REGULATION OF HEALTH INSURANCE MARKETS

Lessons from enrollment, plan type choice, and adverse selection in Medicare Part D

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Abstract: We study the Medicare Part D prescription drug insurance program as a bellwether for designs of private, non-mandatory health insurance markets that control adverse selection and assure adequate access and coverage. We model Part D enrollment and plan choice assuming a discrete dynamic decision process that maximizes life-cycle expected utility, and perform counterfactual policy simulations of the effect of market design on participation and plan viability. Our model correctly predicts high Part D enrollment rates among the currently healthy, but also strong adverse selection in choice of level of coverage. We analyze alternative designs that preserve plan variety.

Keywords: Medicare; prescription drugs; health insurance demand; consumer-directed healthcare.

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1 Introduction

Health-care systems with mandated health insurance financed from some combination of consumer, employer, and government sources is standard in all developed countries except the United States, where about 18 percent of the non-elderly population is currently uninsured (Gruber, 2008), and many of the insured face financially risky gaps in coverage. The health cost of incomplete coverage is substantial: In comparison with other countries, the United States ranks 25th in the survival rate from age 15 to age 60, which impacts the population of workers and young parents whose loss is a substantial cost to families and to the economy.[1] If the U.S. could raise its survival rate for this group to that of Switzerland, a country that has mandatory standardized coverage offered by private insurers, this would prevent more than 190,000 deaths per year. The elderly in the United States aged 65+ do have universal coverage under the Medicare program, with prescription drug coverage (Medicare Part D) added in 2006. This may explain the somewhat better comparative performance of the United States for seniors, a rank of 14th in life expectancy at age 65. Since the U.S. has a population that at retirement has the poorest health in the developed world, this is a medical accomplishment, but it is very costly – U.S. health expenditures per capita are 50 percent higher than those in any other country.

An important question for health policy in the U.S. is whether starting from the current private markets for health insurance and services and honoring the entitlements of current stakeholders and freedom of choice for consumers, it is possible to achieve essentially universal health insurance coverage at feasible levels of government involvement and total cost. If so, what are the mechanisms for regulation and subsidy that could accomplish this? Some lessons can be drawn from the Medicare Part D program, which provides the Medicare-eligible population with universal access to a subsidized market for non-mandatory standardized prescription drug coverage through government-approved contracts sponsored by private insurance firms; see Bach and McClellan

[1] These and following statistics are based on World Health Organization data for 2006, and U.S. Census data on population by age in 2006.

(2005). This new market is representative of a trend toward "consumer-directed healthcare" that relies on consumer behavior and competition among insurance firms to attain satisfactory allocation of health care resources with limited government regulation, and is one model for more comprehensive reform of health care insurance (see Newhouse, 2004; Buntin *et al.*, 2006; Goodman, 2006; and the references therein).

Overall, Medicare Part D is considered a success story: Despite a rocky start, enrollment rates are high[2], consumers have a broad choice of sponsors, and premiums are lower than anticipated by policymakers and sponsors (Heiss, McFadden, and Winter, 2006, 2007; Goldman and Joyce, 2008; Duggan, Healy, and Scott Morton, 2008). However, as we show in this paper, variety in available levels of coverage has diminished sharply for individual buyers in the first three years of operation of the Part D market. Offerings of plans with the most comprehensive coverage have collapsed, and plans with intermediate coverage are at risk of a death spiral of rising premiums and falling enrollment, a phenomenon predicted for this market by Pauly and Zeng (2004) as a consequence of adverse selection, and observed in other health insurance markets; see Cutler and Reber (1998)[3].

This paper examines the success of the Part D market, and the lessons that can be drawn from it on the broader questions of how to organize and regulate private health insurance markets. We present a structural model of insurance enrollment and plan type choice of a rational, forward-looking consumer in a stylized environment with uncertain future health outcomes. We include key features of the Medicare Part D program: a late-enrollment penalty, a coverage gap, government subsidies, and risk adjustment (see section 3.1 for a discussion of these institutional features of the Medicare Part D market). We calibrate the resulting discrete dynamic decision process with transition probabilities for the state variables (survival, health status, and prescription drug expenditure) estimated from Medicare Current Beneficiary Survey (MCBS) data using a dynamic

[2] In the first year of Medicare Part D, more than 90% of the eligible population obtained prescription drug coverage, either from a Medicare Part D plan or a source with comparable coverage (Heiss-McFadden-Winter, 2006).

[3] Union and employer-provided retiree plans that are coordinated with Part D, and Medicare Advantage plans that bundle drug coverage with other medical services in an HMO-like setting, are not subject to the same selection pressures, and continue to offer a variety of coverage levels. However, health insurance provided under such plans is dropping in the working population, and individual policies for prescription drugs will become more important in the future.

model of health and drug use based on Heiss (2009). Our model correctly predicts high enrollment rates among the currently healthy, and strong adverse selection in choice between standard and extended benefit plans. We also simulate counterfactual scenarios that manipulate the key institutional features of the Medicare Part D market mentioned above, and examine the consequences for access, coverage, and market viability.

To our knowledge, this is the first paper that develops a structural intertemporal model for health insurance decisions that allows for plan types with varying generosity. Most closely related to our analysis of demand in a market modeled after Medicare Part D is a paper by Yang et al. (2009), who analyze the choice of supplemental health insurance among Medicare beneficiaries, their medical care demand, and subsequent health outcomes. With respect to the modeling approach, a paper related to our work is Gilleskie (1998), who analyzes the decisions to visit a doctor and/or to miss work during an episode of acute illness as the sequential choices of individuals solving a discrete choice stochastic dynamic programming problem.

Section 2 of this paper discusses the effect of selection in health insurance markets, and the roles that subsidies and coverage requirements can play. Section 3 describes the new Medicare Part D prescription drug program, reviews the existing literature on its operation, and gives summary statistics on supply and demand for Part D plans with different levels of coverage. In Section 4, we introduce a discrete dynamic decision model of enrollment and plan choice in Medicare Part D. Section 5 contains our estimation and simulation results. In Section 6, we summarize our findings, draw policy conclusions, and discuss avenues for future research.

2 Selection and Health Insurance

Heterogeneity in consumer tastes and needs, and in cost and quality of products, are ubiquitous features of resource allocation. When heterogeneities are publically observable, markets can price, sort, and match these variations efficiently, and product choices made by consumers yield demand signals that foster efficient resource allocation. For example, in a competitive insurance market where neither buyers or sellers have private information that they can use to "cherry pick" or "lemon drop" contracts, *competitive underwriting* which prices insurance contracts on their actuarial value will attract all sufficiently risk-adverse consumers and achieve market efficiency. An essential insurance aspect of these contracts will be inclusion of clauses that limit the ability of the insurer to reprice policies, or restrict or cancel coverage, as a result of subsequent buyer experience. In an efficient market, these clauses will be offered and priced as part of the competitive underwriting process.

Now consider an alternative situation in which consumers have private information on the risks they face, or insurers are restrained from competitive underwriting based on some of the information they can collect on consumers.[4] Then, there may be a gap between the consumer's perceived expected benefits from an insurance contract, and the premium this consumer faces. If consumers recognize and respond to such gaps by switching away from contracts perceived to be unfair, the result is classical adverse selection, which Akerlof (1970) and Rothschild and Stiglitz (1976) show can induce costly and inefficient screening, and market unraveling in which many less risky consumers are unable to obtain insurance at premiums that reflect their expected benefits.

Healthy people appear to be more risk adverse than sick people, and this can offset some of the effects of adverse selection; see Buchmueller et al (2008), Fang, Keane, and Silverman (2006), Finkelstein and McGarry (2003), De Donder and Hindriks (2006), and Cutler, Finkelstein, and McGarry (2008).[5] However, the demonstrable evidence is that current health insurance markets in the U.S. are severely impacted by adverse selection despite this offset – premiums for individuals are much higher than premiums for employee groups where automatic enrollment eliminates selection effects, and many individuals are denied coverage, particularly for pre-existing conditions. Control of adverse selection through the organization and regulation of health insurance markets then has to be a critical component of initiatives to reform and expand the current private health insurance system. The market for Medicare Part D contracts is potentially affected by all the selection problems induced by asymmetric information among consumers, providers, and third-party insurers in health insurance markets (for a comprehensive review, see Cutler and Zeckhauser, 2000).

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[4]For example, insurers may be required to exclude race, gender, or pre-existing conditions from determination of premiums or screening of enrollees, or to include no-cancellation clauses in their policies.

[5] People in poor health may be more tolerant of risk not because they are more risk-adverse, but rather because losses have less life-cycle impact. When mortality risk is high, there is less likelihood of suffering continuing correlated losses and restricted consumption into the future, and hence less need to protect assets.

A number of measures to control adverse selection have been incorporated in the Part D market, and our analysis and simulations will evaluate the effectiveness of these and alternative mechanisms.

3 The Medicare Part D Prescription Drug Program

3.1. Medicare Part D. Before 2006, roughly 25 percent of the U.S. elderly population (age 65 and above) had little or no insurance coverage for their prescription drugs, and 10 percent had annual pharmacy bills exceeding $5600 (Winter et al., 2006). Median per capita income in this population was $15,700 in 2005, and 29 percent of this population had incomes below $10,000.[6] Uninsured prescription drug costs were thus a heavy burden on unhealthy elderly.

The Centers for Medicare and Medicaid Services (CMS) within the U.S. Department of Health and Human Services administer health insurance coverage for older Americans via the Medicare program. The Medicare Modernization Act of 2003 (MMA) was enacted to extend coverage for prescription drugs to the Medicare population. Beginning in 2006, the new Medicare Part D benefit reduced the financial burden of prescription drug spending for beneficiaries, especially those with low incomes or extraordinarily high ("catastrophic") out-of-pocket drug expenses. CMS administers this program, subsidizing outpatient prescription drug coverage offered by private sponsors of drug plans that give beneficiaries access to a standard prescription drug benefit. In the following, we describe those features of Medicare Part D that are relevant for our subsequent analysis of consumer behavior in this market. More details on the Medicare part D prescription drug benefit can be found on the CMS website and in Bach and McClellan (2005).

A number of mechanisms to mitigate adverse selection and assure broad access have been incorporated in the design of the Medicare Part D market. Every insurer in the market must offer a "Standard plan" designed by Medicare that has tightly controlled features and is available to all Medicare-eligible individuals in a geographical area at the same premium. Insurers may offer plans that are actuarially equivalent to the standard plan, and plans with added coverage, but offerings must be approved by Medicare, and the number and features of alternative contracts are regulated to avoid proliferation of plan types. All plans must be open to all eligible consumers. There is an annual open enrollment period, and consumers are free to switch insurers and plan types each year.

[6] U.S. Bureau of the Census, Current Population Survey, 2006, Annual Social and Economic Supplement.

Sponsor's formularies must cover designated therapeutic categories, and some drugs are "protected" and must appear in every formulary. One important feature is a penalty for late enrollment. Individuals who failed to enroll in Part D when they first became eligible (upon enrollment in Medicare A or B), or by the end of the initial enrollment period (May 15, 2006) if that came later, and did not have creditable coverage from another source, faced a late enrollment penalty fee of 1% a month for every month that they waited to join. The penalty is computed based on the average monthly premium of Part D standard plans in a given year. As the analysis of an intertemporal discrete choice model by Heiss, McFadden, and Winter (2007) shows, the late-enrollment penalty provides a strong monetary incentive for consumers to enroll when they first become eligible, rather than wait to join after health problems develop and drug costs rise. This alleviates adverse selection by encouraging the healthy to enroll.

Critical parameters in determining Standard plan benefits are the plan formulary, the beneficiary's annual pharmacy bill for drugs in the plan formulary, the beneficiary's *true out-of-pocket* (TrOOP) payments for these covered drugs and threshold for catastrophic coverage, and the average monthly premium. In the benefits formula, expenditures for drugs not in the plan formulary are *not* counted in the pharmacy bill or in TrOOP payments. Part D premiums are also excluded from TrOOP payments. The Standard Medicare Part D plan had the following benefit schedule in 2006 (standard plan coverage in later years has the same structure, with annual adjustments for inflation in drug prices): The beneficiary had an annual pharmacy bill deductible of $250, and a copayment of 25% of drug costs above $250 and up to $2,250. The TrOOP payment is then $750 for a beneficiary whose pharmacy bill has reached $2,250. The beneficiary paid 100% of drug costs above $2,250 and up to a TrOOP threshold of $3,600; this is referred to as the *coverage gap* or *doughnut hole*. The TrOOP threshold of $3,600 was attained at a drug bill of $5,100. The beneficiary had a copayment of 5% of drug costs above the drug bill threshold of $5,100 where the TrOOP threshold level was achieved; this is referred to as *catastrophic* coverage. Monthly premiums varied with plan sponsor and area, and were publically available to consumers at the CMS Part D website, along with a national average premium determined by CMS.

Heiss, McFadden, and Winter (2007) provide a calculation of the actuarial value of Standard plan benefits, based on a projection by CMS in 2005, the year prior to the introduction of Part D, of the distribution of 2006 drug costs for the full Medicare-eligible population. The 2006 expected drug cost in this population was \$245.03 per month. If enrollment in the Part D Standard plan had been universal, the expected benefit would have been \$128.02 per month, or \$91.13 net of the monthly average premium of \$36.90 anticipated in 2005, and the expected TrOOP cost would have been \$117.01 per month. TrOOP plus premium then represented 62.8% of expected drug cost. Expressed as shares of total expected benefits, reinsurance was at 29.9% and the total subsidy was at 84.2% (corresponding to 74.5% of total expected benefits *plus* administrative costs). The actual monthly average premium of \$32.20 in 2006 was lower than anticipated; this may have been the result of lower drug costs arising from pharmacy benefit management and drug price negotiations by sponsors.

Medicare Part D plans sponsored by private insurance firms may differ from the Standard plan in their premiums and other plan features, provided that their benefits for any drug bill are on average at least as high as those of the Standard plan; see Bach and McClellan (2006, p. 2313). "Actuarially Equivalent" plans have copayment tiers rather than a copayment percentage, while "Basic Alternative" plans have copayment tiers and no deductible. "Enhanced plans" may include gap coverage for generic drugs, or for all formulary drugs. Duggan, Healy, and Scott Morton (2008) describe the Part D market using this CMS classification of plan types. In this paper, we use a somewhat different classification of plans into three types that emphasize differences in level of coverage. Mimicking the terminology of some sponsors, we name these Silver, Gold, and Platinum types. Silver plans include the Medicare-specified Standard plan, and alternatives that are actuarially equivalent and vary only in copayment structure and/or handling of an initial deductible. Our Silver plan benefit schedule (in 2006 prices) is $B_S(D) = 0.75 \cdot \max(0, \min(D - \$250, \$2000)) + 0.95 \cdot \max(D - D_S, 0)$, where D is the annual drug bill at the pharmacy, and $D_S = \$5100$ is the Silver threshold for catastrophic coverage, determined by the drug bill at which the enrollee's TrOOP reaches \$3600. This is the actual Standard plan benefit schedule, and is a good characterization of benefits for all plans in the Silver class. A key characteristic of Silver plans is that they offer no benefits for drug costs in the *gap* $\$2250 < D < T_S$.

The Platinum class offering the broadest coverage is assumed to eliminate the deductible and provide a 75 percent benefit on all formulary drug costs up to an annual drug bill of $D_P = \$14{,}400$, the threshold where the enrollee's TrOOP reaches \$3600 and 95 percent catastrophic coverage starts. The corresponding benefit schedule is $B_P(D) = 0.75 \cdot \min(D, D_P) + 0.95 \cdot \max(D - D_P, 0)$. This is a good characterization of the class of "enhanced" plans with gap coverage for all formulary drugs. The Gold class offering an intermediate level of coverage is assumed to eliminate the deductible and provide a 30 percent benefit on drug costs through the gap, with the benefit schedule $B_G(D)$ = 0.75·min(D,\$2250) + 0.3·max(min(D,D_G)-\$2250,0) + 0.95·max(D-D_G,0), where D_G = \$6589 is the drug bill threshold where the enrollee's TrOOP reaches \$3600 and catastrophic coverage starts. Our Gold plan benefit schedule is chosen to approximate extended plans that cover 75 percent of the cost of generic drugs in the gap, but do not cover brand-name drugs. Generic drugs constitute roughly 40 percent of drug costs when drug bills are between \$2250 and \$6600, leading to the 30 = 0.75·40 percent benefit that we assume in the gap for Gold plans. In actuality, there is variation across sponsors in generic formularies, and variation across consumers in needs for brand-name drugs. As a result, the actual benefits to individuals under plans offering gap coverage for generics can vary considerably. In addition, individuals taking generic gap coverage have a strong incentive to use generic substitutes where possible. Thus, selection effects within the Gold class may be important. We will abstract from this level of detail for study of consumer choice among plan types, and take $B_G(D)$ as a reasonable stylized representation of Gold class benefits. Figure 1 graphs the benefit schedules for the Silver, Gold, and Platinum plans. One feature that will figure in plan type choice is that enrollees in enhanced plans must reach higher drug bills than Silver plan enrollees before they reach the TrOOP thresholds beyond which their copayments drop to 5 percent of their drug costs. Thus, at very high drug bills, the extra benefit from a Gold or Platinum plan rather than a Silver plan is largely dissipated.

The mechanism used by CMS to subsidize Part D plan sponsors determines the premiums for the Standard plan, and affects the cost to sponsors of offering enhanced plans. Key features of the mechanism are established in the Medicare Prescription Drug Improvement and Modernization Act (MMA) of 2003. Detailed descriptions of the mechanism are given in CBO (2004), CMS (2005), Medpac (2006), Simon and Lucarelli (2006), and Heiss, McFadden, and Winter (2007). Basically, the CMS subsidy of plan sponsors has two components, a direct subsidy, paid prospectively, and reinsurance of 80 percent of catastrophic benefits, paid retrospectively. The prospective payments include risk adjustments for the sponsor's enrollee mix that are intended to neutralize adverse selection, and premium subsidies for qualified low-income enrollees. A key feature of the subsidy mechanism is that sponsors submit bids annually to CMS for their anticipated costs of providing standard plan benefits to a representative Part D enrollee, including administrative costs and return on capital, but excluding reinsurance of catastrophic benefits. CMS then processes these bids to produce a national base premium that covers 25.5 percent of the prospective national average total benefits and administrative cost of a representative Part D enrollee (including reinsurance cost), and an associated base direct subsidy equal to the national average bid less the base premium. Premiums for individual plans are then set to the plan's bid less the base direct subsidy. As a consequence, each plan has a premium that when added to the base direct subsidy equals the plan's bid, and the plan bid determines its premium. The principle behind the Part D market design is that competition for enrollees should limit the ability of plan sponsors to profit from increasing their bids, encourage cost-saving, and drive bids toward actual long-run cost. The high overall market subsidy of 74.5 percent of benefit and administrative cost is designed to keep premiums low and induce nearly universal enrollment.

The subsidies described above also apply to enrollees in enhanced plans, and thus appear to be neutral with respect to plan type choice. However, two factors affect the expected benefit cost of enhanced plan enrollees, and the viability of enhanced plans in the market. First, the delays in reaching the thresholds for catastrophic coverage in enhanced plans affect their profitability for sponsors. Under the Gold Plan, the sponsor must cover 30 percent of incremental drug costs between D_S and D_G, and under the Platinum Plan, the sponsor must cover 75 percent of incremental drug costs between D_S and D_P, while if the same enrollee were on the Silver plan, the sponsor would have to cover only 15 percent of incremental drug costs, due to reinsurance. These are reductions in the Medicare subsidy for enrollees in enhanced plans relative to the Silver plan, effectively a net tax that sponsors will pass on to enrollees in higher enhanced plan premiums. However, some enhanced plans qualify for a Medicare demonstration that capitates catastrophic reinsurance to levels that are expected for Standard plan enrollees in a given risk class. This has the effect of reversing the net tax, with sponsors now collecting 25 percent copayments, but liable for only 20 percent of incremental drug costs due to reinsurance, for incremental drug bills between the thresholds. Capitation of reinsurance does have the drawback of giving a sponsor a strong incentive to use its formulary and step therapies to suppress drug use by high-need enrollees, since in the catastrophic region it is at the short-run margin liable for 95 percent of incremental benefit costs. We will assume in our simulations that the demonstration subsidy program applies to enhanced plans, so that in effect the sponsor is relieved of liability for 80 percent of incremental drug costs above the Silver plan threshold of $5100.

Second, the CMS risk adjustment of the direct subsidy, described by Robst, Levy, and Ingbas (2007), begins with a regression equation that can be written schematically as $B = \gamma + RxHCC \cdot \delta + DC \cdot \eta + \varepsilon$, where B is the Standard plan benefit cost, RxHCC is a hierarchical condition codes for health that are related to drug use, DC is a vector of demographic characteristics, ε is a disturbance, and γ, δ, η are coefficients. This model is estimated for a representative sample of the population of persons enrolled in Medicare and eligible for Part D, with the dependent variable scaled so that it averages to one in this population. The risk factor for a sponsor is the average of B - 1 for its enrollees, using fitted B's from the regression, and its net risk adjustment payment per enrollee equals its bid times its risk factor. If the risk adjustment mechanism were perfectly predictive, it would completely neutralize the impact of enrollee risk mix on sponsor benefit cost. In practice, risk adjustment will be only partial, due to classical regression to the mean. Robst (2007) reports that the proportion of variance explained by the regression is around 0.25, which means that there is considerable variation in risks which is not accounted for. In addition, the current Medicare procedure omits past year's drug bill as an explanatory variable, which if included raises the proportion of variance explained to around 0.55. Then, sponsors of continuing enrollees can easily predict winners and losers whose expected benefit cost variations are not removed by risk adjustment. A potential adverse selection problem is that sponsors may modify formularies and tiers using this information to reduce the cost of enrollees who are losers; CMS plans to alter risk adjustment in the future to include past drug use and remove this problem. The effect of risk adjustment on the viability of plan types comes from the fact that enhanced plans attract enrollees with more health problems and higher benefit costs. Because risk adjustment addresses only the Standard plan component of benefits, it does not help compensate sponsors for taking on increased expected benefit costs in the gap, and is not effective in mitigating adverse selection in choice of enhanced plans.

3.2. Part D Demand and Supply, 2006-2009. To motivate our subsequent analysis, we present in this section a few summary statistics on the dynamics of the market for Medicare Part D plans. First, we consider the evolution of plan supply in this market. Official CMS data allow us to classify all Part D plans that have been offered from 2006 through 2009 into the Silver, Gold, and Platinum types defined in Section 3.1 which correspond to the Medicare Standard Plan and equivalents, an enhanced plan with gap coverage for generic drugs, and an enhanced plan with gap coverage for all formulary drugs. Table 1 shows that while the number of plans offered and average premium of Silver plans have remained relatively stable, premiums for Gold plans have been rising sharply and the number of these plans peaked in 2008. The number of Platinum plans offered plummeted in 2007 to half the number offered in the previous year. In 2008 and 2009 there very few plans remaining in this class, and their premiums skyrocketed. A plausible interpretation for these patterns is that sponsors initially underestimated the average benefits paid in Gold and Platinum plans, perhaps because they did not anticipate the full effects of adverse selection, and their subsequent price adjustments toward break-even have been frustrated by further adverse selection.

Enrollment statistics given in panels B and C of Table 1 also show the downward spiral of Platinum and Gold plans. In the universe of persons eligible to enroll in Part D, including disabled persons under age 65, the overall share enrolled in Platinum plans peaked in 2007 at 0.3 percent, and these plans were not a factor in the market in 2008 and 2009. The overall share enrolled in Gold plans also peaked in 2007 at 3.1 percent, and by 2009 had declined to 2.6 percent. *Active deciders*, people aged 65+ who are not enrolled in a Medicare Advantage plan, an employer retiree plan, or other plans such as FEHB or TRICARE that offer automatic drug insurance coverage, and who must choose a stand-alone PDP or no insurance, constitute about 26 percent of the eligible age 65+ population. In this group, the downward spiral appears to be more rapid.[7] In 2007, 31.7 percent of active deciders choose a Gold plan, but by 2009 this share had dropped to 11.1 percent. At the 2009 incremental premium of $41.40 for a Gold plan rather than a Silver plan, there is a relatively narrow band of expected drug bills around the upper end of the gap at which the added benefits from a Gold plan are actuarially favorable – bills below this range will not produce benefits that exceed the added premiums, and bills above this range are unattractive because the delay in onset of low catastrophic coverage copayment rates due to exclusion of the incremental premium from the TrOOP calculation has the effect of recovering all additional Gold plan benefits from persons with very high drug bills.

[7]The enrollment statistics for active deciders utilize data from the Retirement Perspectives Survey (RPS), a national sample of Medicare Part D eligible individuals surveyed in four waves between 2005 and 2009 using an internet panel format. This panel may be affected by relatively small sample sizes, the questions used to elicit plan choices and financial responsibility for premiums, and aging and losses from attrition and death over the life of the panel; see Heiss, McFadden, and Winter (2006, 2007, 2009). In particular, the high share of Gold and Platinum plans in 2007, and the uptick in the share of uninsured in 2009 may be sampling artifacts.

Thus, only people who have drug bills in this narrow range, or who are extremely risk averse or mistaken in their perceptions, are likely to find Gold coverage attractive in the future. It is possible this group will be sufficient to sustain a small market for Gold plans, but these plans will not be actuarially acceptable for the bulk of the elderly population.

Table 2 classifies Retirement Perspectives Survey respondents in 2006, 2007, and 2009 by enrollment and plan choices versus demographic, socioeconomic, and health variables. Choice variations with age, gender, education, and income are not statistically significant, perhaps due to small sample sizes. There is a marginally significant tendency for people with low income and education to more often choose no insurance or the basic Silver plan, even though this group is on average sicker, and should benefit more from more generous coverage. Evidence that adverse selection is responsible for the downward spirals of Gold and Platinum plans is provided by the panels in Table 2 giving coverage choices versus number of prescriptions used, prior year drug bills, and self-rated health status (SRHS). Individuals enrolled in Gold and Platinum plans have above average 2005 pharmacy bills, and therefore above average expected benefits in 2006, while there is no significant difference between the pharmacy bills of those who were not enrolled and those who were enrolled in Silver plans. These facts suggest that adverse selection was not important at the enrollment stage, probably as a result of the risk adjustment and statutory mechanisms in place to mitigate selection, but was important for choice of plan type. We will explore this aspect of adverse selection in the reminder of this paper.

3.3. Related Literature. Duggan, Healy, and Scott-Morton (2008) give a comprehensive review of the Medicare Part D prescription drug program. In the remainder of this section, we review selected recent papers that are directly related to the present paper.

Levy and Weir (2008, 2009) use data from the 2004 and 2006 waves of the Health and Retirement Study (HRS) to estimate the extent of adverse selection into Part D and the impact of Part D on medication use and out-of-pocket spending. They conclude that there was substantial adverse selection into Part D. Among Medicare beneficiaries with no drug coverage in 2004, those with high use and/or spending in 2004 were most likely to be enrolled in Part D in 2006. Many of those who remained without coverage in 2006 reported that they did not use prescription drugs, and the majority had relatively low out-of-pocket spending. These results are in line with findings by Heiss, McFadden, and Winter (2006, 2007, 2009).

Levy and Weir (2008) report that the use of prescription drugs did not change dramatically in response to Medicare Part D.. They conclude that the Part D program has experienced adverse selection but not moral hazard. Lichtenberg and Sun (2007) also investigate the effect of Medicare Part D on prescription drug use and out-of-pocket costs of eligible seniors. Using data on prescriptions filled by a large retail pharmacy chain during the period September 2004–December 2006, they estimate that Medicare Part D reduced user cost among the elderly by 18.4 percent, increased their use of prescription drugs by about 12.8 percent, and increased total U.S. usage by 4.5 percent in 2006. Lichtenberg and Sun estimate that every seven prescriptions paid for by the government crowded out five other prescriptions and resulted in only two additional prescriptions used. Similarly, Yin et al. (2008) find that the Medicare Part D prescription benefit resulted in modest increases in average drug utilization and decreases in average out-of-pocket expenditures among Part D beneficiaries. Using data from a random sample of pharmacy customers who were beneficiaries of the program after the enrollment deadline, they estimate that the drug benefit saved beneficiaries about $9 a month and gave them an extra 14 days of pills, on average. From a public health policy perspective, an important related issue is whether the introduction of Medicare Part D has reduced cost-related medication nonadherence, i.e., whether the number of individuals who do not (re-)fill their prescriptions because they can't afford it has gone down as a result of Part D. Madden et al. (2008) conducted surveys among of the population eligible for Medicare Part D before and after its introduction and found evidence for a small but significant overall decrease in nonadherence. However, they did not find a net decrease in nonadherence among the sickest beneficiaries, who continue to experience higher nonadherence rates; see also Levy-Weir (2008).

Several papers study enrollment and plan choice decision process in more detail. Heiss, McFadden, and Winter (2007, 2009), using their RPS internet survey data, as well as Levy and Weir (2009), using HRS data, conclude that Medicare beneficiaries seem to have been able to make economically rational decisions about Part D enrollment (but not necessarily plan choice) despite the complexity of the program. Nevertheless, there is also evidence that the complex details of Medicare Part D are poorly understood by seniors. For instance, Hsu et al (2008) conducted telephone interviews with a stratified random sample of beneficiaries of a large Medicare Advantage plan aged 65 years or older. They found that respondents had limited knowledge of cost sharing rules, including awareness of the coverage gap, gap start and end amounts, and drug cost sharing before, during, and after the gap. A related issue is whether enrollees have picked the best available option given a level of plan generosity (say, within the class of "enhanced plans"). Early in this discussion, Frank and Newhouse (2007) argued that a set of standardized plans should be created within Part D and that new participants should be automatically enrolled in a plan but allowed to opt out. Evidence that has emerged in the meantime appears to supports their view.

Kling et al. (2008) investigate sub-optimal plan choice from another viewpoint; their analysis is motivated by recent models of individual misperception of prices. They present results from a randomized experiment conducted in the open-enrollment period at the end of 2006 which gave individuals an opportunity to switch plans. One group of seniors enrolled in Medicare drug plans was presented personalized information on the potential cost savings from changing to the lowest cost plan while another group received information about how to access the Medicare website, where this same information was available. The intervention group plan-switching rate was 28 percent, while the comparison group rate was 17 percent. Average predicted costs for 2007 were lower for the intervention group as a whole and lower for those potentially affected by the intervention.

Abaluck and Gruber (2009) analyze plan choice accounting for the wide array of Part D options available within a level of plan generosity, using a data set of prescription drug claims matched to information on the characteristics of choice sets. They document that the vast majority of elders are choosing plans that are not on the "efficient portfolio" of plan choice in the sense that an alternative plan would have offered better risk protection at a lower cost. Their analysis suggests that individuals place much more weight on current plan premiums than on expected out-of-pocket costs. Further, individuals appear to place almost no value on variance reduction.

Also related to the issue of whether consumers can make well-informed choices among a large number of plans available to them, Lucarelli, Prince, and Simon (2008) study the welfare impacts of limiting the number of Part D plans based on a joint estimation of plan supply and demand. They assess the effects on equilibrium premiums and welfare of reducing product differentiation and of reducing the maximum number of plans each firm can offer. Lucarelli et al. find that implied search costs would have to be at least two thirds of the average monthly premium in order to justify a regulation that allows only two plans per firm. This number would be substantially lower if the limitation in the number of plans were to be coupled with a decrease in product differentiation (e.g., by removing plans that provide coverage in the gap).

4. A Structural model of Part D enrollment and choice of plan type

To understand adverse selection and its effect on the workings of the market for Part D insurances plans under different government interventions, we develop a structural model in which individual enrollment and plan choice are related to features of the market.

4.1. the Consumer's Decision Problem. Let $\boldsymbol{D}_t$ denote the set of choice alternatives for age t, including different Part D insurance plans and the non-enrollment option. In our application, $\boldsymbol{D}_t$ = {0, 1, 2} with the indices corresponding to None, Silver, and Enhanced (Platinum). Individuals who are alive at the start of the year in which they are age t make a choice d_t from $\boldsymbol{D}_t$ to maximize their expected present value of utility over the remainder of their life, given information available at the time,

$$\sum_{j=t}^{100} \beta^{j-t} \boldsymbol{E}_t\Big(s_j\, U_j(w - c(d_j,b_j,y_j) + \delta(d_j,d_{j-1}),h_j,x)\Big),$$

where β is a discount rate, $\boldsymbol{E}_t$ denotes expectation at age t, s_j is an indicator that is one if the individual is living at the end of the year in which they are age j and zero otherwise, b_j is current annual drug bill, and y_j is an indicator of late enrollment penalty status, equal to the number of years the individual has been eligible for Part D but has not enrolled. The period-specific utility U_j at age j depends on current consumption (measured in thousands of dollars per year), which equals permanent income w, less the sum of out-of-pocket drug costs and drug insurance premiums, $c(d_j,b_j,y_j)$, plus the consumption equivalent of plan-specific tastes and switching costs, $\delta(d_j,d_{j-1})$.[8] The utility U_j may also depend on health status h_j and on a (time-invariant) vector x of individual characteristics such as race, gender, age in 2006 when the Part D market opened, and indicators of socioeconomic status (e.g., education, home ownership, wealth bracket) in the year the consumer first became eligible for Medicare. The expectation $\boldsymbol{E}_t$ may also depend on x. The consumer receives zero utility in the years of death and

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[8]Interpret $\delta(d,d)$ for $d > 0$ as a summary of attributes of plan d other than its net cost schedule, such as convenience, and normalize $\delta(0,0) = 0$. Interpret $\delta(d,d_{-1})$ as a summary of attributes that also incorporates plan switching costs when $d \neq d_{-1}$. For example, $\delta(d,0)$ - $\delta(d,d)$ is the cost of switching from the (initial) state of no insurance to plan d.

beyond, which corresponds to an assumption that deaths occur early in a year, before there is an opportunity to accrue a part-year utility. We assume that there is no utility of bequests; this is consistent with an assumption that permanent income w is a single-life annuity. We also assume that the consumer is an individual utility-maximizer, without constraints or utility related to the welfare of other household members. We assume that 100 is the maximum attainable age.

This model of the consumer's decision problem has some significant limitations. First, it assumes that utility is intertemporally additive and at the same time captures risk preference through an expected utility structure; this structure is difficult to reconcile with the theory of intertemporal risk preferences, particularly when the consumer faces both small scale and large scale risks; see Epstein and Zin (1989), Rabin (2000). Second, the model ignores the important influence that household welfare and joint maximization of household members may have on individual insurance decisions. Third, life cycle consumption and savings decisions are simplified by our assumption that the consumer has a fixed level of permanent income w, and absorbs all current shocks in out-of-pocket drug costs in current consumption, rather than adjusting assets to smooth drug cost shocks over time. This is consistent with the finding that consumers tend to undersmooth consumption, absorbing most current income shocks through adjustments in current consumption rather than through changes in assets; see Deaton (1992). However, the assumption is not plausible when medical costs reach catastrophic levels that can be paid only through spend-down of assets, and it leaves out the complex but potentially important interaction of health expenditures, mortality risk, and asset management over remaining life.

In addition, limits on data currently available require us to simplify the model by omitting the dependence of period-specific utility on health status, and excluding plan-specific and switching effects. In fact, health may affect the marginal utility of consumption and the degree of risk aversion. For example, people in poor health may be restricted in their range of consumption activities, reducing the marginal utility of consumption. Use of palliative, preventative, and therapeutic prescription drugs is a consumer decision that may influence both period-specific utility and the evolution of health, and one would expect drug utilization to depend on incremental out-of-pocket cost, and on consumer expectations on drug efficacy for current and future health. For example, Goldman et al (2004) finds for some preventative drugs that an increase in use induced by lower out-of-pocket cost reduces total lifetime medical costs by reducing hospitalizations. Full modeling of the causal links from prescription drug choices to future health consequences, and study of how consumers take these links into account in their insurance choices, may become feasible in the future when Medicare Part D claims data is made available to researchers.

In this paper, we model prescription drug coverage solely as insurance against the financial risk of developing a need for medications. Omitting the feedback from drug utilization to health is a reasonable approximation if individuals do not take into account the effect of plan choice on effective costs and use of drugs, and thereby on subsequent health and life expectancy. Studies of intertemporal decision-making suggest that humans lack nuance in their reckoning for future risks; see Prelec and Loewenstein (1991, 1992), Frederick, Loewenstein, and O'Donoghue (2002), and Loewenstein and Elster (1992). CMS's Part D "Plan Finder" encourages consumers to compare plans based solely on benefits calculated for current drugs, and does not dwell on future risks, and marketing by plan sponsors has the same focus; see Domino et al (2007). Then, enrollees are unlikely to exhibit much sensitivity to the future health consequences of variations in drug utilization induced by level of coverage. We believe this justifies our approximation. However, future studies of the feedbacks from utilization to health are a research priority for understanding the overall social welfare consequences of health insurance policy. Even without the feedback from drug utilization to health outcomes, there will be a correlation of survival and drug expenditures induced by unobserved health status, so that expectations have to be taken using the joint distribution of these two random variables; e.g., developing a cancer will dramatically increase both subsequent drug needs and the mortality risk. We take this into account by developing and estimating a joint model of health dynamics, drug use, and mortality.

4.2. Health and Drug Dynamics. Given our assumption that when individuals make their enrollment and plan decisions, they consider the financial consequences only, and disregard potential feedback effects from the insurance choice to health and mortality, we can specify a model of health and drug use dynamics and mortality that does not depend on insurance coverage. Due to the late enrollment penalty, a rational enrollment decision today must take into account all future consequences. A rational individual therefore has to form expectations for the future evolution of health, drug needs, and mortality. Plan choice for enrollees, on the other hand, does not have to be farsighted if plan switching costs are absent – only pharmacy bill risks in the coming year will then matter for choice of coverage level.

Assume that in addition to observable characteristics of an individual x, survival status s_t, late enrollment penalty status y_t, and independent random shocks, self-reported health r_t (with categories j = 1,...,5 respectively for excellent, very good, good, fair, poor), drug use b_t (equal to the annual pharmacy bill), and mortality m_t (equal to zero if alive, one otherwise) are all driven by the individual's health state h_t, a variable that is not observed directly. We interpret h_t as an individual's *frailty* relative to the cohort with the same observable covariates x, and normalize it at age 65 to have a standard normal distribution, independent of x. We assume that h_t evolves as age increases according to a stationary AR(1) process $h_t = \rho h_{t-1} + \sqrt{1-\rho^2}\,\nu_t$, where ν_t is standard normal and ρ is the serial correlation. The survival indicator satisfies $s_t = (1 - m_t)s_{t-1}$, with $s_t = 0$ an absorbing state after which none of the variables r_j, y_t, or m_j are observable. The distribution of h_t among survivors at ages above 65 will be shaped by selection. The enrollment status indicator advances by one for each year past 65 in which the consumer is not enrolled in a prescription drug plan, so that $y_t = y_{t-1} + \mathbf{1}(d_t=0)$.

Conditional on a sequence $\{h_1 ,..., h_T\}$ and the covariates x, all outcomes $\{r_1 ,..., r_T, b_1,..., b_T, m_1 ,..., m_T\}$ are assumed to be mutually independent. We specify parametric models for these probabilities. Denote the CDF of a logistic random variable z by $\Lambda(z)= 1/(1 + \exp(-z))$. We specify the conditional mortality risk as

$$\Pr(m_t = 1 \mid x, h_1 ,..., h_T) = \Lambda(x\kappa_m + \lambda_{tm} + h_t\gamma_m),$$

where κ_m, λ_{tm}, and γ_m are parameters, with λ_{tm} (which in general may depend on x) determining age-specific mortality rates given consumer characteristic x and relative health h. For self-rated health, we specify for j=1,..,5

$$\Pr(r_t = j \mid x, h_1 ,..., h_T) = \Lambda(\theta_{jr} + x\kappa_r + \lambda_{tr} + h_t\gamma_r) - \Lambda(\theta_{j-1,r} + x\kappa_r + \lambda_{tr} + h_t\gamma_r),$$

where κ_r, λ_{tr}, γ_r and θ_{jr} are parameters, with $\theta_{0r} = -\infty$ and $\theta_{5r} = +\infty$. Drug bills are discretized into B = 12 categories described in Table 3. The conditional outcome probabilities for j = 1,..,12 are

$$\Pr(b_t = j \mid x,h_1 ,..., h_T) = \Lambda(\theta_{jb} + x\kappa_b + \lambda_{tb} + h_t\gamma_b) - \Lambda(\theta_{j-1,b} + x\kappa_b + \lambda_{tb} + h_t\gamma_b),$$

where κ_b, λ_{tb}, γ_b, and θ_{jb} are parameters with $\theta_{0b} = -\infty$ and $\theta_{12,b} = +\infty$. Heiss (2009) presents a similar model for health and mortality without prescription drugs and shows that it captures well the evolution of these variables.

We estimate this model using the method of Heiss (2008) and data from the Medicare Current Beneficiary Survey (MCBS). A detailed description of this data set and the sample we use for our estimation can be found in the Appendix. In Table 4, we report the parameter estimates. The latent health component is highly correlated over time, with estimated yearly correlations of 0.97 for males and 0.96 for females, but both parameters are highly significantly smaller than one. This implies that ten years after a health shock, 66 percent ($= 0.96^{10}$) of it is still present. The latent health component highly significantly affects all three outcome equations, leading to contemporaneous and intertemporal correlation of self-reported health status (SRHS), drug use, and mortality. High education is associated with better SRHS, reduced drug use, and lower mortality. Health status varies with race, with non-whites reporting worse SRHS, non-white females using less drugs, and the mortality rates slightly elevated for non-white males relative to white males.

4.3. Optimal Insurance Choice Given Health and Drug Dynamics. We will assume that rational individuals make their enrollment and plan choices employing expectations regarding current and future pharmacy bill risks that are consistent with our estimated model for health, drug needs, and mortality. When making a choice for age t, individuals are assumed to know their current health status h_{t-1}. For the calculations, we discretize latent frailty, $h_t \in \boldsymbol{H} = \{\Phi^{-1}(0.5/R), \Phi^{-1}(1.5/R), ..., \Phi^{-1}((R-0.5)/R)\}$, with R=1000 nodes, where $\Phi^{-1}()$ denotes the inverse CDF of the standard normal distribution.

Using the notation of Section 4.1, assume a constant absolute risk aversion (CARA) single-period utility function of consumption,

$$u(w-c(d,b,y))) = [1 - \exp(-\alpha(w-c(d,b,y)))]/\alpha = [1 - \exp(-\alpha w)\exp(\alpha c(d,b,y))]/\alpha.$$

A risk-adverse individual will have $\alpha > 0$, while an individual who is risk-neutral will have $\alpha = 0$ and period-specific utility $u(w-c(d,b,y)) = w - c(d,b,y)$. The CARA period-specific utility is also well-defined in the case of risk-affinity, $\alpha < 0$, so preferences in this range are allowed.

The decision problem corresponds to a finite horizon Markov decision processes and can be solved by backward recursion, see Rust (1994). First, consider the decision for the final age 100, made if the consumer is alive at age 99 and knows her health status h_{99}. Expected utility given plan choice d, previous health status h_{99}, and number of years previously uninsured y_{99} is

$$U(d|h_{99},y_{99}) \;=\; \sum_{h\in\boldsymbol{H}} Pr(h_{100}=h|h_{99})Pr(m_{100}=0|h)\sum_{b=1}^{B} Pr(b_{100}=b|h)\,U(w-c(d,b,y_{99}))\,.$$

Individuals maximize this expression by choosing the best insurance state $d^*_{100} \in \boldsymbol{D}_{100}$. This yields the value function for the final year of life, $V_{100}(h_{99}, y_{99}) = \max_d \mathrm{U}(\mathrm{d} \mid h_{99}, y_{99})$. Now suppose that by backward induction one has reached the decision at an age t < 100. The value function to be maximized is the expected discounted utility value over remaining live given optimal decisions in the future. Given health status h_t and insurance status y_t, the value function $V_{t+1}(h_t, y_t)$ is available from previous calculations. Choosing the best alternative for age t given information available at t-1 then yields the value function

$$V_t(h_{t-1},y_{t-1}) \;=\; \max_d\sum_{h=1}^{H} Pr(h_t=h|h_{t-1})Pr(m_t=0|h)\left[\sum_{b=1}^{B} Pr(b_t=b|h)U(w-c(d,b,y_{t-1})) \;+\; \beta V_{t+1}(h,y_{t-1}+\mathbf{1}(d{=}0))\right],$$

with a maximand d^*_t. The backward recursion is carried back to the age of initial eligibility for each exogenous x, determining the optimal policy function at each age t for each of the finite number of possible states $\{h_{t-1},y_{t-1}\}$. The optimization model depends on the coefficient of risk aversion α and the discount factor β; these are varied parametrically in our simulations.

5. Simulation results

We use the dynamic decision model described in the previous section to simulate choices of a population of individual "active deciders" in a stylized market for Medicare Part D plans. We assume that this market offers a large number of identical plans in each of two types, Silver plans that are actuarially equivalent to the Medicare Part D Standard plan, and Platinum plans that eliminate the gap. We assume that Silver plans have the Standard plan's benefit schedule, with a deductible and a coverage gap, while the Platinum plan has no deductible, 75% coverage up to its drug bill catastrophic threshold of $14,400, and 95% coverage above that value. We abstract from formulary restrictions, and assume that the plans offered in our hypothetical market cover all drugs. We omit the intermediate coverage plans previously labeled "Gold" that cover some generic drugs in the gap, but not brand-name drugs, and assume they are absent from the market. These are clearly substantial simplifications relative to the actual Part D market, but they provide a clear contrast in plan types that allows us to draw conclusions on the impact of adverse selection on the viability of enhanced plans.

Individuals differ by gender, age, race, education, and current level of relative health, h_0. For each combination of these characteristics, we simulate optimal decisions (enrollment and plan type choice) by backward induction given premiums for the plan types and the institutional features of the market. The government interventions we analyze are (i) the number of plan types and their payment schedules, (ii) the late-enrollment penalty, (iii) premium subsidies, and (iv) risk adjustment; the scenarios we construct in these four dimensions we will be described below in more detail. We aggregate the simulated optimal decisions using the population distribution of the characteristics of active deciders to infer the distribution of drug expenditures by enrollment and plan type status, given premiums. These distributions together with the institutional features determine the profits of the plan sponsors, again given premiums. The plan sponsors' profit is given by the difference between premiums collected and drug costs reimbursed, plus subsidies and risk-adjustment payments specified in the scenario. We abstract from administrative cost and any cost reductions sponsors can achieve by negotiating drug prices with the pharmaceutical industry. Assuming a competitive market, the equilibrium will be defined by zero profits. For given institutional arrangements, we can in particular determine whether a zero-profit premium exists.

In our simulations, we fix the discount factor at $\beta = 0.95$.[9] We also present results for perfectly myopic preferences ($\beta = 0$); assuming that plan switching is costless, this is equivalent to an institutional scenario that does not have a late-enrollment penalty. To investigate the sensitivity of our simulations to the level of risk aversion, we use four alternative values for the Arrow-Pratt measure of absolute risk aversion ($\alpha = 0, 0.1, 0.2,$

[9] As in many intertemporal choice situations, decisions are fairly insensitive to discount factors β in the conventional range near one.

and 0.5). For a gamble with a 50% chance of winning $5000, these parameters imply a willingness to pay of $2500, $2191, $1899, and $1229, respectively. Finally, the distributions of gender, age, race, education, and current level of relative health are based on the MCBS data that were also used to construct the state transition probabilities; see section 4.2.

5.1. A market with Silver Plans only. We first consider a market in which only Silver Plans are offered. The purposes of this analysis are (i) to replicate some key features of the Medicare Part D market using our stylized model, (ii) to investigate the sensitivity of our simulations to variations in risk aversion, and (iii) to study the effect of the LEP and of premium subsidies on enrollment and viability of plans.

As specified in the model in section 4, individuals decide whether to enroll into a Silver Plan or remain uncovered. Figure 2 shows the share of the population who finds it advantageous to enroll as a function of the monthly premium, stratified by whether the government imposes the late-enrollment penalty (LEP) and by the degree of risk aversion. At a zero premium, the entire population of rational deciders enrolls voluntarily. As the premium increases, an increasing fraction of individuals do not find it beneficial to enroll. The rate at which enrollment decreases as the premiums increases depends on risk preferences and on whether the LEP is enforced. Without the LEP (and with costless switching, as we assume throughout), the rational enrollment decision takes into account only the expected drug expenditures in the first year; an alternative interpretation is that individuals are myopic. In this situation, the enrollment rate is 62% at a monthly premium of $100. Risk aversion has little impact on the results. When the LEP is enforced, enrollment rates are higher because individuals take into account the chance that drug expenditures will increase in the second year or beyond; enrollment rates at a $100 premium are 75% when individuals are risk neutral and rise to 91% when they are highly risk averse ($\alpha = 0.5$).

Those individuals who rationally decide not to enroll are relatively healthy. The higher the premium, the more extreme is the adverse selection into Medicare Part D plans. Figure 3 depicts this effect. It shows the average drug bill of the individuals who rationally enroll, which increases from the population average of $3100 at a zero premium at which all enroll to $4330 at a monthly premium of $100 when there is no LEP. As intended, the LEP mitigates adverse selection when individuals are rational. With LEP, average annual drug bills at a $100 premium are $3360 when $\alpha = 0.5$ and $3860 when $\alpha = 0$.

The composition of the enrollees together with the government interventions and subsidies determine the profits for a given premium. Figure 4 shows profits given the simulated populations of enrollees under alternative values of the risk aversion parameter, given the actual CMS subsidies described in Section 3.2.

It is important to note that given these high subsidies, risk aversion and the LEP have little effect on the zero-profit premium. In the absence of more generous plans, the Silver Plan is profitable at monthly premiums of $35 and above. At this low premium, most risk-neutral rational individuals find it advantageous to enroll even when only first year costs and benefits matter; risk aversion or the LEP induce only a few more individuals to enroll. Notice that the simulated zero-profit premium is strikingly close to observed average premiums for Part D Silver plans; see Table 1.

To study the effects of the subsidies on the market equilibrium, we show in Figure 5 profits as a function of premiums, keeping risk aversion fixed at an intermediate value ($\alpha = 0.2$) and varying the level of government subsidies. In addition to the current Medicare Part D subsidy, we show scenarios without subsidies and with the 80% reinsurance for catastrophic drug bills only. In the absence of any subsidies, there is no premium at which insurance companies can offer a Silver plan without incurring losses. This is a classic market failure due to adverse selection. Alternately, with catastrophic reinsurance only and the LEP, the zero-profit premium is $124, without the LEP it is $143. At these respective premiums, 68% and 31% of rational individuals would enroll.

5.2. A market with Silver and Platinum plans. To analyze the selection of individuals into different plan types, we introduce a Platinum plan in addition to the Silver plan. We assume throughout this section that there is an LEP, and we keep the premium of the Silver Plan fixed at $35 per month.

Figure 6 shows enrollment rates for the two types of plans, with the premium of the Platinum plan on the horizontal axis. At a $40 monthly premium, almost the entire population enrolls in the Platinum Plan, which has much better coverage and is only slightly more expensive than the Silver Plan. As the premium of the Platinum Plan increases, its enrollment share decreases. The degree of risk aversion has almost no impact on relative enrollment in to two plan types. Those individuals who decide to switch from the Platinum Plan to the Silver Plan as the former's premium increases are among the best risks among the enrollees of the Platinum Plan and among the worst risks among the Silver Plan. Therefore, as Figure 7 shows, the average drug bill of the enrollees increases in both plan types as the premium of the Platinum Plan increases – this is adverse selection at work.

Are the Platinum Plans viable given that there is such strong adverse selection? To answer this question, we now must consider risk adjustment as well. Figure 8 shows the profits of both plan types, keeping the Silver Plan premium fixed at $35 and the risk aversion coefficient at its intermediate level of 0.2. Without any risk adjustment, the Silver Plan makes positive profits at a premium of $35/month. Compared to the case with Silver Plans only in which this premium generated zero profits, this is due to the fact that the worst risks have moved to the Platinum plan. The Platinum plan incur losses at any premium, so the market for them is not viable without risk adjustment. This is due to the fact that Platinum plans receive no additional subsidy even though they are drawing the worst risks and in effect cross-subsidizing Silver plans.

Since the enhanced plans draw the worst risks, on average they receive net payments from the risk adjustment, but this is not sufficient to compensate for the additional risks. In addition to that, the risk adjustment is only based on liabilities for the Standard Plan portion of the benefits and additional benefits are not compensated. We add risk adjustment to our simulations using the formula described in Section 3.1. Figure 8 shows the profits with the implemented risk adjustment. Since the Standard Plans have a positive selection of enrollees, they are net payers for the risk adjustment an their profit decrease. But they are still positive since risk adjustment is imperfect. This and the fact that enhanced benefits are unadjusted leads to the result that profits for the enhanced plans increase but not nearly as much as needed to become non-negative for any premium.

Let B^{Si} denote expected Standard plan benefit cost for individual *i*, scaled so that it averages to one over the entire Medicare population. Letting B^{SA} denote the average of B^{Si} over a sponsor's enrollees, the net risk payment to this sponsor per enrollee under risk adjustment as implemented is $(B^{SA} - 1)\cdot(\text{Bid})$, with B^{SA} estimated from the regression described in Robst, Levy, and Ingbas (2007). Figure 10 also shows results using a "full" risk adjustment that undoes all effects of selection on profits per enrollee in both the Standard and enhanced plans. Let B^{Ei} denote the expected enhanced plan benefit cost for individual *i*, again scaled so that it averages to one over the entire Medicare population. If the sponsor sets an incremental premium for enhanced coverage equal to the expected incremental benefit cost for a representative individual, then the risk adjustment per enrollee that would leave sponsor expected profit invariant to his enrollee mix and its distribution across plan types is

$$\theta_S(B^{SS} - 1)(\text{Bid}) + \theta_E(B^{EE} - 1)(\text{Bid + Enhanced Coverage Incremental Premium})$$

$$= (B^{SA} - 1)(\text{Bid}) + \theta_E(B^{EE} - 1)(\text{Enhanced Coverage Incremental Premium}),$$

where θ_S and θ_E are the shares of enrollees in the sponsor's Standard and enhanced plans, and B^{SS} and B^{EE} are the averages of B^{Si} and B^{Ei} over the sponsor's enrollees in these respective plans. Our "full" risk adjustment assumes that the terms in this net subsidy are exact, rather than estimated; this corresponds to retrospective rather than prospective risk adjustment. With this "full" risk adjustment, there is a joint equilibrium in which both plan types generate zero profits at premiums of $35 for the Standard plan and $102 for the enhanced plan. Note that this risk adjustment is not budget neutral. At the equilibrium, total government spending on Part D would have to be increased by 17%.

In practice, the government does not want to compensate sponsors fully for the spending of their enrollees in order to maintain the incentive to keep spending low. A practical version of the "full" risk adjustment scheme could define two plan types like those modeled here. Sponsors for a plan of one type would be compensated for the difference of average liabilities associated with the spending of the whole eligible population and the individuals who are enrolled in a plan of the same type. This would undo all selection effects into plan types while maintaining the competition of sponsors within each plan type.

5.3 A market with Platinum Plans only. The coverage gap – the infamous doughnut hole – has been a major concern in the debate surrounding the introduction of Medicare Part D, and proposals to abolish it abound. In this last section, we present simulation results for a market in which only Platinum plans that provide coverage through the gap are offered. We restrict attention here to the case of a high level of risk aversion (α=0.5). The sequence in which we present the simulation results is that same as in the previous sections.

Figure 9 shows enrollment rates in the Platinum plan as a function of the monthly premium. As before, at a zero premium all eligible individuals enroll. As the premium increases, those individuals with lower current and/or expected future drug expenditure drop out, following the intertemporal optimization model. Enrollment rates are lower when there is no late enrollment penalty or when individuals are myopic since in either case, the possibility of larger future drug expenditures is not taken into account. The enrollment rates shown in this figure are, for any given premium, higher than those in a market with only a Silver plan (Figure 2). For instance, at a $100 monthly premium and with the LEP in effect, if only one plan type were offered, 94% of rational, highly risk averse individuals would enroll in a Platinum plan, and 91% in a less generous Silver plan. The difference between enrollment rates in the two Scenarios gets larger with increasing premiums as selection leads to enrollees with higher current or higher expected future drug bills for whom gap coverage is more important. At a monthly premium of $35, the differences in enrollment rates are small.

Figure 10 shows average drug bill of those enrolled in a Platinum plan when that is the only plan type in the market. As in Figure 3, drug bills increase with premiums due to adverse selection. This increase is less pronounced than in the market with only a Silver plan since more individuals enroll at higher premiums, reducing adverse selection. Taking again rational, highly risk averse individuals in market with a late enrollment penalty, the average annual drug bill per enrollee is $3280 in a Platinum-only market and $3360 in a Silver-only market at the same premium of $100.

Figure 11 shows sponsor profit as a function of premium. For this simulation, we keep the subsidy per enrollee at the same dollar level as the current implementation of the Standard plan. Sponsors can break even at a premium of $55 per month, at which enrollment remains very high. The reason that the premium increase over current levels required for viability is modest is that all enrollees, including the relatively healthy who do not reach the gap, share the cost of gap coverage. This policy alternative would reduce problems of non-adherence to drug therapies when marginal drug costs rise sharply when enrollees hit the gap, and simplify the Part D program without additional government subsidies.

6. Conclusions

In this paper, we study how high voluntary enrollment rates can be achieved in a competitive private market for health insurance through subsidies and tight regulation. We base our analysis on the Medicare Part D prescription drug insurance program offered to older Americans since 2006.

Two features of enrollment and plan supply during the first four years of Medicare Part D motivate our analysis: First, enrollment rates are high, with non-enrollment coming primarily from healthy "active deciders". Second, premiums for standard plans as well as the number of plans among which consumers can choose have remained reasonably stable over time. Then, the Medicare Part D market design has achieved its primary political goal of providing near-universal coverage in a viable private market. Put differently, Part D has effectively countered adverse selection into a non-compulsory health insurance program through subsidies that makes Part D a favorable lottery for most, through inducing enrollment by the healthy due to the option value of avoiding late enrollment penalties, and through exploitation of advantageous selection resulting from higher levels of risk aversion among the healthy and wealthy. Second, plans with enhanced coverage have a falling share of the market, an apparent consequence of adverse selection in plan choice. Non-capitated extended plans contain an implicit tax due to the delayed onset of catastrophic reinsurance, and this load and the absence of any direct government subsidy for extended benefits reinforce the effects of adverse selection of sicker consumers into enhanced plans.

The main goal of our analysis was to understand the role of different government interventions in countering adverse selection. To this end, we develop a structural intertemporal decision model of enrollment and plan-type choice, and to use this model to simulate market demand under alternative institutional arrangements. In particular, this structural model allows us to distinguish the separate effects of four institutional features of Medicare Part D: direct government subsidies, government catastrophic reinsurance, the late enrollment penalty, and risk adjustment. An important finding is that elasticities of enrollment with respect to premiums are very low at the current subsidy and resulting range of premiums. Then, the program could tolerate modest increases in premiums, particularly if these are used to enhance plan benefits rather than shave subsidies, without jeopardizing the target of nearly universal enrollment.

Summarizing our baseline simulation results, our model successfully replicates two key outcomes in the Part D market: A large proportion of the population enrolls, with only the healthiest individuals choosing not to purchase coverage. At the same time, adverse selection strongly affects selection between Standard plans and enhanced plans that provide coverage in the Standard plan gap. In fact, the market for enhanced plans, whose extra coverage is not subsidized, breaks down in our simulations, with demand driven to zero as premiums rise to covers expected benefit cost.

We analyze the effect of subsidies. Our baseline simulation had subsidies similar to those provided with Medicare Part D, around 80% of sponsor cost. At zero subsidies, our simulations confirm that a private market for prescription drug insurance is not viable, even with regulation that fixes a single Standard plan type and eliminates costly screening by requiring that sponsors accept all applicants at a posted premium. At a level of subsidies at which the government provides only reinsurance, covering about 30% of sponsor cost, the market is viable, but premiums would be substantially higher, and enrollment rates would be much lower, so that the government would not reach its political goal of near-universal coverage.

Next, we analyzed the late enrollment penalty which was also intended to counter adverse selection by providing incentives for younger, healthy individuals to enroll. Ours simulations show that given the high level of subsidies provided in Medicare Part D, the late enrollment penalty has a negligible additional effect on enrollment rates. This complicated and controversial feature of Medicare Part D thus does not seem to be essential to counter adverse selection in enrollment, although it could become important at higher premiums. If in reality, consumers don't understand or neglect the penalty's intertemporal incentives, its effects will be even smaller.

We investigate alternative risk adjustment schemes. The implemented risk adjustment is not sufficient to make enhanced plans viable. We explore a "full" risk adjustment that subsidizes the difference between the benefit cost of the actual mix of enrollees in a given plan type, and the benefit cost if these enrollees were all representative of the population. This adjustment would make enhanced plans viable, at a cost of an increase of about17% in the total government subsidy of this market.

Finally, we examine the impact of eliminating the gap in Standard plan coverage, estimating the effect of replacing the Standard plan with a Platinum plan that covers 75% of all formulary drug costs in the gap. We find that a modest increase in Part D premiums to around $55 per month from the current $35 per month would make this alternative viable, with no increase in current subsidies. Thus, it appears to be practical to eliminate the gap in the Part D Standard plan at current subsidy levels , a simplification that would appeal to consumers, without threatening the viability of the market.

An important limitation of our analysis is that we take drug use as given. In our model, consumers take all prescribed medications even if they are hit by a negative health shock that implies a very high drug bill. This is not realistic - in fact, non-adherence related to drug costs is well documented (Goldman, et al. 2004) and has been a major argument for the introduction of Medicare Part D. To address these effects in a structural model, one would need allow for drug use as a choice variable and specify (i) a utility function that depends not only on consumption (or disposable income net of drug and insurance costs as in our implementation) but also on health, and (ii) a technology that maps drug use into health outcomes so that current non-adherence may have negative health effects in the future. These are promising, but very demanding modeling issues which we leave to future research.

Two broad questions to which our research can give only partial answers is whether Medicare Part D has performed better than a conventional government-run single-payer system would have done, and whether the Part D market should be a model for general health insurance reform. On the first question, what we can say is that the Part D market seems to be successful in providing access and coverage at a reasonable administrative cost, and that competition between sponsors seems to have induced innovative cost-cutting. Most importantly, the market establishes that it is feasible to subsidize and regulate a private insurance market so that it is viable and meets broad social policy needs for access. The evidence for adverse selection in plan type choice indicates that preservation of variety should be one of the criterion for the design of private insurance market regulations. On the second question, we conclude that the Part D market is sufficiently successful so that a private insurance market with subsidies and tight regulation should be one of the candidates for comprehensive health insurance reform.

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Appendix: Data sources

A.1 The Retirement Perspectives Survey

Four waves of the Retirement Perspectives Survey (RPS) were administered in 2005, 2006, 2007, and 2009 to obtain data on health status, prescription drug use, and Medicare Part D enrollment and plan type choice by U.S. seniors. The sample was obtained using an internet panel of individuals maintained by Knowledge Networks (KN), a commercial survey firm. The members of the KN Panel are recruited from an initial sample obtained by random-digit-dialing sampling that is representative of the U.S. non-institutionalized population in terms of demographics and socioeconomic status. Participants are provided with web TV hardware to respond to periodic internet surveys with content from both commercial and academic clients. KN Panel members are compensated for participation. For a detailed discussion of representativeness of the RPS sample and of the weighting procedures employed, see Heiss, McFadden, and Winter (2007, 2009).

The first RPS wave (RPS 2005) was conducted in November 2005, just before the initial enrollment period for the new Medicare Part D prescription drug benefit began. This survey focused on prescription drug use and intentions to enroll in the new Medicare Part D program. Additional questions concerned long-term care, and a sequence of questions was designed to obtain simple measures of respondents' risk attitudes. The second wave (RPS 2006) was fielded in May 2006, after the initial enrollment period had ended. For this survey, the Medicare eligible respondents of RPS 2005 we re-contacted, and their prescription drug insurance status and their Part D decisions were obtained. Two additional waves (RPS 2007 and RPS 2009) were conducted in March/April 2007 and February/March 2009, respectively; their samples consisted of re-interviewed respondents of earlier RPS waves plus refreshment cases. The four RPS interviews required between 25 and 40 minutes for completion, with variations due to variations in the length of the questionnaire.

The variables age, gender, education, and monthly net household income were provided as respondent background data by Knowledge Networks. The variables "number of prescription drugs taken on a regular basis", "self-rated health status" (SRHS), and the Medicare Part D enrollment status were elicited in the RPS questionnaires. The total annual expenditure for prescription drugs was estimated based on detailed information elicited in the RPS questionnaires, using the methods described by Winter et al. (2006). Summary statistics for these variables are contained in Table A.1.

A.2 Construction of the Medicare Part D supply and demand data reported in Table 1

Table 1 summarizes the supply of, and demand for, Medicare Part D stand-alone plans in the first four years of the program, 2006–2009. Panel A of Table 1 summarizes features of the stand-alone plans that were offered in those years. The raw data, including premiums and plan features such as deductible, gap coverage, and limited details on the plan formulary, were obtained from the web site of the Centers of Medicare and Medicaid Services (CMS).[1] Panel B reports enrollment data for the universe of individuals eligible for Medicare Part D; the raw data were also taken from the CMS web site. Panel C reports enrollment data for "active deciders" estimated using the RPS data. Active deciders are defined as individuals who make and pay for their drug insurance choice. This excludes individuals with existing coverage for prescription drugs (most importantly from a current or former employer's health insurance) as well individuals on Medicaid and programs such as FEHB and TRICARE are excluded. Additional details and remarks on the construction of the variables reported in Table 1 follow.

1. Number of plans offered (Panel A): These figures refer to the number of unique plans offered by sponsors, including regional and national plans offered in one or more states. As explained in section 3.2, plans are classified as "Silver" if they have no gap coverage, "Gold" if they have gap coverage primarily for generic drugs, and "Platinum" if they have gap coverage for all drugs. The CMS identification system for plans was modified after 2006, and the 2006 counts and shares are generally but not strictly comparable to these statistics in later years.

1. Share-weighted mean premium (Panel A): These figures refer to the average premium weighted by total enrollment of aged and disabled in individual plans. The percent increase is year over year, in current prices.
2. Medicare-eligible population (Panel B): These figures refer to the count of Medicare eligible individuals aged 65 and older without drug insurance (???); obtained using an assumption supplied for 2006 by the Office of the Actuary at CMS that 32% of the disabled do not have Part D or other creditable drug insurance.
3. Prescription-drug insurance status (Panel B): The category "other" includes Medicare retiree subsidy plans such as FEHB and TRICARE.

[1] As of September 16, 2009, the internet address for the CMS Medicare Part D data page is http://www.cms.hhs.gov/PrescriptionDrugCovGenIn/, but the location of plan feature and enrollment files changes over time. Copies of the CMS Excel data files as used for this paper are available from the authors on request.

4. Active deciders (Panel C): The share of active deciders is estimated from the count of uninsured 1individuals aged 65 and older and the share of uninsured respondents in RPS 2006, RPS 2007, and RPS 2009. In 2008, RPS data on active deciders was incomplete, and the share is interpolated from 2007 and 2009.
5. Shares of Silver, Gold, and Platinum plans (Panel C): These numbers are calculated from corresponding RPS shares for weighted sample individuals for in 2006, 2007, and 2009, adjusted by iterative proportional fitting to match the marginal distribution of individuals with no coverage reported by CMS. The 2008 shares are interpolated using the 2007, 2008, and 2009 shares among PDP plans for the enrolled Medicare population.

A.3 Construction of the MCBS dataset used to the estimate the dynamic health model

The Medicare Current Beneficiary Survey (MCBS) is a nationally representative survey designed to elicit healthcare utilization and expenditures for the Medicare population, especially those expenditures born by the beneficiary or supplemental insurance. It is administered by the Centers of Medicare and Medicaid Services (CMS) of the U.S. Department of Health and Human Services.[2] The sample frame consists of aged and disabled beneficiaries enrolled in Medicare Part A and/or Part B; for our purposes, only the aged (Medicare Part A) beneficiaries are relevant. The MCBS attempts to interview each person twelve times over three years, regardless of whether he or she resides in the community, a facility, or transitions between community and facility settings. The first MCBS interview was conducted in 1991. Since 1996, the MCBS uses a rotating panel design. Each fall a new panel is introduced, with a target sample size of 12,000 respondents, and each summer a panel is retired so that respondents remain in the sample for three years; for each respondent, there are at most four observations (one baseline survey and up to three “continuation” surveys). The MCBS contains self-reported information, including self-reported health status (SRHS); the prevalence of various health conditions; and measures of physical limitation in performing daily activities (ADLs) and instrumental activities of daily living (IADLs). In addition, the MCBS contains detailed self-reported data on health service use, as well as Medicare service use records. In this paper, we a dataset combined from the Access to Care files (1999-2002) and the Cost and Use files (2000-2003). Summary statistics are reported in Table A.2.

[2] See the CMS internet site at http://www.cms.hhs.gov/MCBS for details on the MCBS.

Table A1: Descriptive statistics for the RPS dataset

	2006		2007		2009	
Age band						
-64	411	19.8%	204	7.6%	24	1.5%
65-69	550	26.5%	863	32.4%	538	34.1%
70-79	832	40.1%	1,180	44.2%	781	49.6%
80-89	262	12.6%	393	14.7%	214	13.6%
90+	22	1.1%	27	1.0%	19	1.2%
Non-missing total	2077		2667		1576	
Gender						
Male	937	45.1%	1,186	44.5%	707	44.9%
Female	1,140	54.9%	1,481	55.5%	869	55.1%
Non-missing total	2,077		2,667		1,576	
Education						
Up to high school	1,162	55.9%	1,392	52.2%	770	48.9%
More than high school	915	44.1%	1,275	47.8%	806	51.1%
Non-missing total	2,077		2,667		1,576	
Total household net income						
Below $20,000	511	24.6%	577	21.6%	232	14.7%
$20,000 to 60,000	1,160	55.8%	1,534	57.5%	859	54.5%
More than $60,000	406	19.5%	556	20.8%	485	30.8%
Non-missing total	2077		2667		1576	
Number of prescription drugs taken on a regular basis						
None	177	9.9%	260	9.7%	186	11.8%
1 or 2	501	28.0%	659	24.7%	346	22.0%
3 or more	1,113	62.1%	1,748	65.5%	1044	66.2%
Non-missing total	1791		2667		1576	
Estimated total annual prescription drug cost						
costs=0	268	12.9%	227	13.8%	117	14.0%
0<costs<=250	130	6.3%	112	6.8%	59	7.1%
250<costs<=1000	204	9.8%	177	10.7%	86	10.3%
1000<costs<=2250	559	26.9%	459	27.9%	225	26.9%
2250<costs<=5100	617	29.7%	467	28.4%	248	29.7%
costs>5100	299	14.4%	205	12.4%	100	12.0%
Non-missing total	2077		1647		835	
Self-rated health status (SRHS)						
Excellent	121	5.8%	138	5.2%	86	5.5%
Very good or good	1,407	67.8%	1,883	70.7%	1132	71.9%
Poor or fair	546	26.3%	641	24.1%	357	22.7%
Non-missing total	2074		2662		1575	
Education-income interactions						
Low education, low income	353	17.0%	393	14.7%	151	9.6%
Low education, mid income	667	32.1%	817	30.6%	470	29.8%
Low education, high income	142	6.8%	182	6.8%	149	9.5%
High edudation, low income	158	7.6%	184	6.9%	81	5.1%
High education, mid income	493	23.7%	717	26.9%	389	24.7%
High education, high income	264	12.7%	374	14.0%	336	21.3%
Non-missing total	2077		2667		1576	
Total	2077		2667		1576	

Table A2: Descriptive statistics for the MCBS data

Discrete variables		
Year		
2000	8,815	25.4%
2001	8,705	25.1%
2002	8,634	24.9%
2003	8,493	24.5%
Non-missing total	34,647	
Gender		
Male	14,628	42.2%
Female	20,019	57.8%
Non-missing total	34,647	
Race		
White	30,368	87.6%
Non-white	4,279	12.4%
Non-missing total	34,647	
Education		
Up to high school	21,422	61.8%
More than high school	13,225	38.2%
Non-missing total	34,647	
Self-rated health status		
Excellent	5,306	15.4%
Very good	9,893	28.7%
Good	11,576	33.6%
Fair	5,853	17.0%
Poor	1,853	5.4%
Non-missing total	34,481	
Total	36,647	

Continuous variables	N	Mean	St.Dev.	Median	Min	Max
Age	34,647	77.05	6.99	76	67	104
Prescription drug costs ($1000)	34,647	6.13	3.12	6	1	12

Table 1. Part D Plan and Enrollment Statistics, 2006-2009

Sub-category percentages are in italics

A. Market for Stand-Alone PDP	**2006**		**2007**		**2008**		**2009**	
	Count	**Share**	**Count**	**Share**	**Count**	**Share**	**Count**	**Share**
Number of Plans Offered [1]								
Silver	1236	84.3%	1,359	71.2%	1331	70.9%	1309	75.2%
Gold	190	13.0%	525	27.5%	546	29.1%	432	24.8%
Platinum	40	2.7%	25	1.3%	---	---	---	---
Total Classified	1466	100.0%	1909	100.0%	1877	100.0%	1741	100.0%
Share-Weighted Mean Premium [2]	**Mean**	**Pct Incr**	**Mean**	**Pct Incr**	**Mean**	**Pct Incr**	**Mean**	**Pct Incr**
Silver	$26.50	---	$24.50	-7.8%	$27.10	10.1%	$32.20	17.2%
Gold	$48.70	---	$54.40	11.1%	$66.80	20.5%	$73.60	9.7%
Platinum	$47.90	---	$103.90	77.4%	---	---	---	---
B. Enrollment -- Eligible Universe								
Medicare-eligible population (mil) [3]	**Count**	**Share**	**Count**	**Share**	**Count**	**Share**	**Count**	**Share**
Age 65+	36.32	85.2%	36.99	85.4%	37.68	85.3%	38.40	84.9%
Disabled 64-	6.32	14.8%	6.32	14.6%	6.52	14.7%	6.84	15.1%
Total	42.64	100.0%	43.31	100.0%	44.20	100.0%	45.24	100.0%
Prescription Drug Insurance Status (mil) [4]	**Count**	**Share**	**Count**	**Share**	**Count**	**Share**	**Count**	**Share**
No coverage	4.42	10.4%	4.28	9.9%	4.61	10.4%	4.46	9.9%
Age 65+	*2.40*	*5.6%*	*2.26*	*5.2%*	*2.33*	*5.3%*	*2.27*	*5.0%*
Stand-alone PDP coverage	16.44	38.6%	17.25	39.8%	17.39	39.3%	17.48	38.6%
Silver	*15.55*	*36.5%*	*15.79*	*36.5%*	*16.12*	*36.5%*	*16.30*	*36.0%*
Gold	*0.86*	*2.0%*	*1.34*	*3.1%*	*1.27*	*2.9%*	*1.18*	*2.6%*
Platinum	*0.02*	*0.1%*	*0.12*	*0.3%*	*0.00*	*0.0%*	*0.00*	*0.0%*
MA and related plans	6.04	14.2%	6.65	15.4%	8.01	18.1%	9.17	20.3%
Other creditable coverage	15.74	36.9%	15.13	34.9%	14.19	32.1%	14.13	31.2%
Total	42.64	100.0%	43.31	100.0%	44.20	100.0%	45.24	100.0%
C. Enrollment -- Active Deciders Age 65+								
	Count	**Share**	**Count**	**Share**	**Count**	**Share**	**Count**	**Share**
Medicare-eligible Age 65+ population (mil)	36.32		36.99		37.68		38.40	
Active Deciders [5]	9.58	26.4%	9.48	25.6%	9.71	25.3%	10.00	26.0%
No coverage [6]	*2.40*	*25.0%*	*2.26*	*23.8%*	*2.33*	*23.2%*	*2.27*	*22.7%*
Silver	*6.51*	*67.9%*	*4.20*	*44.3%*	*4.77*	*49.1%*	*6.62*	*66.2%*
Gold	*0.39*	*4.1%*	*3.01*	*31.7%*	*2.68*	*27.7%*	*1.11*	*11.1%*
Platinum	*0.29*	*3.0%*	*0.02*	*0.2%*	---	---	---	---

Sources and Notes: See Appendix A.2.

Table 2. Enrollment and Plan Choices of RPS Respondents

Age	65-69			70+		
	2006	2007	2009	2006	2007	2009
None	18.3%	21.8%	32.9%	25.2%	24.3%	40.7%
Silver	72.5%	44.3%	61.6%	68.5%	46.1%	49.4%
Gold + Platinum	9.2%	33.9%	5.5%	6.3%	29.6%	9.9%
Count	142	174	73	270	371	162
Gender	**Male**			**Female**		
	2006	2007	2009	2006	2007	2009
None	21.5%	26.7%	42.4%	22.0%	22.1%	35.3%
Silver	69.2%	46.6%	50.5%	71.8%	44.8%	55.1%
Gold + Platinum	9.3%	26.7%	7.1%	6.3%	33.0%	9.6%
Count	172	206	99	287	348	136
Education	**Up through High School_**			**More than High School**		
	2006	2007	2009	2006	2007	2009
None	23.2%	23.8%	39.2%	19.8%	23.8%	37.3%
Silver	68.4%	46.7%	52.8%	74.3%	43.8%	53.6%
Gold + Platinum	8.5%	29.5%	8.0%	5.9%	32.3%	9.1%
Count	272	319	125	187	235	110
Income	**Income below $20K**			**Income $20K or more**		
	2006	2007	2009	2006	2007	2009
None	16.8%	27.8%	42.5%	23.9%	22.7%	37.4%
Silver	77.4%	38.9%	50.0%	68.0%	47.4%	53.8%
Gold + Platinum	5.8%	33.3%	7.5%	8.1%	29.9%	8.7%
Count	137	126	40	322	428	195
Prescriptions	**Less than Three**			**Three or More**		
	2006	2007	2009	2006	2007	2009
None	33.1%	43.5%	56.1%	7.3%	12.1%	23.4%
Silver	65.0%	34.8%	41.1%	50.1%	51.9%	63.3%
Gold + Platinum	1.8%	21.7%	2.8%	7.6%	36.0%	13.3%
Count	163	207	107	341	347	128
Drug Cost	**Up to $2250 per year**			**More than $2250 per year**		
	2006	2007	2009	2006	2007	2009
None	29.5%	33.5%	45.5%	9.6%	10.6%	28.6%
Silver	66.5%	41.2%	46.6%	77.5%	57.0%	57.1%
Gold + Platinum	3.9%	25.3%	8.0%	12.9%	32.4%	14.3%
Count	281	233	88	178	142	42
SRHS	**SRHS Good, Very Good, or Excellent**			**SRHS Poor or Fair**		
	2006	2007	2009	2006	2007	2009
None	23.6%	25.1%	37.2%	15.5%	19.5%	43.6%
Silver	70.2%	45.3%	54.1%	72.8%	46.1%	48.7%
Gold + Platinum	6.2%	29.6%	8.7%	11.7%	34.4%	7.7%
Count	356	426	196	103	128	39
Income/Education	**Low Income and Education**			**Other**		
	2006	2007	2009	2006	2007	2009
None	16.8%	28.4%	54.2%	23.1%	23.0%	36.5%
Silver	76.8%	38.6%	41.7%	69.2%	46.8%	54.5%
Gold + Platinum	6.3%	33.0%	4.2%	7.7%	30.3%	9.0%
Count	95	88	24	364	466	211

Table 3 : Classification of yearly drug bill

Bill class	Share	Average bill
bill = \$0	6.9%	\$0
\$0 < bill ≤ \$250	4.3%	\$116
\$250 < bill ≤ \$1000	9.9%	\$647
\$1000 < bill ≤ \$1500	9.0%	\$1,236
\$1500 < bill ≤ \$2250	15.2%	\$1,888
\$2250 < bill ≤ \$3000	14.0%	\$2,597
\$3000 < bill ≤ \$4000	16.3%	\$3,471
\$4000 < bill ≤ \$5100	8.2%	\$4,476
\$5100 < bill ≤ \$7000	8.4%	\$5,925
\$7000 < bill ≤ \$10000	5.3%	\$8,256
\$10000 < bill ≤ \$20000	2.4%	\$12,327
bill > \$20000	0.1%	\$29,282

Source : MCBS

Table 4: Parameter estimates for the model of health dynamics

	Males		Females	
Mortality:				
Non-white	0.309*	(0.127)	-0.083	(0.117)
High education	-0.734**	(0.094)	-0.706**	(0.089)
Latent frailty γ	1.336**	(0.061)	1.728**	(0.057)
Drug bill:				
Non-white	-0.271	(0.301)	-0.683**	(0.246)
High education	-1.133**	(0.209)	-1.232**	(0.185)
Latent frailty γ	6.124**	(0.175)	6.228**	(0.150)
SRHS:				
Non-white	0.370**	(0.065)	0.465**	(0.052)
High education	-0.914**	(0.044)	-0.847**	(0.039)
Latent frailty γ	0.877**	(0.025)	0.910**	(0.022)
Latent frailty				
Serial correlation ρ	0.967**	(0.0001)	0.963**	(0.001)

Notes: Standard errors are in parentheses All equations also include age splines. SRHS is coded 1 for Excellent to 5 for Poor. Parameters significantly different from zero are marked ** if p<.01, * if p<.05.

Figure 1. Out-of-Pocket Costs for Part D Insurance Contracts

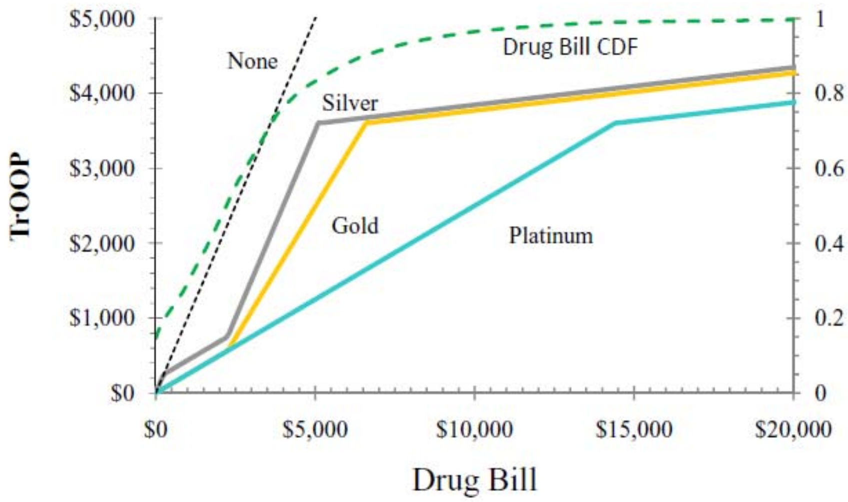

Figure 2: Simulation results with only the Standard Plan: Enrollment shares

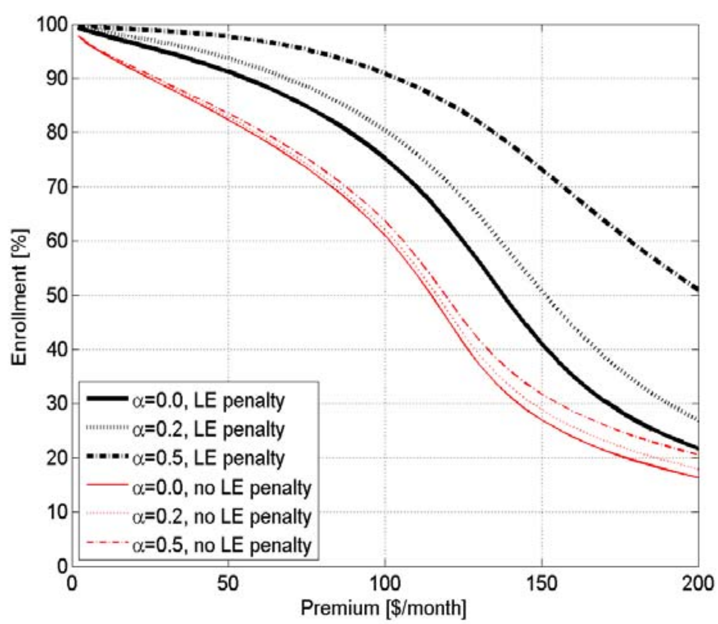

Figure 3: Simulation results with only the Standard Plan: Adverse selection

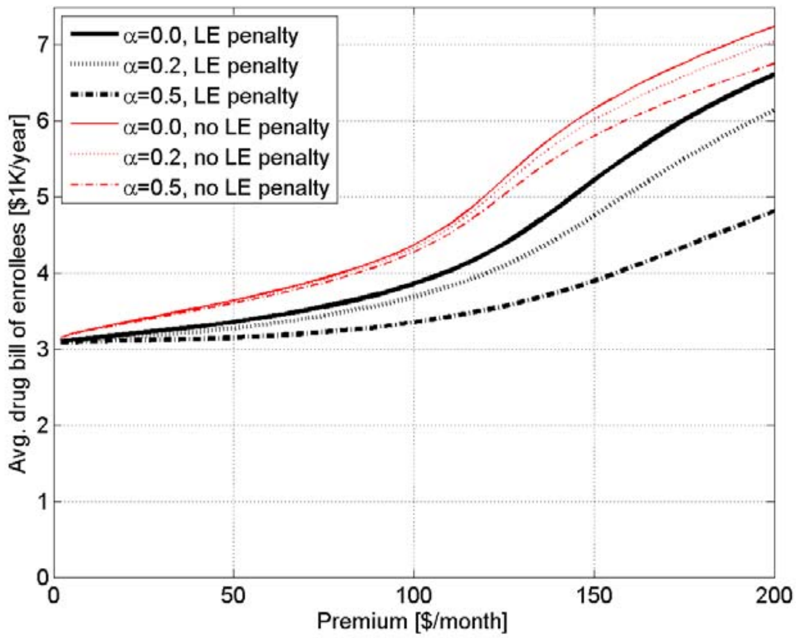

Figure 4: Simulation results with only the Standard Plan: Profits with actual subsidies

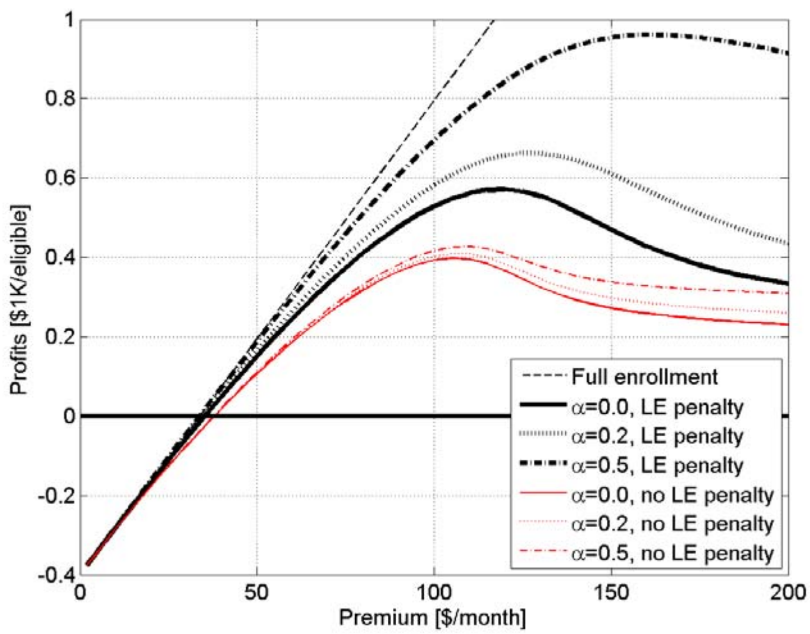

Figure 5: Simulation results with only the Standard Plan: Profits with different subsidies

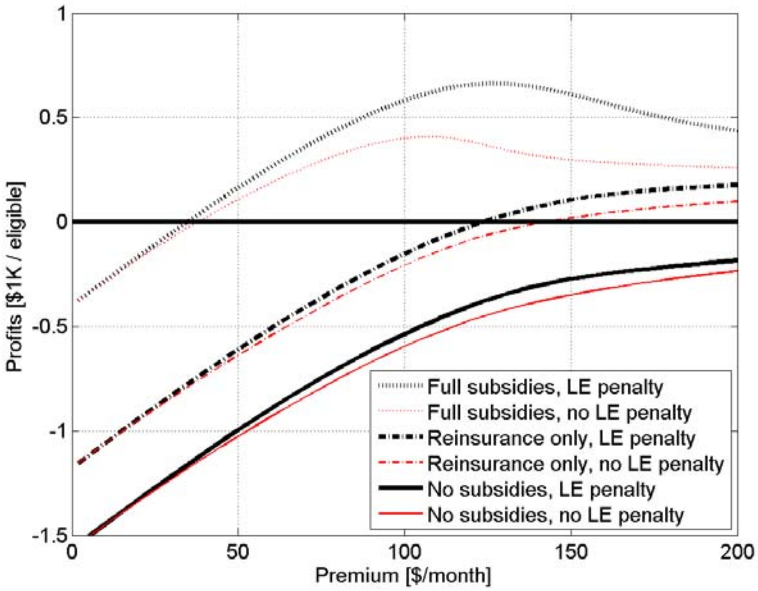

Figure 6: Simulation results with two plan types: Enrollment

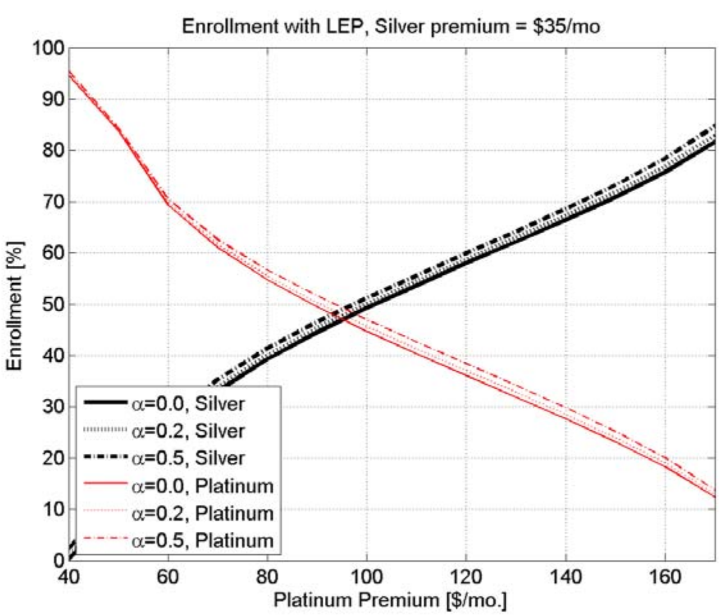

Figure 7: Simulation results with two plan types: Enrollees' avg. drug bill

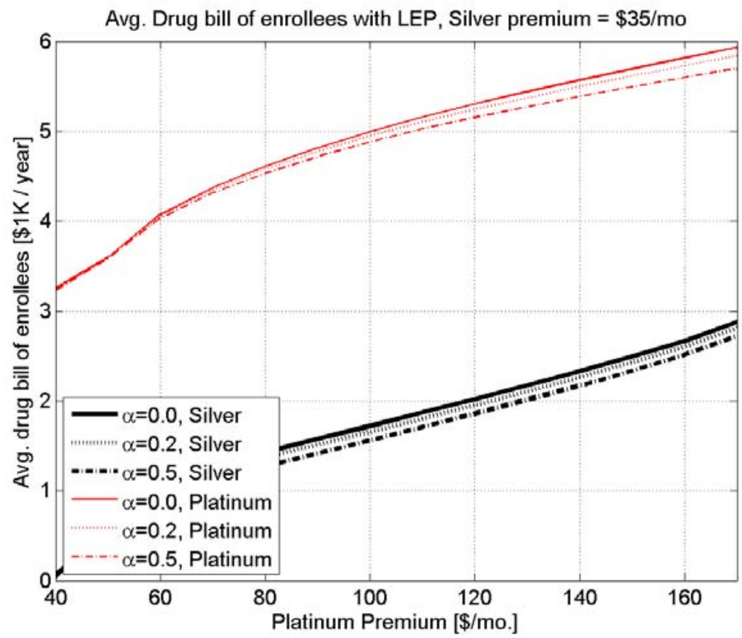

Figure 8: Simulation results with two plan types: Profits and risk adjustment

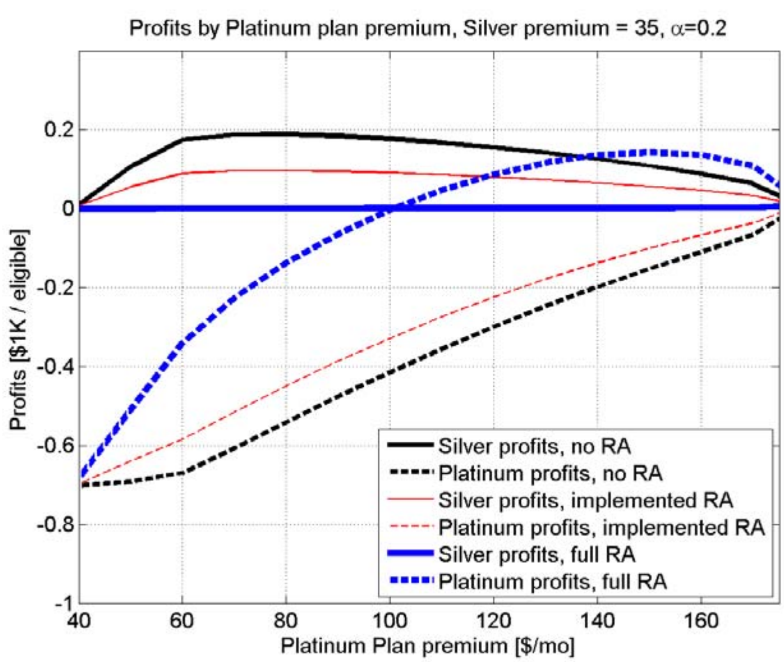

Figure 9. Simulation results with only the Platinum Plan: Enrollment shares

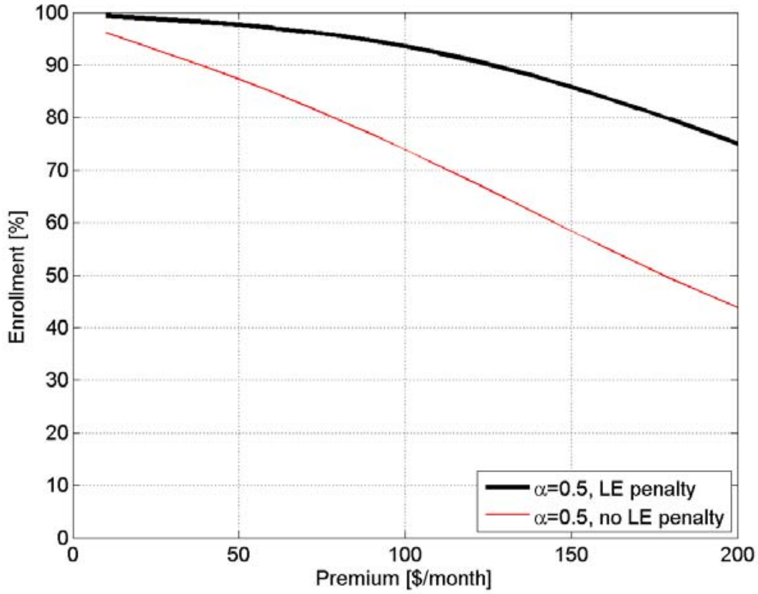

Figure 10. Simulation results with only the Platinum Plan: Adverse selection

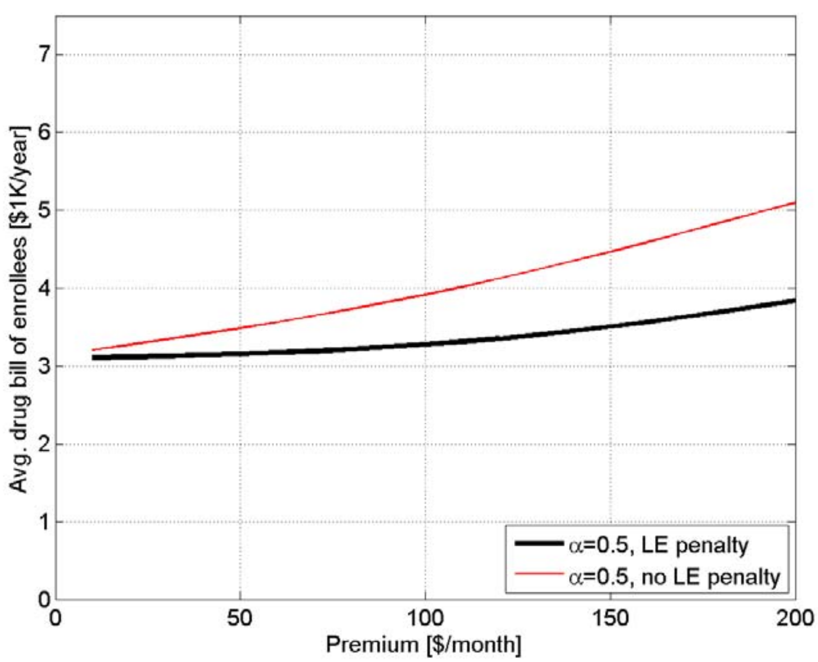

Figure 11. Simulation results with only the Platinum Plan: Profits with different subsidies