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PREDICTING ADVERSE SELECTION FOR MEDICARE PRESCRIPTION DRUG PLANS

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Abstract

Objective: To use statistical models to predict adverse selection and stability for the new stand-alone Medicare prescription drug plans (PDPs) created by the Medicare Modernization Act of 2003.

Data Sources and Study Setting: This is a retrospective observational study using national data from the Medicare Current Beneficiary Survey (MCBS). These data are linked to administrative information on plan benefits and premiums.

Study Design: We begin by estimating a statistical model of consumer choice across alternative Medicare insurance plans including traditional fee-for-service, Medicare HMOs, and individually purchased Medicare supplements. Next, we modify the data to reflect the new PDPs available to beneficiaries starting in 2006 and use the model to predict the probability of enrollment for each beneficiary in each plan type. Finally, we tabulate adjusted actual drug and non-drug spending by plan type.

Data Extraction Methods: Our sample consists of all MCBS respondents from 1998-2001 excluding those under 65, in institutions, eligible for Medicaid, or enrolled in employer-sponsored Medicare supplements.

Principal Findings: We find that adverse selection into PDPs will be substantial, with predicted drug spending 78% higher than in HMOs. Nevertheless, enrollment and premiums will be stable.

Conclusions: Premium subsidies will be sufficient to make PDPs a stable option for Medicare beneficiaries.

Keywords: Medicare, Adverse Selection, Econometrics, Financing and Insurance

INTRODUCTION

On January 1, 2006 a new era began for the Medicare program. For the first time, coverage for outpatient prescription drugs became available at subsidized rates to all beneficiaries. This much needed benefit was created by the Medicare Prescription Drug, Improvement, and Modernization Act (MMA) of 2003. After extensive debate about the relative merits of public and private administration of benefits, Congress established new types of private insurance plans to administer the new MMA benefit. Principal among these are regional prescription drug plans (PDPs) and regional preferred provider organizations (PPOs). These plan types supplement health maintenance organizations (HMOs) that have existed in Medicare since 1982.

In this paper we focus on the future of PDPs, which we argue will be central to the ultimate success or failure of the Medicare prescription drug program. These plans provide stand-alone coverage for outpatient prescription drugs. Because drug utilization by the elderly typically is highly persistent (Coulson and Stuart, 1992), some researchers have expressed concern that stand-alone drug insurance plans might be vulnerable to severe adverse selection and therefore might not be financially viable without heavy subsidies (Pauly and Zeng, 2003). This concern was shared by industry representatives prior to the passage of MMA. The president of the Health Insurance Association of America said, “It would be like providing insurance for haircuts” (Pear and Bogdanich, 2003). If PDPs turn out not to be financially viable, the remaining nationally available option for beneficiaries would be regional PPOs. However, in earlier work we examined the competitive prospects for regional PPOs (Pizer, Feldman, and Frakt, 2005), concluding that without very heavy subsidies they will be a minor presence in the

market.[1] Entry by PPOs into the program has been weak to date even with subsidies.[2] Accordingly, this study focuses attention on PDPs with the presumption that the viability of PDPs will be the single most important determinant of the success or failure of the MMA drug benefit.

Congress and the administration included several provisions in MMA to reduce adverse selection and promote participation by PDP plans in the program. These included a premium subsidy of at least 74.5% for all beneficiaries and additional subsidies for beneficiaries with low incomes as well as risk adjustment, risk sharing and reinsurance for PDPs. Such large premium subsidies might be enough to ensure plan stability on their own. In what follows we investigate whether this is indeed the case.

Specifically, we attempt to determine how severe adverse selection will be in PDPs and assess whether it could lead to instability in enrollment if unsubsidized costs are passed on to beneficiaries. In so doing, we also predict how the Medicare market will be divided among PDPs, HMOs, and Medicare supplements (also known as Medigap insurers). We employ a three-step approach. First, we estimate a statistical model of plan choice among respondents to the Medicare Current Beneficiary Survey (MCBS). The model includes both Medicare HMOs and Medigap insurance products as well as traditional fee-for-service Medicare as plan choices. Second, we modify the data to add new choices created by MMA. Third, we apply the estimated parameters of the model to the modified data to predict plan choices under the new regime and tabulate actual expenditures for survey respondents to evaluate selection. We combine data from MCBS, Medicare Personal Plan Finder, and premiums from a major Medigap insurer to support the estimation stage of the study.

Because stand-alone drug insurance plans like PDPs have never existed before in Medicare or in the private insurance market, the questions we investigate have not been empirically addressed in the literature. Nevertheless, our model of plan choice is similar to previously published models (particularly Atherly et al., 2004), with the modification that we include Medigap options as well as HMOs and traditional fee-for-service (FFS) Medicare. The addition of Medigap options allows us separately to identify the selection effects of low premiums (FFS and HMOs), restrictive networks (HMOs), low cost sharing (HMOs and Medigap plans), and drug coverage (some HMOs and some Medigap plans). This is essential because PDPs combine these characteristics in new ways that could not be accommodated by older models.

We find that PDPs will attract large enrollments among those beneficiaries whose choices will not be mediated by former employers or state Medicaid programs. Selection into PDPs will be adverse relative to HMOs and those choosing to remain with FFS coverage only. Because of selection, average per enrollee expenditures for drugs will be approximately 78% higher in PDPs than in HMOs. Nevertheless, enrollment in PDPs will be stable, even without the further stabilizing effects of risk adjustment, risk sharing and reinsurance.

BACKGROUND

For historical reasons, Medicare did not cover outpatient prescription drugs originally, leaving beneficiaries to acquire coverage from their former employers or from individually purchased (and very costly) supplemental policies (Atherly, 2002). Starting in the early 1990s, beneficiaries began to take advantage of the more affordable option of obtaining drug coverage through a Medicare HMO, initially under the Medicare risk

program authorized by the Tax Equity and Fiscal Responsibility Act (TEFRA) of 1982 and later under the Medicare+Choice program established by the Balanced Budget Act (BBA) of 1997 (Berenson, 2004). However, even at the height of M+C enrollment in the late 1990s, premiums and benefits varied widely across the country, and beneficiaries in rural areas typically lacked access to an HMO (Pizer and Frakt, 2002).

Medicare HMOs define their own service areas on a county-by-county basis, typically favoring urban areas and often avoiding rural areas completely. In addition to limited availability, Medicare HMO enrollment has been restrained by beneficiary resistance to the restricted choice of doctors and hospitals offered by HMOs and by negative responses to instability in premiums and benefits (Biles, Dallek, and Nicholas, 2004). Enrollment in Medicare HMOs peaked at 18% of beneficiaries in 1999, and declined to 13% by the end of 2003, recovering very slightly by the end of 2004 in response to improved benefits and lower premiums brought about by recent payment rate increases (CMS, 2005).

The Medicare+Choice program was frequently criticized because Medicare HMOs typically experience favorable selection (that is, they enroll disproportionately healthy beneficiaries who use fewer services), and the administrative systems for establishing payment rates were inadequate to adjust for it (Biles, Dallek, and Nicholas, 2004; Mello et al., 2003). Partly in response, the BBA began to reduce the growth of payments to HMOs. Plans responded by cutting benefits, increasing premiums, and withdrawing from selected markets (Pizer and Frakt, 2002).

At the same time as Medicare HMO enrollment declined, employer-sponsored retiree drug coverage was becoming less available (Stuart et al., 2003). As a result,

political support for legislative action grew, culminating in MMA's passage in 2003 (Freudenheim, 2003). By raising payment rates and by creating two new types of private plans in Medicare – stand-alone prescription drug plans (PDPs) and PPOs – Congress attempted to make drug coverage available in areas not traditionally served by Medicare HMOs. HMOs will continue to operate under the Medicare Advantage program, the successor to Medicare+Choice.

Among its many provisions, MMA established minimum standards for drug coverage offered by PDPs and Medicare Advantage plans, created premium subsidies available to all enrollees, and provided additional subsidies and enrollment assistance for low-income beneficiaries. At a minimum, all drug plans must cover 75% of drug expenses over a $250 deductible, up to a limit of $2,250. Additional drug expenses need not be covered until an out-of-pocket limit of $3,600 is reached (the infamous "doughnut hole"). Expenses over this threshold must be 95% covered. In general, subsidies are equal to 74.5% of average PDP plan costs (as determined through a competitive bidding process). Beneficiaries dually eligible for Medicaid, receiving Supplemental Security Income, or with incomes below 135% of poverty and limited assets qualify for full premium subsidies and reduced cost sharing. Some additional subsidies are available for those with incomes up to 150% of poverty. Beneficiaries dually eligible for Medicaid who do not select a plan will be enrolled automatically by CMS.[3]

MMA created several inducements for plans to participate in the Medicare market. First and foremost, MMA increased payment rates for HMOs relative to average fee-for-service costs in 2004 and 2005 and then shifted to a new competitive bidding methodology for future years that will be based on 2005 rates (Berenson, 2004).

In addition, MMA reduced the risks faced by plans by implementing risk corridors, reinsurance, and risk adjustment. Risk corridors partially reimburse the plan if total costs exceed those predicted by the plan by more than a specified amount. Likewise, if total costs are less than predicted, the plan will partially repay the government. Reinsurance is a similar retrospective payment mechanism, based on individual beneficiaries who incur costs over the catastrophic threshold. Risk adjustment, by contrast, is a prospective mechanism whereby plan payments are adjusted for the characteristics of their enrollees at the beginning of the year—plans with sicker enrollees are paid more (see CBO, 2004 for a concise summary of these measures). Each of these provisions mitigates the risk faced by PDPs, but does not eliminate it. If PDPs experience unexpected adverse selection, premium increases still would be needed.

PREDICTING SELECTION

Our goal is to predict the selection experience of PDPs based on the past plan choices of Medicare beneficiaries. This would be relatively straightforward if PDPs existed in the historical data, but they do not. Our strategy, therefore, is to construct a statistical model of plan choice that separately estimates the selection effects for a variety of plan characteristics, which, when combined in a new way, look like a PDP. These characteristics are: drug coverage with modest cost sharing up to a limit (like Medicare HMOs and some Medigap plans), free choice of providers (like Medigap plans), and relatively low premiums (like HMOs). Once we estimate the model, we modify the survey data used for estimation to reflect new plan types and apply the parameters of the model to predict beneficiaries' choices.

DATA AND SAMPLE

The principal source of data for this study is the Medicare Current Beneficiary Survey (MCBS), an ongoing panel survey of a nationally-representative sample of Medicare beneficiaries (aged and non-aged, institutionalized and non-institutionalized). We used the 1998-2001 MCBS Cost and Use files, which include demographic variables, health insurance choices, health and functional status measures, diagnoses, utilization, and expenditure. Our models include the respondent's drug expenditures in the prior year as well as amounts of past spending that would have been covered by each plan currently available to the respondent. Thus, from the full MCBS sample, we retain only observations with data from the prior year. Because one-third of the sample is replaced every year, our sample is reduced by this proportion (more information on the content and sample design of MCBS is available at http://www.cms.hhs.gov/MCBS/default.asp). See Table 1 for the number of observations remaining after this and subsequent data preparation steps.

We excluded several groups of beneficiaries from our analysis either because their circumstances are unusual or because they do not make their own insurance choices. Non-elderly Medicare beneficiaries and the institutionalized were excluded because their characteristics and insurance options are sufficiently different to require different models. Medicare-Medicaid dual enrollees were automatically enrolled in a PDP in January 2006 if they did not make a choice on their own. These beneficiaries were excluded because their choices reflect the influence of administrators to an unknown extent. Some beneficiaries have the option of enrolling in an employer-sponsored Medicare supplement (ESMS) and 32 percent of our sample did so. It cannot be discerned from MCBS whether an employer-offered plan is available to a beneficiary unless he or she enrolls, so

we must assume that all beneficiaries offered such a plan choose to enroll. Because the choice of an ESMS plan also reflects the decision of a former employer, these beneficiaries must be excluded as well. An implication of this decision is that our model cannot predict enrollment or selection among those previously covered by an ESMS plan. In the short run, this is not a severe limitation because approximately 80% of employers questioned in a recent survey plan to maintain their ESMS plans (Kaiser Family Foundation, 2005). However, long run prospects for the stability of these plans are far less certain.

Additional details about the construction of key variables are provided in Table 2 and in the Technical Appendix. Merging MCBS observations with HMO, Medigap, and FFS plan data resulted in 47,770 person-plan-year observations. Table 2 provides person-level descriptive statistics for many of the individual characteristics included in our models. Also included are person-plan-year means of plan characteristics.

ESTIMATION

We closely followed a statistical model of beneficiary choices among plans published in the literature by Atherly, Dowd, and Feldman (2004). They constructed a model of health plan choices for Medicare beneficiaries using the same major data sources that are available to us. Using a two-step "nested logit" technique, they first estimated how beneficiaries choose between two distinctly different types or "nests" of plans (a FFS nest and an HMO nest); then they modeled choices among the more similar options within the HMO nest. They found that beneficiary choices were particularly sensitive to the availability of drug benefits and that sicker beneficiaries were attracted to plans that covered drugs. We use the same technique with the important modification

that we model choices among three nests instead of two: FFS, Medigap, and HMO. We also find that drug benefits can profoundly affect beneficiary choices and that plans that offer drug coverage will attract sicker enrollees. Details of the estimation technique are discussed in the Technical Appendix. We take the analysis further by using the estimated parameters of the model to simulate beneficiary choices among the new plan types created by MMA.

SIMULATION

Once parameters for the statistical model were estimated, we predicted plans' market shares and selection under MMA in four steps. The first step was to modify the data to reflect expected market entry by PDPs and changes in existing HMOs and Medigap plans. Second, we applied the estimated coefficients from the statistical model to the modified data to predict probabilities for each beneficiary of enrolling in each option that they will face in 2006. Third, we created observations for each beneficiary-choice combination, weighted by the product of the original survey weight and the predicted probability for that choice. Finally, we tabulated simulated market shares and per beneficiary actual drug expenditure and non-drug expenditure by plan type.

A wide variety of plans and plan types was offered to beneficiaries beginning in January 2006. The actual variation was so large that simulating the full range of options would be confusing and impractical. We have simplified the array of options for ease of exposition without compromising the contrasts that we think are essential. Specifically, we simulated competition among HMOs as they existed in our sample, one PDP, one Medigap plan (without drug benefits), and FFS Medicare. The PDP could be combined

with the Medigap plan or purchased separately. All plans except for the HMOs were available everywhere and supplemented coverage from FFS.

For the simulation we fixed the premiums and benefits of Medigap and HMO options at their historical values, with premiums adjusted for inflation to 2006. To select values for PDPs that reflect low- and high-benefit alternatives we sorted the 2006 Medicare Plan Finder data into low-, medium- and high-benefit options based on whether the plans charged a deductible (yes=low) and the "doughnut hole" coverage they offered (none=low; generics only=medium; generics and brand name=high). Premiums for the simulation were set at the actual means within each group. Cost-sharing for drug benefits did not appear to differ systematically between PDPs and HMOs in the 2006 data. We simplified this dimension of benefits by assuming that PDPs covered 75% of drug expenses between $250 and $2,250 ($3,600 for the high-benefit option) and 95% above $3,600.

Once the new plan options were defined for the simulation, we applied the estimated model coefficients to the new data to produce estimated probabilities for each possible combination of beneficiaries and plans. Next, we recalculated the sample weight for each beneficiary-plan observation to equal the product of the sample weight for the beneficiary and the simulated probability. The last step was to calculate average actual drug and non-drug expenses by plan type, scaled by the mean values for the entire sample. These scaled means are our measures of adverse (>1) or favorable (<1) selection.

Prior to tabulating these expenses we made an adjustment for the fact that those with insurance typically incur more costs than those without. Our measures of selection

are based on reported drug and non-drug expenditures, and those who transition from being uninsured in the estimation phase to being insured in the simulation phase (mostly for drugs) have spending lower than their true risk to a plan. This difference is due to the "moral hazard" effect of insurance and may also reflect supplier induced demand and uneven access to care. In addition, uninsured respondents may be more likely than their insured counterparts to under-report their drug utilization (Davis et al., 1999). To account for these problems we inflate drug spending for those without drug coverage by a factor calculated separately for each year. These factors were developed using regression models to predict drug spending as a function of health conditions for the insured, then applying the model to the uninsured and comparing average predicted spending to average actual spending in each year. The final scaling factors were 1.33, 1.35, 1.29, and 1.34 for 1998, 1999, 2000 and 2001, respectively.

RESULTS

Results from the nested logit can conveniently be divided into two parts, results from the choice of plan (bottom level) and results from the choice of nest (top level). Results from the choice of plan model were consistent with expectations (Table 3). The estimated coefficient on coverage minus premium was significant and positive, indicating that beneficiaries were more likely to select plans that had lower premiums and covered more of their lagged expenses. Among the personal characteristics interacted with the drug plan indicator, those with hypertension, heart problems, cancer, diabetes, Alzheimer's, and emphysema were more likely to enroll in a drug plan. Whites, veterans, and those with any ADL dependencies were less likely. Finally, the highest income individuals were more likely to purchase drug coverage.

Results from the choice of nest model were also typically consistent with expectations (Table 4). Beneficiaries with college degrees, insurance through a spouse, or high lagged drug spending were less likely to select an HMO (first three columns of table). Members of these groups probably find HMOs relatively unattractive either because they have the resources to purchase less restrictive coverage or because their health care needs are such that they perceive HMO restrictions to be burdensome. By contrast, older, female, white beneficiaries and those with higher incomes were more likely to purchase Medigap coverage. Among health conditions, arthritis, cancer, and hypertension were associated with a higher probability of enrolling in an HMO. Stroke, diabetes, and being in fair or poor health were all associated with a lower probability of enrolling in Medigap plans while cancer was associated with a higher probability (fourth through sixth columns of table). In addition, those with high drug spending in the prior year were more likely to purchase Medigap coverage.

In general, these results are consistent with recently published work (Atherly et al., 2004) showing that drug benefits unambiguously attract Medicare beneficiaries with health problems and that beneficiaries are sensitive to variations in premiums and coverage. In addition, these results confirm that beneficiaries with health problems and financial resources prefer to avoid HMOs.

Market shares

In the actual data, 12% of elderly Medicare beneficiaries were dually enrolled in Medicaid and 35% had an employer sponsored Medicare supplement (Table 1). After excluding these two groups, FFS had 24% of the remaining market, HMOs had 23%, and Medigap plans had 53% (Table 5). After the simulation of the low-benefit PDP, 13% of

beneficiaries were in FFS, 19% were in an HMO, 23% were in Medigap (non drug), 29% were in Medigap+PDP, and 16% were in a PDP only (Table 5). Taking the Medigap+PDP and PDP-only configurations together, 45% were enrolled in a PDP ("All PDP" in the table). We also simulated market shares for the high-benefit PDP, and results were similar.

Inspection of these results indicates that PDP enrollment will come principally from those currently purchasing Medigap coverage (30 percentage points) and from those currently in FFS only (11 percentage points), with only 4 percentage points coming from HMO enrollees.

Selection

In the actual data, selection into FFS-only was adverse overall but less so by drug spending alone (1.16 by non-drug expenditures; 1.02 by drug expenditures). Selection into HMOs was favorable by both measures (0.60 and 0.80, respectively), and selection into Medigap was adverse (1.11 and 1.08).

In the simulation for the low-benefit PDP, selection by non-drug expenditures was favorable for FFS (0.75), HMO (0.81), and PDP-only (0.94). It was slightly adverse for Medigap (1.02), and more so for Medigap+PDP (1.25). Selection by drug expenditures followed a qualitatively identical pattern except that Medigap selection was favorable (0.82) and PDP-only was adverse (1.16). Selection for all PDPs was severely adverse by drug expenditures (1.30) and somewhat less severely adverse by non-drug spending (1.14). Comparing predicted drug expenditures between all PDP enrollees and HMO enrollees we find that PDP enrollee drug expenditures will be 78% higher (1.30 compared to 0.73).

To check the stability of these results we repeated the simulation analysis with premiums for PDPs and Medigap plans adjusted upwards to account for predicted adverse selection.[4] These results are reported in the "Low-benefit PDP with iterated premium" rows of Table 5. Market share for PDPs fell by 2.5 percentage points and selection became more adverse; moving from 1.30 to 1.32 by drug expenditures. This selection result indicates relative stability, despite a very high degree of adverse selection by historical standards.

In addition to the low-benefit PDP, we also simulated results for the high-benefit PDP. Although market share was only modestly lower (42.5% compared to 45.3%), selection for the high-benefit plan was substantially more adverse (1.39 compared to 1.30). This finding suggests that plans seeking to differentiate themselves from the competition by offering more generous benefits may have to charge distinctly higher premiums.[5]

DISCUSSION

In this study we used MCBS and Medicare Personal Plan Finder data from 1998-2001 to estimate a statistical model of health insurance plan choice among elderly Medicare beneficiaries. We used the parameters of the estimated model to simulate plan choices under MMA, with a particular focus on PDPs. We tabulated actual drug and non-drug expenditures, normalized to the population means, to evaluate predicted selection into each plan type. We find that PDPs will acquire a very substantial market share, drawing enrollees principally from those currently covered by Medigap plans and by FFS only. PDPs will experience severe adverse selection by historical standards as measured by drug expenditures, but it will be stable.

Several features of MMA not accounted for in our model will mitigate predicted adverse selection. First, as we noted earlier, risk corridors, reinsurance, and risk adjustment will blunt the impact of adverse selection on plan profits, helping to keep premiums affordable. Second, MMA imposes a penalty on beneficiaries who enroll in a PDP after May 15, 2006 (see CBO, 2004 for details). As a consequence, some beneficiaries who we have predicted will not purchase drug coverage will do so to avoid the penalty. On the other hand, our model also does not account for the degree of confusion that has been generated by the new law. Media reports of enrollment problems coupled with baffling complexity and an overwhelming number of choices have slowed enrollment in the early months of the program (Rovner, 2006). These informational and administrative barriers are likely to discourage some beneficiaries who would have otherwise enrolled, making adverse selection worse. On balance, it is far from clear which effect will dominate.

Aside from these policy issues, the most important limitation of our work is also its most valuable feature. This study forecasts selection into PDPs based on data collected from a time when PDPs did not exist. This is a limitation because predictions by necessity are based on an “out-of-sample” forecast with respect to plan characteristics. It is a valuable feature because this is the only way to produce predictions now. An alternative would be to wait until beneficiary-level enrollment and claims data become available to researchers (there are no plans to release these data at present). Although we certainly think such retrospective analysis should be done, we do not know when this will be possible and the prospective forecasting in this study gives us reason to expect that PDPs will be stable. Consequently, if policymakers begin to review the provisions of

MMA as part of an effort to reduce spending, we would argue that support for PDPs is worth preserving.[6]

Another limitation is that we were not able to adjust our premium and coverage variables to account for the subsidies that some beneficiaries will receive. This cannot be done accurately with MCBS data due to the lack of information on respondents' assets. To test whether the results would be sensitive to this issue, we conducted a separate estimation and simulation analysis excluding all beneficiaries with incomes below 135% of the federal poverty line, producing qualitatively similar results.

In contrast, our results might be quite different if large numbers of beneficiaries previously covered by employer-sponsored plans are moved into the individual market. There is great uncertainty among researchers, policymakers, and employers themselves (Kaiser, 2005) about whether employers will maintain their retiree health benefits in future years. Our study simply excludes 35% of non-institutionalized elderly beneficiaries currently covered by these arrangements, so we cannot address expected selection from this population.

Finally, we do not test for selection differences among different types of competing PDPs. For example, we have not investigated how high-premium and benefit plans will fare in competition with low-premium and benefit plans. Given the large number of market entrants and the sensitivity of selection to benefits, it seems likely that competition between PDPs will engender some instability, even if the PDP sector as a whole is stable.

NOTES

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[1] Other researchers also have reached this conclusion (Hurley et al., 2004).
[2] As of December 2005, 5 of 24 PPO regions had no entrants (Frakt and Pizer, 2006).
[3] Convenient summaries of MMA and the implementing regulations are available from the Kaiser Family Foundation (Kaiser, 2004).
[4] Plans already may have factored expected selection into their premiums for 2006, so this analysis is an upper bound on selection-driven premium adjustments in the next round of competition.
[5] This prediction has been borne out in the products offered for 2006 (Frakt and Pizer, 2006).
[6] Note that we would not reach the same conclusion about regional PPOs (Pizer, Feldman, and Frakt, 2005).

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Table 1: Counts

Data	Number Excluded	Number Remaining
MCBS 1998-2001		52,009
Exclude if no lag year	28,611	23,398
Exclude ages 0-64 or institutionalized	5,335	18,063
Exclude if in Medicaid	2,120	15,943
Exclude if in employer-sponsored supplement	6,326	9,617
Exclude if missing/inconsistent data[a]	1645	7,972

(a) Additional details are provided in the Technical Appendix.

Table 2: Descriptive Statistics

Person-Year Observations				
Variable	**Mean**	**Std. Dev.**	**Min.**	**Max.**
age	77.32	7.09	65	106
female	0.57	0.49	0	1
white	0.89	0.32	0	1
married	0.51	0.50	0	1
HS dropout	0.37	0.48	0	1
HS diploma	0.51	0.50	0	1
college degree	0.12	0.33	0	1
num. household relatives	1.83	0.91	1	11
veteran	0.28	0.45	0	1
fair or poor health	0.23	0.42	0	1
smoked	0.60	0.49	0	1
hypertension	0.59	0.49	0	1
heart problem[(a)]	0.36	0.48	0	1
stroke	0.12	0.32	0	1
cancer	0.35	0.48	0	1
diabetes	0.17	0.38	0	1
arthritis	0.63	0.48	0	1
Alzheimer's	0.03	0.18	0	1
emphysema	0.14	0.35	0	1
psych. disorder	0.04	0.19	0	1
any ADL	0.09	0.28	0	1
private ins. thru spouse	0.05	0.22	0	1
income 0-13.5k	0.25	0.43	0	1
income 13.5-21k	0.24	0.43	0	1
income 21-35k	0.25	0.44	0	1
income 35-77.5k	0.21	0.41	0	1
income 77.5k+	0.05	0.22	0	1
lag. indiv. Rx spending	0.99	1.14	0	20.41
Person-Plan-Year Observations				
coverage – premium[(b)]	1341.37	3717.76	-11146.44	95015.79
drug plan	0.52	0.50	0	1
FFS indicator	0.17	0.37	0	1
HMO indicator	0.53	0.50	0	1
Medigap indicator	0.30	0.46	0	1

(a) Myocardial Infarction or CHD or other heart problem.
(b) "Coverage" is the amount of individual's lagged expenditures for doctor visits and prescription drugs that would be covered by this plan. Prescription drug expenditures are adjusted for moral hazard.

Table 3. Nested Logit Results: Choice of Plan

Variable	Coef.	Std. Err.	z	P > | z |
cov. – premium	0.001	0.000	20.43	0.000
drug plan	0.275	0.485	0.57	0.570
Rx*Variable				
age	0.001	0.005	0.23	0.821
female	-0.093	0.104	-0.90	0.368
white	-0.404	0.141	-2.86	0.004
married	0.008	0.091	0.09	0.929
HS diploma	0.051	0.078	0.66	0.511
college degree	0.019	0.123	0.15	0.878
num. household relatives	-0.055	0.047	-1.17	0.241
veteran	-0.378	0.107	-3.53	0.000
fair or poor health	0.103	0.090	1.13	0.257
smoked	-0.080	0.074	-1.09	0.276
hypertension	0.127	0.070	1.81	0.071
heart problem	0.218	0.073	2.99	0.003
stroke	-0.031	0.112	-0.28	0.782
cancer	0.125	0.070	1.78	0.076
diabetes	0.351	0.096	3.67	0.000
arthritis	0.066	0.072	0.92	0.360
Alzheimer's	0.554	0.193	2.88	0.004
emphysema	0.230	0.101	2.27	0.023
psych. disorder	-0.137	0.191	-0.72	0.474
any ADL	-0.407	0.141	-2.88	0.004
private ins. thru spouse	-0.201	0.146	-1.38	0.168
income 13.5-21k	0.051	0.104	0.49	0.621
income 21-35k	0.197	0.105	1.87	0.062
income 35-77.5k	0.187	0.115	1.63	0.104
income 77.5k+	0.343	0.171	2.00	0.045

Regional dummy variables omitted (midatlantic, eastnorthcentral, westnorthcentral, westsouthcentral, mountain, pacific)
N = 31,360. The sample is less than the total number of person-plan-years because beneficiaries with no bottom-level choices are excluded.

Table 4. Nested Logit Results: Choice of Nest

	HMO dummy *Variable			MGAP dummy*Variable		
Variable	**Coef.**	**Std. Err.**	**P> | z |**	**Coef.**	**Std. Err.**	**P> | z |**
constant	-1.649	0.532	0.002	-4.223	0.423	0.000
age	-0.012	0.006	0.054	0.045	0.005	0.000
female	0.447	0.114	0.000	0.423	0.092	0.000
white	0.878	0.108	0.000	1.523	0.101	0.000
married	0.328	0.095	0.001	0.123	0.079	0.118
HS diploma	0.171	0.087	0.050	0.439	0.069	0.000
college degree	-0.376	0.137	0.006	0.167	0.110	0.128
num. household relatives	0.017	0.040	0.679	-0.186	0.037	0.000
veteran	0.080	0.115	0.485	-0.081	0.092	0.376
fair or poor health	-0.130	0.099	0.189	-0.321	0.077	0.000
smoked	0.062	0.086	0.469	-0.007	0.069	0.925
hypertension	0.243	0.082	0.003	0.127	0.065	0.052
heart problem	-0.140	0.085	0.099	-0.041	0.068	0.545
stroke	-0.026	0.121	0.830	-0.216	0.096	0.024
cancer	0.207	0.084	0.014	0.259	0.067	0.000
diabetes	-0.056	0.103	0.590	-0.117	0.084	0.165
arthritis	0.192	0.081	0.017	0.140	0.065	0.031
Alzheimer's	0.179	0.216	0.406	0.177	0.179	0.323
emphysema	-0.153	0.116	0.188	-0.115	0.089	0.197
psych. disorder	-0.052	0.206	0.801	-0.182	0.162	0.260
any ADL	-0.122	0.152	0.424	-0.099	0.117	0.395
private ins. thru spouse	-2.478	0.342	0.000	0.503	0.150	0.001
income 13.5-21k	0.423	0.109	0.000	0.465	0.086	0.000
income 21-35k	0.439	0.116	0.000	0.761	0.093	0.000
income 35-77.5k	0.256	0.132	0.052	0.885	0.105	0.000
income 77.5k+	-0.166	0.220	0.450	1.067	0.174	0.000
lagged indiv. Rx spending	-0.513	0.043	0.000	0.089	0.028	0.002
inclusive value parameter	0.679	0.027	0.000	0.679	0.027	0.000

N=21,371, which is the number of person-nest-years.

Table 5. Market Share and Selection: Actual and Simulated

	FFS only	HMO	Mgap	Mgap +PDP	PDP only	All PDP
1999-2001						
Market share[a]	23.9	22.9	53.2			
Rx spending[b]	1.02	0.80	1.08			
Non-Rx spending	1.16	0.60	1.11			
Simulation						
Low-benefit PDP						
Market share	13.1	19.0	22.6	29.3	16.0	45.3
Rx spending	0.69	0.73	0.82	1.37	1.16	1.30
Non-Rx spending	0.75	0.81	1.02	1.25	0.94	1.14
Low-benefit PDP with iterated premium						
Market share	14.0	19.8	23.3	27.3	15.5	42.8
Rx spending	0.70	0.73	0.83	1.39	1.18	1.32
Non-Rx spending	0.76	0.82	1.03	1.26	0.95	1.15
High-benefit PDP						
Market share	14.0	19.6	23.9	27.7	14.8	42.5
Rx spending	0.65	0.70	0.76	1.46	1.25	1.39
Non-Rx spending	0.74	0.80	0.99	1.30	0.98	1.18

(a) Market shares in percents.
(b) Spending is relative to the population mean, so figures greater than one indicate adverse selection.

TECHNICAL APPENDIX

ANALYTIC MODEL

To organize our thinking about beneficiary choices under MMA we consider a simple model of consumer choice among mutually exclusive options. Assume that each beneficiary's utility is given by the expression in Equation (1)

$$(1)\ U_{ij} = x_i\beta_0 + x_i z_j \beta_1 + z_j \beta_2 + \varepsilon_{ij}$$

where U_{ij} denotes utility for beneficiary i when they choose plan j, x_i is a vector of beneficiary characteristics, z_j is a vector of plan characteristics, β_0, β_1 and β_2 are unknown parameters and ε_{ij} represents unobservable factors. Beneficiary i will choose plan j if $U_{ij} > U_{ik}$ for all k not equal to j. This implies

$$(2)\ U_{ij} - U_{ik} = x_i(z_j - z_k)\beta_1 + (z_j - z_k)\beta_2 + \varepsilon_{ij} > \varepsilon_{ik} \quad \forall\, k \neq j$$

where the beneficiary characteristics ($x_i\beta_0$) drop out of the expression leaving plan characteristics and interactions between beneficiary and plan characteristics. These interactions will determine the degree of adverse selection to be experienced by each plan. This type of model is typically estimated using a conditional logit statistical model (McFadden, 1974; Maddala, 1983).

STATISTICAL METHODS

Estimation

We start with a conditional logit model that includes all possible choices among HMO, Medigap, and FFS-only options for each beneficiary (Equation 3):

$$(3)\quad P_{ij} = \frac{e^{\beta X_{ij}}}{\sum_j e^{\beta X_{ij}}}$$

where i indexes individuals and j indexes plans. In this equation, X denotes a set of plan characteristics and individual characteristics interacted with plan characteristics and β is a vector of coefficients to be estimated. Not all choices are available to all beneficiaries because HMOs are offered on a county-by-county basis and because Medigap plans with drug benefits are subject to underwriting restrictions.[1] Thus, the model is considered "unbalanced." After estimating this model, we tested for the independence of irrelevant alternatives (IIA) assumption implicit in the conditional logit model (Greene, 1992). As Atherly et al. (2004) found with a similar model, our model failed the IIA test, indicating that a more complex specification was needed. The nested logit model provides a

[1] In the estimation phase, we approximate underwriting restrictions by denying access to new coverage from Medigap drug plans to any beneficiaries who had drug expenses over a threshold amount in the prior year. Based on private communications with an insurer, we set these thresholds at $1,200 for 1999, $1,283 for 2000, and $1,373 for 2001. This restriction does not apply in the simulation phase because Medigap drug plans cease to exist and the plans created by MMA will have open enrollment periods.

potentially useful alternative specification in situations such as this. In the nested logit model, sets of options are grouped into nests, within which the IIA assumption is more likely to hold. Choices within nests are then modeled jointly with choices among nests (Equation 4):

$$(4)\quad P_{ijk} = P_{ij|k} * P_k = \frac{e^{\beta X_{ijk}}}{\sum_j e^{\beta X_{ijk}}} * \frac{e^{\gamma I_k + \alpha Y_k}}{\sum_k e^{\gamma I_k + \alpha Y_k}}$$

where k indexes nests and $I_k = \ln(\sum_j e^{\beta X_{ijk}})$. In this model, X again denotes a set of plan characteristics and individual-plan interactions and Y represents individual-plan interactions that are constant within nest. The term denoted by I_k is known as the "inclusive value," and the estimated coefficient γ is known as the "inclusive value parameter." This model is more flexible than the conditional logit model given by Equation (3) because the inclusive value parameters allow the coefficients on the X variables to shift from nest to nest while preserving their relative magnitudes within nests.[2]

After testing several alternatives, we found that three nests were necessary (IIA was not rejected within each nest). One nest contained all HMO options, a second nest contained the two Medigap options, and the third nest contained FFS only (Figure 1). Because this third nest contains only one option, it is a degenerate nest and cannot be estimated by standard nested logit methods. Fortunately, a two-step approach has been developed to obtain consistent estimates with this model (Hunt, 2000). The first step is to estimate a nested logit model for the HMO and Medigap nests and use the results to construct inclusive values for the observations in the FFS nest. The second step is to estimate a new top-level conditional logit including all observations. In this model the inclusive value parameter for the FFS nest is normalized to one for identification purposes.

Simulation Nesting Structure

Because PDPs do not exist in the survey data, we cannot estimate a new nesting structure that takes them into account. Therefore, the nesting structure for the simulation is dictated by the nesting structure for the estimation (Figure 1). The question arises: In which nest does the PDP belong? Because a PDP can be combined with a non-drug Medigap plan, it would seem to belong in the Medigap nest. This would be consistent with thinking of a PDP as a new type of Medigap plan—one that covers drugs but not non-drug services. Alternatively, one could argue that a PDP without Medigap belongs in the FFS nest because it does not cover non-drug cost sharing. We cannot perform IIA tests to evaluate these options because PDPs don't exist in the survey data. After some experimentation, we placed the PDP + Medigap option in the Medigap nest and the stand-alone PDP in the FFS nest, as shown in Figure 2. This preserves the coverage of non-drug cost sharing as the distinguishing characteristic of all plans in the Medigap nest, a feature that we think is essential.

[2] Note that if the inclusive value parameters are constrained to equal one, the nested logit is equivalent to a conditional logit.

DATA AND SAMPLE

Each MCBS respondent in our sample with Medigap or HMO coverage was linked to the Medigap or Medicare HMO plan in which he or she enrolled. MCBS does not provide sufficient information to match to non-standard Medigap plans, e.g., those in the three waiver states: MA, MN, and WI. Therefore, observations residing in MA, MN, or WI are excluded. We also exclude observations indicating the choice of both a Medicare HMO and a Medigap policy simultaneously on grounds that such a choice represents duplicative coverage and is either an error or reflects very unusual circumstances.

In addition, observations with missing values for variables included in our models or with inconsistent data (e.g., indicating an HMO that doesn't exist in the beneficiary's county) are excluded. The final person-year sample consists of 7,972 elderly, non-institutionalized Medicare beneficiaries who are not on Medicaid or enrolled in an employer-sponsored Medicare supplement.

These 7,972 MCBS observations are matched with plan-level benefits and cost-sharing data. Medicare HMO benefits and cost-sharing were coded from the Medicare Personal Plan Finder (MPPF) database (formerly known as Medicare Compare), publicly available on the CMS website. Because MCBS only includes HMO contract identifiers and a drug coverage indicator but not specific plan identifiers, the MPPF data were simplified to include up to two plans per contract number, a drug and non-drug plan.[3] HMO premium, doctor visit cost-sharing, and drug cost-sharing variables were coded. Medigap premium data were obtained from a large insurer and reduced to two plan types, drug and non-drug, by an enrollment-weighted average of the premiums. Medigap premiums, doctor visit cost-sharing, and drug cost sharing variables were coded. The benefits in our models are constant across non-drug Medigap plans. For the drug plans, we computed the enrollment-weighted average of the drug cap. In addition to HMO and Medigap plans, a FFS plan was added to the data by constructing the relevant premium and cost-sharing variables.

KEY VARIABLE CONSTRUCTION

A key person-plan level variable in our nested logit model is "coverage – premium." It measures the difference in dollars between the amount of the individual's lagged spending that would have been covered by the plan and the plan's premium. We constructed the amount covered in two components: drugs amount covered and non-

[3] An insurer may offer multiple plans under a single contract with CMS and many insurers do so. These plans may have substantially different benefits, including the offer of drug benefits. While benefits data for all plans under a single contract are available in the MPPF database, enrollment data at the contract-plan level are not (including that provided by MCBS). A standard technique (Atherly et al., 2004; Pizer and Frakt, 2002) for dealing with this mismatch in data specificity is to reduce the MPPF benefits data to "basic plans" (the lowest premium plan under a contract with ties broken by drug benefit generosity, otherwise randomly). We slightly modified this basic plan approach to take advantage of the fact that MCBS provides a drug coverage indicator. For each contract, we selected a basic non-drug plan and a basic drug plan (if one existed).

drugs amount covered. Because it is more complex, this section describes computation of the drugs version; the non-drugs computation is similar.

For plans with a deductible or cap, the amount covered only includes spending between those values. Below we describe the calculation for a plan with no deductible and no cap. Modification for plans with either or both of these is straightforward. Specifically, for person i, plan j (with no deductible or cap), and year t,

drugs amt. $cov._{ijt}$ = total drug $spending_{jt-1}$ – (ave. $copay_{jt}$) x (num. $prescriptions_{it-1}$).

Lagged total drug spending and lagged number of prescriptions are obtained from the prior year's MCBS dataset. We adjusted lagged total drug spending for moral hazard as described in the main body of the paper. The remainder of this section describes the computation of the average copay for a plan.

Coinsurance for Medigap drug plans is 50%.[4] Copayment and coinsurance data for Medicare HMOs are obtained from the Medicare Personal Plan Finder database. Data from this source are in string format, self-reported by plans. Hence they are idiosyncratic and required considerable parsing, coding, cleaning, and imputation. These steps produced cost sharing for two classes of drugs: generic and brand. We combined these two cost sharing rates to produce an overall average rate by forming a weighted average with the proportions of utilization for generic and brand drugs as weights.

MCBS does not have data on whether particular drugs taken were generic or brand name, but the total amount of drug spending covered by insurance is available. We inferred the proportion of drug utilization attributable to generics by determining the proportion necessary to combine the generic and brand cost sharing rates to get the total rate. For each person-plan-year in our data we computed the ratio

lambda = (tot pct cov – brand pct cov) / (generic pct cov – brand pct cov),

where tot pct cov is itself the ratio of drugs spending by the plan to total drug spending (computed entirely from MCBS data) and brand and generic pct cov are coinsurance rates for the plan (from our Medigap or Medicare Personal Plan Finder data). Finally, average copay is computed from generic and drug copayment using lambda:

ave copay = lambda x (generic copay) + (1-lambda) x (brand copay).

[4] Conversion between coinsurance and copayment was made by scaling by the per-prescription average drug spending (based on MCBS data).

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Figure 1. Estimation Nesting Structure

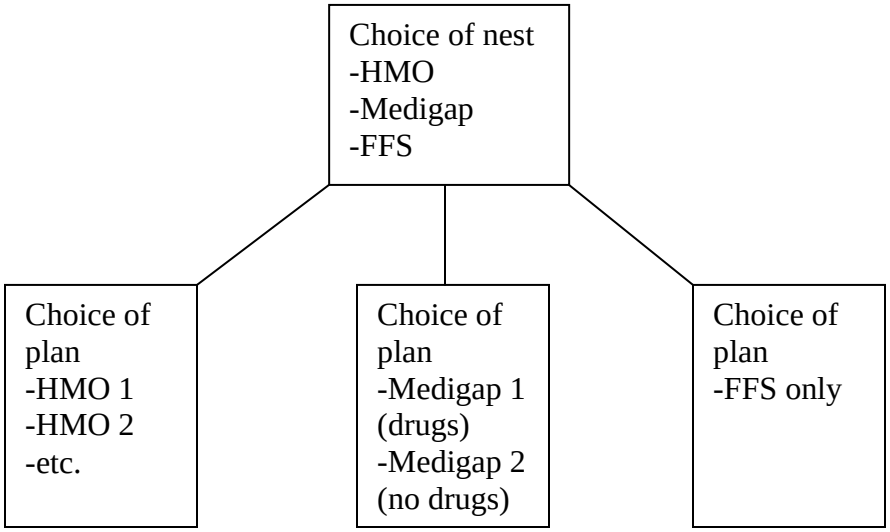
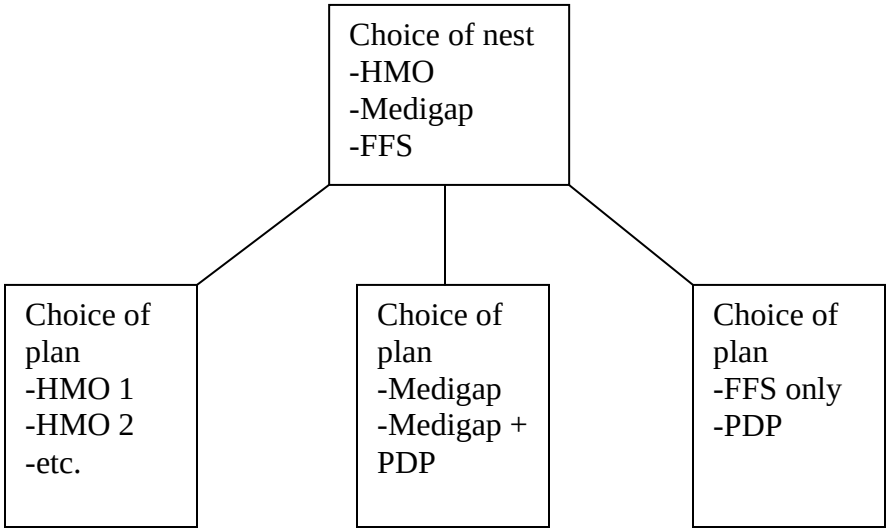
Figure 2. Simulation Nesting Structure