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"Pricing and Incentives in Publicly Subsidized Health Care Markets: The Case of Medicare Part D"

by

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Pricing and Incentives in Publicly Subsidized Health Care Markets: the Case of Medicare Part D

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Abstract

In Medicare Part D, low income individuals receive subsidies to enroll into insurance plans. This paper studies how premiums are distorted by the combined effects of this subsidy and the default assignment of low income enrollees into plans. Removing this distortion could reduce the cost of the program without worsening consumers' welfare. Using data from the the first five years of the program, an econometric model is used to estimate consumers demand for plans and to compute what premiums would be without the subsidy distortion. Preliminary estimates suggest that the reduction in premiums of affected plans would be substantial.

JEL: I11, I18, L22, D44, H57.

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1 Introduction

Medicare Part D is the Medicare program dedicated to provide Medicare enrollees with insurance for prescription drugs. It is organized as a market in which private plans compete to offer insurance plans to Medicare enrollees under the rules established by the Medicare regulation. It is a large public program, costing about 50 billion to the government and enrolling about 25 million individuals in 2010.

The use of a market mechanism to deliver to Medicare enrollees discounts over prescription drugs has been a substantial novelty relative to the previous Medicaid system. Moreover, Part D is typically considered a successful case since it costed to the government substantially less than expected. Nevertheless, this cost has been quickly rising after the first years of the program. Moreover, several recent studies have expressed concerns regarding the possibility that the simple encounter of demand and supply will guarantee efficiency in this market.

In this paper, I study how the presence of public subsidies has distorted firms pricing behavior. Almost 90% of plans revenues do not come from enrollees payments but from various Medicare subsidies. Therefore, the way in which these subsidies are set is necessarily of crucial importance to understand plans prices. In turn, these prices are what determines the increases in the cost of the program and, ultimately, the efficiency of the system.

The major source of distortion that I identify is the so called Low Income Subsidy (LIS) that Medicare pays to enrollees of limited financial resources. About 9 million enrollees (40% of the total) are entitled this subsidy, which is a major source of plans revenues. In 2010, the LIS accounted for 19.9 billion of the 57.3 billion paid to plans, making the LIS the single most important source of plans revenues.[1] The distortive effects of this subsidy are due to the combined effects of how this subsidy is calculated and how LIS enrollees are assigned to plans. As regards the calculation of the subsidy, this results from a weighted average of plans premiums. Instead, the allocation of LIS enrollees by Medicare consists in randomly assigning these consumers to plans that have premiums not greater than the low income subsidy itself. Although LIS enrollees could opt out of the reassignment process, few do that

[1] Table 1 reports the various sources of payments to plans, which are explained in detail in the section 2.

and every year about 7 million enrollees are potentially subject to the reassignment.

With the help of a simple theoretical model, this paper will show that these two rules induce firms to engage in manipulations of the subsidy. At the most basic level, since most firms offer multiple plans, the price of each plan can be used to increase the subsidy at the benefit of the other firm plans. However, I will argue that firm strategies are possibly more refined exploiting to the full extent the fact that low income individuals are treated by the random assignment rule not as consumers choosing plans but as a "prize" allocated to plans pricing in a certain range. This will imply that the LIS is possibly a significant cause of the increased program cost. Moreover, since firms are required to charge a single price to all enrollees subscribing to the same plan and plans serving exclusively LIS enrollees are forbidden, the distortions induced by the LIS will spill over to the whole market. This will imply that allocative efficiency is unlikely to be attainable under the current market design.

In order to quantify the effect of the LIS on premiums, I empirically analyze data on plans enrollment and prices between 2006 and 2011. The study of both aggregate regional average premiums and of the prices of individual plans suggests that firms respond strongly to the LIS incentives. Motivated by this evidence, I estimate a structural model of consumers demand for plans and firms pricing behavior to better quantify the effects of the distortion. In particular, I apply a discrete choice framework to infer from the aggregate plans market shares the consumers preferences over plans prices, financial structure, drugs coverage and pharmacy network. To estimate firms unobservable marginal costs, I use the demand parameters together with an equilibrium assumption on firms behavior to invert the firms first order conditions. However, since the LIS distortion makes this approach unfeasible for certain groups of firms, I select three groups of firms for which it can be applied. The estimates of how these costs depend on plan characteristics is then used to construct counterfactual prices also for those firms for which the first order condition approach could not be used.

The comparison between the observed prices and these predicted prices gives a first, rough measure of the distortion due to the LIS. The preliminary estimates suggest the presence of a significant distortion. Using both firms costs and demand estimates, the final part of this paper estimates counterfactual prices under alternative scenarios for the LIS enrollees.

This part (not completed yet) will likely evaluate two scenarios: one in which LIS consumers are fully absent (as if they were assigned to a government plan specifically designed only for them) and one in which they demand plans like regular consumers (as if they were subject to beneficiary-centered instead of random assignment).

Related literature: This paper contributes to the studies of the Medicare Part D program, which is extensively described in Duggan, Healy and Scott-Morton (2008). The most direct contribution of this study is to offer a novel explanation for the increased program cost. Duggan and Scott-Morton (2011) argue that such increase cannot be explained by increases in drug costs. A similar conclusion is reached by Aaron and Frakt (2012). Ericson (2010), instead, offers an explanation of the cost increases based firms exploiting consumers inertia in plans choice. I offer an explanation that is complementary to Ericson (2010).

Secondly, this paper contributes to the studies that have tried to assess the efficacy and efficiency of Part D. Most of the existing studies have focused on consumers' choice of plans. Several of them have concluded that choices are suboptimal (Heiss, McFadden and Winter, 2007, Abaluck and Gruber, 2009, and Kling, Mullainathan, Shafir, Vermeulen and Wrobel, 2010, Heiss, Leive, McFadden and Winter, 2012). However, Ketcham, Lucarelli, Miravete and Roebuck (2010) have argued that over time consumers rapidly improve their choice of plan. This paper, by arguing that prices are distorted, suggests that they cannot properly guide consumers choices. Therefore, efficiency in this market requires solving not only the consumers difficulties in making choices but also firms pricing distortions.

Other recent papers have questioned the possibility that market mechanisms could deliver efficient outcomes in complex and heavily regulated health insurance markets. In particular, Glazer and McGuire (2009) and Bundorf, Levin and Mahoney (2011) show how the requirement of a uniform price across consumers distorts prices and allocations. In my study, I explain how in Part D the distortions due to the uniform price are exacerbated by the presence of subsidies. Given the widespread presence of subsidies in public programs, the results are likely to apply to other markets. Clearly, they apply to environments where similar incentives to manipulate prices are present. Far from being unique to Part D, very similar manipulable mechanisms are used in Medicare Part C and in the Medicare DEMPOS auctions studied by Katzman and McGeary (2008) and Cramton et al. (2011). More generally, this type of mechanisms are widespread in public procurement as documented in Decarolis (2009) and Conley and Decarolis (2010).

2 Data and Description of the Market

Part D was instituted in 2003 and started to operate in 2006. The program divides the US territory into 34 geographical regions. For each region, firms submit in June the list of prescription drug plans they will offer for the following year. In the fall, this list of plans becomes available to consumers on the CMS web site. Consumers compare plans features and select one plan before the enrollment period ends in December. The selected plan will give the consumer discounts on prescription drugs for the following year. The typical structure of a plan is described in Figure 2: for the first \$310 spent on prescription drugs the enrollee pays the full amount (this is the "drug deductible"), for expenses between \$311 and \$2,830 he pays only 25% out of his pocket, for expenses between \$2,831 and \$6,440 he pays once again the full amount[2] (this is the "coverage gap" or "donut hole") and, finally, for expenses over \$6,440 he pays only 5% (there is no limit for these "catastrophic expenses"). Finally, enrollees face a variable copay that differs for brand and generic drugs and depending on the level of out of pocket expenditures reached.

All enrollees receive a subsidy, known as "direct subsidy" to pay for plans premiums. Moreover, Medicare beneficiaries with limited financial resources[3] are entitled a Low Income Subsidy (LIS). I will refer to these latter individuals as LIS enrollees and to the remaining customers as regular enrollees. Table 7 shows that LIS receivers are about 40% of all the enrollees. LIS enrollees receive a subsidy that equals the lesser of their plan's premium for basic coverage and a regional low-income premium subsidy amount (LIPSA), described

[2] Starting in 2011, enrollees receive a 50% discount on the cost of brand-name drugs while in the donut hole (the remaining 50% is paid by pharmaceutical manufacturers). The full retail cost stills apply to getting out of the donut hole. In the donut hole, there is at most 93% co-pay on generic drugs.

[3] In 2009, Medicare beneficiaries with limited resources (\$12,510/individual; \$25,010/couple) and income below 150% of poverty (\$16,245/individual; \$21,855/couple) are entitled for the low-income subsidy.

below.[4] Therefore, if a LIS individual is in a plan having a premium below the regional LIPSA, this individual will face a zero premium. Otherwise, if the premium exceeds the LIPSA, the LIS individual has to pay the difference.

There are two main distinctions between plans. The first one is between plans that serve only the Part D program, known as Prescription Drug Plans (PDPs), and plans that are part of a Medicare Advantage policy giving also access to Medicare Part A/B, know as MA-PD. The second distinction is between plans offering only covered drugs (basic plans) and those covering additional drugs (enhanced plans).[5] The premium of enhanced plans is divided into two components, basic and enhanced, and Medicare subsidies can be used only to pay for the basic portion.

In Table 4, I report some summary statistics for the plans distinguishing between basic PDP, enhanced PDP and MA-PD for the years 2006-2011.These plan-level data, released yearly by CMS, allow to observe enrollment (separately for regular and LIS enrollees) and several other plans characteristics. The main ones are: the basic and enhanced components of the premium, the type of PDP and MA plan, the deductible, the type of coverage in the gap, the identity of the plan sponsor, the drug formulary and the pharmacy network.[6] The statistics in the table reveal that the average total premium is lowest in MA-PD plans, followed by basic PDPs and then by enhanced PDPs. The latter group of plans also experienced the sharpest change in the average premium in the period 2009-2011 relative to the period 2006-2009. The data also indicate that LIS enrollees are very relevant counting for about 40% of total enrollment and even more for basic PDPs. Finally, the number of plans appears to be large for each category of plans. Figure 3 shows that the large number of PDPs is quite evenly spread across the 34 regions. Nevertheless, the market is rather concentrated with few large firms enrolling most of the consumers: Table 3 shows that in 2010 the combined market share of the three largest firms equals 47.5% of the whole population

[4]Moreover, LIS individuals have advantages in terms of both the co-pay for drugs and the coverage of expenses in case total expenses reach the "catastrophic" level.

[5]As described in the note to Figure 2, basic plans can be further subdivided into three distinct groups that differ in their coverage structure. See Duggan et al. (2008) for further descriptions.

[6]For the demand estimation, I supplemented these data with demographic information about the 34 regions obtained from the IPUMS.

of PDPs enrollees.

The plans payment system and the LIS

For this study, the most significant aspect of the complex Part D regulation concerns the plans payment system and, more specifically, the role of the LIS. Table 1 shows the decomposition of plans payments. It reveals that plans revenues come from both enrollees premiums and Medicare payments. Premiums are worth around 10% of the total while the rest is paid by Medicare. There are four distinct sources of Medicare payments: (a) direct subsidy, which is paid for every consumer enrolled and is identical for all enrollees up to an adjustment for their risk score; (b) low income subsidy, which is a contribution for consumers of limited financial resources; (c) individual reinsurance, which consists in the payment of 80 percent of drug spending for “catastrophic expenses”; (d) end of the year reconciliation payments that ensure that the profits/losses made by the sponsor are within a predefined risk corridor (illustrated in Figure 4). Of these four channels, the reinsurance and the risk corridor are taken as given by firms. Instead, the amount of both the direct and low income subsidies depend on plans actions because they are determined by plans bids.

Each sponsor submits a bid for each of its plans on the first Monday of June each year. On the basis of the bids received, CMS calculates plan premiums as the difference between the plan bids and a ”direct subsidy.” This latter quantity is a fixed proportion (63% in 2012) of the weighted average of all bids, with weights proportional to the enrollment in the plan in the previous year.[7] Therefore, if a plan bid is equal or lower than the direct subsidy, the premium for this plan is zero. Otherwise, the premium is positive but smaller than than the original bid by the amount of the direct subsidy.[8] CMS then calculates the LIPSA for each region by taking a weighted average of premiums of the plans in that region. The next two paragraphs clarify important details of how this calculation is made and of what are its implications for LIS enrollees allocation.

LIS Rule I: LIPSA Calculation. As regards the determination of the LIPSA, this is

[7] A slightly different weighting system was used for the first two years of the program. See the appendix for more details.

[8] Starting from 2012, for individuals of high income, an extra financial contribution is required on the top of the premium.

computed each year by the Center for Medicare and Medicaid Services (CMS) for each of the 34 regions in which the US states are divided. In particular, CMS calculates this value as a weighted average of the monthly beneficiary premiums of both PDP and MA for basic prescription drug coverage in the region. The details of how the LIPSA is calculated have changed over time: (a) for 2006 and 2007, all PDP were assigned an equal weight, while the weight of MA was proportional to their enrollment in the previous year; (b) for 2008, a weighted method was used in which 50% of the weight was assigned with the same method of 2006 and 2007 and the remaining 50% was assigned to a weighted average of PDP and MA bids with weights proportional to total enrollment (in the previous year); (c) for 2009, the benchmark was calculated as the weighted average of PDP and MA bids with weights proportional to LIS enrollment (in the previous year); (d) from 2010 onward, the calculation is identical to that in 2009 with the only exception that MA bids are considered before the application of a rebate for Part A/B. For all the years, if the benchmark calculated as above resulted lower than the lowest PDP premium for that region, then this lowest PDP premium would be the new benchmark. I offer a more complete presentation of the exact details of the calculation of the direct subsidy and the LIS benchmark in the appendix.

The main change in this part of the regulation entails the switch in 2009 from method (b) to method (c), that is from weights based on total enrollment to weights based on LIS enrollment. This change was fostered by the objective to ease the downward pressure on bids exercised by the positive weights that method (b) was attributing to some low-premium MA-PD plans with few or no LIS enrollees. Another innovation in the same spirit has been that of not considering MA bids after the rebates they offer for Part A/B are detracted but before this detraction. Although, this latter reform was originally mandated only for 2010, the broad health care reform of the Obama administration extended it for the following years.[9] All these rule changes are summarized in Table 2.

The relevant aspect of the LIPSA is that, by being a weighted average of plans premiums, firms control it through their bids. There are at least three elements in the data that suggest that firms should significantly respond to the incentives to manipulable this subsidy. The

[9]H.R. 3590, Patient Protection and Affordable Care Act, and H.R. 4872, Health Care and Education Reconciliation Act of 2010.

first one is that, as shown by Table 7, there is a large number of LIS enrollees. There are about 9 million LIS enrollees and most of them will stay in the plan to which they are assigned regardless of its quality or its marketing. The second one is that typically firms have multiple plans within the same region. Therefore, increasing the LIPSA through an higher bid with a plan benefits the other plans. Thus, coordination of prices to increase the LIPSA does not require communication between firms but it simply the result of each single firm independently maximizing its own profits.[10] The third element is that while manipulating the direct subsidy is hard because of the small weights associated with each plan, manipulating the LIPSA is simple. Table 5 offers an illustration of this point by documenting the differences in the distribution of the weights used by CMS in its calculations of two subsidies: the direct subsidy and the LIPSA. The first two columns report the distribution, respectively, of all the weights and of those greater than 1% that enter into the calculation of the direct subsidy. For this subsidy, the first two columns show that across all the years between from 2006 to 2011 the plans weights are typically extremely low. Only 23 plans have a weight greater than 1%. Thus, manipulations are hard to achieve. On the contrary, the last 4 columns show that there is a substantial number of plans with rather high weight in the calculation of the LIPSA. In particular, the comparison between the years before 2009 and those from 2009 onward shows a marked increase of high weight plans in the latter group. Indeed, in the period 2009-2011 there are 8 cases of plans with weight greater than 30% while there is not even one plan with such a high weight in the previous period.

LIS Rule II: Random Reassignment: The second key rule concerns how LIS are allocated to plans. Indeed, contrary to regular enrollees, LIS enrollees typically do not choose their plan but are assigned to it. For the first year of operation of Part D in 2006, the Social Security Act mandated the initial enrollment of LIS individuals into PDPs with premiums no greater than the LIPSA.[11] Using its authority, CMS specified *"that LIS-eligible individuals facing the above situation may elect a PDP with no premium (to which they would be randomly assigned) by taking no action"*. Therefore, all firms that had at least one plan

[10] All the large insurers are multiplan firms. In 2010, the largest firms were United Health, Humana, Universal American and Well Point, having market shares among PDP enrollees respectively of 27%, 12%, 8% and 5%.

[11] See section 1860D-1(b)(1)(C) of the Social Security Act.

with premium at or below the LIPSA received an equal share of LIS enrollees. Typically, this random assignment is repeated in the following years to assign new LIS enrollees and reassign those LIS individuals enrolled in plans that are above LIPSA in the following year.

In particular, each fall CMS announces the reassignment decision to LIS individuals who at that time are enrolled in plans that in the following year will have a premium greater than the LIPSA. Table 7 shows that the number of reassigned enrollees varies substantially from year to year and it peaked in 2008 with about 2.5 million reassignments. However, not all LIS enrollees are reassigned but, instead, CMS reassigns only those that: (a) maintain their status of full LIS receivers[12] and (b) never opted out of a plan to which CMS assigned them in the past (unless their plan was terminated, in which case they are again reassigned). Individuals who violate condition (b) are referred to as "choosers"Ȯpting out to choose a plan can be done at any time during the year. For choosers, every year in November CMS sends a letter to remind that they need to take action on their own to avoid paying a positive premium, but no automatic reassignment occurs.[13] Table 7 reveals that the number of choosers is rather stable and represents about a third of all LIS receivers. Finally, for a plan to qualify for a share of randomly assigned beneficiaries, it must meet both design and cost requirements. First, only PDP plans that are designed as a standard benefit, or actuarially equivalent to the standard benefit, are eligible for assignment of LIS receivers.[14]. Second, plans must have a premium below the LIPSA. To each sponsor having at least one plan respecting these two conditions, CMS assigns an equal share of the reassigned individuals in the region and matches individuals to plans randomly.[15] This means that if there are more sponsors with plans that qualify, each sponsor will approximately get the same number of reassigned LIS enrollees. For a sponsor having multiple qualified plans within a region, each plan will receive an approximately equal share of the reassigned LIS individuals. Table 6 reveals that indeed it is very common to observe firms that have multiple basic PDP within

[12] Individuals eligible for a partial premium subsidy are not subject to reassignment.

[13] Elections made on behalf of beneficiaries by "authorized representatives", such as some State pharmacy programs, are treated as individual choice and are not subject to re-assignment.

[14] This means that the third type of non-enhanced plans, the basic alternative ones, are not eligible

[15] CMS is studying alternatives to the random reassignment model which should entail a "beneficiary centered" reassignment in which the reassigned individual is matched to a plan similar to the one he previously had according to several factors.

the same region and year.

Although the reassignment process limits the risk that LIS individuals have to pay positive premiums, it harms continuity and stability in coverage. Reassigned individuals may have to change their pharmacy, get new copies of their prescriptions, and determine whether they need to change drugs because the formulary might be different. Therefore, CMS has used its authority to offer to the sponsors the possibility of retaining LIS beneficiaries if the plan's premium exceeds the LIPSA only by a small amount (so called "de minimis"). The "de minimis" policy was active in 2007, 2008, 2011 and 2012. The actual amount in these was, respectively, \$1 in 2008 and \$2 in the other years. This means, that for instance, in 2007 a plan that had a premium that was above the LIPSA by no more than \$2 could decide to keep its LIS beneficiaries that would be otherwise randomly reassigned by accepting to get reimbursed by Medicare only up to the benchmark. In 2009, CMS abandoned the "de minimis" policy because it considered the reform of the weighting formula of the LIPSA introduced that year as a more effective way to satisfy to conflicting objectives of keeping incentives for low bids and limiting the number of reassignments. The 2010 health care reform reintroduced the "de minimis" mandating that CMS decides every year its amount.

The random reassignment has generated substantial concerns for its perceived lack of both fairness and efficiency. Therefore, certain States have taken steps toward alternative assignment procedures aimed at picking the best plan. However, Maine is the only state that fully replaced the random assignment with a beneficiary-centered assignment process. Using prior information of drugs usage, the match between LIS and the formularies of the various plans was assessed and used to reallocate those LIS that had a particularly bad match due to the random assignment. This intelligent assignment is helpful to prevent the distortions that a purely mechanical random assigned coupled withe the endogenous LIPSA could generate. The next section formalizes the intuition about the nature of this distortion.

3 A Basic Model for Plans' Bidding

The market for part D plans combines features of auctions and differentiated product markets. To illustrate these two features, this section abstracts away from many real world complications that will be part of the empirical model.[16] Therefore, I consider a single market where there are N firms offering insurance plans. For each plan i belonging to firm f, the firm chooses a premium, $p_i \in [\underline{p}, \bar{p}]$ within the floor and ceiling prices allowed by Medicare[17], and bears a cost $c_i \in \{c_i^U, c_i^L\}$, where c_i^U is the cost to insure for one period an unsubsidized consumer and c_i^L is the analogous cost for a subsidized consumer[18]. Let's also indicate by M^U and M^L the total number of unsubsidized and LIS consumers in this market that we assume to be fixed throughout time and by s_i^U and s_i^L their share enrolled in plan i.

Then, in any period t the profits of a firm f offering multiple plans in this market is:

$$\Pi_{f,t} = \sum_{i \in f} [p_{i,t} - c_{i,t}^U] s_{i,t}^U M^U + \sum_{i \in f} [p_{i,t} - c_{i,t}^L] s_{i,t}^L M^L \tag{1}$$

The firm must choose prices to maximize profits but the fact that the same price is applied to both unsubsidized and LIS consumers complicates the analysis. To proceed we need to specify how prices influence the enrollment shares. Consider the situation in which the utility of an unsubsidized consumer j for plan i is given by the indirect utility: $u_{j,i|j \in U} = \delta_i - \alpha p_i + \epsilon_{j,i}$ where δ_i is the mean quality of plan i, p_i its price and $\epsilon_{j,i}$ is an idiosyncratic preference of i for j. If we normalize to zero the mean utility of not enrolling, we can obtain the logit formula

[16] These complications are the non zero cross-market elasticities due to the national subsidy, the distinction between enhanced and non-enhanced plans, etc.

[17] The presence of known floor and ceiling prices is a simplification that captures the following regulatory features: (i) in every period Medicare announces the closed list both those drugs that can be offered and of those that must be offered; (ii) Medicare has the right to ask firms to revise the bids submitted in June when they are considered excessively high or low.

[18] As I argued before, plans are paid both by enrollees and by Medicare for each enrollee. Medicare's reimbursements are the rather complex combination of subsidies and reinsurance described before. Since the reimbursement is function of both the consumer risk characteristics and all the plans bids, the cost c could be written as the true cost (c^*) net of reimbursements. Since the basic result that we present would not be substantially affected by this complication we neglect dealing with it in this proposal.

for the share s_i^U that is usual in the study of demand in differentiated product industries:

$$s_i^U = \frac{e^{(\delta_i - \alpha p_i)}}{1 + \sum_{r \in R} e^{(\delta_r - \alpha p_r)}}$$

Instead, similarly to what happens in auctions, the share s_i^L is determined only by prices (no measure of quality enters in the allocation rule). Moreover, for all periods after the first one, it is also determined by past enrollment.[19] Defining the LIPSA in period t as: $LIPSA_t = \sum_{r=1}^{R} w_{r,t} p_{r,t}$, where $w_{r,t}$ are the weights associated to plan r in the calculation of the subsidy for period t, we have:

$$s_{i,t}^L = \begin{cases} 0 & \text{if } p_{i,t} > LIPSA_t; \\ s_{i,t-1}^L + s_{i,t}^{L,RR} & \text{if } p_{i,t} \leq LIPSA_t. \end{cases} \tag{2}$$

where $s_{i,t}^{L,RR}$ is a complicated function depending on how many other plans each of the firms has and what is the share of LIS enrollees in those plans that lost eligibility in period t. To simplify, consider the case in which each firm has exactly one plan. Assume no ties in prices. Then, relabeling the plans in the order of their prices $p_1 > p_2 > ... > p_N$ and indicating as j^* the index of the first price that is above the LIPSA$_t$, for a plan i that is eligible in period t we have $s_{i,t}^{L,RR} = \frac{1}{j^*-1} \sum_{j=j^*}^{N} s_{j,t-1}^L$. Depending on what the LIS rule says about the weights $w_{r,t}$, the market could evolve in rather different ways. In particular, if the ranking of firms by their cost to enroll consumers does not change through time, we have the following lemma:

Claim 1 - *If the weights are based on the previous period LIS enrollment, then, regardless of the initial allocation of LIS enrollees, within a finite number of periods they will all be concentrated in a single plan (unraveling). This might not happen when weights are fixed.*

If in the initial allocation one plan has all the weight, then clearly the LIPSA will always be equal to this plan's price and this plan will remain the monopolist forever. Instead, when we start with multiple plans having positive weight, assuming no ties in prices and fixed cost ranking implies by a Bertrand argument that at every round at least one plan becomes ineligible. Thus, the LIPSA unravels toward the plan with the lowest price which then be-

[19] Since the LIS consumers have an opt-out option, this amount to assume that their utility is $u_{j,i|j \in L} = \delta_i - \alpha p_i + \epsilon_{j,i} - K$, where K is the cost of opting out. With a sufficiently high K no consumer will opt-out.

comes permanently the monopolist. Once monopoly has been reached, the monopolist could drive the price as high as the maximum price allowed. Whether this occurs depends on the trade-off he faces between exploiting the subsidy and retaining unsubsidized clients.[20]
Despite enrollment weighting, lemma 1 does not apply if at least one firm has multiple plans:

Claim 2 - *With enrollment-based weights a multiplan firm might prevent the unraveling.*

To see this, consider an environment with three plans: q, j, k. Suppose unsubsidized consumers have utility: $u_{j,i|j \in U} = \delta_i - p_i$ for $i = q, j, k$. There is an outside good giving a utility of zero. Plan costs and qualities are: $c_j = c_k = 1 > .01 = c_q$ and $\delta_q = 1 > 0.1 = \delta_j = \delta_k$. If the three plans are independent, it is clear that in equilibrium all consumers, both LIS and unsubsidized, must end up in plan q. However, suppose now that j and k belong to the same firm. Furthermore, suppose that the ceiling price is 4 and that the LISPA is calculated using enrollment-based weights (with identical weights in the first period). Then, the only equilibria are those of the type illustrated (for the first three periods) in Figure 1. In these equilibria, the independent plan serves all the unsubsidized and $\frac{1}{2}$ of the LIS consumers charging a price $p_q = 1$. The remaining LIS consumers are served by the multiplan firm at a price of 2.5. Over the periods the multiplan firm rotates its plans. The plan entering period t with weight $\frac{1}{2}$ rises its price to 4 to push the LIPSA to 2.5. The partner plan sets a price of 2.5 and receives all the reallocated LIS customers.

There are a number of unpleasant features associated with this equilibrium:

- Inefficiency: half of the consumers remain forever into plans that have the highest cost
- Reassignments: consumers cycle between the j and k plan
- Lack of fairness for consumers: for purely random reasons some LIS consumers get forever quality 1 while the others get zero.
- Lack of fairness for the firms: the profits of the multiplan firm are higher than those of the other firm

[20]This unraveling property is not an artifact of the full information assumption. If costs are private information and their evolution through time does not cause too much reshuffling of the ranking by costs, a result analogous to claim 1 can be proved using a modification of the main theorem in Decarolis (2009).

- Cost for the government: the government will pay forever 2.5 for half of the IS enrollees while it could have paid 1

I conclude this section with four observations. The first one is that the discussion in this section suggests that after 2008 the strategies used to pilot the LIPSA might involve complex dynamics. This might make detecting these strategies in the data harder. On the contrary, until 2008 the manipulating strategies are simper since the role of dynamic considerations is more limited. For instance, in the example presented above, if all three plans have fixed and identical weights through time, then in addition to the equilibrium described above there is another pure strategy equilibrium in which the first period bids reported in Figure 1 are repeated in all periods. The second observation is that for moderate degrees of adverse selection in the LIS population, it would be still convenient for a firm to behave as the multiplan firm described in the example. The fact that Medicare payments to plans are risk adjusted suggests that indeed we should not expect extreme differences in the cost of enrolling LIS relative to regular consumers. The third remark is that the manipulability of the LIS gives a strong incentive to firms to coordinate their bids. In my analysis, I will ignore this possibility that firms collude and focus on manipulations by multiplan firms. However, the presence of colluding firms would magnify the distortions due to the LIS. The fourth remark is that in the data, premium increases might be generated by numerous other factors that my model ignores. In particular, the large wave of mergers and acquisitions occurred since 2006 suggests that they could reflect changes in the market structure. A second explanation, analyzed in Duggan and Scott-Morton (2010), is that they could be driven by increases in the cost of prescription drugs. A third one, explored in Ericson (2010), is that firms are exploiting consumer switching costs by entering with low prices and then rising them once enrollees are locked in. Although ignored in the simple model, I will try to control for these forces in my empirical analysis. I begin this analysis with some preliminary evidence on correlations between premium changes and LIS manipulation.

4 Preliminary Empirical Evidence

This section presents three sets of results. The first one regards the question of whether LIS are profitable for firms given the potential adverse selection risk. The second one illustrates some evidence on the association between LIPSA manipulation and changes in LIPSA and average premium at regional level. The last results look at the pricing of individual plans to assess how manipulations occurr.

1) Do Insurers Avoid LIS Beneficiaries?: An influential study of Hsu et al. (2010) compares the drug expenditures of LIS and non LIS enrollees. This study finds that the current level of risk adjustment used by Medicare is insufficient to compensate for the extra consumption of LIS enrollees: currently Medicare pays an extra 8% for LIS enrollees relative to similar but non LIS enrollees, but the extra payment needed to fully compensate insurers is estimated to be 21%. From this finding, the study derives the implication that insurers want to avoid LIS enrollees. However, a closer look at the data suggests that this latter implication is not correct. There are at least two observations suggesting the different conclusion that plans find LIS profitable. First of all, Hsu et al. argue that the main difference in spending between LIS and non LIS is due to spending above the catastrophic threshold. However, the Medicare reinsurance policy is such that plans bear only 15% of the expenditure of their enrollees above the catastrophic threshold. It is not clear whether this element was included in the calculations of Hsu at al. or not. Secondly, in my data I observe 3 years in which Medicare put in place a de minimis policy: the amount was $2 in 2007 and 2011 and $1 in 2008. The number of plans affected was: 73 in 2007, 43 in 2008 and 58 in 2011. These were non enhanced plans priced above the LIPSA but within the de minimis. Out of all these plans, my data indicate that just one of them opted not to use the de minimis while all the other accepted to discount their price in order to keep their LIS enrollees. The default option established by Medicare is that the de minimis option is *not* used. Hence, these plans had to actively choose to retain their LIS enrollees. The second piece of evidence comes from the acquisition by CVS Caremark of the whole PDP business line of Universal American. Since the latter firm had mostly LIS enrollees (1.43 million out of a total of 1.88 million enrollees) and since the price paid was 1.25 billion, a back of the envelope calculation suggests that the net present value of a LIS beneficiary is about $660 which is in line with the price per consumer paid in other mergers involving companies with mostly regular consumers. Given these findings, the results of Hsu et al. about the inadequacy of the risk adjustment are even more suggestive that firms have found a way to profit from LIS enrollees.

2) Aggregate Evidence Of particular interest for this research is the behavior of the average premium and of the average LIPSA.[21] As Figure 5 shows, after an initial decline, the LIPSA steadily increased from 2009 onward. This increase goes together with the increase of the basic premium although it appears at times more pronounced than that of the premium. The turning point for the LIPSA is in 2009 and it is likely associated with the greater concentration of weights driven by the switch to enrollment weighting. Additional evidence on the association between the LIS weights and changes in LIPSA and premium is presented in Table 8. The dependent variable is the change in the LIPSA (for the same region, between two consecutive years from 2006 to 2011). The first column uses data for the period before 2009, while the second column uses data for the years 2009-2011. The independent variables capture the concentration in the market through a C4 index. Thus, Mkt. Share (C4) is the sum of the market share of the 4 largest firms. While this variable uses total enrollment, the other variable Mkt. Share LIS (C4) uses only LIS enrollment. Finally, LIS Weights (C4) sums the weights of all the plans of the 4 largest companies in terms of their LIS weights. Interestingly, it is not the concentration of total (or LIS consumers) enrollment, but that of LIS weights that is strongly associated with greater changes in LIPSA and the average premium. This result remains true when controls for the plan age (a proxy for the switching cost) and measure of costs as the number of active principles are controlled for. Finally, it is interesting to notice some marked differences in the evolution of the LIPSA across regions. Although there are no regions in which the LIPSA declines for each of those years, region 1 (NH and ME) registers the largest decline of the LIPSA between 2006 and 2011. Interestingly, Maine is the only state that in this period had replaced random reassignment of LIS with beneficiary-centered assignment. Similar albeit not identical programs were implemented to a lesser extent in other states. In the fourth and eight column of Table 8 I

[21]The LIPSA is above the Basic Premium because in the calculation of the latter enter many MA-PD with a price of zero.

report the results obtained excluding all those regions in which at least half of the region LIS were potentially affected by the beneficiary-centered assignment. The size of the coefficients for the LIS weight concentration almost doubles in both regressions suggesting that LIS manipulations might be less of a problem when beneficiary-centered assignment is used.

3) **Manipulation of Plans Premiums** The last set of correlations that I present concerns the prices of individual plans. First, I look at the decision to submit extremely higher/lower premiums from one period to the next. In particular, for every plan I calculate the percentage change in its price from one year to the next. Then I create dummy variables to indicate which of these changes qualify as "jumps". In Table 9, I consider 3 cases: first, a dummy equal to 1 when the premium increases more than 50%; second, a dummy equal to 1 when the premium increases more than 75%; third, a dummy equal to one when the premium decreases by more than 40%. For the independent variables, I look at plan in the initial period. The functioning of the LIS and RR rules suggests that a firm decision to submit a jump bid depends on the weight of the plan. Moreover, a firm will like to submit a positive jump bid only if there are some other of its plans to benefit from the higher LIPSA. Therefore, I construct a dummy (Eligible Firm) equal to one when the firm has for that region/year at least one other plan that is eligible to receive LIS enrollees. A second dummy, Only Eligible Plan, equals one in the event in which this plan is the only plan of the firm that is eligible for that region/year. In this case, a firm should be concerned of completely losing all its LIS enrollees and might want to reduce its bid. Finally, I also use a dummy for enhanced plans because these are the plans that, especially in the pre 2009 period, were useful to move the LIPSA but could not collect by themselves LIS enrollees. Table 9 suggests that all these effects are present in the data.[22]

A second set of results is presented in Table 10. In this case, I look at how firms split the total premium of enhanced plans between the enhanced and the basic component. Given that only the latter affects the LIPSA, one might expect that firms that can profit more from increasing the LIPSA will skew the price of their enhanced plans toward the basic

[22]Moreover, results not reported in the paper indicate that all the effects described are even stronger when the sample is limited in the regions not adopting beneficiary-centered assignment. Instead, most of the relevant coefficients lose significance when the sample consists only of the 6 regions using some forms of beneficiary-centered assignment.

component. Indeed, the table suggests that in the period from 2009 onward when it is the weight of the enhanced plans that determines how much skewing the bid is profitable, there is an association between greater skewing and the interaction between the plan weight and the eligible firm dummy. Overall, the results in both Table 9 and 10 confirm that firms respond to the incentive to manipulate the LIPSA, which is not surprising given that this is what a profit maximizing firm should do.

5 Empirical Model

In this section, I specify a richer model for demand and supply than the one used before to exemplify the effects of the LIS and RR rules. For the demand side, I follow the discrete choice literature and assume a random coefficients logit indirect utility. For the supply side, I assume Nash-Bertrand pricing behavior and carefully select those markets where this assumption appears more appropriate. For a firm f offering multiple plans in a certain market, if the marginal cost of enrolling customers is known and constant, profits can be written as:

$$\Pi_f = \sum_{i \in f} [b_i - c_i] M s_i(p_i, p_{-i}) - C_f \tag{3}$$

where M is the size of the market, s_i is the share of plan i, which is a function of the prices in all plans in the market, C_f is the fixed cost of production, c_i is the marginal cost and b_i is the bid. The goal of this section is to show how to use consumers demand for plans to identify the relationship between prices and the market shares. Then, in the analysis of the supply side I will isolate firms for which it is possible to back out the marginal cost despite the LIS induced distortion. I will then estimate the relationship between these costs and the plans characteristics. These estimates are used to predict costs for the plans that because of the LIS distortion were left out from the previous steps. Finally, provided with cost estimates for all plans, I quantify the price distortion due to the LIS.

5.1 Demand

Indirect utility specification The indirect utility function that consumer i gets from plan j in market t is given by:

$$u_{ijt} = -\alpha_i p_{jt} + x_{jt}\beta_i + \xi_{jt} + \epsilon_{ijt} \tag{4}$$

where p_{jt} is the price, x_{jt} contains observable characteristics of plan j in market t, ξ_{jt} is the unobserved characteristic of the plan[23], and ϵ_{ijt} is a random disturbance of type I extreme value distribution. A consumer chooses the plan giving him the highest utility. The model is estimated using 2007-2011 market shares of PDP plans of the 34 continental regions. The market share of the outside option is defined as the consumers enrolled in MA-PD plans or not enrolled[24]. The utility from the outside good is normalized to 0[25].
The outside good is comprised both of people entering into MA-PD plans and not entering Part D at all. It seems appropriate to collapse these two different choices because not getting insurance at all and getting Medicare via MA-PD are both typically considered in the literature lower quality options that enrolling in PDPs.[26]

In the random coefficient specification, the coefficient on price interacts with demographics. Its distribution is assumed to be normal, conditional on demographics. That is:

$$\alpha_i = \alpha + \Pi D_i + \sigma \nu_i \tag{5}$$

$$\text{where } \nu \sim \mathcal{N}(0, 1) \tag{6}$$

and where D_i is a dx1 matrix of demographic variables and Π is a matrix of 1xd coefficients measuring how tastes change with demographics.[27] In the results presented below, the only demographic characteristic used is the income of the household[28] Given this relationship

[23]The assumption is either that this effect is independent of the consumer characteristics or that it is the average across consumers.

[24]The population not enrolled is calculated as the difference between the population over 65 years and total enrollment in PDP and MA-PD plans.

[25]As usual, the "outside good" is needed to avoid that homogeneous increases in all prices leave quantities purchased unchanged.

[26]Although this definition of the outside good includes private drug insurance, few elderly use this coverage option.

[27]All the demographic data come from the IPUMS survey. Further details are given in the Appendix.

[28]Results remain substantially unchanged using additional characteristics. Those that I experimented are

between the taste coefficients and the demographics, we can rewrite the utility function as:

$$u_{ijt} = -\delta_{jt} + (\mu_{ijt} + \epsilon_{ijt}) \text{ where } \delta_{jt} = -\alpha p_{jt} + \xi_{jt} \text{ and } \mu_{ijt} = p_{jt}(\Pi D_i + \sigma \nu_i)$$

Consumers can purchase just one plan and we assume they purchase the one that gives the highest utility, thus the choice of plan j in period t is:

$$A_{jt} = \{(D_i, \nu_i, \epsilon_{it}) \| u_{it} \geq u_{ilt} \forall l\} \tag{7}$$

Hence, the market share of the j-th product in market t is just the integral over over the joint distribution of (D, ν, ϵ). Finally, the indirect utility from the outside good is:

$$u_{i0t} = -\xi_{jt} + \pi_0 D_i + \sigma_0 \nu_{i0} + \epsilon_{ijt} \tag{8}$$

The estimation of this mixed logit then proceeds using the traditional BLP nested algorithm. **Discussion of the assumptions**: Using this discrete choice approach has two major drawbacks. The first one is that the indirect utility specification does not allow to infer interesting parameters of the utility function like the risk aversion coefficient. Nevertheless, the advantage of this approach is that it allows to easily incorporate a rich set of plans characteristics in the consumer problem. Given that the objective of this analysis is to understand the pricing behavior of firms offering plans with different characteristics, learning about the values for consumers of these characteristics is more relevant that learning about consumers utility. Nevertheless, this limitation matters for the type of counterfactual analysis that can be conducted.

The second drawback is that the estimates are potentially affected by an endogeneity bias. In principle, this regards both price and some quality measures of the plans that firms can adjust. As regards the latter, firms certainly have incentives to choose strategically the quality features of their plans. For instance, this is because randomly assigned LIS are (almost) perfectly inelastic to quality. Thus, a firm can reduce the quality of its plans having many

race, age and the marital status (transformed into a dummy equal to one if the both the respondent and the spouse live in the household).

LIS enrollees. However, it is not clear to what extent this decline of quality can happen since the regulation poses at least two constraints to this type of behavior. First, there are strict requirements in terms of the minimum quality for plans to qualify for Part D. Second, when firms submit plans bids in June, CMS evaluates whether the requested prices are justified by quality. These contrasting forces might explain why an analysis of the association between LIS manipulation and quality measures gives ambiguous results. Therefore, in the rest of this paper I will consider plans characteristics as exogenous.

Instead, I will take prices as endogenous and use instruments to correct for the potential bias in the estimate sof α and σ. I use both instruments that are conventional in the BLP framework and instruments that are specific to the Part D market. As regards the former group, I constructed the set of instruments that are traditionally referred to as BLP [29], Hausman[30] and Train-Whinston[31]. Moreover, I also construct instruments specific for Part D based on the idea that the number of LIS enrollees influences firms costs without affecting regular consumers demand. In fact, having a larger number of LIS enrollees in the previous period might give a firm greater bargaining power with both drug manufacturers and pharmacies in the current period. However, it should not have any direct effect on the current demand by regular enrollees. The results reported in the next section seem to indicate that these instruments work well to correct the endogeneity bias.[32]

[29] First, I compute the total number of basic and enhanced PDPs and of MA-PD offered in the market. Furthermore, for a given characteristics of plan j in market t, I compute the (previous year) enrollment-weighted average of characteristics of both plans offered by the same firm (but excluding plan j) and plans offered by other firms. The characteristics are: i) deductibles ii) active principles (all active principles, the number of the 100 most used and the number of restricted active principles) iii) number of drugs, iv) dummy for coverage in the gap, v) dummy basic plan.

[30] These instruments are constructed as follows. The 34 regions are divided into three macro-regions, roughly coinciding with the east, the south, the and the west of the US. Then, I compute the (previous year) enrollment-weighted average of prices of plans offered in other regions in the same macro region and in the other macro-regions by the same company, distinguishing between enhanced and non-enhanced plans.

[31] For the characteristics (i) to (iii) listed in the previous note, I computed the sum of squared differences between the product and the other product by the same and other firms.

[32] The results in Table 11 are obtained using the following subset of the instruments described above: the number of enhanced, standard and MA plans in the region-year market, the average of deductible, active principles (both total and top 100) of MA plans in the market, the mean of active principles offered by all plans, the lagged LIS enrolled in the company, the Hausman instruments using the macro-region different from the one of the market, and the Train-Whinston instruments constructed using the number of drugs and active principles in the market.

5.2 Supply

In the differentiated-product literature, typically the first step is to assume that prices are the outcome of a Nash-Bertrand equilibrium. The second is then to use the first order conditions of the profit maximization problem to back out unobserved marginal cost from prices, market shares and estimated market share elasticities. Both steps generate concerns in the context of Part D. As regards the Nash equilibrium assumption, the auction-like assignment of LIS consumers could be not well described by a full information environment. However, the Bayesian-Nash alternative structure would require making assumptions on what underlying variables are stochastic, what is the firms information structure and, especially, how costs and information on them evolve through time. Instead of taking this route, I will maintain the full information Nash equilibrium assumption. However, I will try to selectively study portions of the market where the first order approach would still be a reasonable approximation of firms behavior despite the LIS distortion.

As illustrated by the previous examples, the possibility that firms manipulate the LIPSA implies that prices might result from corner solutions. Moreover, after 2009 firms might be using complex dynamic strategies. Thus, relying on the first order conditions of a static maximization problem might not always be legitimate. However, there are portions of the market that are unaffected or only marginally affected by the LIPSA distortions and can thus be used to back out firms costs. In particular, I find that there are three cases for which it is possible to rely on first order conditions: *i)* when considering firms that are never LIS eligible (i.e., those that have has no basic PDP or all basic PDP always above benchmark); *ii)* when looking at plans in region 1, where because of beneficiary-centered assignment in Maine there is a very small presence of auto-assigned LIS; *ii)* when considering firms for which a statistical test to detect LIPSA manipulation fails to find evidence of this behavior.

Case 1 To see why the first group is selected, consider the period 2009 and 2011 in which LIS weights are based on previous period LIS enrollment. A firm engaged in exploiting the LIS might be playing complex dynamic strategies like those discussed earlier. However, given all other firms prices, a multiplan sponsor that never competes for the autoenrolled LIS by never having any LIS eligible plan will be little affected by the LIS distortion. In particular, the profits of this firm are given by:

$$\Pi_f = \sum_{i \in f} [b_i - c_i^U] s_i^U M^U + \sum_{i \in f} [b_i - c_i^{LC}] s_i^{LC} M^{LC} \tag{9}$$

Where LC denotes the LIS choosers who enroll in plans above benchmark. Assuming Nash-Bertrand prices and an interior solution, the equilibrium bids are defined by the system of first order conditions for each $b_j \in f$:

$$s_j^U M^U + \sum_{i \in f} [b_i - c_i^U] \frac{\partial s_i^U}{\partial b_j} M^U + s_j^{LC} M^{LC} + \sum_{i \in f} [b_i - c_i^{LC}] \frac{\partial s_i^{LC}}{\partial b_j} M^{LC} = 0 \tag{10}$$

The demand side estimates allow us to obtain $\frac{\partial s_i^U}{\partial p_j}$. Then, to get the share derivative in terms of b_j, i follow Miller and Yeo (2011) and assume that:

$$b_j = b_j^{basic} + b_j^{enhanced} = b_j^{basic}(1 + \gamma_j) = p_j + \lambda \sum w_i^{national} \frac{b_i}{1 + \gamma_i}$$

Where $w_i^{national}$ is the weight assigned to plan i in the calculation of the national average. However, since these weights are extremely small and they get multiplied by a term λ that is around 0.6 and divided by a term $(1 + \gamma)$ that is around 1.03, we approximately have that:

$$\frac{\partial s_j^U}{\partial b_j} = \frac{\partial s_j^U}{\partial p_j} \frac{\partial p_j}{\partial b_j} = \frac{\partial s_j^U}{\partial p_j} [1 - \frac{\lambda w_j^{national}}{1 + \gamma_j}] \approx \frac{\partial s_j^U}{\partial p_j}$$

The bid b_j translates into even a lower premium for LIS choosers enrolled in non benchmark plans who only pay the difference between the total premium and the LIPSA. Thus, our demand side estimates gives us $\frac{\partial s_i^{LC}}{\partial p_j^{LIS}}$ which after some algebra can be expressed as:

$$\frac{\partial s_j^{LC}}{\partial b_j} = \frac{\partial s_j^{LC}}{\partial p_j^{LIS}} \frac{\partial p_j^{LIS}}{\partial b_j} = \frac{\partial s_j^{LIS}}{\partial p_j^{LIS}} [1 - \frac{w_j^{LIS}}{1 + \gamma_j}]$$

To use the system of equations defined by the first order conditions to retrieve firm costs, an additional assumption about the relationship between c_i^U and c_i^{LC} is needed. Three cases might be considered: *i)* $c_i^{LC} = c_i^U$, *ii)* $c_i^{LC} = (1.08) c_i^U$ and *iii)* $c_i^{LC} = (1.21) c_i^U$ where the second scenario follows the constant of proportionality that CMS applies to LIS consumers and the latter is the Hsu et al. (2010) estimate of this quantity. The results presented in the next section use the former assumption.

Overall, the approach outlined above has two disadvantages: the first one is that by disregarding the role of the endogeneity of the national average, a linkage between plans in different regions is assumed away. However, the small size of the national weights suggests this might not be a problem. The second and more serious problem is that only a selected subgroup of plans is used. Moreover, these plans are those having a higher premium and they might not be representative of all plans. This latter problem is addressed by the next method.

Case 2 In Maine, from the beginning of the program the random assignment of LIS was replaced by a beneficiary-centered assignment. Hoadley et al. (2007) describe this alternative assignment. To simplify, this policy generated an allocation of LIS that was as if these individuals decided their plan not at random but, similarly to the regular consumers, on the basis of plan characteristics. Therefore, for plans pricing above the benchmark equation (10) still applies. Instead, for plan i priced below the benchmark the first order condition is:

$$[s_j^L M^L + s_j^U M^U] + \sum_{i \in f} [b_i - c_i^U] \frac{\partial s_i^U}{\partial b_j} M^U = 0 \tag{11}$$

Thus, using together the system of equations equation (10) and equation (11) it is possible to back out the marginal costs for all the firms active in region 1. Similarly to the previous case, this approach disregards the linkage between markets due to the national weights. Moreover, another limitation is that Maine is part of region 1 jointly with New Hampshire. Therefore, in the overall region there will be around 14% of autoassigned LIS enrollees. To the extent that this is enough to induce a strong response by firms, first order conditions might fail to hold.

Case 3 For a related mechanisms known as Average Bid Auction, Conley and Decarolis (2011) developed an ad hoc statistical test detect firms manipulating the average bid. Their test is based on the idea of randomization inference and, in essence, compares the joint bidding behavior of members of a know cartel to the joint bidding behavior of random groups of comparable bidders. In their application, the test correctly detected the coordination of bids among members of cartels sanctioned by the Italian judiciary. Similarly to the auctions in Conley and Decarolis, the incentive to manipulate the LIPSA is due to its endogenous nature. Nevertheless, contrary to Conley and Decarolis, in this case the manipulation does not require collusion between firms but results from the simple maximization of an individual firm profits. Therefore, the testing procedure that I develop is motivated by the bidding strategy that a multiplan firm should follow to maximize its rents from LIPSA manipulation. To make the argument more precise, I focus on the period before 2009 when all plans have (almost) the same weight and there is no dynamic linkage between the weights. In this case, a firm trying to manipulate the LIPSA will place some of its bids as high as possible and some others right at the LIPSA. As an illustration of this type of behavior, Figure 6 reports the premiums in region 31 for 2007 and 2008. It is interesting to compare Aetna and Humana: while both have some very high priced plans, only the former seems to take advantage of the higher LIPSA by placing his other plans right below this threshold. Instead, Humana prices are substantially below what it could charge to LIS enrollees without risking losing them.

Assuming that in the period under consideration there is no linkage between the bids neither across regions nor within regions over time, LIPSA manipulation can be tested in the following way. For each market (a pair year-region), select all plans of a given firm i. Then, for each market m where i offers at least 3 plans compute a statistic that takes a value very close to zero when firm i follows the conjectured strategy and a very high value when it does not. In particular, for firm i in market m the following statistic $\theta_{i,m}$ results from the sum of three components which are going to be close to zero respectively when: eligible plans of I are priced close to the LIPSA in m (first term), non eligible basic plans of i are priced close to the highest price in m (second term) and non eligible enhanced plans are priced close to the highest price in m (third term).

$$\theta_{im} = \sum_{j=1}^{J^s} \left[|L^m - b^s_{imj}| \mathbf{1}\{b^s_{imj} \leq L^{dm}\} + (M^b - b^s_{imj}) \mathbf{1}\{b^s_{imj} > L^m\} \right] + \sum_{j=1}^{J^e} (M^b - b^e_{imj}) \quad (12)$$

Where:

- b^s_{imj} is the price of the $j-th$ standard (i.e., all non enhanced plans) plan offered by firm i in market m and J^s is the total number of standard plans offered by the firm in the market;

- b^e_{imj} is the price of the $j-th$ enhanced plan offered by firm i in market m and J^e is the total number of enhanced plans offered by the firm in the market;

- L^m is the LIPSA plus the de minimis for market m;

- $\mathbf{1}\{.\}$ is the indicator function;

- M^b is the maximum of the prices of all plans offered in market m.

In order to decide whether the behavior of firm i in market m is suspicious, we need to compare $\theta_{i,m}$ to a reference distribution. What we can do is computing for every comparable collection of plans in m the same statistic. Thus, for instance if firm i has 2 basic plans and 2 enhanced plans, we can simulate a large number of comparable groups formed by 2 basic and 2 enhanced plans and calculate for each of these groups their associated $\theta_{j,m}$. The distribution of $\theta_{j,m}$ from these randomly chosen groups is then the distribution to which $\theta_{i,m}$ also belongs. Since $\theta_{i,m}$ will be closer to zero the more firm i bids resemble the conjectured manipulation strategy, then we can use as a statistical criterion to define a suspicious behavior the events in which $\theta_{i,m}$ is not larger than a critical value of the reference distribution, for instance 5%.

The construction of the control groups is the key element to ensure that this method truly detects a specific pricing strategy and not just a certain cost condition of the firm. In fact, $\theta_{i,m}$ might be very close to zero just because of its high costs. In this preliminary version of the paper, I constructed control groups conditioning on two plans characteristics: whether the plan is enhanced or not and to what quartile in belongs in the distribution of the number of active principles covered.[33]

Finally, notice that the test achieves power form the fact that we repeatedly observe the same firm offering its plans in several regions and over several years. Therefore, we can also collect for each of these single market tests the percentile of the reference distribution to

[33] Using the number of drugs instead of the number of active principles dos not alter my results.

which $\theta_{i,m}$ corresponds and report in an histogram all these percentiles. I did this for all the 15 largest firms in terms of market share for 2007 and 2008. In Figure 7, I report the histograms for the two firms that the test indicates as the most suspicious. In particular, the histograms for Aetna indicate that in both 2007 and 2008 in a large number of regions the value of $\theta_{Aetna,m}$ in the lowest end of the reference distribution. Thus, its prices were much closer to the conjectured strategy than those of most of the control groups. For Medco, instead, the difference between 2007 and 2008 indicates that only in 2008 this firm adopts the conjectured strategy. This could be explained, for instance, if Medco "learned" to manipulate the LIPSA. In addition to Aetna and Medco, CVS is the other firm that seems to engage in LIPSA manipulation in the period considered. Thus, I will consider these three as the manipulating firms and I will thus apply the first order approach described above only to the other firms.

6 Results and Counterfactual Analysis

The results of the demand estimation are reported in Table 11. These estimates show how market shares of regular enrollees choosing PDPs respond to plans prices and characteristics.[34] The last column of the table contains the estimates for the mixed logit model described before. OLS and nested logit estimates are reported for comparison purposes.

Focusing on the random coefficient logit, I find that consumers seem to dislike plans that cost more, conditional on other plan characteristics.[35] Consumers also dislike enhanced plans and plans with a higher deductible. The effect of the number of pharmacies is negative but essentially zero in terms of magnitude. On the contrary, consumers like receiving coverage in

[34]These three sets of estimates are broadly in line with previous results by Miller and Yeo (2011) and Lucarelli et al. (2011).

[35]The OLS provides a smaller estimate but this is also likely affected by an endogeneity bias. In the nested logit model, the endogeneity is addressed by instrumenting for prices and for the market size of the "nest". I experimented with various ways or nesting plans and report results that nest together plans of the same parent organization and type (basic or enhanced). The reported instrumental variable estimates use LIML which has the advantage of revealing which endogenous variables are poorly instrumented for. Indeed, while the narrow confidence interval for the price variable suggests that the IV are adequate for it, the large bands for the market share nest suggest the opposite. The price coefficient is larger in the mixed logit possibly because of a more accurate correction for the endogeneity bias.

the gap, having more active principles covered and that these active principles are available through drugs in low tiers (for which copays are lower). Older plans might be more valuable because of either their more estabished reputation, or selection (only plans that are liked survive) or the presence of switching costs. The lack of significance of the σ coefficient is suggestive that our observed characteristics capture well the sources of variation in consumer tastes. This suggests that using these estimates to construct a counterfactual LIS consumers demand is not contradicted by the data. However, the fact that the interaction with income is significative means that income differences between the two groups need to be considered to construct the LIS consumers demand. The negative sign is possibly additional evidence of the LIS distortion, but further analysis is needed to rule out alternative explantions like consumers selection.

Provided with the demand estimates, I then proceed to estimate firms costs. Using the estimated demand parameters, it is possible to estimate the change in the market share of a plan given the change in the price of any other plan. These quantities are used to estimate shares price elasticities. Moreover, these quantities allow to use the firms first order conditions to solve for the unobserved marginal costs. To avoid the instances in which the LIS distortion is more likely to invalidate this approach, I focus on the three cases described earlier. In the first and second case, the "control group" of firms for which the first order approach is used consists, respectively, of firms that never have a LIS eligible plan and of firms in region 1. Instead, for the third case the control group includes all firms excluding those detected by the test for LIPSA manipulation: Aetna, CVS and Medco. Separately for each control group, I compute the firms marginal cost of each plan. For instance, using the control group of Case 1, one obtains the price cost markups (PCM) reported in figure 8. Then, a simple OLS regression is used to estimate the relationship between these marginal costs and both plans observable characteristics and the estimated unobservable quality measure. Using these estimated coefficients together with the plans characteristics of the firms outside the control groups, I obtain predicted marginal marginal costs also for these firms.

Finally, with these predicted marginal costs, the observed market shares and the estimated shares elasticities it is possible to calculate counterfactual prices for the firms outside the control groups. The difference between the observed prices and these counterfactual prices is a first rough measure of how much firms are overpricing their plans in response to the LIS distortion. Preliminary results indicate that, absent a more accurate matching between the control and the outside firms for each of the three groups, the results obtained for the three groups are not identical. In particular, the average premium overpricing is almost zero if evaluated under case 1, in the order of 3% under case 3 and just above 10% under case 2. This ranking is not too surprising since case 1 uses the plans pricing the highest to predict the cost of the plans pricing the lowest. The results under case 2 are possibly the most relevant because they relay on a clear policy experiment that substantially reduced the possible LIS distortions. Moreover, only under this case it is possible to match distorted and not distorted plans within the same firm (and across different regions). Preliminary results matching plans via propensity scores confirm an overpricing of around 10% for case 2.

However, these rough measures of premiums overpricing cannot be used to assess how average premiums would have been absent the LIS distortion. In fact, if plans were to price differently also their market shares would differ from the observed ones. Therefore, a counterfactual analysis needs to simulate new prices and market shares in an environment where the LIS distortion is absent. To do so, I assume that regular consumers are characterized by a demand function with the parameters given by the mixed logit estimates. Firms are characterized by the costs estimated in the way described above for Case 2. The counterfactual that I consider consists in eliminating all the LIS consumers from the market as if they were all allocated to an ad hoc, possibly publicly owned plan.[36] This is not an unreasonable counterfactual scenario because, this would fully solve in a simple way the distortive effects due to the LIS and would avoid the unfairness resulting from LIS enrollees allocated at random across plans of different quality. Moreover, this is essentially how Medicaid used to work.

In this counterfactual environment, I will assume that the plans ownership structure

[36] I will ignore any potential interaction between this hypothetical public plan and the remaining PDPs. Miller and Yeo (2012) study the effects of introducing a public plan that competes with the existing plans. Moreover, I will also ignore potentially relevant general equilibrium considerations, for instance, the fact that altering the market shares in Part D might change firms bargaining power with drug manufacturers and hence firms costs (as argued in Lakdawalla and Yin, 2011) or the fact that firms also owning MA-PD might be playing more complex strategies (as argued in Lavetti and Simon, 2012).

is the observed one and that prices are the Nash-Bertrand solution to the game in which only regular consumers enroll into plans. Under these assumptions, I use firms costs and consumers demand to simulate equilibrium prices and market shares. I focus on the year 2008 and simulate prices and market shares for each of the 34 regions. Table 12 reports both the actual and the counterfactual enrollment-weighted average premium in each region as well as for the whole US. Regarding the whole US, the results indicate a counterfactual average premium that is $3.58, or about 10%, lower than observed premiums. Since these results are based only on costs estimated for region 1, their usefulness is the greatest for regions similar to region 1. Nevertheless, overpricing appears to be rather systematic. Finally, despite I did not explore other counterfactuals in this preliminary version of this work, it would be interesting to consider what would happen if LIS enrollees were endowed with a demand for plans similar to that of regular enrollees. This would be a type of beneficiary-centered assignment that the case of Maine proves to be not only feasible but also quite successful in terms of containing costs and limiting cost increases for the government.

7 Conclusions

This study has presented an analysis of how the low income subsidy distorts firms pricing behavior in Medicare Part D. The complexity of this market implies that firms are subject to numerous and possibly conflicting incentives. Therefore, there is still an open debate regarding the causes of the premiums increases. The low income subsidy which had received little attention in the previous studies has been shown to likely be a relevant cause. Preliminary evidence suggests that because of this subsidy, premiums might be 10% higher than what they would be otherwise. Moreover, these findings also complement those in the vast literature on the demand side by showing that an efficient allocation of consumers to plans requires not only helping consumers to choose plans but also fixing premiums distortions. Allocating LIS enrollees to separate plans or using of beneficiary-centered assignment are easily implementable solutions to the problems described in this study that would contain the government cost of the program and address other deficiencies of the current system.

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Table 1: Aggregate Plans Reimbursement Amounts

		Medicare				
Year	Premiums	Direct Subsidy	LIS	Rein-surance	Risk Sharing	Total
2006	3.5	17.3	15.1	8.6	-	44.5
2007	4.1	18.4	16.5	7.1	-0.7	45.4
2008	5.0	17.5	17.4	6.7	-1.3	45.3
2009	6.1	18.8	20.3	11.4	-0.1	56.5
2010	6.7	19.9	20.9	10.5	-0.7	57.3
2011	7.3	20.1	22.3	12.8	-1.0	61.5
2012	8.2	21.6	22.4	14.4	-0.8	65.8

Premiums are paid by enrollees. Medicare pays the direct subsidy (which includes risk adjustment payments), the low income subsidy (LIS, which includes contribution for drug copayment), reinsurance payments (80% of the expenditures above the catastrophic threshold) and makes (or receives) risk sharing payments according to the risk corridors (negative amounts are net gain-sharing receipts from plans and may include the delayed settlement of risk sharing from prior years). The values for year 2012 are estimates. All data are from Table IV.B11 of the Trustees of Medicare 2012 Report.

Table 2: Main Regulation Changes, 2006-2011

Enrollment Year	Reform Description
2007	Introduction of a $2.00 "de minimis"
2008	Reduction of the "de minimis" to $1.00
2009	Elimination of the "de minimis" and to switch enrollment based LIPSA
2010	Switch to LIPSA calculated on MA-bids gross of Part C rebates
2011	Reintroduction of a $2.00 "de minimis"

Table 2 reports the major regulation changes affecting the LIS.

Table 3: Enrollment into PDP in 2010

Plan Sponsor	No. Enrollees	Market Share
UnitedHealth	6,859,222	27.1%
Humana	3,107,641	12.3%
UniversalAmerican	2,070,725	8.2%
WellPoint	1,170,386	4.6%
CVS-Caremark	1,105,262	4.4%
WellCare	860,477	3.4%
Total of All PDP	25,040,622	100%

Table 3 reports for all enrollees in PDPs, their share in 2010 in plans of the 6 largest companies.

Table 4: Summary Statistics

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Basic PDP, 2006-2008				Enhanced PDP, 2006-2008				MA-PD, 2006-2008			
VARIABLES	mean	sd	p50	N	mean	sd	p50	N	mean	sd	p50	N
Basic Premium	30.55	9.652	29.10	2,699	31.62	12.08	29.94	2,420	14.02	12.45	12	8,809
Total Premium	30.55	9.652	29.10	2,699	46.58	18.41	43.40	2,420	19.55	16.52	20.73	8,809
Deductible	173.9	119.9	250	2,699	12.22	46.48	0	2,420	54.70	105.2	0	8,809
Tot. Enrollment	14,252	29,454	3,719	2,698	3,953	10,808	831	2,418	1,984	6,046	156	8,803
LIS Enrollment	8,612	17,019	1,674	2,698	359.4	842.0	90.50	2,418	438.1	1,552	18	8,803
No. Top Drugs	76.27	18.33	85	2,478	83.27	15.46	88	1,967	82.43	17.27	88	6,174
No. Drugs	4,124	1,255	3,840	2,478	4,502	1,437	4,256	1,967				
No. Pharmacies	1,776	1,313	1,457	2,478	1,712	1,322	1,385	1,967				

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Basic PDP, 2009-2011				Enhanced PDP, 2009-2011				MA-PD, 2009-2011			
VARIABLES	mean	sd	p50	N	mean	sd	p50	N	mean	sd	p50	N
Basic Premium	35.49	10.03	34	2,725	43.27	18.36	42	2,688	16.98	14.53	19	12,157
Total Premium	35.49	10.03	34	2,725	63.62	24.12	63.40	2,688	20.44	18.45	21.50	12,157
Deductible	250.7	106.7	310	2,725	23.75	56.64	0	2,688	62.06	117.5	0	12,157
Tot. Enrollment	18,040	35,216	5,288	2,184	4,990	11,550	1,484	2,191	2,579	6,622	460.6	9,570
LIS Enrollment	10,697	20,853	2,928	2,146	543.5	1,408	175	2,138	622.2	1,895	92	8,987
No. Top Drugs	91.34	5.493	90	2,033	93.15	4.895	92	2,029	92.89	5.640	92	7,540
No. Drugs	3,261	553.0	3,134	2,033	3,397	675.3	3,305	2,029				
No. Pharmacies	1,872	1,357	1,540	2,033	1,861	1,349	1,540	2,029				

Table 4 contains summary statistics for the plans dividing the sample into the periods from 2006 to 2008 and from 2009 to 2012. The statistics are reported separately for basic PDP, enhanced PDP and MA plans. The sample includes all PDP and MA-PD excluding MA private fee-for-service plans, PACE programs under section 1894, 800 series plans, and 1876 (Cost Plans). Plans with enrollment of less than 11 customers are reported as zero enrollment.

Table 5: Weights of the PDP Plans

Weights of All PDP Plans, 2007-2011

	National Weights		LIPSA Weights 2007-2008		LIPSA Weights 2009-2011	
	Full Sample	$\geq$ 1%	Full Sample	$\geq$ 1%	Full Sample	$\geq$ 1%
Average	0.045	1.144	1.453	1.815	2.333	7.099
SD	0.091	0.099	1.154	1.284	5.037	6.938
5thPerc	0.000	1.014	0.594	1.063	0.000	1.151
25thPerc	0.008	1.076	0.870	1.298	0.039	2.174
50thPerc	0.023	1.142	1.271	1.543	0.196	5.115
75thPerc	0.038	1.184	1.649	1.751	1.873	9.267
95thPerc	0.168	1.336	2.783	3.638	12.490	20.895
99thPerc	0.484	1.336	6.695	8.268	23.849	33.896
N	8,062	8	3,690	2,413	4,372	1,365

Top 8 Weights of PDP Plans, 2007-2011

	National Weights		LIPSA Weights 2007-2008		LIPSA Weights 2009-2011	
	Year	Weight	Year-Region	Weight	Year-Region	Weight
1st	2011	1.336	2008-01	19.757	2010-29	63.989
2nd	2011	1.222	2008-34	18.038	2011-33	52.369
3rd	2010	1.147	2008-04	13.462	2011-01	51.002
4th	2011	1.147	2008-05	12.800	2011-18	44.032
5th	2010	1.138	2008-17	12.343	2011-28	43.001
6th	2011	1.083	2008-10	11.182	2011-28	42.200
7th	2010	1.070	2008-33	10.967	2010-28	39.310
8th	2009	1.014	2008-15	10.620	2010-01	38.830

Top 8 Cumulative Weights of Plan Sponsors, 2007-2011

	National Weights		LIPSA Weights 2007-2008		LIPSA Weights 2009-2011	
	Firm Year	Weight	Firm Year Region	Weight	Firm Year Region	Weight
1st	UHG 2010	24.7	UHG 2008-28	33.2	Coventry 2010-29	64.7
2nd	UHG 2011	24.4	UHG 2008-27	30.9	UHG 2011-33	52.4
3rd	UHG 2009	23.4	UHG 2007-27	30.4	UHG 2011-01	51.0
4th	UHG 2008	20.5	UHG 2007-28	29.2	Universal 2011-18	44.3
5th	Humana 2009	19.2	UHG 2008-34	27.3	UHG 2010-01	43.7
6th	Humana 2008	16.1	UHG 2008-01	27.0	UHG 2010-33	43.7
7th	UHG 2007	15.7	Humana 2008-31	26.3	HealthNet 2011-28	43.1
8th	Humana 2010	12.3	Humana 2008-11	25.6	UHG 2011-28	43.1

Table 5 reports in the top panel the distribution of weights for the calculation of the direct subsidy and the LIPSA. Both the distribution across all PDP and across the subset of PDP with at least a weight of 1% is reported. The middle panel reports for each distribution the 8 highest order statistics. The bottom panel aggregates the regional weights by firm and reports the 8 cases with the highest weights.

Table 6: Plans of Top Multiplan Firms

Year	1	2	3	4	5	Total
2006	247	246	84	8	5	590
2007	326	302	105	0	0	733
2008	344	250	135	0	0	729
2009	409	230	57	20	0	716
2010	332	350	12	0	0	694
2011	474	72	0	0	0	546
2012	390	126	0	0	0	516
Total	2,522	1,576	393	28	5	4,524

Table 6 reports the number of basic plans of the top 20 firms (in terms of enrollment) distinguishing by the number of other basic plans of the same parent organization for the same year and region (partner plans). Plans in column 1 are those that do no partner plans. In 2006, for instance, there were 247 basic plans of firms that have no other basic plan in the same year and region Plans in column 2 have exactly one partner plan. In 2006, for instance, there are 123 cases of pairs of basic plans active in the same year and region and belonging to the same firm. Similarly columns 3, 4 and 5 report the number of plans that have respectively, 2, 3 and 4 other plans of the same partner organization in the same year and region.

Table 7: Number of Enrollees by Type of Enrollee

Year	Tot Enrollment	Tot. Lis	Tot. Lis PDP	Reassigned	Choosers	Choosers PDP	Autoenrolled
2006	20,514,830	8,680,126	8,072,304	0	919,227	311,405	7,760,899
2007	21,856,800	8,709,675	8,004,997	1,140,917	1,035,489	330,811	7,674,186
2008	23,100,694	8,910,216	8,028,385	2,465,767	2,599,930	1,718,099	6,310,286
2009	24,094,520	8,993,114	7,923,221	1,991,534	3,112,388	2,042,495	5,880,726
2010	25,040,622	9,182,241	7,970,999	1,194,565	2,942,184	1,730,942	6,240,057
2011	25,877,644	9,483,357	8,223,792	413,793	2,299,716	1,040,151	7,183,641

Table 7 is based on the same sample used for the summary statistics. The number of choosers and reassigned is computed following Summer et al. (2010). For 2010, the only year in which the official values are available, there are minor differences between the official estimates and the values in the table: 1,164,690 reassigned instead of 1,194,565 reported in the table. Moreover, the official value is based on estimates made before the enrollment period ends. Instead, the numbers in the table are computed using the realized enrollment values.

Table 8: Aggregate Changes of Plans Premiums and LIS

	OLS Δ LIS	OLS Δ LIS	OLS Δ LIS	OLS Δ LIS	OLS Δ Premium	OLS Δ Premium	OLS Δ Premium	OLS Δ Premium
LIS Weights (C4)	6.34**	7.80***	6.13**	13.08***	3.88**	4.65**	3.91**	5.34**
	(2.558)	(2.49)	(2.53)	(3.15)	(1.83)	(1.83)	(1.83)	(2.24))
Mkt. Share (C4)	-10.06*	5.30	-10.88*	-13.34**	-11.73***	-3.63	-12.44***	-10.94**
	(5.763)	(7.09)	(5.66)	(6.58)	(4.13)	(5.19)	(4.09)	(4.69)
Plans Age			2.44**	1.45			0.66	-0.15
			(1.18)	(1.30)			(0.85)	(0.92)
Pharmacies			0.22	0.27			0.23	0.27*
			(0.21)	(0.21)			(0.15)	(0.15)
Active Princ.			-6.87*	-3.92			-6.64**	-4.10
			(3.96)	(4.35)			(2.87)	(3.10)
Mkt. Share LIS (C4)		-14.27***				-7.52**		
		(4.11)				(3.01)		
Constant	-0.011	0.16	2.66	-0.88	4.79*	4.88*	8.70**	(3.27)
	(3.95)	(3.79)	(4.67)	(3.88)	(2.83)	(2.78)	(3.38)	(2.76)
Obs	170	170	170	145	170	170	170	145
R^2	0.63	0.66	0.65	0.67	0.46	0.49	0.49	0.52

Significance: *** is 1%, ** is 5%, * is 10%. The dependent variables are Δ LIS and Δ Premium: respectively the yearly difference in the enrollment weighted average LIPSA and the enrollment weighted average premium. The averages are calculated for all the 34 regions for the years until 2011, with the exception of columns (4) and (8) for which region 1, 3, 4, 6 11 and 29 are excluded. All regressions include dummy for the years and the regions.

Table 9: Large Changes of Plans Premiums

VARIABLES	Probit Jump >50%	Probit Jump >75%	Probit N.Jump >40%	Probit Jump >50%	Probit Jump >75%	Probit N.Jump >40%
Firm LIS W.	0.264***	0.107**	-0.191***	0.272***	0.104***	-0.129***
	(0.059)	(0.042)	(0.046)	(0.059)	(0.039)	(0.038)
Eligible Firm	0.0167*	0.0235***	-0.0177***	0.005	0.016***	-0.010***
	(0.009)	(0.006)	(0.005)	(0.009)	(0.006)	(0.003)
Only Eligible Plan	-0.051***	-0.031***	0.059***	-0.037***	-0.026***	0.050***
	(0.010)	(0.005)	(0.019)	(0.011)	(0.005)	(0.018)
Enhanced	0.047***	0.032***	0.055***	0.067***	0.040***	0.0480***
	(0.008)	(0.006)	(0.006)	(0.009)	(0.006)	(0.006)
Plan Age				-0.016***	-0.005	-0.027***
				(0.005)	(0.003)	(0.003)
Pharmacies				0.754**	0.262	-0.182***
				(.335)	(230)	(0.049)
Active Princ.				0.174***	0.080*	0.027*
				(0.056)	(0.042)	(0.017)
Observations	6,479	5,828	5,021	5,932	5,281	4,605

Significance: *** is 1%, ** is 5%, * is 10%. The variable Jump >50% equals 1 if the yearly increase in the plan premium exceeds 50%. The variable Jump >75% equals 1 if the yearly increase in the plan premium exceeds 75%. The variable Jump >40% equals 1 if the yearly decrease in the plan premium exceeds 40% Regressions include a constant and controls for the year and the region.

Table 10: Bid Skewing

VARIABLES	OLS BP Share 2006-8	OLS BP Share 2006-8	OLS BP Share 2009-11	OLS BP Share 2009-11
Eligible Firm	-0.033***	0.007	-0.015**	-0.014**
	(0.012)	(0.012)	(0.006)	(0.007)
LIS Weight	2.095***	5.376***	1.261*	0.721
	(0.692)	(0.854)	(0.664)	(0.696)
LIS W.#Eligible F.	0.347	-2.435***	1.229*	1.595**
	(0.794)	(0.777)	(0.728)	(0.771)
LIPSA	1.220	0.112	-0.974	-0.502
	(1.022)	(1.031)	(1.031)	(1.090)
Vintage 2006	0.140***	-0.001	-0.061	-0.066
	(0.008)	(0.019)	(0.055)	(0.049)
Humana	-0.038*	-0.012	-0.029**	-0.080***
	(0.020)	(0.042)	(0.015)	(0.023)
Plan Age		0.026***		-0.015***
		(0.006)		(0.003)
Pharmacies		0.006		-0.117
		(0.035)		(0.254)
Active Princ.		-0.164***		0.307***
		(0.027)		(0.074)
Constant	0.468***	0.657***	0.887***	0.729***
	(0.025)	(0.056)	(0.059)	(0.068)
Obs.	2,419	1,966	2,188	2,029
R^2	0.52	0.54	0.58	0.60

Significance: *** is 1%, ** is 5%, * is 10%. Standard errors clustered by firm, year and region. The dependent variable is the ratio between the basic portion of the premium and the total premium. The sample consists of all the enhanced PDP plans in all the regions and years. All regressions include a constant and controls for the year, the region, the identity of the firm, the number of LIS in the region.

Table 11: Demand Estimates - All PDP in all regions and years

	OLS	Nested Logit	Random coeff.
Price	-0.0344***	-0.0404***	-0.1460***
	(0.0012)	(0.0055)	(0.0018)
Deductible	-0.0033***	-0.0035***	-0.0073***
	(0.0001)	(0.0002)	(0.0002)
Active Principles	0.0002	-0.0002	0.0031***
	(0.0041)	(0.0042)	(0.0003)
Top 100 Active Principles	0.0341***	0.0327***	-0.0333
	(0.0058)	(0.0058)	(0.0067)
Top 100 A.P. in Tier 1 or 2	0.0144***	0.0149***	0.0177***
	(0.0018)	(0.0020)	(0.0026)
Dummy Enhanced Plan	-0.0042	-0.0037	-0.2007***
	(0.0319)	(0.0386)	(0.0666)
Dummy Cov. Gap	0.1473***	0.3306***	2.6160***
	(0.0534)	(0.1731)	(0.1643)
N. Pharmacies	0.0002***	0.0002***	-0.0014***
	($5x10^{-5}$)	($5x10^{-4}$)	($1x10^{-4}$)
N. Years in the Market	0.4122***	0.4343***	0.6978***
	(0.0159)	(0.03340)	(0.0265)
Market Size Nest		0.3072	
		(4.1475)	
Interaction Price-Income			-0.0924***
(x1000 $)			(0.0230)
S.D. Consumer Heterogeneity			0.3529
			(3.8764)
N. Obs.	7141	7141	7141

Significance: *** is 1%, ** is 5%, * is 10%. OLS standard errors clustered by firm-region-year. Nested Logit estimated using limited information maximum likelihood. Random coefficient logit estimated BLP. The sample consists of all PDP plans in all the regions and years. All models include a constant and controls for the year, the region and firms identity.

Table 12: Counterfactual Premiums: No LIS Enrolles - Year 2008

Region	Actual Premium	Simulated Premium	Δ Premium
Region1	35.50	26.71	8.79
Region2	36.22	31.73	4.49
Region3	28.68	29.92	-1.24
Region4	31.42	30.01	1.41
Region5	35.63	31.77	3.86
Region6	31.49	29.83	1.66
Region7	37.17	32.53	4.64
Region8	41.52	32.55	8.97
Region9	36.54	33.85	2.69
Region10	35.54	33.56	1.98
Region11	32.49	28.11	4.38
Region12	34.65	33.49	1.16
Region13	35.10	30.42	4.69
Region14	36.24	32.30	3.94
Region15	38.95	34.71	4.25
Region16	34.59	18.87	15.71
Region17	34.62	34.38	0.24
Region18	33.57	27.17	6.40
Region19	31.96	27.23	4.73
Region20	34.23	32.15	2.08
Region21	34.49	32.75	1.75
Region22	33.89	31.76	2.13
Region23	33.94	29.10	4.85
Region24	33.46	27.44	6.02
Region25	30.38	19.15	11.23
Region26	27.48	21.69	5.79
Region27	34.57	31.06	3.50
Region28	28.16	23.36	4.80
Region29	30.40	25.09	5.31
Region30	34.36	29.06	5.30
Region31	36.92	30.44	6.48
Region32	33.63	32.20	1.42
Region33	28.66	23.85	4.82
Region34	38.04	24.77	13.27
US Total	33.58	30.00	3.58

The table reports the actual and simulated enrollment weighted average premiums in the 34 regions. The simulated premiums and enrollment are calculated using the estimated demand parameters and the marginal costs obtained using plans Region 1 (i.e., Case 2).

Figure 1: Example: Two Firms and Three Plans

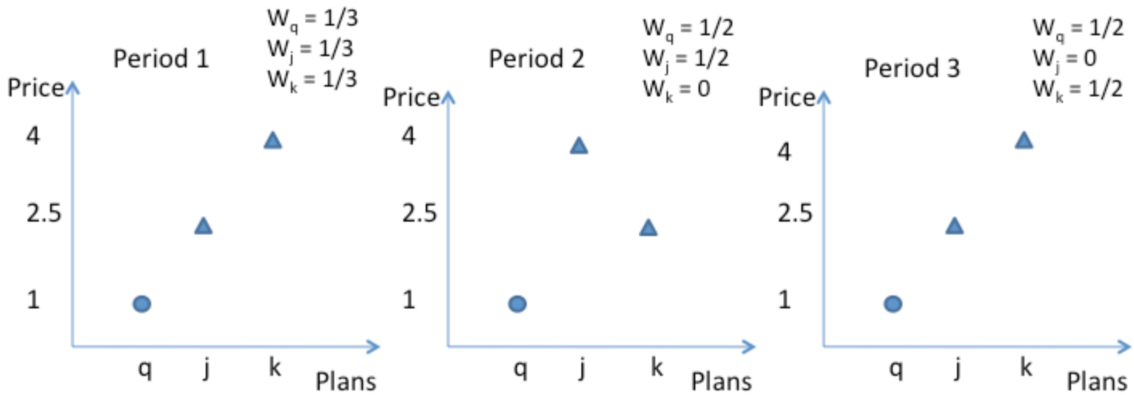


Figure 1 reports the prices of the three plans (q, j, k) in three periods. The two plans indicated by triangles (j, k) belong to the same firm. Plans start in period 1 with equal weights and then in periods 2 and 3 have weights proportional to enrollment int he previous period. In the first period the LIPSA is 2.5 and the LIS consumers are shared equally between q and j. In the second period j the prices of q and j keep the LIPSA at 2.5 and all the LIS consumers of j are moved to k according to the preference that the RR assign to reassignments within the same firm. In period 3, the roles of j and k are reversed.

Figure 2: Unsubsidized Enrollee Contribution under a Standard PDP in 2010

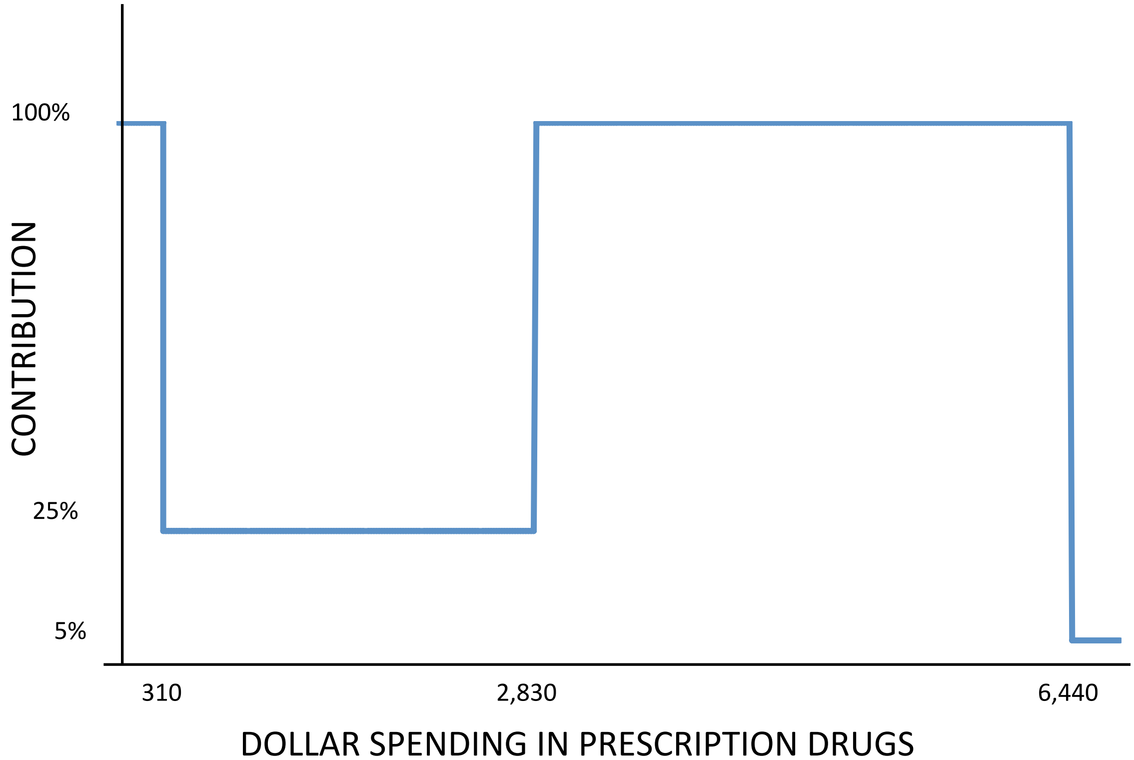


Figure 2 shows the insurance structure of the, so called, Defined Standard Plan for the year 2010. There are 4 types of plans that sponsors of PDP and MA can offer: (1) Defined Standard Plan, characterized by (i) a monthly premium, (ii) a $310 annual deductible (for 2010), (iii) a 25% coinsurance for the cost of covered drugs up to an initial coverage limit of $2,830 (2010), (iv) a coverage gap (doughnut hole) between $2,830 and $6,440 (in 2010) in costs for covered drugs, (v) catastrophic coverage where the beneficiary pays the greater of 5% coinsurance or a copayment of $2.50 for a generic or preferred drug and $6.30 for other drugs for the rest of 2010. (2) Actuarially Equivalent Standard Plan: the only difference with type (1) regards (iii) which for these plans consist in a cost-sharing structure that may have flat copayments instead of a 25 percent co- insurance or uses a combination of copayment and coinsurance charges. Enrollees pay these costs for their covered drugs up to the initial coverage limit of $2,830 (for 2010). Typically, these plans have a tiered cost-sharing, that is, cost-sharing percentages that vary by whether the drug is generic or brand or preferred or not preferred. (3) BasicAlternativePlan: the only difference with type (2) regards (ii) which for these plans consists in a reduced or eliminated annual deductible (ranging from $0 to $310 in 2010). (4) EnhancedAlternativePlan: they have two differences with type (3). The first one is that they can include coverage in the doughnut hole (between $2,830 and $6,440 in 2010). The second one is that formularies may be broader, and may cover drugs that are generally excluded from Part D coverage.

Figure 3: Availability of PDP Plans Across Regions

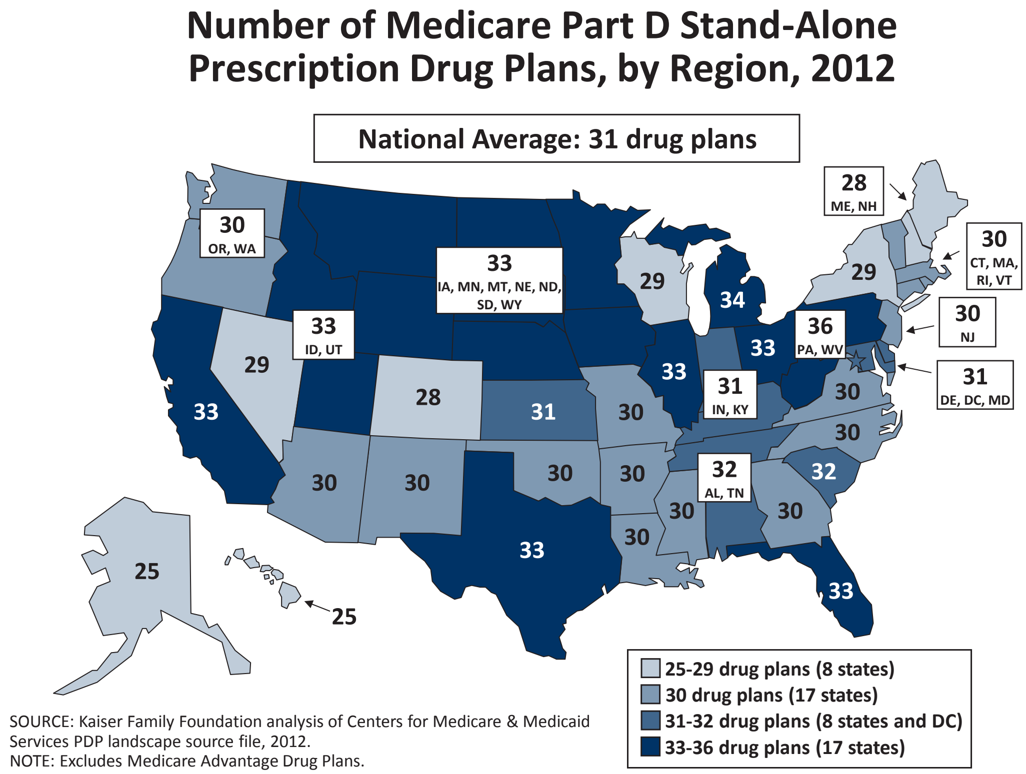
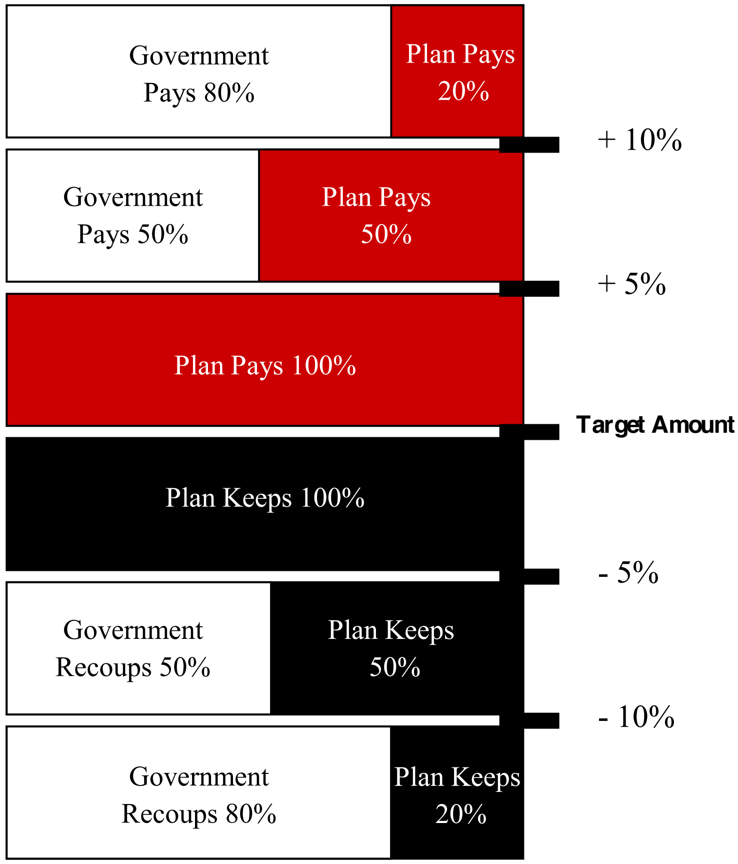


Figure 3 reports the number of PDP offered in each one of the 34 regions in which the US market is divided.

Figure 4: Risk Corridors



Source: CBO. Figure 4 illustrates the risk corridors which define how the plans profits and losses are shared. The target amount is the sum of the direct subsidy and the enrollees premium (basic component) minus the administrative costs. At the end of the year, the total cost for drugs related to the basic benefit portion (net of the reinsurance subsidy and any discount/rebate enjoyed by the plan) is subtracted from the target amount. If the difference is within +/-5% of the target amount, then the plan keeps 100% of the profits/losses. If the cost is below the target by an amount greater than 5%, then only half of the portion of the profits between 5% and 10% is retained by the plan and the rest has to be reimbursed to CMS. For the portion of profits exceeding 10%, the plan can retain only 20% of them, while the rest has to be paid to Medicare. The risk corridor is symmetric for the losses that the plan face if the costs are above the target amount. The corridor described here is that that was in place between 2008 and 2012. In 2006 and 2007, the corridor was narrower leaving to the plan 100% of the profits/losses only up to +/- 2.5%, then between +/- 2.5 and 5% the plan kept 25% of the profits/losses and, finally, above +/-5% the plan kept only 20%.

Figure 5: Evolution of LIS and Basic Premium

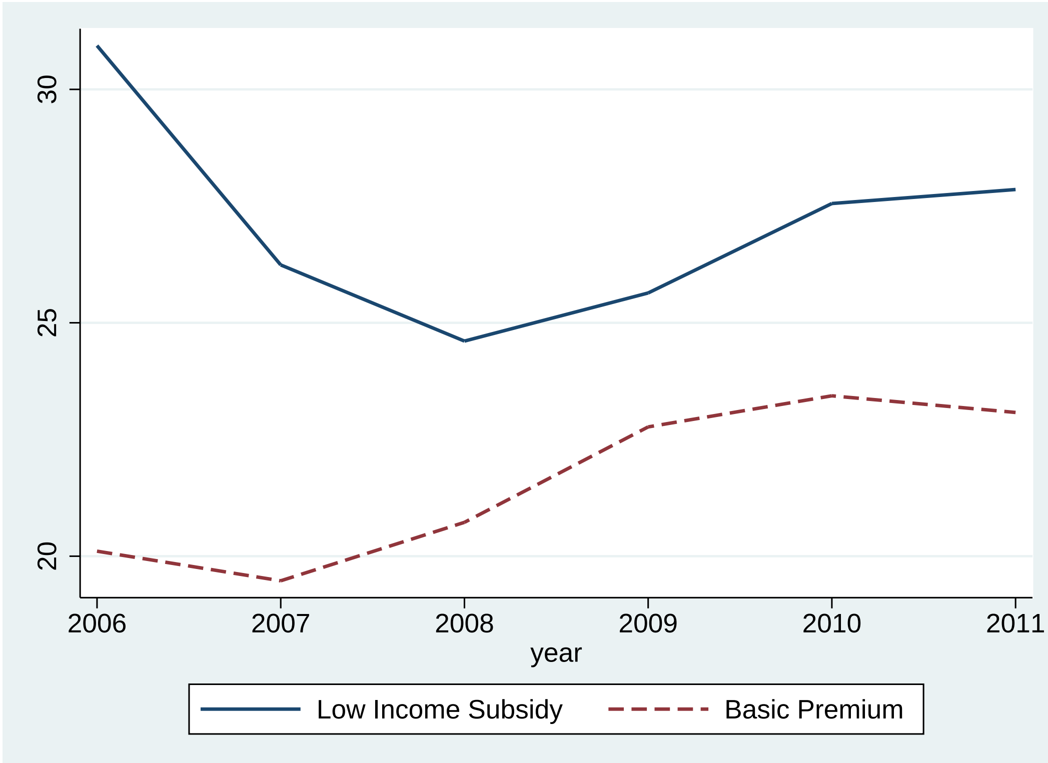


Figure 5 describes pay care: prices are converted to real 2006 by using medical cpi. we do weighting by total population and we account for the discount received by the LIS under the de minimis.

Figure 6: "Support Bids" by Aetna

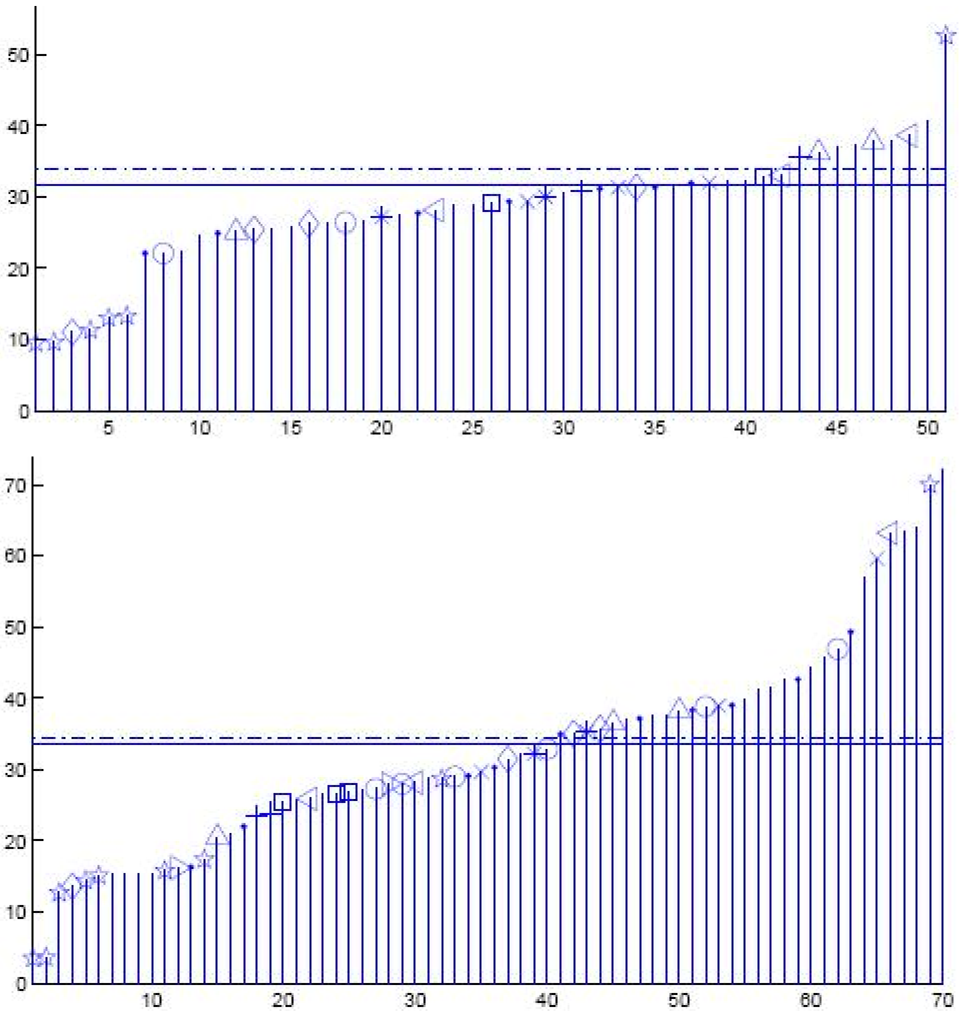


Figure 6 reports plans basic premiums in Region 31 in the year 2007 (top panel) and 2008 (bottom panel). Only plans having a positive LIS weight are reported. Plans are sorted according to their basic premium (from the lowest to the highest): the height of each bar represents the basic premium of the corresponding plan. The symbol at the top of each bar identifies to which sponsor the plan belongs. In particular, the star represents Humana while the triangle pointing left represents Aetna. Finally, the solid horizontal line indicates the LIPSA while the dashed line indicates the effective LIPSA plus de minimis.

Figure 7: Bid Test for Aetna and Medco

(a) Aetna in 2007 (b) Aetna in 2008

(c) Medco in 2007 (d) Medco in 2008

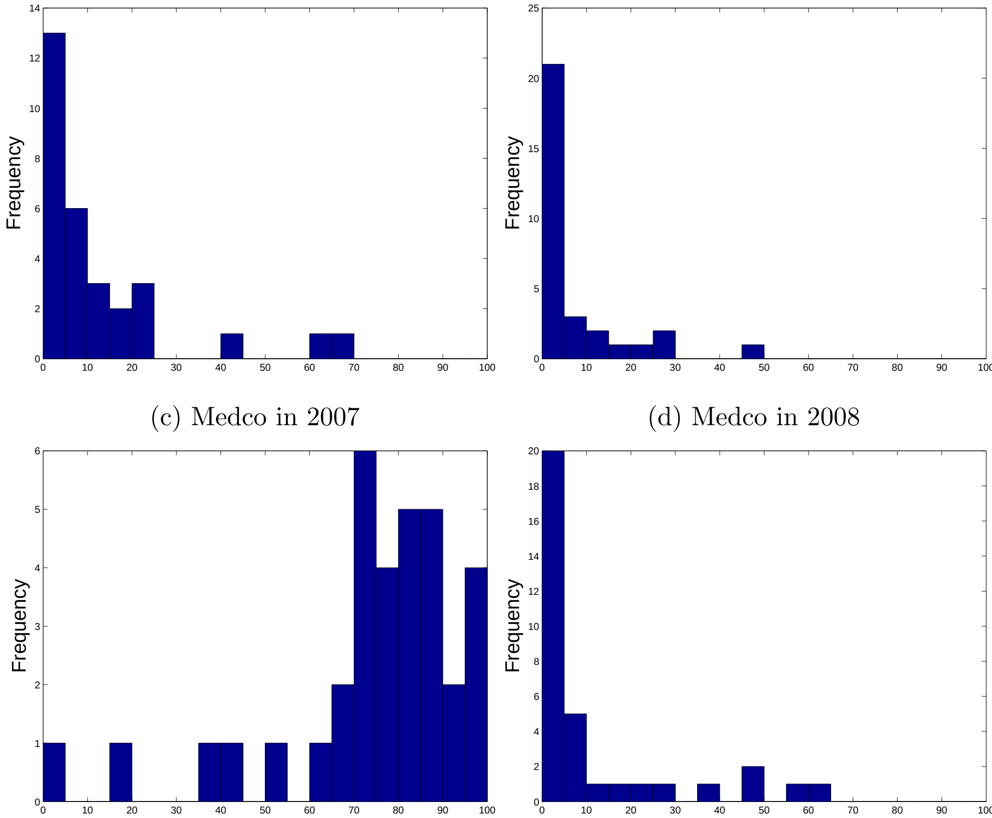


Figure 7 presents histograms summarizing the outcome of the bid test across the 34 regions for Aetna and Medco in 2007 and 2008. Each histogram reports the 34 pvalues of the bid test performed for each of the regions. Pvalues falling in the leftmost bins are suggestive of LIPSA manipulations.

Figure 8: Estimated Markups

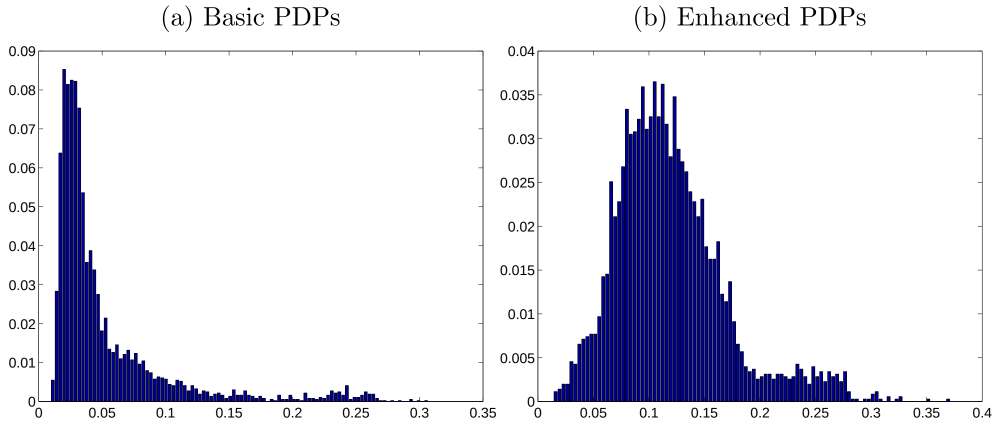


Figure 8 describes the distribution of the markups for basic and enhanced PDPs. The sample consists of the firms in the control group for case 1.