premium nonenhanced	34.18		34.27	
Avg. premium	38.46			40.58
Avg. premium merging firms	33.43	35.02		
Avg. premium nonmerging firms	39.26	39.64		

$$CS = \sum_t 12 * M_t * \int \frac{\ln\left(\sum_{j=0}^{J} \exp(u_{ijt})\right)}{\beta_1^{\mathrm{p}}} dF_\beta(\beta), \tag{15}$$

where the integral is calculated by simulation. Here, M_t is the number of potential customers in market t and $subs_t$ is the subsidy provided in market t.[25]

The first column of Table 5 contains our estimates for these measures for the PDP market as it was in 2006. Using (14), we find producer surplus was \$1.27 billion. Then, using (15), we find that consumer surplus was \$1.98 billion. It is interesting to see that the distribution of surplus between consumers and producers is skewed toward consumers; however, this is clearly due to the large subsidy in the market. We note that the consumer welfare calculations contain only those beneficiaries who made an active choice. The overall welfare provided by PDP plans would be larger if we included the LIS-eligible beneficiaries and the subsidies they receive.

6.2. *Policy Experiments.* Before conducting our two counterfactuals concerning limitation of choice, we seek to validate our model by simulating the impact of the merger of two important participants in this market, United and PacifiCare, whose effect occurred between the first year and second year outcomes. The Department of Justice's Antitrust Division did challenge this merger, but the focus was on the firm's commercial health care plans in Tucson, Arizona, and Boulder, Colorado (Department of Justice, 2005). There were no stated concerns involving the

[25] We calculate the subsidy as (74.5/25.5) times the mean of the premiums (postsubsidy) for the nonenhanced plans. This is because the enhancements are not subsidized by the government. Market size is defined as the sum of those who are enrolled in PDPs in the region plus those who chose the outside option.

markets for Medicare Part D. The merger was ultimately allowed pending divestitures in these two markets.

In this counterfactual, the bids in 2006 are treated as being submitted by two separate firms, and after 2006 they are treated as behaving as one firm.[26] We implement this counterfactual by perturbing the ownership matrix $\Delta(p, X; \theta)^{-1}$ above as in Nevo (2000) and Town (2001). Implicitly, we are assuming that the firms do not change the menu of plans offered when they merge, and marginal costs remain the same, which we believe is a sensible assumption, as the possible cost advantages are not materialized instantaneously. Therefore, the change in ownership structure is the only change to the choice set. As shown in the second column of Table 5, our model predicts that the increase in market power due to this merger would result in a 4.7% increase in average premiums for the merged firms and a 0.9% increase in premiums for other firms. Consumer surplus would decline by 1.73% although producer surplus would increase by 1.15%.

We then use postmerger data to provide some validation for our predictions about premium change. This is the only dimension for which actual data exist for validation. Because our model is static, it is not informative about the nominal premium the merging firms will charge postmerger, but it does provide information about their relative premium with respect to the average market premium. We observe from the 2007 equivalent of our CMS landscape file that the actual 2007 premiums show a 4.0% increase of this ratio, whereas our model predicts a 3.2% increase. These results not only illustrate the effects of a merger of this magnitude on this market, but also demonstrate our model's ability to produce sensible counterfactual results, consistent with economic theory and out-of-sample predictions.

We now present the results for our two policy experiments focusing on the effects of removing plans from the market. The first of these policy experiments involves the removal of plans offering gap coverage.[27] This policy would reduce the number of plans by 18%. We perform this experiment to assess the welfare losses that would have occurred had the government not allowed gap plans to be offered. It also illustrates the consequences of an intervention that not only limits the number of choices, but also decreases product differentiation. As shown in column 3 of Table 5, we find that consumer and producer surplus decrease by 5.75% and 2.76%, respectively.[28] We decompose the total effects by premium and product substitution (including the outside option). We find that, in this counterfactual, the premium response is fairly limited and that most of the loss in both consumer and producer surplus comes from substitution to less preferred plans. This result is consistent with theory. We would expect limited premium responses when a reduction in competitors is coupled with the elimination of a dimension along which products can be differentiated. At the bottom of the table, we show that the effect of this policy on equilibrium premiums is very small for nongap and nonenhanced plans (0.8% and 0.2%, respectively) and even rather modest for remaining enhanced plans (1.5%), which we might think would be most able to increase price after removing those covering the gap. Enrollment is also moderately affected (–2.9%).

The second of these policy experiments explores what would be the effect of a more universal limitation in the number of options. In particular, we consider the effect of restricting firms to a maximum of two plan offerings per region. When imposing this rule in our model, we assume firms keep the plans that had the largest enrollment. This experiment reduces the number of

[26] The merger took place after the 2006 plans bids had been placed and the 2006 offerings decided by CMS. In announcing the merger, the CEO of PacifiCare is quoted as saying: "This merger will enhance our resources, strengthen our product offerings..." (Press release from UnitedHealth, July 6, 2005). The actual merger took place in late 2005, before the 2007 plan bids were due (Cubanski and Neuman, 2007).

[27] Both of these counterfactuals should be interpreted under the assumptions that firms do not change the design of their contracts when one of their own or competitors' product is removed and further exit or entry do not occur if a nest becomes more or less competitive.

[28] Our producer surplus calculations do not include fixed costs. Adding estimated fixed costs from an exercise imposing free entry equilibrium (Bresnahan and Reiss, 1991) only shifts the calculated producer surplus down by a small constant given that the number of participating firms does not change across counterfactual scenarios

plans by 21%. As shown in column 4 of Table 5, we find that this counterfactual has a notably larger impact on both consumer and producer surplus. We find that consumer surplus falls by approximately 15.34% and producer surplus falls by about 11.34%. Enrollment falls by 11.7%. Decomposing the effects, we find that most of the consumer welfare loss comes from premium increases, which on average increased by 5.5% (as shown at the bottom of the table).

The two policies we consider result in similar-sized reductions in plans, but have drastically different effects on welfare and premiums. By eliminating a dimension of product differentiation, the former forces the remaining plans to still compete heavily on price, resulting in minimal consumer surplus losses due to price changes (–0.63%). In contrast, the latter policy still allows firms to offer plans that cover the gap, preserving a dimension of product differentiation that allows firms to significantly soften price competition. Consequently, we observe a significant loss of consumer surplus due to price changes (13.51%). When we calculate the loss in surplus (per capita) for both policy experiments, the former results in a reduction of only $9.61, although the latter results in a loss of $25.66 (approximately two thirds of the average monthly premium). Along with the loss of participation, these losses must be weighed against the expected gain due to reduced search costs when evaluating policies that reduce choice. Our findings strongly suggest that policies designed to reduce the number of plans will have significantly lower welfare costs if they also restrict firms' abilities to differentiate their products.

6.3. *Robustness of the Results*. In this subsection, we discuss the robustness of our findings, particularly with regard to our counterfactual results on choice size—the main focus of our analysis. In particular, we address possible concerns about (i) our model choice and (ii) the validity of instruments. Regarding our model choice, although the BLP model has become the standard for analyzing these types of data, we recognize that there may be concern about welfare measures given the presence of the idiosyncratic error terms (ε'). Specifically, the presence of these error terms increases the dimensions or product differentiation and, therefore, ensures that welfare always increases with the size of the choice set and vice versa. In response to such a concern, we make two points. First, our analysis is a comparison of welfare losses and not a measure of welfare loss per se. Consequently, for similar-sized reductions in the choice set, welfare losses due to elimination of the error terms should be roughly comparable and hence have little impact on the difference. Second, we could, in principle, control for congestion effects along the lines described in Ackerberg and Rysman (2005). This essentially involves including a control for the number of products in a given market when it was observed. In our model, such a control is effectively subsumed in our region fixed effects because the number of products only varies across region in our data.

The validity of our instruments may pose a concern because it could be argued that characteristics of Part D plans (that are used as instruments) are easier to adjust in the short run than, say, automobile characteristics. We again make two primary points to address this concern. First, we note that the reasonable accuracy of our out-of-sample validation in the merger analysis is consistent with a well-specified model. Beyond just helping to validate our instruments, this helps increase our confidence that we are utilizing a well-specified model. Second, as 2006 was the first year this market existed, firms would have had relatively little demand information on which to condition their product offerings that year. Consequently, more than any other year, we believe the assumption of exogenous product characteristics is quite plausible in 2006.

Given that current legislation is designed to *both* remove unpopular plans and close the gap, it is tempting for us to try and use our model to make predictions for this more elaborate counterfactual. However, this counterfactual involves us actually altering existing plans' characteristics and therefore would require us to make adjustments to plans' marginal costs. We could simply estimate a regression-linking estimated costs to plan characteristics, but it is reasonable to believe this relationship will vary by region and likely by firm as well. Consequently, our predicted costs for the adjusted plans will be either extremely noisy or impossible to estimate, making for an uninformative counterfactual.

Finally, we note that we do not model selection in this article, but it could be that despite the features of the market that reduce its scope, insurers may still adjust plan characteristics to avoid perceived adverse selection. If so, welfare may be lower than we calculate in the scenario with insurers restricted to a two-plan maximum, because it leaves room for more selection due to greater product variety than when plan choice is reduced by removing gap covered plans.

6.4. *Discussion and a Possible Alternative.* The above analysis generates insights about recent American health care legislation and some important economics underlying a major health care market. Recent legislation has attempted to reduce choice in a manner similar to our counterfactual of reducing the cap per region from three to two plans. Our results indicate that this change, in isolation, can lead to notable consumer welfare losses and higher prices. The insight here is that, after the change, the market is left with a significantly smaller number of plans that are still differentiated along the same number of dimensions. Given that the American government chose an approach similar to this to reduce the number of plans, our results show the possible merits of its attempt to concurrently fill the gap for the remaining plans. By closing the gap, the government effectively equalizes all plans along this dimension of differentiation. This directly addresses the problem of price competition being "too soft" among remaining plans due to differentiation along gap coverage.

On a broader economic level, our results show that offering gap coverage serves as a significant means of differentiation that quite effectively softens price competition between plans. Interestingly, we find that preservation of price competition is important enough in this market to warrant elimination of even a very highly valued product characteristic when reducing the size of the choice set. As a result, any regulation seeking to reduce plan offerings is likely best served if it is coupled with a limitation on firms' ability to differentiate.

Of course, there are many other ways that the American government can reduce choice in the Part D market, and it is certainly possible that there exist far superior alternatives. We conclude this subsection by briefly considering what might be an ostensibly better approach, but that requires substantially more information from the regulator.[29] In particular, the American government could limit choice by setting a certain cap, X, on the number of plans allowed in each region, and then have firms compete to have their plans included in that set. In an ideal scenario, the government would accept the top X plans as measured by consumer surplus. Firms would choose plan characteristics and prices to submit for government evaluation, recognizing that their plans will only have access to consumers if they rank well in generating consumer surplus.

Our model is equipped to evaluate such a counterfactual if we treat the set of potential plans as given. That is, we fix the characteristics (both observed and unobserved) and the number of plans firms are willing to submit and simply allow them to adjust their prices as they compete to be among the top X plans in a region. A complication of this approach to limiting choice is that there are billions of market structures to be evaluated, as consumer surplus will depend on the combination of plans that is selected.[30] We simplify the problem by observing that the consumer surplus in Equation (15) can be calculated ex ante if the regulator knows the demand for each product and consumers' heterogeneity. Also, if the regulator knows the marginal costs for each plan, the products can be ranked in terms of their potential to generate surplus if they priced at marginal cost. If X plans are selected, the last plan selected should provide at least as much surplus as the surplus that the $(X + 1)$th plan would provide by pricing at marginal cost (call this value S_{x+1}). Proceeding in this way, the regulator can let the selected firms choose their prices with the requirement that at least $S_{x\ +1}$ is provided by each firm; otherwise firm $X + 1$ would have been selected to enter.

[29] We thank a referee for suggesting this counterfactual exercise.

[30] The average number of plans in 2006 is 36.7 plans. If $X = 20$ there are 7.3 billion combinations of plans.

TABLE 6
ALLOWING ONLY PLANS WITH HIGHEST SURPLUS

Number of Plans	Consumer Surplus (Billion)	Producer Surplus (Billion)	Enrollment (Million)
Baseline (36.7 plans)	1.98	1.27	11.83
20 plans	1.98	1.24	11.84
15 plans	2.00	1.17	11.96
11 plans	2.09	0.98	12.42
10 plans	2.10	0.92	12.49
9 plans	2.07	0.90	12.42
5 plans	1.86	0.76	11.65

In Table 6, we report the consumer surplus, producer surplus, and enrollment for varying levels of X, starting with 20. As X declines, consumers lose surplus because they have fewer plans from which to choose, but those losses are initially outweighed by the gains in surplus because firms must compete harder on price to have their plan included. We see that under this mechanism, 20 plans provide as much surplus as the baseline of 36.7 plans on average per region. As X decreases from 20, the competition effect dominates at first, resulting in increased consumer surplus. However, at about $X = 10$, it appears the value of the marginal plan lost is equal to the benefit from the increase in price competition. After $X = 10$, the loss of consumer surplus from losing plans dominates, and so consumer surplus begins to fall overall.

This third alternative method of reducing choice suggests that, when combined with ex ante competition to be among the included plans, reducing choice could actually increase consumer welfare regardless of any reduction in search costs.

7. CONCLUSIONS

This article studied the impact of reducing choice in the Medicare prescription drug insurance program. We used discrete choice methods for aggregate data to estimate the demand for stand-alone PDP plans, where each plan is a bundle of attributes to which consumers attach value. We provided evidence of the relative value of various features of the plan's design. Assuming a Bertrand game with differentiated products, we were able to identify marginal costs for each plan and provide welfare calculations. Our primary analysis focused on two easily implementable and fundamentally different policy experiments concerning reductions in the number of Part D plans, the results of which may help guide current and future policy in the area of choice limitation. The first policy experiment removes plans covering the gap, and the second lowers the maximum number of plans per firm per regions from three to two.

We found that regulating down the number of plans could have a large impact on consumer (and producer) surplus, depending on how the reduction of plans is made. We found that reducing choice will have a notably smaller welfare cost if it is coupled with a decrease in product differentiation. We also demonstrate that our model performs well in an externally verifiable counterfactual exercise, the merger of two insurers in this market.

Each of the policy simulations in our article is relevant for efforts currently underway to reform the Part D program. In one recent development, the number of plans in the Part D market is now reduced because CMS regulations issued in 2010 affecting plans offered in 2011 prevent insurers from offering plans that are not substantially different from that firm's other offerings. Also starting in 2010 are provisions to eventually remove the donut hole. Our work demonstrates the likely importance that this second change occurs concurrently with the first. Beyond the head-to-head comparison of these two ways of reducing choice, we also comment on the welfare implications of a third way that, to our knowledge, is not in the currently advanced policy efforts. Under this scenario, policymakers would restrict the number of choices available in a region to some specified level and select only that many of the top plans submitted, based on expected welfare from models such as ours. Our calculations display how welfare changes according to the number selected and imply that using this regulatory design would increase consumer welfare even if there were no search-cost induced welfare improvements to reduced choice.

As policymakers look for alternatives to reduce the number of plan choices, further research is needed to explore the available alternatives more thoroughly. In particular, further analysis of the benefits and costs of imposing a general limit on choice and having firms compete for the right to enter markets and/or data that better allow for measurement of welfare effects when all plans provide donut hole coverage may be especially compelling.

APPENDIX

TABLE A.1
FIRST STAGE REGRESSION (DEPENDENT VARIABLE IS PREMIUM)

	Parameter Estimate	S.E.
Count of plans in same group	10.446	2.345***
Sum of premiums of other plans in same group	−0.159	0.012***
Count of plans sold by focal firm	0.659	0.911
Count of plans sold by focal firm in same group	0.015	0.455
Sum of deductible of other plans in same group	−0.010	0.001***
Sum of Form_100 of other plans in same group	−0.040	0.022*
Sum of Auth_100 of other plans in same group	−0.117	0.019***
Sum of Under 20 100 of other plans in same group	0.032	0.009***
Sum of Gapgen of other plans in same group	−1.493	0.567***
F-stat: 21.8 (p-value < 0.01)		
$N = 1{,}251$		

NOTE: We denote *, **, and *** statistically significant at the 10%, 5%, and 1% level, respectively.

REFERENCES

ABALUCK, J., AND J. GRUBER, "Choice Inconsistencies among the Elderly: Evidence from Plan Choice in the Medicare Part D Program," *American Economic Review* 101 (2011), 1180–210.

ACKERBERG, D., AND M. RYSMAN, "Unobservable Product Differentiation in Discrete-choice Models: Estimating Price Elasticities and Welfare Effects," *The RAND Journal of Economics* 36 (2005), 771–88.

BERRY, S., "Estimating Discrete-Choice Models of Product Differentiation," *The RAND Journal of Economics* 25 (1994), 242–62

———, J. LEVINSOHN, AND A. PAKES, "Automobile Prices in Market Equilibrium," *Econometrica* 63 (1995), 841–90.

BRESNAHAN, T., AND P. REISS, "Entry and Competition in Concentrated Markets," *Journal of Political Economy* 99 (1991), 977–1009.

———, S. STERN, AND M. TRAJTENBERG, " Market Segmentation and the Sources of Rents from Innovation: Personal Computers in the Late 1980s," *The RAND Journal of Economics* 28 (1997), S17–44.

CENTERS FOR MEDICARE AND MEDICAID SERVICES (CMS), "Medicare Prescription Drug Benefit Manual," Chapter 6, 2007. Available at: https://www.cms.gov/PrescriptionDrugCovContra/Downloads/Chapter6.pdf (last accessed July 28, 2012).

CONGRESSIONAL BUDGET OFFICE (CBO), "A Detailed Description of CBO's Cost Estimates for the Medicare Prescription Drug Benefit," Technical Report, 2004.

CUBANSKI, J., "Knowledge of the Medicare Prescription Drug Benefit: Do Beneficiaries Really Know as Much as They Think They Do?" 2008. Available at: http://www.academyhealth.org/2008/monday/virginiaab/6_9_2008_4_45/cubanskij.pdf (last accessed August 1, 2008).

———, AND P. NEUMAN, "Status Report of Medicare Part D Enrollment in 2006: Analysis of Plan Specific Marketshare and Coverage," *Health Affairs* 26 (2007), W1-W12.

DEPARTMENT OF JUSTICE, "Justice Department Requires Divestitures in United Health Group's Acquisition of Pacificare Health Systems," 2005. Available at: http://www.justice.gov/atr/public/press_releases/2005/213814.htm (last accessed July 28, 2012).

Dixit, A., and J. Stiglitz, "Monopolistic Competition and Optimum Product Diverstiy," *American Economic Review* 67 (1977), 297–308.

Domino, M. E., S. C. Stearns, E. Norton, and W. Yeh, "Why Using Current Medications to Select a Medicare Part D Plan May Lead to Higher Out-of-Pocket Payments," *Medical Care Research and Review* 65 (2008), 114–26.

Duggan, M., P. Healy, and F. Scott-Morton, "Providing Prescription Drug Coverage to the Elderly: America's Experiment with Medicare Part D," *Journal of Economic Perspectives* 22 (2008), 69–92.

Federal Register (2010). Available at http://edocket.access.gpo.gov/2010/pdf/2010-7966.pdf (last accessed July 28, 2012).

Hausman, J., G. Leonard, and J. D. Zona, "Competitive Analysis with Differentiated Products," *Annales d'Economie et de Statistique* 34 (1994), 159–80.

Heiss, F., D. McFadden, and J. Winter, "Who Failed to Enroll in Medicare Part D, and Why? Early Results," *Health Affairs* 25 (2006), w344–54.

Hoadley, J., "The Effect of Formularies and Other Cost Management Tools on Access to Medications: An Analysis of the MMA and the Final Rule," Kaiser Family Foundation Report, 2005. Available at: http://www.kff.org/medicare/7299.cfm (last accessed July 28, 2012).

———, J. Cubanski, E. Hargrave, L. Summer, and T. Neuman, "Part D Plan Availability in 2011 and Key Changes Since 2006", Kaiser Family Foundation Report, 2010. Available at: http://www.kff.org/medicare/upload/8107.pdf (last accessed July 28, 2012).

———, E. Hargrave, J. Cubanski, and T. Neuman, "An In-Depth Examination of Formularies and Other Features of Medicare Drug Plans," Kaiser Family Foundation Report, 2006. Available at: http://www.kff.org/medicare/upload/7489.pdf (last accessed July 28, 2012).

Kaiser Family Foundation, "Chart Pack: Seniors and the Medicare Prescription Drug," 2006. Available at: www.kff.org/kaiserpolls/upload/7604.pdf (last accessed July 28, 2012).

Keating, B., "Switching Costs in an Evolving Industry: Assessing Beneficiary and Firm Behavior in the Medicare Prescription Drug Program," Ph.D. Dissertation, Stanford University, 2007.

Kling, J., S. Mullainathan, E. Shafir, L. Vermeulen, and M. Wrobel, "Misperceptions in Choosing Medicare Drug Plans," Mimeo, The Brookings Institution, 2008.

Lakdawalla, D., and N. Sood, "The Welfare Effects of Public Drug Insurance," NBER Working Paper No. 13501, 2007.

Lancaster, K., "Socially Optimal Product Differentiation," *American Economic Review* 65 (1975), 567–85.

Levy, H., and D. Weir, "Take-up of Medicare Part D and the SSA Subsidy: Early Results from the Health and Retirement Study," Michigan Retirement Research Center Paper No. 2007-163, 2007.

Lustig, J., "Measuring Welfare Losses from Adverse Selection and Imperfect Competition in Privatized Medicare," Mimeo, Boston University, 2010.

Mikels, J., A. Reed, and K. Simon, "Older Adults Place Lower Value on Choice Relative to Young Adults," *Journal of Gerontology: Psychological Sciences*, 64B(4) (2009), 443–6.

Neuman, P., M. Strollo, S. Guterman, W. Rogers, A. Li, A. Rodday, and D. Safran, "Medicare Prescription Drug Benefit Progress Report: Findings from a 2006 National Survey of Seniors," *Health Affairs* 26 (2007), w630–43

Nevo, A., "Mergers with Differentiated Products: The Case of the Ready-to-Eat Cereal Industry," *The RAND Journal of Economics* 31 (2000), 395–421.

———, "Measuring Market Power in the Ready-to-Eat Cereal Industry," *Econometrica* 69 (2001), 307–42.

Perry, M., A. Dulio, and J. Cubanski, "Voices of Beneficiaries: Medicare Part D Insights and Observations One Year Later," Kaiser Family Foundation Report, 2006. Available at: http://www.kff.org/medicare/upload/7605.pdf (last accessed July 28, 2012).

Petrin, A., "Quantifying the Benefits of New Products: The Case of the Minivan," *Journal of Political Economy* 110 (2002), 705–29.

Reed, A., J. Mikels, and K. Simon, "Older Adults Prefer Less Choice than Young Adults," *Psychology and Aging* 23 (2008), 671–5.

Rice, T., and J. Cummings, "Reducing the Number of Drug Plans for Seniors: A Proposal and Analysis of Three Case Studies."

Town, R., "The Welfare Effects of HMO Mergers." *Journal of Health Economics* 20 (2001), 733–53.

———, and S. Liu, "The Welfare Impact of Medicare HMOs," *The RAND Journal of Economics* 34 (2003), 719–36.

The Patient Protection and Affordable Care Act. 2010. PL 111–148. March 23, 2010.

Shrank, W., and N. Choudhry, "Time to Fill the Donuts," *New England Journal of Medicine* 364 (2011), 598–601.