What Does Medicare D Share with LIBOR and Procurement Auctions? The Distortionary Effects of the Low Income Subsidy

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Abstract

In Medicare Part D, low income individuals receive a subsidy 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 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, which in 2011 cost roughly 55 billion to the government and enrolled around 26 million people.

In addition to being economically relevant by itself, Medicare D is also the only existing example of a completely privatized market delivering government-mandated healthcare services. Thus, studying Medicare D helps to assess the potential merits of one of the main models of healthcare reform currently debated. Not surprisingly, opposite positions have emerged in the policy debate with advocates of the program stressing that its cost is substantially less than expected, while opponents point to its very steep increase in costs in recent years. Indeed, despite the cost for the government remaining essentially the same for the first three years, about 40 billion per year from 2006 to 2008, the cost increased by about 11% per year in the following three years, reaching 55 billion in 2011, see Table 1 .

The academic research on Medicare D has evidenced that three distinct elements are needed for Medicare D to properly work: consumers must be able to select insurance plans effectively, plans must steer consumption toward generics and less expensive drugs and, finally, plans must compete to maintain low premiums. Most of the existing studies have focused on the first issue, typically finding that consumers make mistakes in choosing plans, but that their choices improve as they become more experienced. As regards the second issue, Duggan and Scott Morton (2011) have found that plans designed their drug formularies in ways that very effectively increased drugs substitutability and limited drug cost increases. The third pillar of Medicare D, competition between plans, however, has received substantially less attention, with the only exception being the study of Ericson (2011) on pricing responses to consumers' inertia in plans choice.

In this paper, I contribute to the analysis of insurers competition in Medicare D by showing how the presence of public subsidies has distorted firms pricing behavior. About 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 in understanding plans prices. In turn, these prices are what determines the increases in the costs of the program observed in recent years 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 all enrollees) are entitled to this subsidy, which is a major source of plans revenues. In 2011, the LIS accounted for 22.3 billion of the 61.5 billion paid to plans, making the LIS the single most important source of plans revenues.[1] The basic idea for why this subsidy affects insurers behavior is straightforward if four facts are simultaneously considered: First, about ⅔ of the 9 million LIS enrollees do not actively select an insurance plan. They are allocated by the Center for Medicare and Medicaid Services (CMS) to plans with a premium not greater than the LIS itself. Conditional on an insurer having at least one plan with premium at or below the subsidy, the allocation rule keeps the LIS enrollees within the same insurer from year to year and, otherwise, allocates them at random across the insures offering plans with premium at or below the subsidy. Second, CMS pays in full premiums for LIS enrollees. Third, the amount of the subsidy is an average of plans premiums. Fourth, all major insurers offer multiple plans that enter into the calculation of the subsidy.

At the most basic level, this means that a firm offering multiple plans can maintain just one plan with a premium equal to the low income subsidy and set high premiums for all its other plans to inflate the subsidy. The large number of LIS enrollees and the fact that they do not require either marketing expenses or a quality above the minimum needed to qualify for Medicare D suggest that firms will respond to this incentive. Like in an auction, the LIS enrollees are treated by the regulation as a "prize" given to plans pricing below a certain threshold. However, this threshold is endogenously determined by plan premiums and can be manipulated. Moreover, this distortion also affects the non-LIS enrollees both because the plans among which they choose also serve LIS enrollees and because each plan must charge the same premium to all its enrollees, regardless of their LIS receiver status.

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

This distortion is closely connected with that observed in two other cases recently at the center of attention: average bid procurement auctions and the LIBOR rate. The latter is a reference interest rate used to set payments on about $800 trillion-worth of financial instruments. This rate is set daily by asking 16 large banks to state the rate at which they are willing to borrow money and then calculating the average of the 8 middle rates. In the summer 2012, it became public that some banks were coordinating their reported rates in order to make bets on LIBOR changes that were highly likely to be successful. Similarly, in the average bid auctions (ABAs), often used to procure public works, the winner is the firm offering the price closest to the average of the offered prices. In various countries where ABAs were used, collusion was discovered with coalitions of firms coordinating on how to pilot the average price. An important difference between these cases and Medicare D, however, is that in Medicare D insurers have multiple plans and, hence, subsidy manipulation does not require collusion, but results from individual firm profit maximization.

This study aims to quantify to what extent the LIS distortion can contribute to explain the cost of the program. To quantify the effect of the LIS regulation on plans premiums, I empirically analyze data on plans enrollment and prices between 2006 and 2011. To start, I show various findings all indicating that the LIS distortion is clearly associated with plans prices. For instance, I find that the choice of drastically raising and lowering premiums has a close association with how much these sharp changes could affect the firm profits through changes induced on the LIS. Similarly, I also find that, at a more aggregate level, LIS manipulations seem to be associated with changes in the average plan price across US regions.

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 infeasible for certain

groups of firms, I select three groups of firms for which costs can be estimated and use their costs to predict those of the remaining plans.

The main goal of the structural analysis is to evaluate how different premiums would be under alternative rules. I present two counterfactual scenarios that allow me to answer two questions. The first one is what premiums would arise were the market populated only by non-LIS enrollees. This is an interesting question because recent policy proposals have suggested dividing the markets for LIS and non-LIS enrollees (see Frank, 2012). Moreover, its answer can give a measure of the effects of the LIS induced distortion. My (preliminary) findings indicate an interesting difference between 2010 and 2011: While in 2010 premiums would have been lower for most of the regions, for 2011 this is true only for 13 regions. I explain this fact as a response to a new regulation implemented in 2011 and explain why, like in the LIBOR and ABAs, this positive effect in unlikely to last.

The second policy counterfactual that I evaluate looks at how premiums would react were LIS enrollees free to choose plans and pay their premiums like non-LIS enrollees do. This exercise requires stronger assumptions because LIS enrollees currently do not choose plans and hence their demand cannot be estimated from the data. However, by projecting the demand estimates of the regular enrollees on various demographic characteristics of LIS enrollees, I am able to simulate their demand. I use the demand estimates of the two groups of enrollees to quantify premium changes when varying the degree of adverse selection in the LIS enrollees population. Preliminary estimates confirm that, at the levels of adverse selection estimated by the previous literature, full risk adjustment could induce a large reduction of premiums.

This paper has numerous policy implications. The first one is that the distortive effect of government subsidies plays an important role in explaining the increased cost of Medicare D. The most straightforward solution to the problems described in this paper is to require firms to have no more than one plan eligible for LIS enrollees. However, as the experience of LIBOR and procurement auctions suggests, the risk would then become that of collusion between firms. Moreover, limits on the drug copays should be introduced to avoid plans from simply shifting from manipulating the premium to manipulating copays. A more sophisticated

policy intervention would be to separate the market for LIS and non-LIS enrollees. My findings suggest that this would reduce the premiums faced by non-LIS enrollees and, hence, the government cost for this portion of the market. For the remaining portion of the market, a 2011 study by the Office of the Inspector General compared unitary costs for 200 drugs commonly purchased under both Medicare D and Medicaid and concluded that costs were substantially lower for the latter. Since the vast majority of LIS enrollees are *dual eligibles* that in 2006 were moved from Medicaid to Medicare D, transferring them back to Medicaid would likely reduce government costs. This solution would also reduce the administrative cost of Medicare D by removing the necessity to both revise the risk adjustment formula for LIS enrollees and annually calculate the amount of subsidy for these enrollees. Finally, the problems that I identified are helpful to understand why the recent reform of Medicare C that introduced a subsidy structure similar to that of Medicare D is problematic.

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 research is to offer a novel explanation for the increased program cost. Duggan and Scott Morton (2011) argue that this increase is not driven by changes in drug costs. A similar conclusion is reached by Aaron and Frakt (2012). Ericson (2010), instead, offers an explanation of the cost increases based on firms exploiting consumers inertia in plan choice. My analysis is complementary to that of Ericson (2010).

Secondly, this paper contributes to the studies of Medicare D efficacy and efficiency. 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 (2012) have argued that over time consumers rapidly improve their choice of plan. This paper, by arguing that prices are distorted, suggests that prices cannot properly guide consumers choices. Thus, efficiency in this market requires solving not only the consumers difficulties in making choices but also firms pricing distortions. Moreover, the paper shows how plans proliferation is, at least in part, due to the LIS distortion. Reforming the LIS would likely

simplify the choice problem of non-LIS enrollees by reducing the number of plans offered.

Furthermore, the population of LIS enrollees that I study is of great policy interest. The LIS enrollees are mostly Medicare/Medicaid dual eligibles, whose high drug consumption is a relevant source of public expenditures. Therefore, the system through which Medicaid provided them drugs has been extensively studied. Its key element is a mandatory rebate that drug manufacturers have to offer to Medicaid. Because of this rebate, the Office of General Inspector (2011) has concluded that drug costs are lower under Medicaid than under Medicare D. Frank and Newhouse (2008) had already suggested this possibility and proposed a return to prices closer to the Medicaid ones. They do not suggest a return to Medicaid because, as shown in Scott Morton (1997) and Duggan and Scott Morton (2006), the mandatory rebate induces drug manufactures to distort prices for non-Medicaid enrollees. This paper contributes to this literature both by describing how Medicare D LIS regulation distorts plan premiums for all enrollees and by suggesting elements of a possible reform.

Finally, this paper contributes to a recent wave of studies asking whether a market mechanism could deliver efficient outcomes in complex and heavily regulated health insurance markets. In particular, Glazer and McGuire (2009) and Bundorf, Levin and Mahoney (2012) show how the requirement of a uniform price across consumers distorts prices and allocations. Medicare D also requires a uniform price and, hence, it is possibly subject to this problem. This study, however, focuses on a different source of distortions: public subsidies. Given the need to subsidize publicly-mandated privatized health care markets, the results will be relevant for other markets. Clearly, they apply to environments where similar mechanisms are present, for instance, in Medicare Part C and in the Medicare DEMPOS auctions studied by Katzman and McGeary (2008) and Cramton et al. (2011). At the most general level, all these studies confirm intuition of the principal-agent literature on multitasking (Holmstrom and Milgrom, 1991) that designing a market to achieve certain desiderata is hard whenever these desiderata contrast with firms profitability and firms can take multiple actions. Duggan and Scott Morton (2006) discuss other examples related to health care markets.

2 Theoretical Example

Suppose there are 3 firms, each one offers one insurance plan. Consumers are divided into two groups: Unsubsidized enrollees at the beginning of each period choose one plan and pay its premium. Subsidized enrollees, instead, at the beginning of each period are assigned by Medicare to a plan, but they pay no premium. Switching between plans can occur only at the beginning of a period. Indicating the three plans as q, j and k, the cost of enrolling a consumer is c_r^U if the consumer is unsubsidized and c_r^L if he is subsidized, for $r \in \{q, j, k\}$.

The regulations require that all consumers in the same plan r pay the same premium, p_r, for $r \in \{q, j, k\}$. Therefore, in any period t the profits of the firm offering plan r is:

$$\Pi_{r,t} = [p_{r,t} - c_{r,t}^U] s_{r,t}^U M^U + [p_{r,t} - c_{r,t}^L] s_{r,t}^L M^L \quad \text{for } r \in \{q, j, k\}. \tag{1}$$

Where M^U and M^L are the total number of unsubsidized and subsidized consumers and $s_{r,t}^U$ and $s_{r,t}^L$ their shares in plan r in period t. These two shares depend on the premiums. For $s_{r,t}^U$, as usual in discrete choice models of differentiated product industries, we can assume that the indirect utility of an unsubsidized consumer i for plan r is: $u_{i,r} = \delta_r - \alpha p_r + \epsilon_{i,r}$ where δ_r is the plan quality, fixed for each plan. If $\epsilon_{i,r}$, the idiosyncratic preference of i for r, is distributed as Type I Extreme Value, this gives rise to the usual logit formula for $s_{r,t}^U$.

The share s_r^L behaves very differently. Medicare assigns subsidized consumers to plans based solely on their premium. First a weighted average of plans premiums, $LIPSA_t = \sum_{r \in \{q,j,k\}} w_{r,t} p_{r,t}$, is computed using weights that are positive and sum to one. Then, subsidized enrollees are allocated to plans with a premium smaller or equal to $LIPSA_t$. Thus, $p_{r,t} > LIPSA_t$ implies that plan r cannot enroll subsidized enrollees in t. If such plan had subsidized enrollees in $t-1$, they are reassigned in equal shares to plans with $p_t \leq LIPSA_t$. These latter plans also maintain in t any subsidized enrollee that they had in $t-1$.

Clearly, which weights are used to compute $LIPSA_t$ can greatly influence the evolution of market shares. In particular, if weights are previous period enrollment shares of subsidized enrollees, a system I refer to as "enrollment weighting", then over time there will be a

tendency for all subsidized enrollees to converge into a single plan. To see why, suppose that there is an initial period, $t = 1$, in which $w_{q,1} = w_{j,1} = w_{k,1}$=⅓. From $t = 2$ onward, enrollment weighting is used. Suppose that premiums are ordered as $p_q < p_j < p_k$ and are fixed over time. Then, certainly $p_k > LIPSA_1$ and possibly also $p_j > LIPSA_1$. In the second period either $LIPSA_2 = p_q$ or $LIPSA_2 = (.5)p_q + (.5)p_j$. In both cases $p_j > LIPSA_2$ and so in at most two periods all subsidized enrollees are in plan q. When prices are set in equilibrium, they may or may not stay constant through time. This can alter the speed of the process, but as long as there is no continuous reshuffling of which is the cheapest plan(s), convergence into the cheapest plan(s) will happen. On the contrary, no such tendency exists in an "equal weighting" system in which all premiums are always weighted equally.

Under enrollment weighting, a firm that, due to its unfavorable cost conditions, cannot offer a cheap plan will eventually loose all its subsidized enrollees. However, before then, this firm might try to keep its premium within LIPSA for as many periods as possible if doing so ensures high enough profits on subsidized enrollees, even though charging an higher premium would have been optimal considering only unsubsidized enrollees.[2] Since over time enrollment weighting increases the weights of the cheapest plans, it might cause a competitive pressure toward low premiums. In contrast, no such pressure exists under equal weighting.

Nevertheless, both weighting schemes are problematic when insurers offer more than one plan, as insurers in Medicare D typically do. To illustrate this, I consider again an environment with three plans: q, j, k, but now assuming that the market is a duopoly with plans j and k belonging to the same multiplan firm. A relevant change to the rule for the assignment of subsidized enrollees is that when at time t a plan of the multiplan firm that enrolled subsidized consumers in $t-1$ has a premium above $LIPSA_t$, then all the subsidized enrollees it had in $t-1$ are reassigned to the other plan of the multiplan firms in period t, provided that this plan has a premium at or below $LIPSA_t$. Hence, the multiplan firm loses all its subsidized enrollees only if in the same period both $p_{j,t} > LIPSA_t$ and $p_{q,t} > LIPSA_t$. The following numerical example shows why this can generate perverse effects. Suppose that an unsubsidized consumer i has utility for plan r: $u_{i,r} = \delta_r - p_r$ for $r = q, j, k$ and receives

[2]On the contrary, a firm finding subsidized enrollees too costly might rise its premium above LIPSA.

a utility of zero from not enrolling. Assume that $\delta_q = 1 > 0.1 = \delta_j = \delta_k$, so that, if all premiums were the same, all unsubsidized consumers would prefer the high quality plan q. Despite being high quality, q has also the lowest cost: $c_j = c_k = 1 > .01 = c_q$. Finally, there is a regulation stating that no premium can be higher than a ceiling price of 4.[3]

Under enrollment weighting, the only pure strategy Nash equilibria of this duopoly game lasting T periods are those of the type illustrated (for the first three periods) in Figure 1. In the first period, the premiums are $p_q = 1$, $p_j = 2.5$ and $p_k = 4$ and, because they are equally weighted, the $LIPSA_1$ equals 2.5. All the unsubsidized consumers choose plan q. The subsidized enrollees are assigned half to plan q and for half to plan j. In the second period, the prices are $p_q = 1$, $p_j = 4$ and $p_k = 2.5$. Thus $LIPSA_2$ equals again 2.5. Plan q maintains all its subsidized enrollees. Instead, all the subsidized enrollees that were in plan j are moved to plan k. In all the following periods, j and k continue endlessly their alternation: The plan that had positive enrollment of subsidized enrollees in $t-1$ chooses a premium of 4 in t, which keeps the LIPSA as high as possible. The other premium is then set equal to the LIPSA at 2.5, which is the highest price that the multiplan firm can charge without losing all the subsidized enrollees. Since plan q is already charging the highest premium to retain the unsubsidized enrollees, it has no incentive to interfere with j and k if the relative size of subsidized over total enrollees is sufficiently small. Under equal weighting, the strategy profile just described is also an equilibrium, but keeping constant the premiums at $p_q = 1$, $p_j = 4$ and $p_k = 2.5$ is an equilibrium too.

This stylized example shows a number of unpleasant features of the system when there is a multiplan firm. Profit maximization will lead this firm to use its plans to extract the highest rents from the system. In the example above, Medicare pays forever 2.5 for half of the subsidized enrollees while it could have paid 1. Moreover, five other problems arise. First, production is inefficient because half of the subsidized consumers remain forever in plans with the highest cost. Second, subsidized consumers are excessively reassigned, cycling forever between plans j and k. This might imply changes in drug formularies that

[3]The presence of a known ceiling price is a simplification that captures the idea that CMS can ask firms to revise premiums when it judges them to be unreasonably high. I also assume a floor price of 1 to rule out equilibria where the multiplan firm earns negative profits in the first period to earn larger profits afterwards.

require consumers to change drugs. Third, it is unfair for subsidized consumers because for purely random reasons half of them get forever high quality and the others low quality. Fourth, paradoxically the inefficient multiplan firm earns an higher profit per enrollee than the efficient firm. The efficient firm would like to enter with an additional plan to mimic the multiplan firm. Inefficient entry might thus be another distortion induced by this system. Fifth, the role of the ceiling price is essential as it avoids that the premiums explode. In practice, Medicare does not announce such price but it achieves something similar by having the right to assess premiums reasonableness and to ask for revisions accordingly. Performing such a process is a delicate and costly activity.[4]

The analysis that follows uses a more general empirical model of consumers and firms behavior to assess the effect the Medicare D subsidy system on plans premiums. However, it is useful to discuss first how in practice a multiplan firm could exploit the enrollment weighting system. Indeed, since Medicare supervises the market, it is unlikely that it will tolerate a cycling of premiums and enrollment like the one in the example. Nevertheless, insurers in Part D have more refined strategies to achieve the same result. For instance, at the beginning of each period a firm can consolidate any old plan into either an existing plan or a new plan. In 2010, CIGNA achieved through plans consolidation something remarkably similar to what is done by the multiplan firm in the example. For Medicare D, the US territory is divided into 34 distinct geographical regions. The strategy that I now describe was used by CIGNA in 14 of them. To make this description concrete, I focus on region 20 (Mississippi). In 2009 CIGNA had only one plan[5] in this region and 96% its enrollees were subsidized (13,737 out of 14,310). In 2010, two new plans, one "cheap" ($28.1 premium) and one "expensive" ($34.1), were introduced and the old plan was consolidated into the *expensive* plan. This meant that CIGNA consolidation choice maximized its positive influence on the subsidy (i.e., the LIPSA): Its expensive plan had a weight of 8% (inherited from the consolidated plan), while its cheap plan had a weight of 0%. Once the LIPSA was calculated, the premium of the expensive plan resulted to be above the LIPSA and so this plan lost its subsidized

[4]Finally, competition between multiplan firms does not necessarily help. For instance, adding a second multiplan firm, identical to the fist, leaves all the negative features of the example unchanged.

[5]Thought this example about CIGNA with the term "plan" I am actually meaning "basic plan." The next section explains what basic plans are.

enrollees. But none of them were lost for CIGNA itself because they were reassigned to its cheap plan. Had CIGNA consolidated the old plan directly into the cheap plan, rather than forcing a Medicare mandated reassignment, the LIPSA would have been 2% lower (holding all other premiums fixed). CIGNA applied this same strategy in other 13 regions that year. Overall, 60,846 subsidized enrollees had to be moved out of CIGNA plans because of Medicare mandated reassignment due excessively high premiums, but the company reabsorbed all of them through other, cheaper plans. The discussion of other related strategies will follow the description of the market regulation.

3 Market Regulation

The regulation of Medicare Part D is complex and has changed over time. The aim of this section is to offer a quick overview of the program in terms of the types of plans and enrollees as well as to describe the system of subsidies. Special attention is given to the calculation of the low income subsidy and the assignment of low income enrollees to plans.

The program divides the US territory into 34 geographical regions, as shown in Figure 2. For each region, firms submit in June to CMS the list of plans that they commit to offer the following year. CMS then verifies that plans conform to the regulatory requirements in terms of their financial structure (premium, initial deductible, coinsurance/copayment for the various drugs) and formulary (the list of covered drugs). It is useful to consider two distinctions between plans. The first one is between plans covering only Medicare approved drugs (basic plans) and those covering also additional drugs outside the Medicare list (enhanced plans).[6] 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. The second distinction between plans is whether they offer only Medicare Part D services (i.e., discounts on certain drugs), in which case they are known as Prescription Drug Plans (PDPs), or whether they also offer Medicare Part A/B (i.e., the benefits of traditional Medicare), in which case they are known as Medicare Advantage Prescription Drug plans (MA-PDs). The list of approved

[6]Basic plans can be further subdivided into three distinct groups that differ in their coverage structure. See Duggan et al. (2008) for a more in depth description.

plans is then released by CMS on its web site in the Fall of the year before the coverage starts. Through this web site consumers can see the list of plans offered in their region and compare plans on the basis of their financial structure, formulary and pharmacy network.

Similarly, for enrollees it is also useful to introduce a distinction between two groups. Medicare beneficiaries with limited financial resources[7] are entitled a Low Income Subsidy (LIS). I will refer to these individuals as LIS enrollees and to the remaining individuals as regular enrollees. LIS enrollees are about 40% of all the enrollees. Both regular and LIS enrollees receive a subsidy to pay for their premium called the "direct subsidy".[8] Moreover, LIS enrollees also receive an additional subsidy to pay for the premium and, also, discounts for any expenditure on drugs not covered by their plan. These subsidies are paid directly by CMS to insurers and, as discussed below, they represent a key component of plans revenues.

1) Payments to Insurers

Table 1 reports the breakdown of plans reimbursements. The first column shows the premiums paid by enrollees while the remaining four columns refer to payments originating from Medicare. Altogether, payments from Medicare are about 90% of the total reimbursements. Medicare payments can be divided into four categories: (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 of the payment of 80 percent of drug spending above a certain value known as the "catastrophic threshold"; (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 3).

A major difference between these four sources of reimbursement is that the latter two are exogenous to firms actions. The amount of both the direct and low income subsidies, however depend on prices set by insurers. In particular, 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,

[7] 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 to the low-income subsidy.

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

CMS calculates the direct subsidy in the following way: it takes the weighted average of all bids (the weights are proportional to the plan enrollment share in the previous year) and it multiplies it by a value smaller than one (in 2012, it was 0.63).[9] The plan premium that an enrollee will see on the CMS web site is the difference between the plan bid and this direct subsidy. Therefore, it can happen that some plans appear with a premium of zero dollars. In turn, these premiums are used to calculate the low income subsidy.

2) LIPSA Calculation

Separately for each of the 34 regions into which the US is divided, CMS determines the additional subsidy for LIS enrollees. The dollar amount of this subsidy, known as Low Income Premium Subsidy Amount (LIPSA), is calculated as follows: for a given region, the LIPSA is the weighted average of plans premiums. However, contrary to the direct subsidy where weights are based on total enrollment, since 2009 the weights are based only on enrollment of LIS beneficiaries when calculating the LIPSA. Before then, all plans were essentially weighted equally in the calculation of the LIPSA.[10] Moreover, in case the value calculated as above results in something lower than the lowest PDP premium for that region, then this lowest PDP premium becomes the LIPSA. I offer a more complete presentation of the exact details of the calculation of the direct subsidy and the LIPSA in the appendix.

As shown by Table 1, the change in the method of calculating the LIPSA that occurred in 2009 is associated with a substantial increase of the LIS reimbursements, amounting to $3.1 billion in a year. Indeed, the new weighting method significantly reduced the weights of MA-PD that typically have both low premiums and few LIS enrollees. Over the years, other regulatory changes, summarized in Table 2, affected the calculation of the LIPSA, but in no other period the LIS reimbursement increased as it did in 2009. However, some of these reforms directly interacted with the rules for assigning LIS enrollees that I explain next.

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

[10] More precisely, 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.

3) Random Reassignment

The last key aspect of the regulation concerns how LIS enrollees are allocated to plans. 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 for each region this assignment was performed by allocating at random all LIS enrollees across all firms that had at least one basic plan with a premium at or below the LIPSA.[12] For a firm with more than one eligible plan, a further round of randomization took place to allocate LIS enrollees assigned to this firm among its eligible plans. With a few exceptions described below, this random assignment has been repeated in each of the following years to assign new LIS enrollees.

For each year after 2006, LIS enrollees are subject to reassignment if they are enrolled in a plan that will have a premium above the LIPSA in the following year. However, in this case the reassignment is slightly more complex. First, if the plan that will have a premium above the LIPSA belongs to an insurer that in the same region offers some other basic plans that will have a premium at or below the LIPSA, then the LIS enrollees are reassigned at random within the same firm to these other plans. Second, not all LIS enrollees are reassigned but, instead, CMS reassigns only those that: (a) maintain their status of full LIS receivers[13] 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". Opting out to choose a plan can be done at any time during the year. For choosers, every year CMS sends a letter to remind them that they need to act on their own to avoid paying a positive premium, but no automatic reassignment occurs.[14]

The reassignment of LIS enrollees is a major feature of this market that substantially affects firms market shares. Inedeed, Table 6 shows that the number of reassigned enrollees

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

[12] More precisely, for a plan to qualify for a share of randomly assigned beneficiaries, it must meet both design and premium requirements. Only PDP that have a premium below LIPSA and that are designed as a standard benefit, or actuarially equivalent to the standard benefit, are eligible for the assignment.

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

[14] Plan choices made on behalf of LIS enrollees by "authorized representatives", such as some State pharmacy programs, are treated as individual choice and so cause an exit from the yearly re-assignment process.

varies substantially from year to year and it peaks in 2008 with about 2.5 million reassignments. Moreover, the table reveals that the number of choosers is rather stable and represents about a third of all LIS receivers. Although the reassignment process was designed to limit the risk that LIS individuals would have to pay positive premiums, it harms continuity and stability in coverage. Reassigned individuals may have to change their pharmacy and, possibly, even drugs. Because of these problems, two exceptions to the regulation above have been introduced. The first reform was introduced by CMS in all regions for the years 2007 and 2008 on a provisional basis. The reform was reintroduced and became a permanent part of regulation beginning in 2011. It is known as the "de minimis" policy and provides the opportunity for those plans with premiums above the LIPSA by just a small amount to avoid losing their LIS enrollees by lowering the premium down to the LIPSA for only their LIS enrollees. For the option to apply, the maximum amount by which the premium could be greater than the LIPSA was set, respectively, to \$1 in 2008 and \$2 in all the other years.[15]

A second and more substantial exception to random reassignment was introduced individually by some States. In particular, already in 2006 Maine modified the random reassignment conducted by CMS by reassigning LIS enrollees based on their past consumption of drugs. This "beneficiary-centered" assignment consisted of matching the past drugs used by each LIS enrollee with the formularies of a subgroup of plans that had previously agreed with Maine to receive LIS enrollees. Only if the original assignment performed by CMS generated a good enough match was the enrollee not reassigned. Otherwise, he was moved to the best match among the participating plans. Similar programs were also implemented in Florida, Nevada, New Jersey, New York and Pennsylvania and their description is presented in the appendix. However, only in Maine were the LIS enrollees directly reassigned. The possibility of separating regions with and without forms of beneficiary-centered assignment is of great importance for the rest of this study because it allows us to isolate cases where the presence of LIS distortions should be absent or, at least, less severe.

[15]This means, that for instance, in 2011 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 a premium equal to the LIPSA.

4 Data

The data for this study consists of aggregate data released by CMS describing enrollment and plans characteristics for all plans offered between 2006 and 2011. In Table 3, I report some summary statistics. Following up on the discussion above about the relevant change that occurred in 2009, I separate the data into two sample periods 2006-2008 and 2009-2011. Moreover, I distinguish between PDP (separately for basic and enhanced plans) and MA-PD.

These plan-level data allow us 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.[16] 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 2 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: in 2010 the total market share of the three largest firms was 47% of all PDPs enrollees.[17]

More in detail, there are three features of these data that suggest that potentially the LIS regulation should have a significant impact on firms pricing behavior.

- First, LIS enrollees are a large share of the total market. As shown by Table 6, there are about 9 million LIS enrollees. Most of them will stay in the plan to which they are assigned as only a third of them becomes choosers. Moreover, even choosers can become again randomly assigned enrollees if the plan in which they are in is terminated.

[16] For the demand estimation, I also use demographic data on the 34 regions obtained from the Integrated Public Use Microdata Series (IPUMS) USA.

[17] In 2010, the largest firms were UnitedHealthcare, Humana, Universal American and Well Point, having market shares among PDP enrollees respectively of 27%, 12%, 8% and 5%.

- Second, the premium amount that can be extracted from LIS enrollees is endogenous to firms actions. As discussed earlier, both the direct and the LIS subsidy are weighted averages of firms bids and premiums. However, Table 4 clearly illustrates that manipulating the LIS is simpler than manipulating the direct subsidy. Indeed, the distributions of the weights used to calculate the LIS is markedly more concentrated toward high weights than that of the direct subsidy. For the direct subsidy, only 23 plans have a weight greater than 1%. In contrast, thousands of plans have weight above 1% for calculating the LIS amount. Moreover, for the period 2009-2011 there is a substantial increase in the weight of the plans at the top of the distribution: 8 plans have a weight greater than 30%, while there is no plan with such a high weight in the previous period.

- Third, firms have multiple plans within the same region. In particular, Table 5 shows that all the major insurers typically have more than one plan that has a benefit structure adapt to receive LIS enrollees. The drop in the number of cases of firms with plans that the table reveals for 2011 is due to a change in regulation requiring firms to have just one basic PDP per region. Nevertheless, firms using different brand names for their plans were allowed to keep one basic plan per brand. The increase observed from 2011 to 2012 is due to an increase in firms with multiple brands that originated from a series of mergers.

Altogether, these three facts suggest that firms pricing behavior should be affected by the LIS regulation. The next section provides descriptive evidence that this is indeed the case.

5 Preliminary Empirical Evidence

This section presents three sets of results. The first one regards the question of whether LIS enrollees 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 both LIPSA and average premium at the regional level. The last results look at the pricing of individual plans to assess how manipulations occur.

1) Do Insurers Avoid LIS Beneficiaries? A preliminary issue is whether LIS enrollees are so much more costly to insure that firms tend to avoid them despite the possibility to gain from the manipulable subsidy. An influential study of Hsu et al. (2010) compares the drug expenditures of regular and 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%. Despite LIS consumers being more costly to insure, there are at least two cases showing that firms are not trying to avoid them. The first case is related to the de minimis policy described earlier and provides the opportunity to retain LIS enrollees for plans with a premium above the LIPSA but within the LIPSA plus the de minims amount. In 2011, 58 plans faced the choice of using the de minimis option or not. All of them decided to apply discounts of up to the maximum of $2 to retain their LIS enrollees. The default option was *not* applying the discount, so all these plans actively elected to apply it. The second case, instead, is 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 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. of an insufficient 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 LIS. Figure 4 shows the evolution over time of the average premium and subsidy for low income enrollees.[18] The turning point for the subsidy is in 2009 and I will argue that this is in part due to the greater concentration of weights, driven by the switch to LIS enrollment weighting. This increase goes together with the increase of the basic premium although it appears at times more pronounced than that of the premium. Additional evidence on the association between the LIS weights and changes

[18]Both are enrollment weighted and in real US dollar. The LIS is above the Basic Premium because in the calculation of the latter enter many MA-PD with a price of zero.

in LIS and premium is presented in Table 7. This table reports the estimates of the two following regression models:

$$\Delta LIS_{mt} = \alpha + \beta LIS_Weight_Concentration_{mt} + \gamma X_{mt} + \tau_t + \lambda_m + \epsilon_{mt},$$
$$\Delta Premium_{mt} = \alpha + \beta LIS_Weight_Concentration_{mt} + \gamma X_{mt} + \tau_t + \lambda_m + \epsilon_{mt}.$$

The coefficient of interest is β. In the first model, β measures how the difference in the LIPSA in region m between year t and year $t-1$ is associated with the concentration of the weights for the LIPSA calculation in m and t. Concentration is measured through the C4 index, that is the sum of LIS weights of all the plans of the 4 largest companies in terms of their LIS weights. In the second model, β measures how this concentration is associated with the change in the region-wise average premium. In both cases, the difference is taken between two consecutive years from 2006 to 2011. In the various models reported in the table, I show how the concentration of LIS weights is positively and significantly associated with an increase of LIPSA and average premium, even when measures of the market concentration in terms of the total market share or the LIS enrollees market shares are included. This result holds controlling for the plan age (a proxy for the switching cost) and measure of costs as the number of active principles.

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 year of the program, 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 with the beneficiary-centered assignment described earlier. Similar, albeit not identical, programs were implemented to a lesser extent in other states. In the fourth and eight column of Table 7 I report the results obtained excluding all those regions in which at least half of the LIS enrollees 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 8, 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%. Separately for each of these three variables I estimate the probit model:

$$Premium_Jump_{jmt} = \Phi(\alpha + \beta_1 LIS_weight_{jmt} + \beta_2 Eligible_Firm_{jmt} + \beta_3 Only_Basic_PDP_{jmt} + \gamma X_{jmt} + \tau_t + \lambda_m + f_j + \epsilon_{jmt}.$$

Where $Premium_Jump_{jmt}$ is one of the three dummy described above and Φ is the CDF of the unit-normal distribution. There are three main dependent variables: The first is LIS_weight_{jmt} that is the total LIS weight (in region m and year t) of all plans of the firm owning plan j. Since firms with higher weight have a greater incentive to increase the LIPSA, then β_1 should be positive when the dependent variable is a positive jump and negative for the case of the negative jump. The second main variable is $Eligible_Firm_{jmt}$, that is a dummy equal to 1 if the firm owning plan j has at least one plan, other than j, eligible for the LIS subsidy in region m and year t. Since making a positive jump serves only when some other partner plan is eligible for LIS enrollees, β_2 should be positive for the case of upward jumps and negative for the case of negative jumps. The third variable is $Only_Basic_PDP_{jmt}$, that is a dummy equal to 1 if the plan is a basic PDP and if in $t-1$ the firm did not have any eligible plan (i.e., no basic PDP below the LIPSA). If a firm is interested in LIS enrollees, then given that in $t-1$ it was ineligible, in t it will likely decrease its premium. Hence, β_3 should be negative for the positive jumps and positive for the case of negative jumps.

The terms τ_t, λ_m and f_j, are, respectively, dummy variables for year, region and insurer identity. Depending on the specification, X_{jmt}, contains either only plan specific variables (the year in which it was introduced and whether it is enhanced) or also other variables

(the age of the plan, the number of network pharmacies and the fraction of active principles covered). Moreover, they are robust to the inclusion in the model of various controls. In particular, including the age of the plan and its vintage year serves to control for the possibility that jumps could be used to exploit consumers inertia. Similarly, including the firm identity allows us to isolate the effect of firms, like Humana, whose strategy is believed to be aimed at exploiting consumers inertia. The results broadly confirm the expected effects. In Table 9, I use the same regression models of the first three columns of Table 8, but I do it separately for two groups of regions: The 6 region implementing forms of beneficiary centered assignment, and all the remaining regions. Overall, the coefficients on the relevant variables seem to retain their sign and significance only for the regions that did not implement any beneficiary-centered assignment. Since pricing due to consumers inertia should be present in both groups of regions, these results suggest that our correlations are not capturing this other motive for price increases.

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 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 8 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.

6 Empirical Model

The evidence in the previous section reveals that the distortion induced by the LIS is likely to have increased premiums. However, it would be relevant to know what premiums would have been had Medicare designed in a different way the LIS. For instance, LIS and regular

enrollees could have been separated with all the LIS enrollees assigned to a plan designed specifically for them. To address this type of question, the estimation of a structural model of demand and supply of plans is required. This section presents an empirical model of demand and supply that follows the discrete choice literature.

The first part illustrates the demand model, which is a random coefficient logit model estimated for the choice of PDPs by regular enrollees. The second part shows how insurers marginal costs are obtained from the demand estimates for a subgroup of plans not affected by the LIS distortion. In turn, the costs of this subgroup of plans are used to predict the cost of the remaining plans. The third part discusses how demand and supply estimates are combined to evaluate two alternative scenarios for this market.

6.1 Demand

Indirect utility specification As is usual in the discrete choice literature, the indirect utility function of a regular enrollee i who chooses plan j in market t is given by:

$$u_{ijt} = -\alpha_i p_{jt} + x_{jt}\beta_i + \xi_{jt} + \epsilon_{ijt} \tag{2}$$

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[19], and ϵ_{ijt} is a random disturbance, distributed as a Type I Extreme Value. 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 regions. The market share of the outside option is defined as the consumers enrolled in MA-PD plans or eligible but not enrolled[20]. The utility from the outside good is normalized to 0. It seems appropriate to collapse these two different choices because not getting insurance at all and getting Medicare via MA-PD are typically both considered in the literature lower quality

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

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

options that enrolling in PDPs.[21]

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

$$\alpha_i = \alpha + \Pi D_i + \sigma\nu_i \tag{3}$$

$$\text{where } \nu \sim \mathcal{N}(0,1) \tag{4}$$

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.[22] In the results presented below, the only demographic characteristic used is the income of the household.[23] Given this relationship between the taste coefficients and the demographics, the indirect utility becomes:

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

Consumers can purchase just one plan and it is assumed that they purchase the one that gives the highest utility.[24] Thus the choice of plan j in period t depends on three stochastic quantities: $(D_i, \nu_i, \epsilon_{it})$. Their joint distribution thus determines the market share of the j-th product in market t.[25]

Discussion of the assumptions: The survey of Einav, Finkelstein and Levin (2010) on empirical models of insurance markets illustrates clearly advantages and drawbacks of using the type of model presented above. The main drawback is that the indirect utility specification does not allow the inference of interesting parameters of the utility function like the risk aversion coefficient. This limits the type of counterfactual analysis that can

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

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

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

[24] As evidenced by the discussion of the literature on Part D, there is an open debate about how capable consumers are to chooses between plans. Since addressing this issue is beyond the scope of this paper, the maintained assumption will be that people optimally chooses plans. However, to account for the fact that this choice might have been particularly problematic, I evaluate the robustness of my estimates to the use of different sample periods.

[25] For the outside good, its indirect utility $u_{i0t} = -\xi_{0t} + \pi_0 D_i + \sigma_0\nu_{i0} + \epsilon_{i0t}$.

be conducted. Nevertheless, the advantage of this approach is that it allows me 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 than learning about consumers utility.

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. This is because randomly assigned LIS enrollees are (almost) perfectly inelastic to quality. Thus, a firm can reduce the quality of its plans having many 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 features other than price as exogenous.

Instead, I will take prices as endogenous and use instruments to correct for the potential bias in the estimates of 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 use the set of instruments that are traditionally referred to as BLP [26], Hausman[27] and Train-Whinston[28]. Moreover, I also construct instruments specific for Part D based on the number of LIS enrollees. The idea is that the lagged number of LIS enrollees can

[26]One instrument is simply the total number of basic and enhanced PDPs and of MA-PDs offered in the market. Other instruments are constructed as follows: 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.

[27]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.

[28]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.

induce price changes that are exogenous to the demand of regular consumers. This happens for two reasons: First, to exploit the LIS distortion, plans will change their price and the exact way they will change it is closely related both to their own LIS weight and to that of their parent company in the same year and region. Second, the number of LIS enrollees affects plans market power and, through it, their cost and prices. To capture both ideas, I construct an instrument for a plan premium that consists of the prior year difference between the total number of LIS enrollees of its parent company (in that region and year) and its own enrollment of LIS consumers. The results reported in the next section suggest that this instrument works well to correct the endogeneity bias of premiums.

6.2 Supply

In the differentiated-product literature, firms marginal costs are typically obtained inverting the first order conditions of a static profit maximization problem. Under the assumption that prices are the outcome of a Nash-Bertrand equilibrium, the demand estimates are all that is needed to make this inversion feasible. Although I maintain the conventional Nash-Bertrand assumption, I try to selectively study portions of the market where the this assumption should be a reasonable approximation of firms behavior. In particular, I avoid imposing this assumption on insurers actively competing to win LIS enrollees. This is because, in violation of my assumption, bidding to be right below the LIPSA likely entails some uncertainty, in a way that resembles bidding in a procurement auction. Moreover, as illustrated in the theoretical example, bidding to win LIS enrollees likely involves complex dynamic strategies, especially after 2008, and discontinuities in the profit function.

Therefore, I focus on three groups of plans which I argue that are not actively competing for LIS enrollees. They are: *i)* plans of firms that in a certain region never had any plan eligible to receive LIS enrollees throughout the entire existence of Medicare D; *ii)* plans in region 1 (Main, New Hampshire) of firms that did not volunteer for the beneficiary-centered assignment of LIS enrollees; *iii)* plans belonging to firms for which a statistical test for LIPSA manipulation fails to find evidence of this behavior.

Case 1 An insurer that in a certain region never had any plan with a premium low enough to qualify for LIS enrollees is arguably not pricing its plans to get the randomly assigned LIS enrollees. Although this assumption appears reasonable, it might seem more surprising that these plans are also comparable to plans qualifying for LIS enrollees. The reason for this latter claim is that there is substantial variation in the LIPSA across regions and, hence, there are many insurers who never qualified for LIS enrollees in at least one region. Furthermore, this variation is mostly due to the different penetration of Medicare Part C: Where in 2006 enrollment in Medicare C was high MA-PD received a high weight in the calculation of the LIPSA and, since their premium is typically close to zero, they induced a low LIPSA.[29] Since plans offered by the same insurer across different regions are remarkably similar, the group of plans in Case 1 can be used to predict the cost of similar plans in other regions for which I could not directly apply the first order condition approach. Indeed, all the major insurers are represented in the group of plans of Case 1, with the only exception of Humana, UnitedHealtcare and WellCare.

For a firm that never qualifies for LIS enrollees, profits earned on its plans come exclusively from regular enrollees and from LIS choosers that voluntarily opted out of the auto enrollment system. Therefore, the profit maximization problem of this insurer f is:

$$\Pi_f = \sum_{i \in f} [b_i - c_i^U] s_i^U M^U + \sum_{i \in f} [b_i - c_i^{LC}] s_i^{LC} M^{LC}. \tag{5}$$

Where U indicates the regular consumers, while LC denotes the LIS choosers. Assuming Nash-Bertrand prices and an interior solution, the equilibrium bids are defined by the system of first order conditions for each plan j of firm f:

$$s_j^U M^U + \sum_{i \in f} [b_i - c_i^U] \frac{\partial s_i^U}{\partial b_j} M^U + s_j^{LC} M^{LC} + \sum_{i \in f} [b_i - c_i^{LC}] \frac{\partial s_i^{LC}}{\partial b_j} M^{LC} = 0 \tag{6}$$

Since the estimates of the share elasticities obtained from the demand model are in terms of

[29] The variation in the total weight assigned to MA-PD in 2006 is substantial ranging from almost 60% in Arizona and Nevada to less than 4% in Mississippi and Maine.

premiums and not bids, I follow the approach of Miller and Yeo (2011) and assume that:

$$b_j = b_j^{basic} + b_j^{enhanced} = b_j^{basic}(1+\gamma_j) = p_j + \lambda \sum_{All\, i} w_i^{national} \frac{b_i}{1+\gamma_i}.$$

Where $w_i^{national}$ are national weights and λ is the constant less than are used for computing the direct subsidy, as described in Section 3. γ_i, instead, is the ratio of the enhanced to the basic component of the bid. Since the $w_i^{national}$ are small and they get multiplied by λ which is around 0.6 and further divided by a term $(1+\gamma)$ that is around 1.03, I will assume that:

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

A similar issue arises for the derivative of the share of LIS choosers.[30] Since their premium is the difference between the premium faced by regular enrollees and the LIPSA, we obtain:

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

To use the system of equations in (6) to retrieve firm costs, an additional assumption about the relationship between c_i^U and c_i^{LC} is needed. Since firms are not allowed to price discriminate between regular and LIS enrollees, any difference in cost between the two groups is a measure of adverse selection. However, it is crucial to point out that c_i^U and c_i^{LC} are the costs that the firm faces after CMS has risk adjusted its payments. Therefore, whether adverse selection is present depends on how effective the CMS risk adjustment is. I will consider two cases: The first one is that this readjustment is perfect ($c_i^{LC} = c_i^U$) and the second is that the LIS are 13% more expensive than the regular enrollees. This value comes from the estimates of Hsu et al. (2010) who find that this is the amount of extra costs of LIS enrollees not covered by the CMS correction.

Case 2 The second group of plans consists of all plans in region 1 belonging to insures not participating in the beneficiary-centered assignment of Maine. As discussed earlier, under this program Maine reassigned LIS enrollees to a subgroup of plans that had previously

[30]Since this share is neither observable nor directly estimable, I simulate it by using the method illustrated in a subsequent section about my second counterfactual scenario analysis.

accepted to receive them. In 2010 and 2011 only CIGNA, Universal American, UnitedHealth and WellCare were still in the program. Altogether, they covered close to 90% of the LIS enrollees in the region. Moreover, although region 1 is composed by both Maine and New Hampshire, only a small fraction of all enrollees (about 6%) were subject to traditional Medicare assignment in those years. Therefore, I will assume that for plans not volunteering to receive LIS enrollees, the pricing decision disregards LIS enrollees. Thus, the first order condition of the maximization problem for any of these firms is[31]:

$$s_j^U + \sum_{i \in f} [b_i - c_i^U] \frac{\partial s_i^U}{\partial b_j} = 0 \tag{7}$$

For each firm in this group, inverting the system of equations above will allow to infer plans marginal costs.

Case 3 For both the LIBOR and the ABA procurement auctions described in the introduction, statistical methods have been developed to detect which firms were rigging the mechanism. In particular, for the ABA Conley and Decarolis (2011) developed a test based on the idea of randomization inference that compares the joint bidding behavior of members of a know cartel to the joint bidding behavior of random groups of comparable bidders. Using judicial evidence form convicted cartels, they verify that the test correctly captures bid manipulations. The case of Part D is similar because bids can be used to manipulate the LIPSA. It is also simpler in the sense that there is no ambiguity about the composition of cartels: every single multipan firm can be thought as a separate cartel which coordinates the bids of its plans. However, Part D is also more complex because the same bid applies to both regular and LIS enrollees and because, especially after 2008, exploiting the LIS might entail complex dynamic strategies.

Therefore, I develop a testing procedure that should capture an intuitive manipulation strategy for the period from 2006 to 2008: a multiplan firm that seeks to exploit the LIS will try to have some plans priced right at the LIPSA and some of is other plans priced as

[31]I also experimented inferring the marginal cost with first order conditions that account for the LIS enrollees. In doing so, I accounted for the potential discontinuity of the profit function at the LIPSA by excluding insurers with at least one plan within $1 around the LIPSA. The results obtained were essentially identical to those described in the text.

high as possible. Figure 5 offers a possible example of this behavior for the case of region 31 in 2007 and 2008. Comparing Aetna and Humana it is possible to see that 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.

To capture this type of behavior through a statistical test, I exploit the idea of the test in Conley and Decarolis (2011). For each market (a pair year-region), I select all plans of a given firm i. Then, for each market m where i offers at least 3 plans I compute a statistic that takes a value tending to zero when firm i follows the conjectured strategy. 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).

$$\theta_{im} = \sum_{j=1}^{J^s} \left[|L^m - b^s_{imj}| \mathbf{1}\{b^s_{imj} \leq L^m\} + (M^b - b^s_{imj}) \mathbf{1}\{b^s_{imj} > L^m\} \right] + \sum_{j=1}^{J^e} (M^b - b^e_{imj}) \quad (8)$$

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 (defined as a year-region pair) 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, $\theta_{i,m}$ needs to be compared to a reference distribution. This distribution is the empirical distribution of the same statistic computed for every comparable collection of plans in m. 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 a suspicious behavior is detected when $\theta_{i,m}$ is smaller 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 high costs inducing high prices. 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.[32]

Finally, notice that the test achieves power from 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 which $\theta_{i,m}$ corresponds and report in an histogram all these percentiles. I did this for the 15 largest firms in terms of market share for 2007 and 2008. In Figure 6, 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 $\theta_{Aetna,m}$ lies in the left tail 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 did this firm adopts prices consistent with 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

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

these three as the manipulating firms and I will exclude them when applying the first order conditions approach described above. Compared to the previous two cases, this latter case is less appealing because it assumes static profit maximization even on firms that carry a large number of LIS enrollees and might be more forward looking. Moreover, assuming equilibrium pricing might be less adequate for the first year of the program.

7 Results and Counterfactual Analysis

Demand. 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. The last column of the table contains the estimates for the mixed logit model described before.[33] 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.[34] Consumers also dislike plans with a higher deductible. The effect of the number of pharmacies is negative but essentially zero in terms of magnitude. It is more surprising to find a negative coefficient for the share of the active principles covered relative to the 100 most commonly consumed active principles. This is possibly do to the correlation with the other measures of plans generosity in terms of drugs, which all have the expected positive sign. Indeed, consumers like both having more active principles and that these active principles are available through drugs in low tiers (for which copays are lower). As expected, the coefficient is positive for receiving coverage

[33]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 enrollment instrument described in the text, 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.

[34]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.

in the gap. Older plans might be more valuable because of either their more established 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. Thus, using these estimates to construct a counterfactual LIS consumers demand is not contradicted by the data. The fact that the interaction of price with income is significative suggests that income differences between enrollees matter with higher income enrollees being less price elastic. Finally, the interaction of price with the measure of health status suggest that less healthy consumers are less sensitive to price.[35]

Calculated Marginal Cost. Using these demand estimates, plans marginal costs are obtained in each one of the three cases illustrated using insurers first order conditions. Separately for the three cases, I compute the firms marginal cost of each plan. Overall the result suggest that markups are around 3% for basic plan and around 9% for enhanced ones. However, marginal cost have been recovered only for the subgroup of plans for which there was no LIS induced distortion. To recover the remaining marginal costs, I use an econometric prediction.

Predicted Marginal Costs. For the plans for which I cannot directly calculate the marginal cost, I use a regression model to predict them. The prediction is based on the estimated coefficients of the following OLS regression of the (calculated) marginal costs on various plans characteristics:

$$MC_{jmt} = \alpha + \beta X_{jmt} + \tau_t + \lambda_m + \xi_{jmt} + \epsilon_{jmt}$$

Where MC_{jmt} is the marginal cost of plan j in region m at time t. τ_t and λ_m are time and region dummy. ξ_{jmt} is the measure of plan quality unobserved by the econometrician and estimated through the mixed logit. X^1_{jmt} contains plan characteristics. In the results that I present next, I include both the covariates used for the last three columns of Table 8

[35]This health status variable is a score that sums the response, 0=No and 1=yes, to six questions in the IPUMS US about: cognitive difficulty, ambulatory difficulty, independent living difficulty, care need snd vision or hearing difficulty.

and the additional variables used for the BLP estimates (the deductible and the dummy for extra coverage in the gap). Figure 7 compares the distribution of the marginal cost used to estimate the OLS regression and those predicted. The variation across plans characteristics is what permits that the latter distribution lies to the left of the former one.

The OLS regression estimates a structural relationship between costs and their determinants. Thus, it is consistent with the assumptions of the model that only prices are endogenous. However, this assumption would be violated if insurers in the two groups of plans had different cost functions. Although, in all the three cases there is a risk of this happening, as discussed above in each case it is possible to argue for the similarity of predicted and predictor plans. Nevertheless, as in any prediction exercise errors could arise from various sources. To account for the fact that the estimated and not the true parameter is used in the prediction (sampling error) and for the fact that ϵ_{jmt} is set to zero in the prediction (random error), I calculate forecast interval and use values in this interval to evaluate the range of my estimates. Moreover, to account for the possible specification error, I estimate models with different sets of covariates and with different functional forms (linear and quadratic). All these robustness results are reported in the Appendix.

Counterfactual 1. The estimates of the demand and supply parameters allow us to evaluate two interesting counterfactual scenarios. My first counterfactual exercise assumes that LIS enrollees are not part of the market. This is what would happen if, for instance, all LIS enrollees were placed in a special plan devoted to them.[36] In this case, with a market populated only by regular enrollees, the demand and cost estimates can be used to simulate what prices and market shares would emerge. I compare the years 2010 and 2011 because while in 2010 the regulation was such that a large number of firms were in the conditions to manipulate the LIS, in 2011 the introduction of a newer regulation implied that almost all insurers had at most one basic plan. Therefore, in 2011 the manipulability of the LIS

[36]This plan could be either public or private. In both cases, I ignore any potential interaction between this hypothetical 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).

was almost completely eliminated and there is a possibility that the competitive pressure due to enrollment weighting prevails. Indeed, this could explain the remarkable difference in the premium of newly entering plan between 2011 and all the other years. As shown in Figure 8, only in 2011 most of the new PDP instead of entering with a premium very close to the LIPSA in their region entered with substantially lower prices. Thus, using the cost estimates for case 1, I 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 for both 2010 and 2011. These preliminary estimates seem to suggest that overpricing appears to be rather systematic in 2010, but much less so in 2011. The counterfactual average premium is lower than the observed one in 26 out of 34 regions in 2010, but in 2011 this is true only for 11 regions.

Counterfactual 2. A second scenario that is interesting to evaluate is the one in which both regular and LIS enrollees were both required to choose plans and pay for their premiums. This second scenario is especially interesting because by varying the parameter that measures the degree of adverse selection of the LIS receivers population, it is possible to quantify what the effect on premiums would be. However, this counterfactual requires stronger assumptions along two dimensions. First, it postulates that LIS enrollees can pick their optimal plan, but previous findings in the literature indicate that this is an unlikely situation. However, my interest is in how firms would price their plans in this environment and not in the consumers. Moreover, this might be a fair assumption for the long run description given that Lucarelli et al. (2012) find that consumers choices rapidly improve as they become more experienced in this market. The second strong assumption is that the choice model estimated for the regular enrollees can be used to simulate the choices of LIS enrollees. This assumption is required because LIS enrollees are for the large part auto assigned and so their plan choices are unobservable. Therefore, my strategy consists in drawing form census data a new vector of demographic characteristics from the low income elderly population of each region. Using the mixed logit estimates of the regular enrollees, these demographic characteristic allow to simulate the probability with which LIS enrollees would select a plan, given the prices and characteristics of all the plans in their choice set. Since regular and LIS enrollees differ at least along the income dimension, validity of the exercise rests on the assumed functional

form of the utility. I compare the average premium in a region for the case in which the cost of regular and LIS enrollees is identical to the case in which LIS enrollees cost 13% more than regular enrollees. The preliminary results obtained from this second counterfactual suggest once again that there is substantial variation across states but also that premiums would increase by about 9%.

8 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 be an important source of distortions. Preliminary evidence suggests that in 2010 in most of the regions premiums paid by regular enrollees would have been substantially lower had the regulation created a separate market for regular enrollees.

These findings also complement those in the vast literature on the consumer choice of plans in Part D by showing that an efficient allocation of consumers to plans requires not only helping consumers to pick plans but also fixing premiums distortions. Allocating LIS enrollees to separate plans or using 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.

In comparison the results found for 2011, the first year in which plans ability to manipulate the LIS are reassuring about the fact that firms in this market respond to competitive pressures. Nevertheless, the cases of LIBOR and ABA procurement auctions suggest that insurers will likely find novel ways to exploit the LIS. Therefore, a more radical reform than the one introduced in 2011 is needed. The design of how an alternative system of subsidies for low income enrollees could be design is a relevant avenue for future research.

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Table 1: Aggregate Plans Reimbursement Amounts

	Enrollees	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

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). Data 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-PDs bids gross of Part C rebates
2011	Meaningful difference among plans and return of a $2.00 "de minimis"

Table 2 reports the major regulation changes affecting the LIS.

Table 3: 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 3 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-PD 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 4: 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 4 reports in the top panel the distribution of weights for the calculation of the direct subsidy and the LIPSA. For the latter weights, 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 values and the corresponding year and region. The bottom panel aggregates the regional weights by firm and reports the 8 firms with the highest weights.

Table 5: 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 5 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 offered in the same year and region (partner plans). Plans in column 1 are those that do not have partner plans. For instance, in 2006 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 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 6: 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 6 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 7: 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 8: 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 Basic PDP	-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 table reports the marginal effects estimated through a probit regression. Three different dependent variables are considered: 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 9: Large Changes of Plans Premiums in Different Sets of Regions

	Not R1,3,4,6,11,29			R1,3,4,6,11,29		
	Probit	Probit	Probit	Probit	Probit	Probit
	Jump	Jump	N.Jump	Jump	Jump	N.Jump
VARIABLES	>50%	>75%	>-40%	>50%	>75%	>-40%
Firm LIS W.	0.311***	0.120**	-0.151***	0.172	0.128*	-0.0412
	(0.0706)	(0.0501)	(0.0438)	(0.121)	(0.0749)	(0.0950)
Eligible Firm	0.0230**	0.0243***	-0.0116***	0.0265	0.0185	-0.0314***
	(0.00947)	(0.00643)	(0.00413)	(0.0223)	(0.0158)	(0.0115)
Only Basic PDP	-0.0360***	-0.0215***	0.0529***	-0.0483*	-0.0424***	0.00757
	(0.0119)	(0.00674)	(0.0196)	(0.0262)	(0.0129)	(0.0228)
Enhanced	0.0462***	0.0333***	0.0430***	0.0366*	0.0218	0.0630***
	(0.00876)	(0.00644)	(0.00609)	(0.0217)	(0.0152)	(0.0157)
Observations	5,264	4,729	4,057	1,167	1,065	819

Significance: *** is 1%, ** is 5%, * is 10%. The table reports the marginal effects estimated through a probit regression. Three different dependent variables are considered: 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. The first three columns are analogous to the first three columns of Table 8, but exclude observations from regions 1, 3, 4, 6, 11 and 29. The regressions using only these six regions are reported in the last three columns.

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***	-0.2614***
	(0.0012)	(0.0055)	(0.0158)
Deductible	-0.0033***	-0.0035***	-0.0010***
	(0.0001)	(0.0002)	($7x10^{-4}$)
Active Principles	0.0002	-0.0002	0.1926***
	(0.0041)	(0.0042)	(0.0022)
Top 100 Active Principles	0.0341***	0.0327***	-0.2790***
	(0.0058)	(0.0058)	(0.0390)
Top 100 A.P. in Tier 1 or 2	0.0144***	0.0149***	0.0277***
	(0.0018)	(0.0020)	(0.0046)
Dummy Enhanced Plan	-0.0042	-0.0037	0.4495***
	(0.0319)	(0.0386)	(0.0112)
Dummy Cov. Gap	0.1473***	0.3306***	0.4707***
	(0.0534)	(0.1731)	(0.0044)
N. Pharmacies	0.0002***	0.0002***	-0.0022***
	($5x10^{-5}$)	($5x10^{-4}$)	(0.0003)
N. Years in the Market	0.4122***	0.4343***	0.6799***
	(0.0159)	(0.03340)	(0.0064)
Market Size Nest		0.3072	
		(4.1475)	
Interaction Price-Income			0.0661***
(x1000 $)			(0.0049)
Interaction Health Status			1.3102***
			(0.2615)
S.D. Consumer Heterogeneity			1.2236
			(1.1019)
N. Obs.	7141	7141	7141

Significance: *** is 1%, ** is 5%, * is 10%. OLS standard errors are clustered by firm-region-year. The Nested Logit is estimated using limited information maximum likelihood. The random coefficient logit is estimated via BLP. The sample consists of all PDP plans in all the regions for the years 2007-2011. All models include a constant and controls for years, regions and firms identity.

Table 12: Counterfactual Scenario 1: Only Regular Enrolles

	Year 2010			Year 2011		
	Actual	Simulated	Δ	Actual	Simulated	Δ
Region	Premium	Premium	Premium	Premium	Premium	Premium
Region1	98.18	90.81	7.37	91.99	98.85	-6.87
Region2	104.23	88.86	15.38	103.95	128.55	-24.60
Region3	95.14	80.90	14.24	98.25	133.19	-34.94
Region4	96.97	89.16	7.81	95.54	131.12	-35.57
Region5	102.78	94.78	8.01	99.30	132.02	-32.72
Region6	95.62	89.09	6.53	96.41	118.64	-22.23
Region7	102.23	88.89	13.34	96.82	92.68	4.14
Region8	105.16	99.93	5.23	104.66	78.27	26.39
Region9	100.91	111.99	-11.08	96.05	83.97	12.08
Region10	98.23	117.65	-19.42	96.27	129.39	-33.12
Region11	94.79	123.72	-28.93	99.55	126.79	-27.24
Region12	99.51	82.31	17.20	100.18	101.29	-1.11
Region13	105.60	105.48	0.12	101.42	101.43	-0.01
Region14	97.29	98.97	-1.68	94.64	80.99	13.65
Region15	104.90	88.42	16.47	98.59	87.83	10.76
Region16	99.13	91.83	7.30	107.12	79.68	27.44
Region17	92.83	102.11	-9.28	93.24	83.81	9.43
Region18	105.87	93.11	12.76	96.57	82.27	14.30
Region19	97.05	126.50	-29.45	101.04	78.42	22.62
Region20	100.79	129.42	-28.62	99.13	61.35	37.78
Region21	100.19	123.81	-23.61	106.30	121.77	-15.47
Region22	98.29	120.45	-22.16	95.79	87.08	8.71
Region23	99.32	136.18	-36.86	99.31	118.32	-19.02
Region24	98.48	108.85	-10.36	97.10	99.88	-2.78
Region25	94.82	82.80	12.02	94.18	82.32	11.85
Region26	88.90	85.54	3.36	90.71	91.51	-0.80
Region27	99.15	90.59	8.57	96.77	103.16	-6.39
Region28	91.76	87.64	4.12	87.73	63.37	24.37
Region29	98.92	88.57	10.35	99.48	119.68	-20.21
Region30	96.64	77.38	19.26	96.68	121.84	-25.16
Region31	103.84	96.55	7.29	97.34	93.08	4.25
Region32	100.52	99.10	1.42	107.08	92.24	14.84
Region33	88.80	86.20	2.60	88.07	88.34	-0.27
Region34	99.50	91.23	8.27	94.11	82.55	11.55

The table reports the actual and simulated enrollment weighted average premiums in the 34 regions. The simulated premiums and enrollment are calculated using estimated the demand parameters and the marginal costs obtained using the method for case 1.

Figure 1: Example: Two Firms and Three Plans

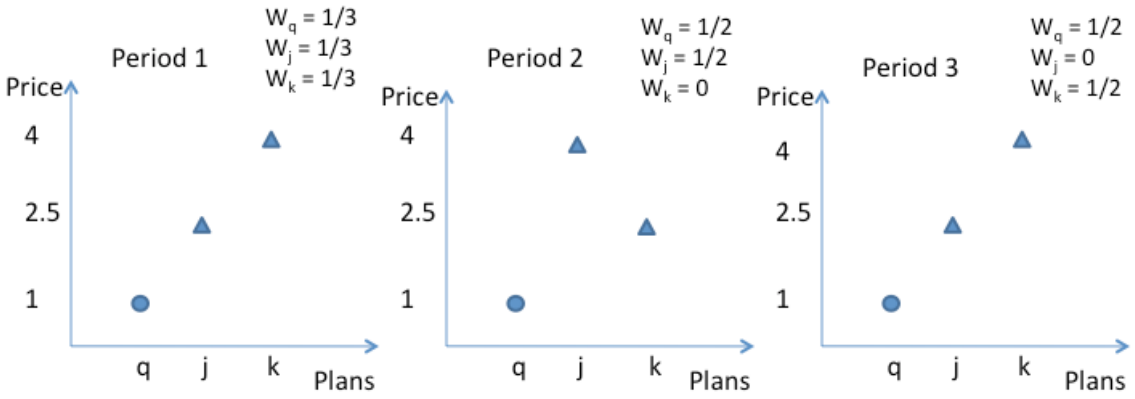


Figure 1 reports the prices of the three plans (q, j, k) in three periods. The two plans indicated by triangles (j, k) belong to the same firm. Plans start in period 1 with equal weights and then in periods 2 and 3 have weights proportional to previous period enrollment. In the first period the LIPSA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

Figure 2: Availability of PDP Plans Across Regions

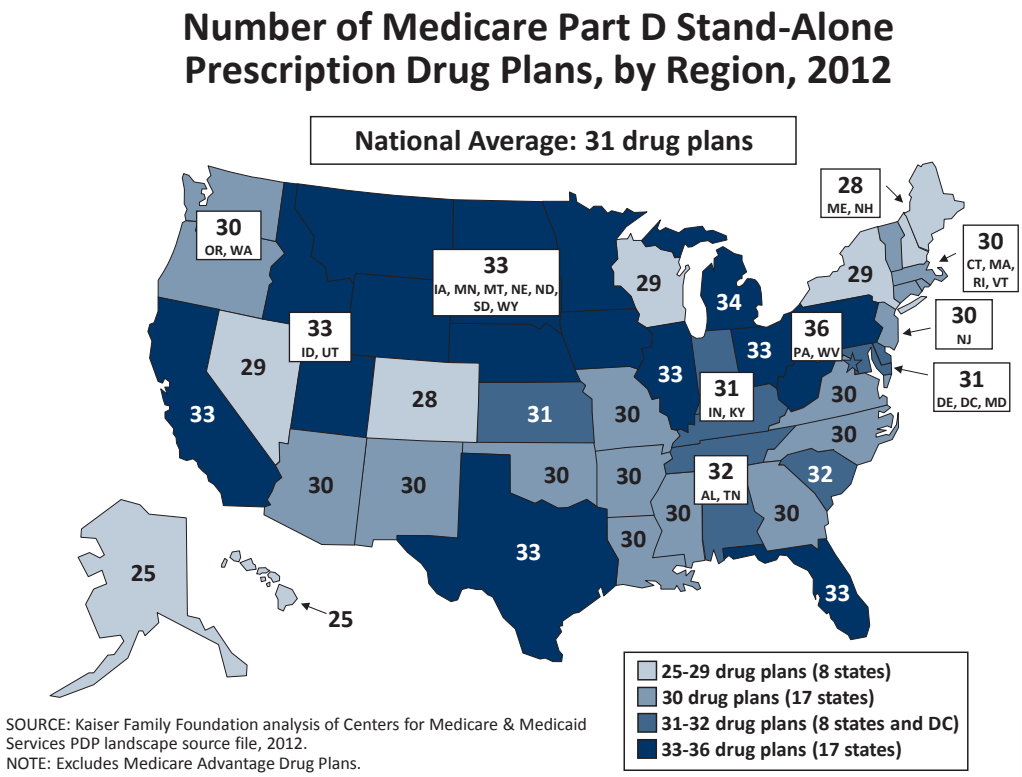
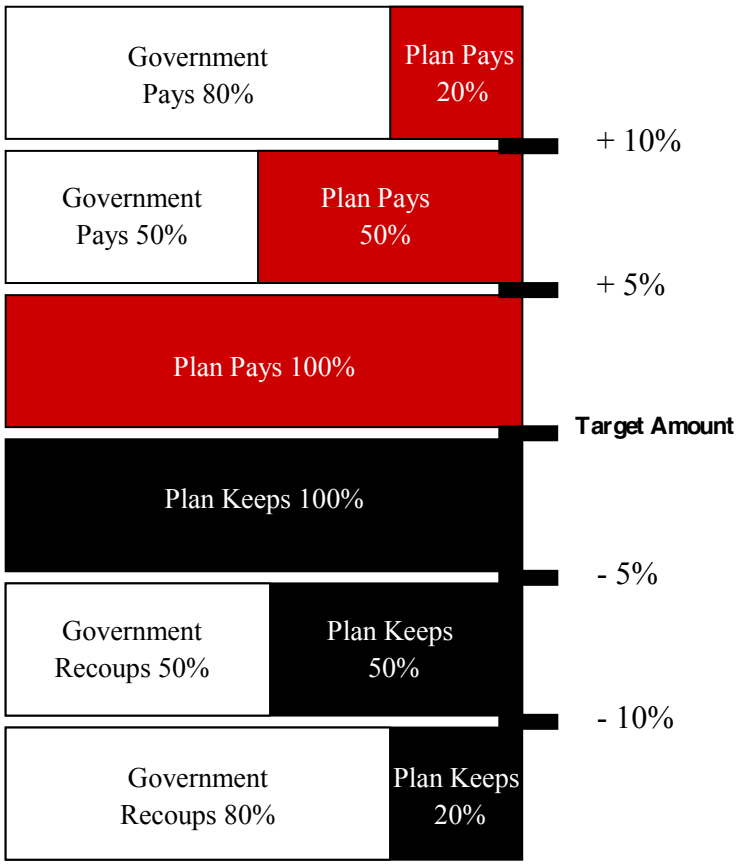


Figure 2 reports the number of PDP offered in each one of the 34 regions in which the US market is divided.

Figure 3: Risk Corridors



Source: CBO. Figure 3 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 4: Evolution of LIS and Basic Premium

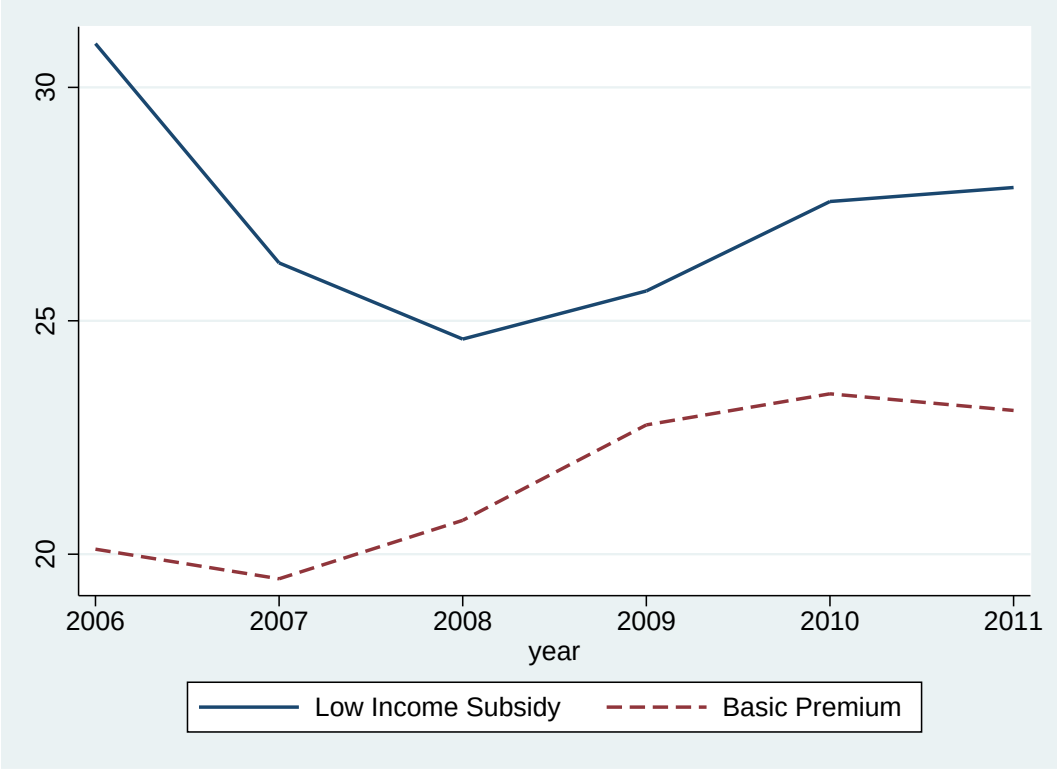


Figure 4 describes the evolution of the (enrollment weighted) average premium and low income subsidy. Values are obtained by converting dollars to real 2006 dollars using the Medical CPI. For the low income subsidy, I incorporate the discount received by the LIS under the de minimis policy.

Figure 5: "Support Bids" by Aetna

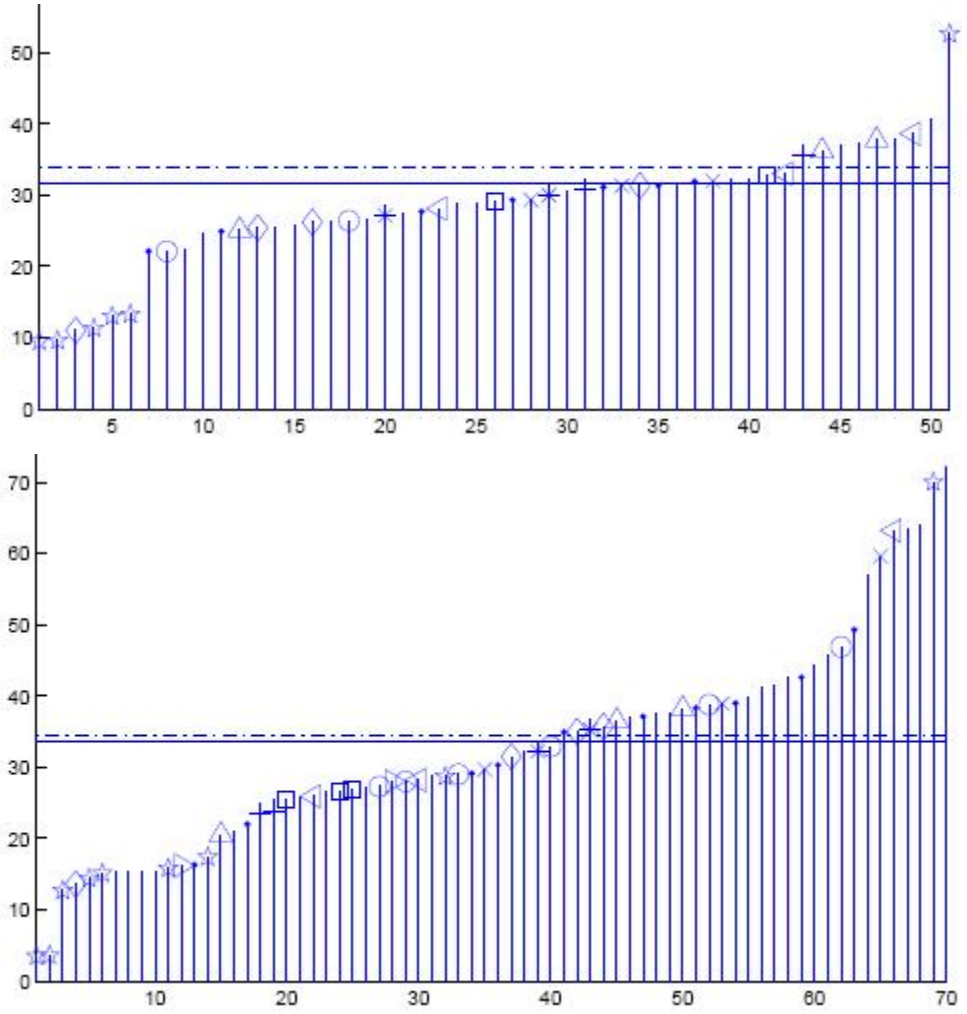


Figure 5 reports plans basic premiums in Region 31 in the year 2007 (top panel) and 2008 (bottom panel). Only plans having a positive LIS weight are reported. Plans are sorted according to their basic premium (from the lowest to the highest): the height of each bar represents the basic premium of the 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 LIPSA plus de minimis.

Figure 6: Bid Test for Aetna and Medco

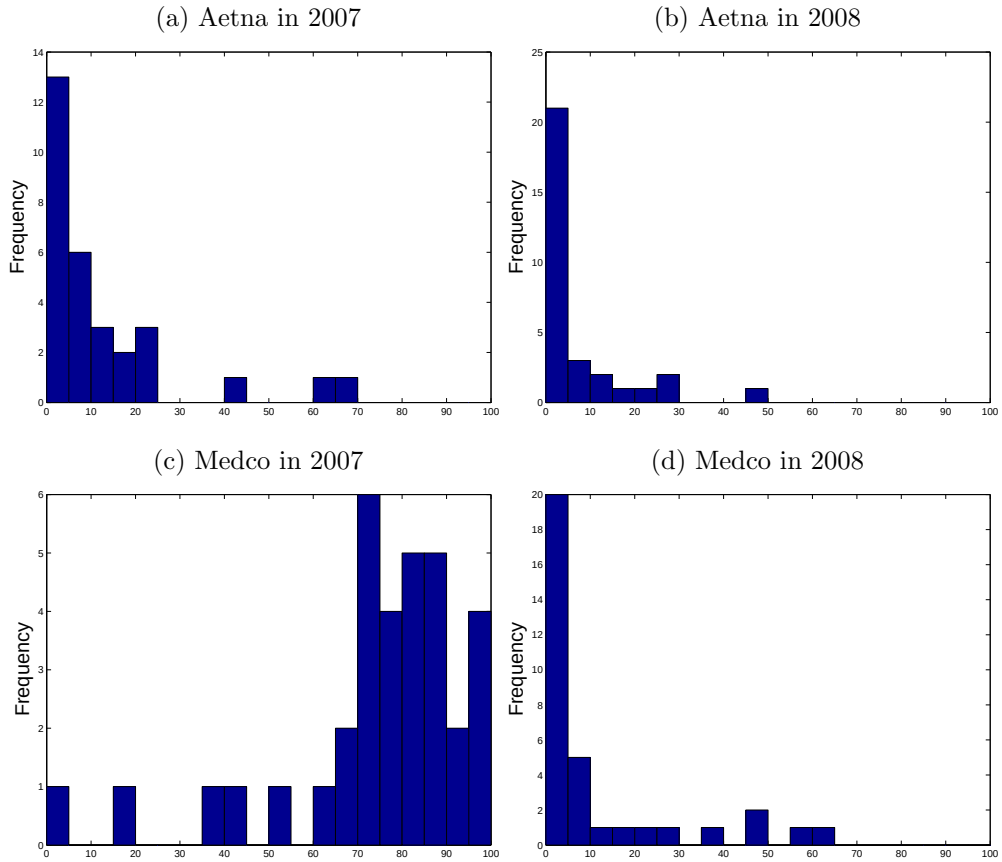


Figure 6 presents histograms summarizing the outcome of the bid test across the 34 regions for Aetna and Medco in 2007 and 2008. Each histogram reports the 34 pvalues of the bid test performed for each of the regions. Pvalues falling in the leftmost bins are suggestive of LIPSA manipulations.

Figure 7: Marginal Costs: Estimated and Predicted Costs for Case 1

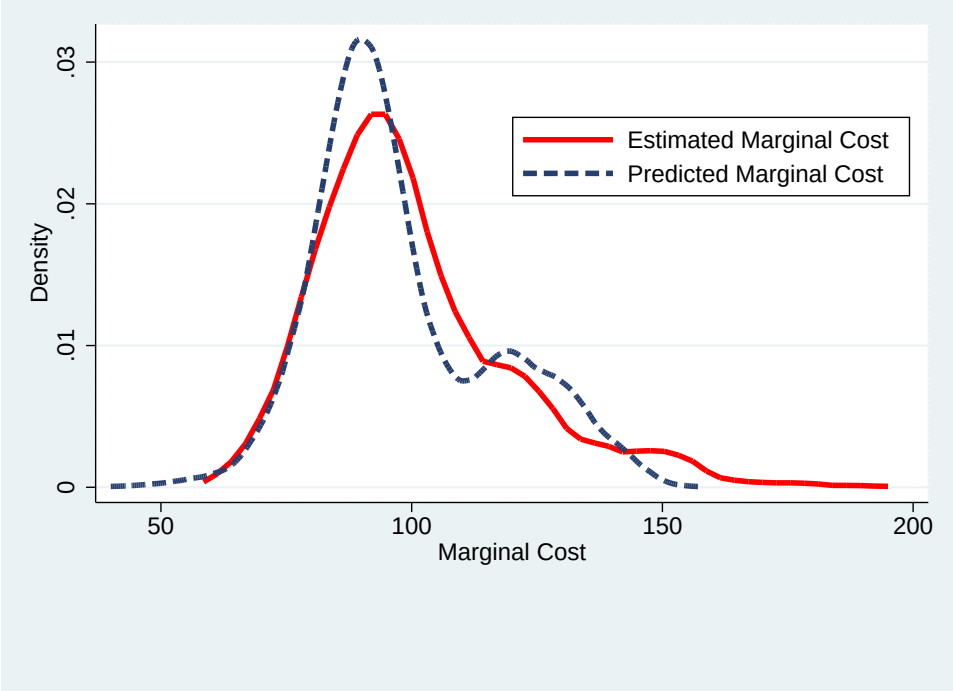


Figure 7 shows kernel estimates of the probability density functions both of the marginal cost estimated for case 1 (solid line) and the predicted marginal cost for those plans not included in the case 1 group.

Figure 8: First Year Premium of Entering PDPs

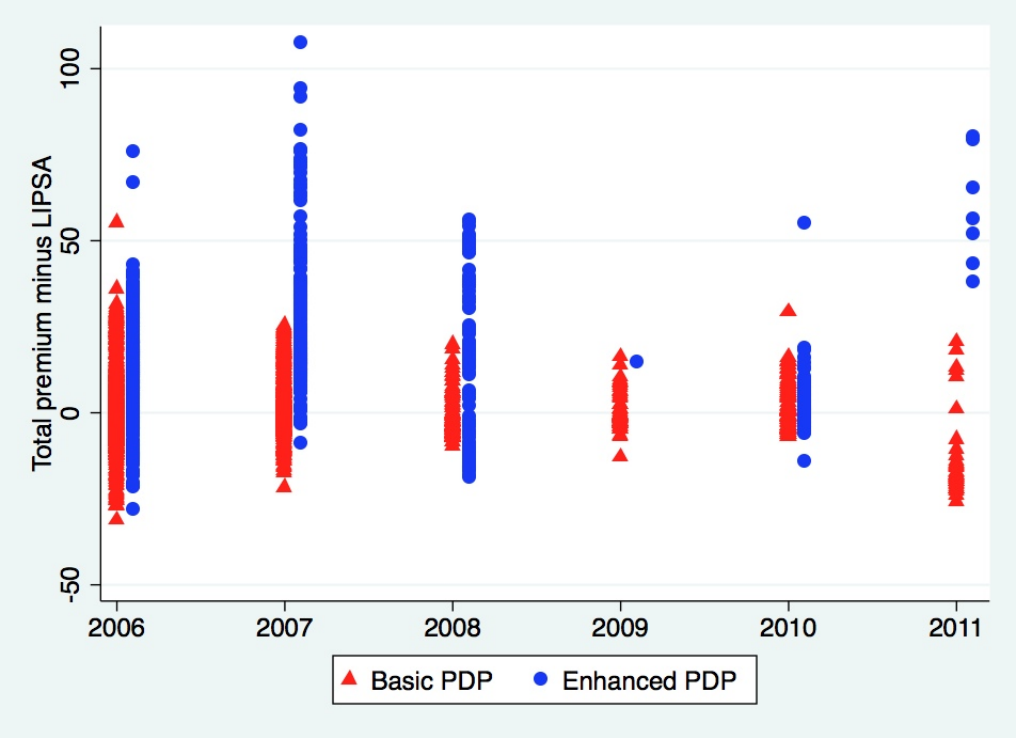


Figure 8 reports the total premium of all the PDPs in the years in which they were introduced. The most interesting aspect is how in 2011 for the first time there is a vast majority of entering PDPs that are clearly below the LIS. This could mean that finally the competitive pressure story is kicking in.