# ONLINE APPENDIX

## Can Health Insurance Competition Work? Evidence from Medicare Advantage

by Curto, Einav, Levin, and Bhattacharya

## Appendix A: Data Set Construction

### A.1 Enrollee-Level Data Set

We combine several sources of data in order to construct a complete panel data set of aged Medicare enrollees during the time period 2006 through 2011. We use four main files, all within the administrative CMS data: the Enrollment Database (EDB), the Risk Adjustment Processing System (RAPS), the Monthly Membership Detail (MMD) database, and the Health Plan Management System (HPMS). We also supplement this with some information from other CMS auxiliary administrative files. In addition to this, we make use of the claim-level files to construct FFS costs at the individual-year level for FFS beneficiaries. The claims files cover a variety of claim types: inpatient, outpatient, home health agency, hospice, skilled nursing facility, durable medical equipment, and Part B carrier, which together provide comprehensive information on Part A and Part B costs for FFS beneficiaries. Our analysis sample consists of every aged Medicare beneficiary enrolled at any point from 2006 through 2011.

We construct a panel data set of individual-year-level observations. The starting sample consists of any individual who was enrolled during any month of an observation year, according to the EDB. The observation years are 2006-2011. We then drop observations according to the following criteria. (i) The individual qualifies for Medicare as "ESRD" (End-Stage Renal Disease) or "Disabled" during any month of the observation year, according to monthly enrollment variables in the EDB. (ii) Months enrolled in Part A is not equal to months enrolled in Part B. This occurs primarily because some Medicare beneficiaries who are still working enroll in Part A, since it is free, but delay Part B enrollment if they receive coverage through an employer and wish to avoid paying the Part B monthly premium. We drop these individuals because they do not receive all of their health benefits through Medicare and their Medicare costs are not directly comparable to those of other Medicare enrollees. (iii) Age on December 31 is less than 65 years old. All individuals who qualify for Medicare on the basis of being aged should be at least 65 years old, so this condition not being met indicates

that the age or birth date is likely incorrect. (iv) The individual is "Dual Eligible" at some point during the sample period. That is, the individual qualifies for both Medicare and Medicaid. We drop these individuals because Medicaid typically covers their Medicare cost-sharing requirements, and MA choices for dual-eligibles are therefore somewhat different. We identify individuals who are dually eligible using a set of monthly Medicaid indicators in the CMS administrative files. (v) The individual lives in Alaska, Guam, Puerto Rico, or the Virgin Islands. (vi) The individual has a missing or invalid county identifier; that is, an identifier that does not appear among the counties with published MA benchmarks. For FFS enrollees, we use the county identifier in RAPS. For MA enrollees, we use the county identifier from the MMD data base in order to be consistent with other MA payment variables. (vii) The individual is missing a risk score. (viii) The individual has a non-Medicare primary payer. (viii) The individual is in Long-Term Institutional (LTI) care, according to a set of monthly LTI indicators that are part of the RAPS database.

In addition to these sample restrictions, we make several additional sample restrictions that are more specific to Medicare Advantage enrollees, corresponding to the restrictions made in constructing the Medicare Advantage plan panel data set. Specifically, we drop observations according to the following criteria. (1) The individual is enrolled in MA according to the EDB but is missing from the records of MA payments, i.e., the MMD database. (2) The individual is enrolled in an MA "Part B Only" plan. (3) The individual is enrolled in an MA Special-Needs Plan (SNP). (4) The individual is enrolled in a plan type other than Local CCP or PFFS. (5) The individual is enrolled outside of the official plan service area, i.e. the individual is enrolled in a plan-county combination that does not appear in the official set of approved plan-county combinations in the HPMS. This can occur if an individual was previously in a plan's service area but then moved to a different location outside of the plan's service area. (6) The individual was enrolled in an employer-sponsored "800-series" MA plan. Although this is a relatively large and important segment of the MA market, we drop these plans from our analysis for three reasons. First, the choice of plan is made not by the Medicare beneficiary but instead by the employer, which renders these plans unsuitable for demand analysis. Second, these plans are not available to all Medicare beneficiaries and are thus not part of the choice set for Medicare beneficiaries who are not affiliated with the relevant employer. Third, it is likely that these plans are subsidized by the employer, and we do not observe the subsidy amounts.

We impose these restrictions to limit the sample to aged Medicare beneficiaries enrolled in Medicare during the sample period from 2006-2011. This procedure yields an unbalanced panel: an

individual can leave the sample before 2011 if he dies, and newly eligible Medicare enrollees enter the sample each year. The exact numbers of observations in the initial and final samples as well as counts of dropped observations are reported in Appendix Table A5.

### A.2 Key Enrollee-Level Variable Definitions

- FFS or MA indicator. The EDB contains information at the monthly level on enrollment in Medicare Parts A, B, and C. We classify an individual as FFS if he was enrolled in Medicare Parts A and B during the first month of enrollment that we observe for the observation year, and we classify him as MA if he was enrolled in Medicare Part C during the first month of enrollment that we observe.

- Age. This is constructed using the beneficiary's birth date in the EDB, and computed as of December 31 of the observation year.

- Male. This variable is constructed from the demographic information in the EDB.

- Urban. We define "urban" using the classification that was used to set the urban floor in 2004, when the urban floor was last set prior to the beginning of our sample period. We identify counties that were at the urban floor in 2004, and we construct an urban indicator that is equal to one if the individual lives in one of these counties.

- New enrollee in FFS/MA. The EDB contains a variable with the Medicare beneficiary's Medicare start date. If the year of this start date is equal to the observation year, then we define that beneficiary as a new enrollee.

- Supplemental insurance (Medigap or RSI). The CMS administrative files contain a beneficiary insurance profile that provides information on which beneficiaries have supplemental insurance on top of regular Medicare. We construct a supplemental insurance indicator that is equal to one if a beneficiary appears in the file that lists those beneficiaries with supplemental insurance.

- Part D. The EDB contains information at the monthly level on enrollment in Medicare Part D. We construct a Part D indicator that is equal to one if the beneficiary is enrolled in Part D during any month of the observation year.

- Inpatient days. For each beneficiary, we sum the inpatient days that appear in the inpatient claims files for the entire observation year. For the rare cases when this exceeds 365, we set the number of inpatient days equal to 365. Although MA enrollees do not generally have FFS claims during our sample period, the one exception is that hospitals are required to submit "information only claims" to CMS for the MA beneficiaries they treat, as of January 2008 (according to http://www.cms.gov/ Regulations-and-Guidance/Guidance/ Transmittals/downloads/R1311CP.pdf). The reason for this is that the total number of days a hospital treats Medicare beneficiaries is incorporated into the formulas used to compute other hospital payments, such as Disproportionate Share Hospital (DSH) payments. For this reason, we do observe inpatient claims for MA beneficiaries, at least from 2008 on, and in principle the inpatient days variable on these claims should be reliable, so we report its mean in our summary statistics table. However, we do not over-emphasize this variable as it is likely that there is a lack of full compliance with this reporting mandate.

- Died during year. The EDB contains a variable with the Medicare beneficiary's date of death. We construct an indicator for death during the observation year that is equal to one if the year of death is equal to the observation year.

- Risk score. For FFS beneficiaries, we use the risk scores in RAPS, which are calculated for all Medicare beneficiaries (not just MA enrollees). For MA beneficiaries, we use the risk scores in the MMD that are used to compute MA payments. We apply year-specific normalization factors to ensure that the FFS risk scores are comparable to the risk scores in the MMD. That is, as CMS publicly reports that it also does, we divide risk scores by 1 in 2006, 1.029 in 2007, 1.040 in 2008, 1.030 in 2009, 1.041 in 2010, and 1.058 in 2011. We are able to verify that the normalized MA risk scores from the RAPS and the MA risk scores from the MA payments file are almost always identical, except for the years 2010 and 2011. In those latter two years, the MA risk scores in the payment files also incorporate an upcoding adjustment (CMS publicly reports that it divided all MA risk scores by 1.0341 and this coincides with what we observe in the MA risk scores that are used to compute payments in the MA payments files).

- FFS monthly claims costs. We use the payment variables in the Medicare claims files to construct total taxpayer costs for the observation year (we exclude beneficiary cost-sharing amounts). We divide this by the number of months enrolled in Parts A and B in order to obtain monthly claims costs for FFS beneficiaries.

- MA monthly total CMS payment. In the MMD database, we observe monthly payments made to MA plans on behalf of each MA enrollee. We assign each MA enrollee to the plan in which he is enrolled in August of the observation year. We use August because September through December is not available for our last two observation years, 2010 and 2011. If the MA enrollee does not appear among the August payments (for instance, because he died earlier during the observation year), then we assign his plan in July, and so on, working backwards until we reach January. Once we have assigned each MA enrollee to a particular MA plan, we also use the MA payment associated with the particular month that was used, and we define this as the MA monthly total CMS payment.

- MA monthly rebate payment. We use the same procedure described in defining the MA monthly total CMS payment. We use the MA rebate associated with the particular month that was used to assign an MA enrollee's plan, and define this as the MA monthly rebate payment.

### A.3 Medicare Advantage Plan Panel Data Set

For our analysis of competitive bidding, we combine information from the HPMS and MMD to construct a panel data set of all MA plans offered from 2006 through 2011. We use the HPMS to construct the official set of plan offerings in each county-year. The HPMS is a database maintained by CMS that contains the official list of approved MA plans in each year, including the list of counties in which each plan can operate (known as the plan's "service area"). The HPMS also has information on the organization that offers each plan (i.e., the name of the private insurer), as well as a unique contract identifier and plan identifier.

In addition, we observe basic plan characteristics, such as whether the plan offers Part C supplemental benefits, whether the plan is bundled with Part D benefits, and how the plan rebate is allocated across four different categories: a reduction in cost sharing, a reduction of the Part B premium, an increase in Part D benefits, and other mandatory benefits.

We do not directly observe the standardized plan bids. However, we do observe the exact difference between the plan bid and the plan benchmark (since we observe the rebate directly). Furthermore, in the MMD file we observe the exact total payment, risk score used to calculate payment, county, contract identifier, and plan identifier for each MA beneficiary during each month of our sample period. In addition, we know the county benchmark, since this information is publicly

available, and we know the formula used to compute the payment and rebate as a function of the bid, benchmark, and risk score. The only component in the mapping from standardized bid to payment that we do not observe is the plan-provided projected enrollment weights that are used to compute Intra-Service Area Rate (ISAR) factors for plan-county-specific payment rates. In some of the analysis, we use realized enrollment weights instead of projected enrollment weights.

The initial sample has 35,367 plan-years. We drop observations according to the following criteria. (a) The plan is only offered in Alaska, Guam, Puerto Rico, or the Virgin Islands (617 plan-years). (b) The plan is a "Part B Only" plan (306 plan-years). (c) The plan is a Special Needs Plan (SNP) (3,079 plan-years). We drop these plans because they are especially designed to serve certain subpopulations, such as Dual Eligibles, that are not the primary focus of our analysis. (d) The plan is of a type other than Local CCP or PFFS (e.g., Regional PPO or Cost) (13,461 plan-years). These alternative plan types, although numerous, serve a small fraction of MA enrollees and do not have the same competitive bidding system as Local CCP and PFFS plans. (e) The plan is an employer-sponsored "800 series" plan (5,402 plan-years). These plans are selected by employers and are not available to all Medicare enrollees. (f) The plan bid is missing (this occurs if we do not observe a single enrollee in a given plan) (191 plan-years).

The final sample has 12,311 plan-years (1,566 plans in 2006, 1,898 plans in 2007, 2,416 plans in 2008, 2,526 plans in 2009, 2,132 plans in 2010, and 1,773 plans in 2011), of which 12,065 have at least one enrollee. There are 4,930 unique plans.

# Appendix B: Construction of Cost Benchmarks

## B.1. Comparison of FFS Costs with MedPAC and Alternative Approaches

Our FFS cost benchmarks are different from the ones published by CMS and used by MedPAC to benchmark the MA program (MedPAC, 2012). CMS publishes county FFS costs based on a sample that includes all aged Medicare beneficiaries, including dual eligibles. Each year, CMS add up FFS claims for each county and divides by the number of FFS enrollees in the county multiplied by 12 (this is done separately for Parts A and B). This is reported as a monthly FFS cost. With dual eligibles included, the average risk score is 1.00, and CMS does not report a separate risk-adjusted number.

Our approach differs in several ways. First, we exclude dual-eligible FFS enrollees. We do this because our analysis of MA excludes the separate special needs plans (SNPs) offered for dual

eligibles, so we want to work with the corresponding FFS population. Second, for each county-year, we add up FFS costs and divide by the total number of risk-months. The latter is important because without dual eligibles, the average risk score of FFS enrollees in our sample is only 0.97, and also because the average number of months that a FFS enrollee is actually enrolled is only 11.3 (due to mortality, as well as mid-year enrollment by newly eligibles). That is, we construct the monthly flow cost for FFS coverage per insured risk unit, rather than the annual cost of an FFS enrollee divided by 12.

The most important difference is the exclusion of dual eligibles. Dual eligibles are about 70 percent more expensive than other aged Medicare beneficiaries. It appears that CMS's risk scoring formula does not fully account for this. The average risk score of FFS dual eligibles is 1.56, compared to 0.97 for the non-dual FFS enrollees in our sample. As a result, including dual eligibles to benchmark non-SNP Medicare Advantage plans would seem to result in counterfactual FFS costs that are too high. Appendix Table A7 reports results about the impact of various sample restrictions on the comparability of our and MedPAC estimates.

Our cost benchmarks are relatively simple, but it is possible to consider some elaborations.

- Allow FFS costs to scale non-linearly with risk score. We estimate a Poisson model of claims with $E[x_i] = \exp(\alpha_k + \beta_k \ln r_i)$, and also with quadratic and cubic terms for $\ln r$, allowing the $\alpha_k$ and $\beta_k$ parameters to vary by location-year. We obtain slope parameters $\beta_k$ slightly above 1, but the overall model does not have superior in-sample fit to the model above.

- Allow the degree of residual selection to vary by plan type or by location and year, or by risk score. One can use proxies other than mortality to estimate the degree of residual selection. We focus on mortality because we observe it reliably for all beneficiaries.

- Estimate a predictive model of FFS costs using the underlying disease codes, while attempting to adjust for differential coding across FFS and MA. This might be something to consider in future work.

### B.2. Using Conditional Mortality to Rescale MA Risk Scores

In this section, we provide the details for how we use mortality conditional on risk score in order to rescale MA risk scores to make them comparable to FFS risk scores. This is relevant for computing predicted FFS costs – that is, the FFS costs associated with MA enrollees had they remained enrolled in traditional Medicare. This adjustment is a way to account for health differences not

captured in the risk score. As discussed in the text, we let $\mu_{FFS}(r)$ and $\mu_{MA}(r)$ denote the one-year mortality rates of FFS and MA enrollees, respectively. Assuming both rates are strictly increasing in $r$ (and that expected costs scale proportionately with mortality rate), we can define $\Lambda(r)$ to be an increasing function such that $\mu_{FFS}(\Lambda(r)) = \mu_{MA}(r)$. To operationalize this, we compute a single scaling factor $\lambda_t$ for each year, so that in year $t$ we have $\Lambda_t(r) = \lambda_t \cdot r$. In other words, we assume that if an MA enrollee is observed to have risk score $r$ in the data, then we can multiply this risk score $r$ by $\lambda_t$ in order to obtain the comparable risk score in traditional Medicare.

In the following, we outline the steps to compute this $\lambda_t$ scaling factor for each year in our data. These steps are as follows:

(1) We construct a geographically balanced sample of MA and FFS enrollees by randomly dropping FFS enrollees in each county-year until their total number equals the total number of MA enrollees in that county (or vice versa if MA enrollees happen to be the majority, which is unusual). This leaves us with a geographically balanced sample of 27,623,126 MA and 27,623,126 FFS beneficiary-year observations over the entire sample period from 2006 through 2011.

(2) We create risk bins that are of width 0.05 for risk scores between 0.3 and 3 and are of width 0.25 for risk scores between 3 and 10. We trim a very small number of outliers (risk scores above 10) from the geographically balanced sample (3,050 out of 55,246,252 observations over the course of the entire sample period).

(3) For each bin, we compute mean FFS risk, mean FFS mortality, mean MA risk, and mean MA mortality (weighting everyone within the bin equally).

(4) We sort all the risk bins by FFS mortality. We also sort all the risk bins by MA mortality. This gives us a monotone function from risk to mortality; one function for FFS enrollees and one function for MA. Thus, each risk bin is associated with a "sorted" FFS mortality rate and a "sorted" MA mortality rate.

(5) For each bin, we find the maximum value of sorted FFS mortality that is less than or equal to the value of sorted MA mortality associated with that bin (this is the FFS mortality lower bound). We then find the value of FFS risk that corresponds to this FFS mortality lower bound, which gives us an "implied lower risk" for that bin (lower bound on the FFS risk score associated with that bin).

(6) For each bin, we find the minimum value of sorted FFS mortality that is greater than or equal to the value of sorted MA mortality associated with that bin (this is the FFS mortality upper bound). We then find the value of FFS risk that corresponds to this FFS mortality upper bound,

which gives us an "implied upper risk" for that bin.

(7) For each bin, we interpolate in order to assign an FFS risk score to the bin. In order to do this, we find that the value of sorted MA mortality is at a certain proportion of the distance between the FFS mortality lower bound and the FFS mortality upper bound associated with that bin. Then, we assign the risk score to this bin that is at the same proportion of the distance between the implied lower risk and the implied upper risk.

(8) For each bin, we divide the FFS risk score by the mean MA risk score to obtain $\lambda$ for that particular bin.

(9) To obtain an overall value of $\lambda_t$ for the given observation year, we compute a weighted average of the bin-specific $\lambda$s, weighting by the number of MA beneficiaries in each bin. These year-specific $\lambda_t$ adjustment factors are reported in the text.

# Appendix C: Additional Details about the Computations and Counterfactual Exercises

## C.1 Variable Definitions

A *market* is a county-year and indexed by $k$. Alternatively, we index counties by $c$ and years by $t$.

A *plan* is a unique MA plan benefit package and plans are indexed by $j$.

A plan's *service area* is the set of counties for which the plan has official approval to enroll and receive payment for Medicare beneficiaries. This is fixed for a given calendar year but may change from year to year.

The *standardized plan bid* is denoted by $b_{jt}$ and defined as the bid that an MA plan submits as its cost to cover an enrollee in its service area with risk score 1. In a given year, a plan submits only one standardized plan bid for its entire service area.

The *plan benchmark* is denoted by $B_{jt}$ and defined as the plan-specific benchmark that CMS calculates. This is a weighted mean of the administrative benchmarks for the counties in the plan's service area, where the weights are equal to projected enrollment weights submitted by the plan.

The *plan price* is denoted by $p_{jt}$ and defined as $p_{jt} = 0.75 \cdot (b_{jt} - B_{jt}) \cdot \mathbf{1}\{b_{jt} \leq B_{jt}\} + (b_{jt} - B_{jt}) \cdot \mathbf{1}\{b_{jt} > B_{jt}\}$.

The *market share of plan $j$ in market $k$* is denoted by $s_{jk}$ and defined as the risk-weighted proportion of Medicare beneficiaries in market $k$ enrolled in plan $j$.

The *market share of Traditional Medicare in market k*, also known as the *market share of plan* 0 *in market k*, is denoted by $s_{0k}$ and defined as the risk-weighted proportion of Medicare beneficiaries in market $k$ enrolled in Traditional Medicare.

The *within-MA market share of plan j in market k* is denoted by $\bar{s}_{jk}$ and defined as the risk-weighted proportion of MA beneficiaries in market $k$ enrolled in plan $j$.

## C.2 Calculating Elasticities

By definition, the own-price elasticity of demand for plan $j$ in market $k$ is $\theta_{jk} = \frac{\partial Q_{jk}/Q_{jk}}{\partial p_j/p_j}$. Noting that the nested logit market share is given by

$$s_j = \frac{\exp\left(\frac{\delta_j}{1-\sigma}\right)}{\sum_{j>0}\exp\left(\frac{\delta_j}{1-\sigma}\right)} \cdot \frac{\left[\sum_{j>0}\exp\left(\frac{\delta_j}{1-\sigma}\right)\right]^{1-\sigma}}{\exp(\delta_0) + \left[\sum_{j>0}\exp\left(\frac{\delta_j}{1-\sigma}\right)\right]^{1-\sigma}},$$

we differentiate the expression for $s_j$ to obtain

$$\frac{\partial s_j}{\partial \delta_j} = s_j\left(\frac{1-\bar{s}_j}{1-\sigma} + \bar{s}_j s_0\right) \text{ and } \frac{\partial s_j}{\partial \delta_l} = -s_j\bar{s}_l\left(\frac{1}{1-\sigma} - s_0\right).$$

Letting $M_k$ denote the size of market $k$, we have $Q_{jk} = M_k \cdot s_{jk}$. Then

$$\begin{aligned}\theta_{jk} &= \frac{\partial Q_{jk}}{\partial p_{jk}} \cdot \frac{p_{jk}}{Q_{jk}} = \frac{\partial s_{jk}}{\partial p_{jk}} \cdot \frac{p_{jk}}{s_{jk}} = \frac{\partial s_{jk}}{\partial \delta_{jk}} \cdot \frac{\partial \delta_{jk}}{\partial p_{jk}} \cdot \frac{p_{jk}}{s_{jk}} \\ &= -\alpha \cdot p_j\left(\frac{1-\bar{s}_{jk}}{1-\sigma} + \bar{s}_{jk}s_{0k}\right).\end{aligned}$$

We estimate the following nested logit specification:

$$\ln(s_{jk}) - \ln(s_{0k}) = \delta_{jk} + \sigma\ln(\bar{s}_{jk})$$

where $\delta_{jk} = x'_{jk}\beta - \alpha p_{jk} + \eta_k + \xi_{jk}$. This yields estimates $\hat{\alpha}$ and $\hat{\sigma}$, which we use to compute $\theta_{jk}$ for each plan-county-year combination. (For the logit demand specifications, we set $\sigma$ equal to 0.) We report the risk-month-weighted mean of $\theta_{jk}$ in the demand tables.

### C.3 Calculating Mark-ups

In the text we show that optimal bidding implies the first-order conditions

$$c = b + (\Omega \cdot D_b Q)^{-1} Q$$

where $c$, $b$, and $Q$ are $J$-dimensional vectors of the implied costs, observed bids, and observed shares, respectively, in each market, $D_b Q$ is the estimated matrix of own- and cross-bid derivatives, and $\Omega$ is the ownership matrix. In this section we discuss how we compute the mark-up vector, $(\Omega \cdot D_b Q)^{-1} Q$, for each market.

We compute mark-ups separately for each market. For a given market, suppose there are $J$ plans. Note that with the nested logit specification it can be shown that

$$\frac{\partial s_j}{\partial b_j} = -0.75 \cdot \alpha s_j \left( \frac{1 - \bar{s}_j}{1 - \sigma} + \bar{s}_j s_0 \right) \times \mathbf{1}\{b_j \leq B_j\} - \alpha s_j \left( \frac{1 - \bar{s}_j}{1 - \sigma} + \bar{s}_j s_0 \right) \times \mathbf{1}\{b_j > B_j\},$$
$$\frac{\partial s_j}{\partial b_l} = 0.75 \cdot \alpha s_j \bar{s}_l \left( \frac{1}{1 - \sigma} - s_0 \right) \times \mathbf{1}\{b_l \leq B_l\} + \alpha s_j \bar{s}_l \left( \frac{1}{1 - \sigma} - s_0 \right) \times \mathbf{1}\{b_l > B_l\}.$$

We define a $J \times J$ matrix called $D_b Q$ with

$$(D_b Q)_{jl} = \frac{\partial s_l}{\partial b_j}$$

(note that the index $l$ that corresponds to the column is the same as the index $l$ that corresponds to the market share; this is necessary for the subsequent matrix multiplication). We use the estimates that we obtain from the nested logit estimation, $\hat{\alpha}$ and $\hat{\sigma}$, to compute the entries of $D_b Q$ for each market. We define the ownership matrix $\Omega$ with $\Omega_{jl} = \mathbf{1}\{\text{plans } j \text{ and } l \text{ owned by same MA parent organization}\}$. Once we have all these components, it is straightforward to compute $(\Omega \cdot D_b Q)^{-1} Q$, which gives us the mark-up for each plan-market combination.

### C.4 Counterfactuals

Let $\phi$ denote the (scalar) pass-through rate estimated from regressions of the plan bid on the plan benchmark. Let $\psi$ denote the current rebate pass-through rate (i.e., $\psi = 75\%$). Let $R_{jt}$ denote the plan rebate. Let $FFS_k$ denote the published monthly Medicare FFS costs in market $k$. Let $n_{jk}$ denote the realized number of MA enrollees for plan $j$ in market $k$, and $n_{jt} = \sum_c n_{jct}$ be the total enrollment in plan $j$ in year $t$. Let $FFS_{jt} = \sum_c \frac{n_{jk}}{n_{jt}} FFS_k$ denote the plan enrollment-weighted

average $FFS$ cost in plan $j$'s service area in year $t$.

The steps involved in computing the counterfactuals are below. Note that we report only a subset of the counterfactuals in the main text (Table 6). The full set is reported in Table A12.

1. Estimate a nested logit specification to obtain estimates $\hat{\alpha}$ and $\hat{\sigma}$.

2. Compute the estimated plan-market-level mark-ups as outlined in the previous section, and let these be denoted by $\hat{m}_{jk}$.

3. Generate a variable for the estimated plan cost $\hat{c}_{jk} = b_{jk} - \hat{m}_{jk}$ (for an enrollee with risk score 1).

4. Compute the counterfactual standardized plan bids, denoted by $\tilde{b}_{jt}$, given the counterfactual plan benchmarks, denoted by $\tilde{B}_{jt}$ and counterfactual rebate rate $\tilde{\psi}$. This step is different in the different scenarios, as described below:

   *Counterfactual 1: Plans bid their cost.* Let $\tilde{b}_{jt} = \hat{c}_{jt}$, where $\hat{c}_{jt}$ is the risk-month-enrollment-weighted average of $\hat{c}_{jct}$. Let $\tilde{B}_{jt} = B_{jt}$.

   *Counterfactual 2: Plans bid the benchmark.* Let $\tilde{b}_{jt} = \tilde{B}_{jt} = B_{jt}$.

   *Counterfactual 3: Benchmarks are set at 100 percent of FFS costs.* Let $\tilde{B}_{jt} = 100\% \cdot FFS_{jt}$ and let $\tilde{b}_{jt} = b_{jt} + (\tilde{B}_{jt} - B_{jt}) \cdot \phi$.

   *Counterfactual 4: Benchmarks are set at 95 percent of FFS costs.* Let $\tilde{B}_{jt} = 95\% \cdot FFS_{jt}$ and let $\tilde{b}_{jt} = b_{jt} + (\tilde{B}_{jt} - B_{jt}) \cdot \phi$.

   *Counterfactual 5: Benchmarks are set at 80 percent of FFS costs.* Let $\tilde{B}_{jt} = 80\% \cdot FFS_{jt}$ and let $\tilde{b}_{jt} = b_{jt} + (\tilde{B}_{jt} - B_{jt}) \cdot \phi$.

   *Counterfactual 6: Rebates are passed through at 50 percent.* Let $\tilde{\psi}$ denote the counterfactual rebate pass-through rate (i.e., $\tilde{\psi} = 50\%$). We make the simplifying assumption that the same plans that previously bid below the benchmark will continue to bid below the benchmark, and the same plans that previously bid above the benchmark will continue to bid above the benchmark. First consider plans bidding below the benchmark. In the mark-up equation $m = (\Omega \cdot D_b Q)^{-1} Q$, for plans that bid below the benchmark we have that entry $(j, l)$ in the matrix $D_b Q$ is $-\psi \cdot \alpha s_j \left( \frac{1-\bar{s}_j}{1-\sigma} + \bar{s}_j s_0 \right)$ if $j = l$ and $\psi \cdot \alpha s_j \bar{s}_l \left( \frac{1}{1-\sigma} - s_0 \right)$ if $j \neq l$. We also assume that given the counterfactual rebate pass-through rate, consumers will value rebate dollars proportionately less. That is, to obtain the counterfactual matrix $\tilde{D_b Q}$ we can

multiply $D_b Q$ by $\tilde{\psi}/\psi$. It follows that the counterfactual mark-ups for plans bidding below the benchmark are given by $\tilde{m} = (\psi/\tilde{\psi}) \cdot m$. For the case with $\psi = 75\%$ and $\psi = 50\%$, this means that counterfactual mark-ups will be higher. In accordance with our assumption that the same plans continue to bid below the benchmark, we assume that if the counterfactual mark-up would cause a plan to bid above the benchmark, then the plan will instead bid the benchmark. Now consider plans bidding above the benchmark. For those plans, the entry $(j,l)$ in the matrix $D_b Q$ is $-\alpha s_j \left(\frac{1-\bar{s}_j}{1-\sigma} + \bar{s}_j s_0\right)$ if $j = l$ and $\alpha s_j \bar{s}_l \left(\frac{1}{1-\sigma} - s_0\right)$ if $j \neq l$; since the rebate pass-through rate does not enter these expressions, we assume that $\tilde{m} = m$ for plans bidding above the benchmark. In summary, we have

$$\tilde{b}_{jt} = \begin{cases} \hat{c}_{jt} + (\psi/\tilde{\psi}) \cdot m_{jt} \text{ if } b_{jt} \leq B_{jt} \text{ and } \hat{c}_{jt} + (\psi/\tilde{\psi}) \cdot m_{jt} \leq B_{jt} \\ \tilde{B}_{jt} \text{ if } b_{jt} \leq B_{jt} \text{ and } \hat{c}_{jt} + (\psi/\tilde{\psi}) \cdot m_{jt} > B_{jt} \\ b_{jt} \text{ if } b_{jt} > B_{jt} \end{cases}$$

and we have $\tilde{B}_{jt} = B_{jt}$.

*Counterfactual 7: Rebates are passed through at 25 percent.* This case is computed in the same way as Counterfactual 6, but with $\tilde{\psi} = 25\%$.

*Counterfactual 8: No rebates.* If there are no rebates, then plans with costs below the benchmark have no incentive to bid below the benchmark. Thus, we have $\tilde{b}_{jt} = B_{jt}$ if $b_{jt} \leq B_{jt}$, $\tilde{b}_{jt} = b_{jt}$ if $b_{jt} > B_{jt}$, and $\tilde{B}_{jt} = B_{jt}$.

*Counterfactual 9: Benchmarks are set at 100 percent of FFS costs and rebates are passed through at 50 percent.* Let $\tilde{B}_{jt} = \gamma \cdot FFS_{jt}$, where $\gamma = 100\%$. Let $b^*_{jt} = b_{jt} + (\tilde{B}_{jt} - B_{jt}) \cdot \phi$. Notice that $b^*_{jt}$ is the bid calculated using the bid-on-benchmark pass-through rate when we have a rebate pass-through rate of 75%. If $b^*_{jt} > \tilde{B}_{jt}$, then there is no rebate and a change in the rebate pass-through rate does not affect the plan bid, so we have $\tilde{b}_{jt} = b^*_{jt}$. On the other hand, if $b^*_{jt} \leq \tilde{B}_{jt}$, then a change in the rebate pass-through rate affects the plan mark-up. To simplify matters, we use the same reasoning as in Counterfactual 6 in order to argue that the mark-up can be approximated using the equation $b^*_{jt} = \hat{c}_{jt} + m^*_{jt}$ and that we can approximate the change in mark-up that results from changing the rebate pass-through rate as $(\psi/\tilde{\psi}) \cdot m^*_{jt}$. We again assume that if this counterfactual mark-up would cause a plan to bid above the benchmark, then the plan will instead bid the benchmark. Finally, we assume that no plan

will bid below cost. In summary, letting $\tilde{\psi} = 50\%$, we have

$$\tilde{b}_{jt} = \begin{cases} b_{jt} + (\tilde{B}_{jt} - B_{jt}) \cdot \phi \text{ if } b_{jt} + (\tilde{B}_{jt} - B_{jt}) \cdot \phi > \tilde{B}_{jt} \\ \hat{c}_{jt} + (\psi/\tilde{\psi}) \cdot (b_{jt} + (\tilde{B}_{jt} - B_{jt}) \cdot \phi - \hat{c}_{jt}) \text{ if } b_{jt} + (\tilde{B}_{jt} - B_{jt}) \cdot \phi \leq \tilde{B}_{jt} \\ \quad \text{and } \hat{c}_{jt} + (\psi/\tilde{\psi}) \cdot (b_{jt} + (\tilde{B}_{jt} - B_{jt}) \cdot \phi - \hat{c}_{jt}) \leq \tilde{B}_{jt} \\ \tilde{B}_{jt} \text{ if } b_{jt} + (\tilde{B}_{jt} - B_{jt}) \cdot \phi \leq \tilde{B}_{jt} \text{ and } \hat{c}_{jt} + (\psi/\tilde{\psi}) \cdot (b_{jt} + (\tilde{B}_{jt} - B_{jt}) \cdot \phi - \hat{c}_{jt}) > \tilde{B}_{jt} \end{cases}$$

with the additional condition that we set $\tilde{b}_{jt}$ equal to $\hat{c}_{jt}$ if it is less than $\hat{c}_{jt}$.

*Counterfactuals 10-17: Benchmarks are set at $\gamma$ percent of FFS costs and rebates are passed through at $\tilde{\psi}$ percent.* These are identical to Counterfactual 9 but with $\tilde{B}_{jt} = \gamma \cdot FFS_{jt}$ and $\gamma$ taking various levels, and also $\tilde{\psi}$ taking various levels.

5. Generate other counterfactual variables: the plan rebate $\tilde{R}_{jt} = -\tilde{\psi} \cdot (\tilde{b}_{jt} - \tilde{B}_{jt}) \cdot \mathbf{1}\{\tilde{b}_{jt} \leq \tilde{B}_{jt}\}$, the plan price $\tilde{p}_{jt} = -\tilde{\psi} \cdot (\tilde{b}_{jt} - \tilde{B}_{jt}) \cdot \mathbf{1}\{\tilde{b}_{jt} \leq \tilde{B}_{jt}\} - (\tilde{b}_{jt} - \tilde{B}_{jt}) \cdot \mathbf{1}\{\tilde{b}_{jt} > \tilde{B}_{jt}\}$, and the plan premium $\tilde{P}_{jt} = (\tilde{b}_{jt} - \tilde{B}_{jt}) \cdot \mathbf{1}\{\tilde{b}_{jt} > \tilde{B}_{jt}\}$.

6. Generate a variable for plan quality $\hat{\delta}_{jk} = \ln(s_{jk}) - \ln(s_{0k}) - \hat{\sigma} \ln(\bar{s}_{jk})$. Also generate a variable for plan quality excluding the component of plan quality generated by rebate dollars, i.e., $\hat{\delta}_{jk}^{NOREBATE} = \hat{\delta}_{jk} + \hat{\alpha} \cdot \psi \cdot (b_{jt} - B_{jt}) \cdot \mathbf{1}\{b_{jt} \leq B_{jt}\}$. Generate a variable for counterfactual plan quality $\tilde{\delta}_{jk} = \hat{\delta}_{jk} + \hat{\alpha} \cdot \psi \cdot (b_{jt} - B_{jt}) - \hat{\alpha} \cdot \tilde{\psi} \cdot (\tilde{b}_{jt} - \tilde{B}_{jt})$ and counterfactual plan quality excluding the component of plan quality generated by rebate dollars $\tilde{\delta}_{jk}^{NOREBATE} = \tilde{\delta}_{jk} + \hat{\alpha} \cdot \tilde{\psi} \cdot (\tilde{b}_{jt} - \tilde{B}_{jt}) \cdot \mathbf{1}\{\tilde{b}_{jt} \leq \tilde{B}_{jt}\}$.

7. Using the expression for market share $s_{jk}$ in terms of plan quality $\delta_{jk}$, compute counterfactual market shares and the MA penetration rate.

8. For a given market $k$ with $J_k$ plans, compute counterfactual market-level consumer surplus using the expression

$$\tilde{CS}_k = \frac{1}{\hat{\alpha}} \ln \left[ 1 + \exp \left( (1 - \hat{\sigma}) \ln \left[ \sum_{j=1}^{J_k} \exp \left( \frac{\tilde{\delta}_{jk}}{1 - \hat{\sigma}} \right) \right] \right) \right].$$

Also compute consumer surplus excluding the component of plan quality generated by rebate

dollars, i.e.,

$$\tilde{CS}_k^{NOREBATE} = \frac{1}{\hat{\alpha}} \ln \left[ 1 + \exp \left( (1-\hat{\sigma}) \ln \left[ \sum_{j=1}^{J_k} \exp \left( \frac{\tilde{\delta}_{jk}^{NOREBATE}}{1-\hat{\sigma}} \right) \right] \right) \right].$$

9. Compute all other variables that are straightforward functions of the bids, benchmarks, and mean risk scores (direct payments to plans, total payments to plans, plan profits, etc.) and report per enrollee-month means in the table with counterfactual results.

# Appendix Table A1: Coverage options available to Medicare beneficiaries

| | Traditional Medicare (TM) | TM + Part D | TM + Medigap | TM + Medigap + Part D | Medicare Advantage (MA) | MA Part D Plan |
|---|---|---|---|---|---|---|
| Monthly Premium | Part B | Part B + Part D | Part B + Medigap | Part B + Medigap + Part D | Part B + MA | Part B + MA |
| Hospital/Physician Cost-Sharing Requirements | Baseline | Baseline | Lower | Lower | Lower | Lower |
| Prescription Drug Cost-Sharing Requirements | Baseline | Lower | Baseline | Lower | Baseline | Lower |
| Additional Benefits | None | None | None | None | Supplemental benefits (e.g., dental, vision) | Supplemental benefits (e.g., dental, vision) |
| Provider Network | Unrestricted | Unrestricted | Unrestricted | Unrestricted | Plan network | Plan network |

Table describes the set of options available to Medicare beneficiaries. The paper focuses on the choice of an MA plan (one of the two last columns), but beneficiaries could also purchase additional coverage (beyond the basic coverage provided by TM) by purchasing Medigap and/or Part D coverage separately.

## Appendix Table A2: Medicare Advantage Concentration Metrics

| | All | Urban | Rural | 2006-07 | 2008-09 | 2010-11 |
|---|---|---|---|---|---|---|
| C2 | 85.6% | 82.0% | 86.5% | 91.1% | 79.3% | 86.5% |
| C2 > 75% | 76.5% | 69.4% | 78.5% | 88.3% | 62.5% | 79.3% |
| C2 > 90% | 47.6% | 37.6% | 50.4% | 65.9% | 28.5% | 49.3% |
| C3 | 93.9% | 91.4% | 94.6% | 97.0% | 89.8% | 95.0% |
| C3 > 75% | 95.4% | 91.5% | 96.5% | 99.0% | 90.4% | 97.1% |
| C3 > 90% | 75.8% | 67.3% | 78.2% | 89.2% | 58.5% | 80.5% |
| HHI | 53.2% | 47.7% | 54.7% | 63.5% | 44.6% | 52.0% |

Statistics in the table are calculated using MA enrollment data from 2006-2011 and are calculated at the county-year level. We report the mean of each variable across the relevant county-years. We only include a county-year if it has at least one MA enrollee, and we weight each county-year equally when we compute the mean across county-years. We define C2 as the market share (of enrollee risk-months) of the top two insurers in a county-year, and C3 is defined analogously. The row labeled "C2 > 75%" is an indicator variable equal to one if C2 is greater than 75 percent. Other indicator variables are defined analogously. The HHI is the Herfindahl Index.

# Appendix Table A3: Top MA Insurers

| Insurer | National Market Share | Percentage of Counties Where Active |
|---|---|---|
| UnitedHealth Group, Inc. | 19.3 | 80.7 |
| Humana, Inc. | 15.7 | 96.7 |
| Blue Cross Blue Shield Affiliates | 8.1 | 25.1 |
| Kaiser Foundation Health Plan, Inc. | 7.8 | 2.4 |
| WellPoint, Inc. | 4.8 | 72.9 |
| Highmark, Inc. | 3.4 | 3.8 |
| Coventry Health Care, Inc. | 3.1 | 87.8 |
| Health Net, Inc. | 3.0 | 19.7 |
| Aetna, Inc. | 2.2 | 20.0 |
| Universal American Corp. | 2.1 | 98.7 |
| HealthSpring, Inc. | 1.5 | 4.8 |
| WellCare Health Plans, Inc. | 1.3 | 64.9 |
| The Regence Group | 1.1 | 2.8 |
| EmblemHealth, Inc. | 1.0 | 2.2 |
| UCare Minnesota | 1.0 | 3.6 |
| Munich American Holding Corporation | 0.8 | 93.1 |
| Cigna | 0.7 | 48.5 |
| University of Pittsburgh Medical Center | 0.7 | 1.4 |
| Universal Health Care, Inc. | 0.7 | 26.4 |
| Group Health Cooperative | 0.6 | 0.6 |
| Top 20 Insurers | 79.2 | 100.0 |
| All Other Insurers | 20.8 | 99.8 |

Statistics in the table are calculated using MA enrollment data from 2006-2011. We use the set of published MA benchmarks as the set of counties where MA is offered, and we drop Alaska, Guam, Puerto Rico, and the Virgin Islands. An insurer is considered to be active in one of the 3,118 remaining counties where MA is offered if the insurer offers at least one plan in that county at any point during the sample period. The national market share is the average national market share during the sample period. In the penultimate row of the last column, we report the percentage of counties where at least one of the top 20 insurers was active during the sample period. In the bottom row of the last column, we report the percentage of counties where at least one non-top-20 insurer was active during the sample period.

# Appendix Table A4: Transition of Beneficiaries across Coverages

| | Outcome in Year *t* + *1* | | | |
|---|---|---|---|---|
| | Died | Stayed | Switched | Observations |
| Medicare Advantage Enrollee in Year *t* | 3.40% | 93.40% | 3.19% | 21,708,071 |
| Traditional Medicare Enrollee in Year *t* | 3.87% | 93.71% | 2.42% | 101,305,965 |

| | Outcome in Year *t* + *1* | | |
|---|---|---|---|
| | Stayed in Contract | Stayed in Plan | Observations |
| Medicare Advantage Stayer in Year *t* | 87.62% | 77.41% | 20,276,057 |

Table tabulates the transitions between MA and TM, as well as switching behavior for those who stay in MA. The table uses individual-year-level data from 2006 through 2010 (the year 2011 is excluded since the potential outcome the following year is not observed). Beneficiaries who exit the analysis sample are excluded (about 3.5 percent of observations). For MA enrollees in year t, the table shows the percentage that died during the observation year, the percentage that stayed in MA the following year, and the percentage that switched to TM the following year. The entries for TM enrollees in year t are defined analogously. In the second panel, the sample is restricted to MA enrollees in year t who stayed in MA in year t+1. The table shows the percentage that stayed in the same MA contract as well as the percentage that stayed in the same MA plan.

# Appendix Table A5: Details about the impact of various sample restrictions

| | 2006-2011 | | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|---|---|---|
| | Count | Percent | Count | Count | Count | Count | Count | Count |
| Starting sample: Enrolled in EDB during any month of observation year | 293,169,686 | 100.0% | 46,260,102 | 47,314,677 | 48,441,818 | 49,477,224 | 50,556,207 | 51,119,658 |
| Initial drops | 110,581,024 | 37.7% | 17,033,876 | 17,661,527 | 18,303,442 | 18,734,503 | 19,442,517 | 19,405,159 |
| Qualifies as ESRD or Disabled during any month of observation year | 55,266,283 | 18.9% | 8,412,921 | 8,689,301 | 8,992,785 | 9,330,322 | 9,741,068 | 10,099,886 |
| Months enrolled in Part A not same as months enrolled in Part B | 21,366,584 | 7.3% | 3,112,109 | 3,335,473 | 3,584,150 | 3,773,718 | 3,914,992 | 3,646,142 |
| Age on December 31 is less than 65 | 373,423 | 0.1% | 41,164 | 48,522 | 55,734 | 67,513 | 81,247 | 79,243 |
| Eligible for Medicaid during any month of observation year | 33,574,734 | 11.5% | 5,467,682 | 5,588,231 | 5,670,773 | 5,562,950 | 5,705,210 | 5,579,888 |
| | | | | | | | | |
| Intermediate sample | 182,588,662 | 100.0% | 29,226,226 | 29,653,150 | 30,138,376 | 30,742,721 | 31,113,690 | 31,714,499 |
| Traditional Medicare enrollees (enrolled in Parts A and B during first month enrolled) | 137,176,644 | 75.1% | 23,858,808 | 23,140,841 | 22,691,319 | 22,470,919 | 22,427,806 | 22,586,951 |
| Medicare Advantage enrollees (enrolled in Part C during first month enrolled) | 45,412,018 | 24.9% | 5,367,418 | 6,512,309 | 7,447,057 | 8,271,802 | 8,685,884 | 9,127,548 |
| | | | | | | | | |
| Traditional Medicare: Intermediate sample | 137,176,644 | 100.0% | 23,858,808 | 23,140,841 | 22,691,319 | 22,470,919 | 22,427,806 | 22,586,951 |
| Additional drops | 11,506,729 | 8.4% | 2,059,496 | 1,920,282 | 1,897,697 | 1,922,797 | 1,935,544 | 1,770,913 |
| Lives in Alaska, Guam, Puerto Rico, or Virgin Islands | 909,311 | 0.7% | 230,385 | 157,686 | 139,414 | 135,382 | 126,550 | 119,894 |
| Invalid county identifier | 296,849 | 0.2% | 74,654 | 45,327 | 45,522 | 45,499 | 44,013 | 41,834 |
| Missing or invalid risk score | 7 | 0.0% | 4 | 1 | 0 | 1 | 1 | 0 |
| Has non-Medicare primary payer | 8,969,583 | 6.5% | 1,517,216 | 1,485,329 | 1,484,423 | 1,526,421 | 1,558,334 | 1,397,860 |
| In Long-Term Institutional (LTI) care | 1,330,979 | 1.0% | 237,237 | 231,939 | 228,338 | 215,494 | 206,646 | 211,325 |
| | | | | | | | | |
| Medicare Advantage: Intermediate sample | 45,412,018 | 100.0% | 5,367,418 | 6,512,309 | 7,447,057 | 8,271,802 | 8,685,884 | 9,127,548 |
| Additional drops | 17,223,122 | 37.9% | 1,999,327 | 2,431,411 | 2,752,777 | 3,116,143 | 3,329,007 | 3,594,457 |
| Does not appear in MA payments records | 2,800,093 | 6.2% | 530,916 | 524,309 | 467,543 | 421,559 | 461,017 | 394,749 |
| Lives in Alaska, Guam, Puerto Rico, or Virgin Islands | 884,136 | 1.9% | 107,335 | 143,560 | 130,560 | 148,310 | 169,404 | 184,967 |
| Invalid county identifier | 24,811 | 0.1% | 7,512 | 5,308 | 3,259 | 3,649 | 3,681 | 1,402 |
| Missing or invalid risk score | 20 | 0.0% | 1 | 17 | 1 | 1 | 0 | 0 |
| Has non-Medicare primary payer | 1,871,545 | 4.1% | 167,101 | 233,263 | 298,472 | 366,700 | 403,645 | 402,364 |
| In Long-Term Institutional (LTI) care | 166,134 | 0.4% | 19,725 | 23,579 | 28,540 | 29,696 | 30,232 | 34,362 |
| Enrolled in Part B Only plan | 548 | 0.0% | 38 | 18 | 137 | 39 | 221 | 95 |
| Enrolled in Special Needs Plan (SNP) | 742,135 | 1.6% | 17,653 | 108,236 | 161,312 | 206,647 | 148,362 | 99,925 |
| Enrolled in plan type other than Local CCP or PFFS | 410,098 | 0.9% | 178,229 | 116,213 | 25,376 | 25,466 | 30,103 | 34,711 |
| Enrolled outside of official plan service area | 2,405,621 | 5.3% | 127,222 | 189,422 | 258,969 | 331,075 | 642,058 | 856,875 |
| Enrolled in employer-sponsored 800 series plan | 7,917,981 | 17.4% | 843,595 | 1,087,486 | 1,378,608 | 1,583,001 | 1,440,284 | 1,585,007 |
| | | | | | | | | |
| Final sample | 153,858,811 | 100.0% | 25,167,403 | 25,301,457 | 25,487,902 | 25,703,781 | 25,849,139 | 26,349,129 |
| Traditional Medicare enrollees (enrolled in Parts A and B during first month enrolled) | 125,669,915 | 81.7% | 21,799,312 | 21,220,559 | 20,793,622 | 20,548,122 | 20,492,262 | 20,816,038 |
| Medicare Advantage enrollees (enrolled in Part C during first month enrolled) | 28,188,896 | 18.3% | 3,368,091 | 4,080,898 | 4,694,280 | 5,155,659 | 5,356,877 | 5,533,091 |

# Appendix Table A6: The Relationship between MA penetration and Mortality

| | Dependent Variable: Mortality Rate for All Medicare Beneficiaries<br>Mean of Dep. Variable = 0.0348; No. of Obs. = 18,683 | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| MA Penetration Rate | 0.00220*** (0.001) | 0.00215*** (0.001) | 0.000995 (0.002) | 0.00579*** (0.001) | 0.00616*** (0.001) | 0.00228* (0.001) |
| Year FEs | N | Y | Y | N | Y | Y |
| County FEs | N | N | Y | N | N | Y |
| Population Weights | N | N | N | Y | Y | Y |

Table presents results from regressions of mortality rate among Medicare beneficiaries on the MA penetration rate. Observations are at the county-year level. Although the sample contains 3,118 counties for 6 years and thus 18,708 potential county-year observations, we exclude a small number of county-years for which there are no Medicare beneficiaries in our sample. We do include counties that have no MA enrollees. Standard errors, reported in parentheses, are clustered at the county level. *p < 0.1, **p < 0.05, ***p < 0.01.

# Appendix Table A7: The Impact of Sample Restrictions on FFS Cost Estimates

| | 2006-2010 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|
| Published CMS FFS Costs for Aged Beneficiaries | | | | | | |
| Part A Expenditures | $676,015,632,882 | $134,767,480,791 | $133,096,727,010 | $133,275,653,014 | $136,890,327,392 | $137,985,444,674 |
| Part A Enrollees | 142,267,605 | 28,894,909 | 28,426,844 | 28,214,643 | 28,193,790 | 28,537,419 |
| Part A Per Capita Expenditures | $4,752 | $4,664 | $4,682 | $4,724 | $4,855 | $4,835 |
| Part B Expenditures | $552,518,614,971 | $107,688,340,192 | $107,385,772,182 | $107,639,028,667 | $113,516,563,487 | $116,288,910,443 |
| Part B Enrollees | 132,724,976 | 27,368,569 | 26,715,175 | 26,282,803 | 26,075,339 | 26,283,090 |
| Part B Per Capita Expenditures | $4,163 | $3,935 | $4,020 | $4,095 | $4,353 | $4,424 |
| Parts A and B Per Capita Expenditures | $8,915 | $8,599 | $8,702 | $8,819 | $9,209 | $9,260 |
| FFS Costs for Aged Beneficiaries Tabulated from Medicare Administrative Data | | | | | | |
| Part A Expenditures | $695,098,811,259 | $136,999,055,203 | $136,543,612,981 | $136,966,284,213 | $142,092,951,533 | $142,496,907,329 |
| Part A Enrollees | 142,346,895 | 28,971,976 | 28,514,641 | 28,249,926 | 28,184,512 | 28,425,840 |
| Part A Per Capita Expenditures | $4,883 | $4,729 | $4,789 | $4,848 | $5,042 | $5,013 |
| Part B Expenditures | $503,912,798,952 | $98,997,689,876 | $98,114,086,264 | $97,928,327,990 | $103,206,623,455 | $105,666,071,367 |
| Part B Enrollees | 131,401,843 | 27,175,471 | 26,533,204 | 26,042,252 | 25,784,390 | 25,866,526 |
| Part B Per Capita Expenditures | $3,835 | $3,643 | $3,698 | $3,760 | $4,003 | $4,085 |
| Parts A and B Per Capita Expenditures | $8,718 | $8,372 | $8,486 | $8,609 | $9,044 | $9,098 |
| FFS Costs for Aged Beneficiaries Tabulated from Medicare Administrative Data, Dropping Beneficiaries if Months in Part A Does Not Equal Months in Part B | | | | | | |
| Part A Expenditures | $681,359,540,103 | $134,562,658,159 | $133,995,086,573 | $134,228,499,471 | $139,085,816,324 | $139,487,479,576 |
| Part A Enrollees | 128,530,312 | 26,600,835 | 25,963,649 | 25,469,192 | 25,202,713 | 25,293,924 |
| Part A Per Capita Expenditures | $5,301 | $5,059 | $5,161 | $5,270 | $5,519 | $5,515 |
| Part B Expenditures | $494,072,806,461 | $97,080,701,878 | $96,218,243,787 | $96,002,716,009 | $101,151,003,729 | $103,620,141,059 |
| Part B Enrollees | 128,530,312 | 26,600,835 | 25,963,649 | 25,469,192 | 25,202,713 | 25,293,924 |
| Part B Per Capita Expenditures | $3,844 | $3,650 | $3,706 | $3,769 | $4,013 | $4,097 |
| Parts A and B Per Capita Expenditures | $9,145 | $8,708 | $8,867 | $9,040 | $9,532 | $9,611 |
| FFS Costs for Aged Beneficiaries Tabulated from Medicare Administrative Data, Dropping Beneficiaries if Months in Part A Does Not Equal Months in Part B or if Age on December 31 is Less Than 65 Years | | | | | | |
| Part A Expenditures | $677,060,185,626 | $134,042,107,655 | $133,360,985,026 | $133,422,018,625 | $138,014,845,056 | $138,220,229,264 |
| Part A Enrollees | 128,320,072 | 26,572,548 | 25,929,899 | 25,429,205 | 25,154,863 | 25,233,557 |
| Part A Per Capita Expenditures | $5,276 | $5,044 | $5,143 | $5,247 | $5,487 | $5,478 |
| Part B Expenditures | $488,030,492,173 | $96,345,332,796 | $95,299,556,177 | $94,885,901,973 | $99,705,300,479 | $101,794,400,747 |
| Part B Enrollees | 128,320,072 | 26,572,548 | 25,929,899 | 25,429,205 | 25,154,863 | 25,233,557 |
| Part B Per Capita Expenditures | $3,803 | $3,626 | $3,675 | $3,731 | $3,964 | $4,034 |
| Parts A and B Per Capita Expenditures | $9,080 | $8,670 | $8,818 | $8,978 | $9,450 | $9,512 |
| FFS Costs for Aged Beneficiaries Tabulated from Medicare Administrative Data, Dropping Beneficiaries if Months in Part A Does Not Equal Months in Part B or if Age on December 31 is Less Than 65 Years or if Dually Eligible for Medicare and Medicaid | | | | | | |
| Part A Expenditures | $466,952,157,292 | $93,407,890,173 | $92,114,890,280 | $91,582,806,739 | $94,918,351,560 | $94,928,218,541 |
| Part A Enrollees | 108,214,984 | 22,357,912 | 21,821,455 | 21,426,710 | 21,298,924 | 21,309,983 |
| Part A Per Capita Expenditures | $4,315 | $4,178 | $4,221 | $4,274 | $4,456 | $4,455 |
| Part B Expenditures | $389,902,811,514 | $76,789,926,382 | $76,020,892,308 | $75,670,150,053 | $79,864,090,752 | $81,557,752,020 |
| Part B Enrollees | 108,214,984 | 22,357,912 | 21,821,455 | 21,426,710 | 21,298,924 | 21,309,983 |
| Part B Per Capita Expenditures | $3,603 | $3,435 | $3,484 | $3,532 | $3,750 | $3,827 |
| Parts A and B Per Capita Expenditures | $7,918 | $7,612 | $7,705 | $7,806 | $8,206 | $8,282 |
| FFS Costs for Aged Beneficiaries Tabulated from Medicare Administrative Data, Dropping Beneficiaries if Months in Part A Does Not Equal Months in Part B or if Age on December 31 is Less Than 65 Years or if Dually Eligible for Medicare and Medicaid or if Does Not Meet Other Sample Restrictions | | | | | | |
| Part A Expenditures | $419,316,222,342 | $84,280,425,901 | $82,962,277,124 | $82,087,559,155 | $84,956,771,529 | $85,029,188,632 |
| Part A Enrollees | 99,335,886 | 20,517,244 | 20,062,763 | 19,687,559 | 19,539,444 | 19,528,876 |
| Part A Per Capita Expenditures | $4,221 | $4,108 | $4,135 | $4,170 | $4,348 | $4,354 |
| Part B Expenditures | $363,618,223,076 | $71,754,651,026 | $71,099,542,530 | $70,634,439,679 | $74,349,548,403 | $75,780,041,438 |
| Part B Enrollees | 99,335,886 | 20,517,244 | 20,062,763 | 19,687,559 | 19,539,444 | 19,528,876 |
| Part B Per Capita Expenditures | $3,660 | $3,497 | $3,544 | $3,588 | $3,805 | $3,880 |
| Parts A and B Per Capita Expenditures | $7,882 | $7,605 | $7,679 | $7,757 | $8,153 | $8,234 |

All spending variables are inflation adjusted to 2010 dollars (adjusted using the CPI-U). CMS statistics are taken from published online reports, which can be found at http://www.cms.gov/Medicare/Health-Plans/MedicareAdvtgSpecRateStats/FFS_Data05a.html and http://www.cms.gov/Medicare/Health-Plans/MedicareAdvtgSpecRateStats/FFS-Data.html. In 2009 and 2010, CMS reported FFS costs separately for non-hospice and hospice costs, with slightly different numbers of Part A Enrollees in each file. In 2009, in the non-hospice cost files, the reported number of Part A enrollees was 28,100,287; in the hospice cost files, the reported number of Part A enrollees was 28,193,790; the latter number is used in the table. In 2010, in the non-hospice cost files, the reported number of Part A enrollees was 28,439,125; in the hospice cost files, the reported number of Part A enrollees was 28,537,419; the latter number is used in the table. For 2009 and 2010, Part B Expenditures and Part B Enrollees numbers come from the non-hospice cost files. In tabulating the administrative data, "Part A Enrollees" is defined as the total number of Part A enrollee-months divided by twelve; "Part B Enrollees" is defined similarly.

# Appendix Table A8: Bid regressions in logs

| | Unit of Observation: Plan-year<br>Dependent Variable: ln(plan bid) | | |
|---|---|---|---|
| Sample | All plans | All plans | All plans |
| | (1) | (2) | (3) |
| ln(plan benchmark) | 0.468 (0.058)*** | 0.451 (0.068)*** | 0.573 (0.058)*** |
| ln(predicted plan FFS cost) | 0.038 (0.069) | 0.062 (0.092) | 0.155 (0.066)** |
| Year FEs | N | Y | Y |
| Contract FEs | N | N | Y |
| Mean of dependent variable | 6.6 | 6.6 | 6.6 |
| R-squared | 0.267 | 0.292 | 0.751 |
| Observations | 10,305 | 10,305 | 10,305 |

| | Unit of Observation: Plan-county-year<br>Dependent Variable: ln(plan bid) | | |
|---|---|---|---|
| Sample | All plans | All plans | All plans |
| | (1) | (2) | (3) |
| ln(plan benchmark) | 0.468 (0.086)*** | 0.451 (0.101)*** | 0.732 (0.046)*** |
| ln(predicted plan FFS cost) | 0.038 (0.050) | 0.062 (0.072) | 0.042 (0.046) |
| Year FEs | N | Y | Y |
| County FEs | N | N | Y |
| Mean of dependent variable | 6.6 | 6.6 | 6.6 |
| R-squared | 0.267 | 0.292 | 0.668 |
| Observations | 181,868 | 181,868 | 181,868 |

Table is analogous to the regressions reported in Table 3 of the main text, except that both the dependent variable and the key right-hand-side variables are measured in natural logarithms.

## Appendix Table A9: Additional Benefits Covered by Plan Rebates

| | All (N = 11,440) | B-b in (0,100] (N = 7,533) | B-b in (100,200] (N = 3,181) | B-b > 200 (N = 726) |
|---|---|---|---|---|
| Cost-sharing benefits | 76.3% | 79.9% | 75.4% | 61.1% |
| Part B premium reduction | 0.8% | 0.1% | 1.1% | 3.4% |
| Part D benefits | 12.5% | 11.2% | 10.9% | 23.8% |
| Other mandatory benefits | 10.5% | 8.8% | 12.6% | 11.8% |

Table reports the mean percentage of rebate dollars allocated across four possible exhaustive and mutually exclusive categories. All reported statistics are weighted by the plan's share of enrollee risk-months. The sample used in the table consists of 11,440 plan-year observations for plans bidding below the benchmark.

# Appendix Table A10(a): Testing for the Equal Sensitivity to Premium and Benefits' Dollars

| | Dependent Variable: ln(plan risk-months market share) - ln(TM risk-months market share) | | | | |
|---|---|---|---|---|---|
| | Mean of Dep. Variable = -6.251; No. of Obs. = 206,110 | | | | |
| | (1) | (2) | (3) | (4) | (5) |
| Part C premium (basic + supplemental) | -0.00542** (0.002) | -0.00761*** (0.002) | -0.00369* (0.002) | -0.0125*** (0.003) | -0.00668*** (0.003) |
| Benefit dollars | 0.00464 (0.003) | 0.00658* (0.004) | 0.00451 (0.003) | 0.0160*** (0.002) | 0.0113*** (0.002) |
| Supplemental benefits | | | -0.374** (0.153) | -0.291* (0.153) | -0.101 (0.168) |
| Part D benefits | | | 0.587*** (0.206) | 0.458* (0.257) | 0.494* (0.289) |
| Plan quality rating FEs | N | N | Y | Y | Y |
| Year FEs | N | Y | Y | Y | Y |
| County FEs | N | N | N | N | Y |
| Contract FEs | N | N | N | Y | Y |
| Contract x county FEs | N | N | N | N | Y |
| p-value: coeff. on Part C premium = -1 x coeff. on benefit dollars | 0.826 | 0.772 | 0.768 | 0.127 | 0.113 |

Table presents demand regression results at the market-plan level. The unit of observation is a market-plan (a market is a county-year). Standard errors, reported in parentheses, are clustered at the contract level. The regressor "benefit dollars" is defined as the number of dollars that can legally be spent on supplemental benefits (which may include reduced cost-sharing requirements, reduction of the Part B premium, additional Part D benefits, or other supplemental benefits such as dental or vision care); letting b denote the plan's standardized bid, B denote the plan's benchmark, and S denote the supplemental premium, this is $-0.75 \times (b - B) \times I\{b - B \leq 0\} + S$. The regressor "Part C premium (basic + supplemental)" is defined as the total Part C premium; letting P denote the basic Part C premium, this is P + S. The final row reports the p-value from testing the hypothesis that the coefficient on "Part C premium (basic + supplemental)" is equal to -1 times the coefficient on "benefit dollars." *p < 0.1, **p < 0.05, ***p < 0.01.

# Appendix Table A10(b): Testing for the Equal Sensitivity to Premium and Benefits' Dollars

| | Dependent Variable: ln(plan risk-months market share) - ln(TM risk-months market share) | | |
|---|---|---|---|
| | Mean of Dep. Variable = -6.251; No. of Obs. = 206,110 | | |
| | (1) | (2) | (3) |
| Part C premium (basic + supplemental) | -0.0109*** (0.002) | -0.0109*** (0.002) | -0.0108*** (0.002) |
| Benefit dollars | 0.0133*** (0.002) | 0.0133*** (0.002) | 0.0131*** (0.002) |
| ln(plan MA share) | 0.309*** (0.029) | 0.302*** (0.030) | 0.324*** (0.023) |
| Part C supplemental benefits | -0.217* (0.112) | -0.219* (0.114) | -0.214* (0.110) |
| Part D benefits | 0.321* (0.178) | 0.324* (0.182) | 0.315* (0.177) |
| Plan quality rating FEs | Y | Y | Y |
| Instrument for ln(plan MA share) | Number of plans | Number of contracts | Contract dummies |
| Year FEs | Y | Y | Y |
| Contract FEs | Y | Y | Y |
| p-value: coeff. on Part C premium = -1 x coeff. on benefit dollars | 0.151 | 0.148 | 0.150 |

Table is the same as Appendix Table A10(a), except that it's using the nested logit specification.

# Appendix Table A11: The effect of bids on plan risk pool

**Panel A:**

| | Dependent Variable: Plan-county-year mean risk score<br>Mean of Dep. Variable = 0.847; No. of Obs. = 206,110 | | | | |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| Plan price | 0.000299 (0.0003) | 0.000341 (0.0003) | -0.000326 (0.0002) | 0.000469*** (0.0002) | 0.000621*** (0.0002) |
| Supplemental benefits | | | 0.0932*** (0.011) | 0.0921*** (0.012) | 0.101*** (0.016) |
| Part D benefits | | | -0.0282*** (0.010) | -0.0205* (0.011) | -0.0200* (0.011) |
| Plan quality rating FEs | N | N | Y | Y | Y |
| Year FEs | N | Y | Y | Y | Y |
| Contract FEs | N | N | N | Y | Y |
| Contract x county FEs | N | N | N | N | Y |

**Panel B:**

| | Dependent Variable: Plan-county-year mortality per 100 risk units<br>Mean of Dep. Variable = 3.22; No. of Obs. = 206,110 | | | | |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| Plan price | 0.00347*** (0.00052) | 0.00338*** (0.00052) | 0.00342*** (0.00066) | 0.00510*** (0.00045) | 0.00737*** (0.00074) |
| Supplemental benefits | | | 0.0412 (0.0738) | 0.188*** (0.064) | 0.258*** (0.079) |
| Part D benefits | | | -0.0274 (0.0274) | -0.323*** (0.063) | -0.345*** (0.058) |
| Plan quality rating FEs | N | N | Y | Y | Y |
| Year FEs | N | Y | Y | Y | Y |
| Contract FEs | N | N | N | Y | Y |
| Contract x county FEs | N | N | N | N | Y |

Table presents regressions of plan mean risk score (top panel) and plan mortality rate per hundred risk units (bottom panel) on plan price and other controls. Each observation is a market-plan (a market is a county-year). Standard errors are clustered at the contract level. Letting b denote the plan's standardized bid and B denote the plan's benchmark, the plan price is defined as $p = 0.75 \times (b - B) \times I\{b - B \leq 0\} + (b - B) \times I\{b - B > 0\}$. *p < 0.1, **p < 0.05, ***p < 0.01.

# Appendix Table A12: Additional results from policy experiments

| Variable | Taxpayer Cost | Implied MA Cost | Insurer Profits | Consumer Surplus | Consumer Rebate Surplus | Rebate | Premiums | MA Penetration | Predicted FFS Cost for MA Enrollees |
|---|---|---|---|---|---|---|---|---|---|
| Observed equilibrium (all years pooled) | $756.21* | $585.63** | $95.39 | $102.60 | $48.79 | $75.57 | $0.39 | 18.2% | $662.49*** |
| Plans bid their cost*** | $732.62 | $581.79 | $0.00 | $119.06 | $87.86 | $150.83 | $0.00 | 31.4% | $660.28 |
| Plans bid the benchmark | $746.49 | $590.50 | $156.00 | $94.75 | $0.00 | $0.00 | $0.00 | 10.2% | $654.67 |
| Benchmark set at FFS 100% | $730.71 | $598.45 | $75.58 | $103.08 | $39.87 | $66.67 | $9.99 | 13.7% | $677.73 |
| Benchmark set at FFS 95% | $697.45 | $598.53 | $58.37 | $100.86 | $33.45 | $56.15 | $15.60 | 12.0% | $677.45 |
| Benchmark set at FFS 80% | $591.59 | $597.85 | $5.57 | $95.13 | $17.71 | $31.16 | $42.99 | 7.9% | $675.86 |
| Rebate passed through at 50% | $743.68 | $590.01 | $132.16 | $96.14 | $16.75 | $22.26 | $0.75 | 12.2% | $659.91 |
| Rebate passed through at 25% | $746.26 | $590.23 | $156.63 | $94.71 | $0.35 | $0.41 | $1.02 | 10.2% | $654.96 |
| No rebates | $746.43 | $590.50 | $157.07 | $94.75 | $0.00 | $0.00 | $1.14 | 10.2% | $654.67 |
| Benchmark set at FFS 100%, rebate passed through at 50% | $683.06 | $594.49 | $85.20 | $95.01 | $13.25 | $19.17 | $15.80 | 10.7% | $666.62 |
| Benchmark set at FFS 100%, rebate passed through at 25% | $655.05 | $589.92 | $85.43 | $94.10 | $0.66 | $0.75 | $21.05 | 9.8% | $656.72 |
| Benchmark set at FFS 95%, rebate passed through at 50% | $651.52 | $594.37 | $64.68 | $94.37 | $11.34 | $16.41 | $23.94 | 10.0% | $667.08 |
| Benchmark set at FFS 95%, rebate passed through at 25% | $622.90 | $589.96 | $63.17 | $93.86 | $0.88 | $0.99 | $31.22 | 9.5% | $657.48 |
| Benchmark set at FFS 90%, rebate passed through at 50% | $558.43 | $595.39 | $20.58 | $92.18 | $6.50 | $9.59 | $67.13 | 7.4% | $669.22 |
| Benchmark set at FFS 90%, rebate passed through at 25% | $526.40 | $591.10 | $16.91 | $92.78 | $1.10 | $1.26 | $82.88 | 8.4% | $660.04 |
| Rebate passed through at 100% | $788.56 | $581.46 | $72.84 | $114.05 | $76.88 | $134.44 | $0.19 | 26.4% | $663.67 |
| Benchmark set at FFS 95%, rebate passed through at 100%, | $751.06 | $599.57 | $53.97 | $113.49 | $60.54 | $108.35 | $10.84 | 14.4% | $686.97 |
| Benchmark set at FFS 90%, rebate passed through at 100% | $720.80 | $601.23 | $43.23 | $110.03 | $52.18 | $93.41 | $17.07 | 11.7% | $688.11 |

Table expands on Table 6 in the main text, using the same calculations described in the notes to that Table, but reports an expanded set of counterfactuals. Details of the counterfactual calculations are described in Appendix C.