Published in final edited form as:

Adv Health Econ Health Serv Res. 2010 ; 22: 317–344.

Patents, Innovation, and the Welfare Effects of Medicare Part D*

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Abstract

Purpose—To evaluate the efficiency consequences of the Medicare Part D program.

Methods—We develop and empirically calibrate a simple theoretical model to examine the static and dynamic welfare effects of Medicare Part D.

Findings—We show that Medicare Part D can simultaneously reduce static deadweight loss from monopoly pricing of drugs and improve incentives for innovation. We estimate that even after excluding the insurance value of the program, the welfare gain of Medicare Part D roughly equals its social costs. The program generates \$5.11 billion of annual static deadweight loss reduction, and at least \$3.0 billion of annual value from extra innovation.

Implications—Medicare Part D and other public prescription drug programs can be welfare-improving, even for risk-neutral and purely self-interested consumers. Furthermore, negotiation for lower branded drug prices may further increase the social return to the program.

Originality—This study demonstrates that pure efficiency motives, which do not even surface in the policy debate over Medicare Part D, can nearly justify the program on their own merits.

Keywords

Prescription drug insurance; Medicare; Innovation

I. Introduction

Patents encourage innovation by awarding inefficient monopoly power to inventors. This leads to the familiar trade-off between inducing innovation, and ensuring the efficient utilization of invented goods. Public prescription drug insurance provides a way out of this dilemma, because it helps decouple the price consumers pay from the price innovators receive. By subsidizing co-insurance for drugs, public insurance encourages utilization, but without necessarily compromising innovators' prices, profits, and incentives for research. As

*We are grateful to the National Institute on Aging for funding (1R01AG021940). For many helpful comments and suggestions, we thank seminar participants at the 2007 NBER Summer Institute Health Care session.

such, public insurance can simultaneously promote static and dynamic efficiency, which are often at odds (Lakdawalla and Sood, 2009).

The rationale for public drug insurance is typically thought to rely on the social value of insuring against financial risk, and on the value of care provided to the less affluent. However, its static and dynamic efficiency effects imply that public drug insurance is valuable to *risk-neutral, self-interested consumers*. We demonstrate that this point has a considerable impact on the welfare analysis of Medicare Part D. Even though Part D is not a particularly generous insurance plan, we find that it generates an annual value of \$5.1 billion in static deadweight loss reduction, and \$3.0 billion in additional innovation. The total value of \$8.1 billion is approximately 95% of Part D's social cost. Part D nearly breaks even, even ignoring the insurance and altruism aspects of the program typically thought to generate its entire social value.

We begin with some relevant background material, and then present our analysis in three parts. Section III presents a simple theoretical model that demonstrates the welfare effects of Medicare Part D, as well as the approach to calculating them. Section IV uses the theoretical model to quantify the welfare effects of the program.

II. The Medicare Part D Program

Medicare Part D subsidizes the costs of prescription drugs for Medicare beneficiaries and was introduced by the passage of the Medicare Prescription Drug, Improvement, and Modernization Act of 2003 (MMA). Beneficiaries can obtain the Medicare Drug benefit through two types of private plans: beneficiaries can join a Prescription Drug Plan (PDP) for drug coverage only, or they can join a Medicare Advantage plan (MA) that covers prescription drugs (MA-PD). Beneficiaries are required to make premium payments to obtain Part D coverage. However, premiums are highly subsidized. Medicare Part D covers roughly 75% of the costs (Kaiser Family Foundation, 2007, Kaiser Family Foundation, 2008a).

Medicare Part D establishes a standard drug benefit that Part D plans may offer. The standard benefit is defined in terms of the benefit structure and not in terms of the drugs that must be covered. In 2007, this standard benefit requires payment of a \$265 deductible. The beneficiary then pays 25% of the cost of a covered Part D prescription drug up to an initial coverage limit of \$2,400. Once the initial coverage limit is reached, the beneficiary is subject to another deductible, commonly known as the “Donut Hole,” in which they must pay the full cost of drugs. When total out-of-pocket expenses on formulary drugs for the year, including the deductible and initial coinsurance, reach \$3,850, the beneficiary then reaches catastrophic coverage, in which he or she pays a 5% coinsurance. In practice, Part D plans might deviate from this standard benefit but they must offer coverage that is equivalent to or better than the standard benefit in actuarial terms. The law also stipulates that employers sponsoring prescription drug coverage for retirees can receive a federal subsidy if the coverage is at least actuarially equivalent to the standard Medicare drug benefit. Employers would receive a 28% subsidy to their portion of the individual retiree's drug costs between \$250 and \$5,000. Finally, Medicare Part D also provides more generous

insurance and additional subsidies to low-income beneficiaries. Currently, dual-eligible (eligible for both Medicare and Medicaid) beneficiaries constitute the majority of the beneficiaries receiving low income subsidies as they are automatically enrolled in Part D plans (Kaiser Family Foundation, 2008a, Kaiser Family Foundation, 2008b).

One of the most controversial features of the MMA was it did not allow Medicare to negotiate prices directly with pharmaceutical companies. Many critics regard this as poor stewardship of tax dollars, while those in favor argue that price-negotiation could dampen innovation incentives by lowering pharmaceutical profits. While this study does not resolve this controversy, the absence of price-negotiation is relevant insofar as it exerts upward pressure on manufacturer prices, which in turn affects dynamic incentives to innovate.

III. The Welfare Effects of Stand-Alone Public Drug Insurance

In earlier theoretical work, we analyzed more generally the welfare effects of public prescription drug insurance (Lakdawalla and Sood, 2009). In this section, we provide a simpler and more concrete analysis applying these results to the case of Part D, which has static and dynamic effects on welfare. Public prescription drug insurance has the potential to lower deadweight loss and raise monopoly profits simultaneously. It can achieve this outcome by partially decoupling the consumer's price from the revenue earned by the monopolist.

Static Implications

The provision of drug insurance can reduce deadweight loss, because copayments below the monopoly price increase utilization by consumers. Define $D(p)$ as the demand function, $P(Q)$ as inverse demand, MC as the constant marginal cost of production, and p_m as the equilibrium monopoly price. The social surplus generated by competitive provision of the good is given by:

$$SS_c \equiv \left(\int_0^{D(MC)} P(Q) dQ - MC * D(MC) \right) \quad (1)$$

In the absence of insurance, deadweight loss in the branded pharmaceutical market is social surplus under competition, minus social surplus under monopoly:

$$DWL \equiv SS_c - \left(\int_0^{D(p_m)} P(Q) dQ - MC * D(p_m) \right) \quad (2)$$

Now suppose that the government offers prescription drug insurance. Specifically, suppose the government covers the share $(1 - \sigma)$ of the market price, and leaves the consumer with the co-insurance rate σ . If the government continues to pay the monopoly price for pharmaceuticals, the actuarial cost of the insurance is $p_m(1 - \sigma)D(\sigma p_m)$. From a purely static point of view, this cost is simply a transfer from the government to the pharmaceutical industry; later, we incorporate the deadweight cost of public funds, which is so far absent. The welfare effects emerge from the change in quantity induced by this policy.

Of course, Part D could impact the monopoly price charged for pharmaceuticals. The monopolists may exploit the subsidy to consumers and choose to raise prices. In earlier

theoretical work, we characterize the class of benefit designs that ensure efficiency gains from public prescription drug insurance even if the monopolist raises prices in response to drug coverage (Lakdawalla and Sood, 2009). Another possibility is that the government or private plans participating in the benefit may use their newfound monopsony power to negotiate prices downward (Duggan and Scott Morton, 2008). For now, we analyze the welfare effects of the program, given some arbitrary post-Part D monopoly price, p'_m . In the empirical section we calibrate the welfare effects of Part D under alternate assumptions about the price charged by manufacturers.

Deadweight loss is a function of what the public program pays monopolists and offers consumers in terms of co-insurance. This relationship can be expressed as:

$$DWL(p'_m, \sigma) \equiv \left(\int_0^{D(MC)} P(Q) dQ - MC^* D(MC) \right) - \left(\int_0^{D(\sigma p'_m)} P(Q) dQ - MC^* D(\sigma p'_m) \right) \quad (3)$$

Ultimately, what matters for deadweight loss is simply $\sigma p'_m$, the price faced by consumers. The welfare effect of lowering the consumer price — either by lowering the co-insurance or by lowering the price paid to monopolists — is given by:

$$-\frac{dDWL}{d\sigma p'_m} \Big|_{p'_m, \sigma} = D'(\sigma p'_m) (\sigma p'_m - MC) \quad (4)$$

From a static point of view, lowering the price paid by consumers always lowers deadweight loss, as long as $\sigma p'_m > MC$, or that consumers continue to face a price that is at least as large as marginal cost. Empirically, this assumption seems to hold for Medicare Part D. Marginal cost is typically estimated to be 20% of the branded drug price (Caves et al., 1991, Grabowski and Vernon, 1992, Berndt et al., 1996). In contrast, the average coinsurance rate under Medicare Part D is currently about 62%, well above marginal cost.¹

Dynamic Implications

The original intent of Medicare Part D was to provide drug insurance without affecting prices paid to innovators. Earlier, we showed that drug insurance improves static welfare by lowering deadweight loss. We now show that this original aspect of Part D induces more innovation, and increases dynamic social surplus.

Let I denote industry investment in research, and let $g(I)$ denote the probability of discovery with $g'(I) > 0$ and $g''(I) < 0$. In other words, R&D investment raises the probability of new drug discovery, but in a concave fashion. Suppose the innovator enjoys a patent monopoly for T periods after the discovery and will make zero profits thereafter. If the firm discounts the future at the rate r , it invests in research in order to maximize the present value of expected profits:

¹This number was calculated by the authors using the Medical Expenditure Panel Survey (MEPS) data described later. Appendix A presents a formal proof that the anticipated percentage change in co-insurance rate (along with the elasticity of demand) is a sufficient predictor of the change in utilization, even with a nonlinear benefit design.

$$\Pi(I) = g(I) \left[\int_0^T e^{-rt} \pi(\sigma, \mathbf{p}_m) dt \right] - I \quad (5)$$

By the envelope theorem, stand-alone drug insurance raises the expected profits of innovators, because $\frac{d\pi}{d\sigma} > 0$, and will also induce more innovation. The privately optimal level of innovation is given by:

$$g'(I) = \frac{1}{\left[\int_0^T e^{-rt} \pi(\sigma, \mathbf{p}_m) dt \right]} \equiv \frac{1}{\Pi^m(\sigma, \mathbf{p}_m, T)} \quad (6)$$

The marginal product of research is the reciprocal of monopoly profits, Π^m and, by extension, of patent length (Nordhaus, 1969). Therefore, since reductions in co-insurance raise profits, they must also stimulate innovation.

Define $I_{pat}(\Pi^m)$ as the level of investment induced by monopoly profits Π^m . Expected social surplus can be written as:

$$S(T, p_m, \sigma) \equiv g(I_{pat}(\Pi^m)) \left[\int_0^\infty e^{-rt} SS_c dt - \int_0^T e^{-rt} DWL(\sigma \mathbf{p}_m) dt \right] - I_{pat}(\Pi^m) \quad (7)$$

The marginal value of introducing stand-alone drug insurance is given by:

$$S_\sigma|_{\sigma=1} = I_\pi \Pi_\sigma^m \left\{ g'(I) \left[\int_0^\infty e^{-rt} SS_c dt - \int_0^T e^{-rt} DWL(p_m) dt \right] - 1 \right\} + g \left[- \int_0^T e^{-rt} DWL'(p_m) p_m dt \right] < 0 \quad (8)$$

The term in curly braces is strictly greater than unity, because total social surplus from the innovation must be strictly larger than the innovator's profits.² Therefore, the first term is negative. This measures the value of drug insurance as a stimulant to innovation. The second term is negative, because $p_m > MC$, implying that deadweight loss will rise with a higher price. This is the value of insurance in mitigating deadweight loss.

Notice the important presumption that the profits of innovators do not exceed social surplus. Clearly, this condition always holds in a completely private market, even one afflicted by moral hazard in insurance provision (Lakdawalla and Sood, 2006). Intuitively, consumers would never voluntarily pay more than their consumer surplus for a drug in a spot market, and they would never pay more for an insurance policy than the expected value of its covered treatments. Public subsidies for employer-provided health insurance make it theoretically possible that profits could exceed social surplus. However, given the estimated rate of surplus-appropriation by innovators (see the discussion beginning on page 19), this would require extremely large transfers. It is even less likely among the elderly population, where prescription drug insurance was relatively uncommon.³

Another more controversial question concerns whether there is currently too much or too little innovation, or equivalently, how much innovators ought to be able to appropriate. In

²In theory, distortions like subsidies for health insurance could result in profits being higher than social surplus. However, we later document empirical evidence confirming social surplus is larger than profits.

³As of 2003, 60% of the aged (65+) population had no drug insurance, or insurance that was less generous on average than the standard Part D benefit (based on authors' calculations from the Medical Expenditure Panel Survey).

the standard model, innovators ought to appropriate the full value of social surplus, which is impossible in the absence of price-discrimination. Some economists have pointed out that patent races, public subsidies, and other imperfections can alter this result, sometimes substantially. Others have emphasized the extremely low rates of social-surplus appropriation by innovators.⁴

Resolving this controversial question lies beyond the scope of this paper, but we can interpret our analytical results, regardless of whether innovation is too high or too low. If, as in the standard case, innovation is too low, Part D has a direct welfare benefit, without any auxiliary provisions. This is the analysis presented above. If in fact there is *too much* innovation, the direct effects of Part D on innovation reduce social welfare. However, this adds additional value to price-negotiation or similar measures to limit, or even reduce, the profits of innovators. In this case, a Part D program coupled with price-reductions that hold innovator profits constant would be strictly welfare-improving. The rest of the analysis is presented from the point of view of the standard model, that there is too little innovation; the possibility of “over-innovation” is discussed further in the sensitivity analyses of Section IV.

Public Financing and Deadweight Cost

In the analysis above, we abstracted from the costs of public-financing. When prescription drug insurance is wholly or partly financed by the public-sector, the last component of the welfare calculation must be the deadweight cost from public, rather than private, financing.

IV. Calibrating the Welfare Effects

In this section, we calculate—in a “back-of-the-envelope” fashion – the welfare impacts of Medicare Part D. We consider both the static and dynamic benefits of increased drug consumption and the associated increase in pharmaceutical innovation induced by Medicare Part D. We also estimate the social costs of financing this benefit due to deadweight loss from increased taxation. We exclude dual-eligibles from the analysis, because they already receive generous public prescription drug insurance from Medicaid. The introduction of Medicare Part D does not substantially change the generosity of insurance for dual-eligibles; it merely transfers insurance from Medicaid to Medicare Part D.

The net benefits of Part D can be calculated according to the following equation:

$$NB = \text{Enrollees} * (\text{PC Static Benefit}) + (\text{Dynamic Benefit}) - (\text{Deadweight Cost}) \quad (9)$$

In words, the net benefit of the program is equal to: the number of enrollees multiplied by the per capita static benefits to those enrollees, plus the dynamic benefit of the program, minus the deadweight costs of financing. The first term embodies the utilization effects on enrollees, the second the innovation effects, and the third the social cost of funding premiums and employer subsidies. A more detailed exposition of this calibration is provided below.

⁴For contrasting views in the context of pharmaceuticals, see Garber et al., (2006), compared with Philipson and Jena (2006). In a broader context, see Shapiro (2007), compared with Nordhaus (2004).

Part D Enrollees and Non-Enrollees

We need to estimate both the number of enrollees, and the number of non-enrollees eligible for the employer subsidy payment. The latter group affects the financial cost of the program, if not the static welfare benefit. We used data from the 2005 Medical Expenditure Panel Survey (MEPS) and the formularies from the top 5 Medicare Part D insurance plans to estimate these quantities.

Methods—The Medicare Modernization Act classifies an individual's private prescription drug coverage as “creditable” or “non-creditable.” Broadly speaking, “creditable coverage” is private insurance that is actuarially at least as generous as Medicare Part D. Individuals without creditable coverage are required to enroll in Part D within 63 days of being eligible, or face a late enrollment penalty if and when they enroll. Those with creditable coverage are not subject to this penalty provision. Moreover, if a firm provides a Part D-eligible employee with creditable coverage, that firm is entitled to a 28% subsidy on their portion of the individual retiree's drug costs between \$250 and \$5,000.

In our calculations, we assume that there are no costs of switching to Part D. Therefore, everyone without creditable coverage (i.e., less generous than Part D) switches to the program. We also assume that people with creditable coverage refuse to switch.⁵ Evidently, therefore, we need to identify individuals with and without “creditable coverage.” To do so, we use actual prescription drug expenditures observed in the MEPS,⁶ and calculate the average co-insurance rate generated by the individual's current plan (or lack thereof), and the lowest cost option among the top 5 Medicare Part D plans. Those whose average co-insurance rate is lower under Part D are classified as having no creditable coverage, and vice-versa. Appendix A presents a formal proof that the average co-insurance rate is a sufficient predictor of value for an insurance plan, even one with a nonlinear benefit design.

Estimates—Using the MEPS sampling weights we estimate that, excluding dual-eligibles, 36 million beneficiaries would be eligible for Medicare Part D. Next, for each MEPS respondent we then calculate the average coinsurance for prescription drugs under 2 scenarios: (1) their current coverage; or (2) enrollment in most generous among the top 5 Part D plans, described earlier. Based on this analysis, we identify individuals with and without creditable coverage. We estimate that 61% of eligible respondents, or roughly 22 million beneficiaries, have no creditable coverage. We assume all these individuals enroll in Part D.

The remaining 14 million already have more generous insurance compared to the standard Part D benefit and are assumed not to enroll in Part D. Based on information about the source of coverage in MEPS we estimate that roughly 57% of those with creditable

⁵This assumption has less transparent foundations. Clearly, people with very generous coverage fail to switch, but the effects for people with marginally more generous coverage are theoretically unclear. On the one hand, the subsidy of the Part D premium suggests that some may switch to Part D. On the other hand, employers could pass along the subsidy they receive for privately insuring a worker who is still employed, which may fully counteract the value of the premium subsidy. We adopt the simple assumption of no-switching, because it generates results that reasonably match actual enrollment data.

⁶Notice that we calculate the effective co-insurance rate from current spending. This is equivalent to calculating the first-order welfare effect of switching to Part D. Individuals with a positive first-order welfare effect will benefit, and vice-versa.

insurance have it through an employer or union, which would then receive the employer subsidy instituted by Medicare Part D. The remaining 43% of those with creditable insurance have it from other sources such as the Veterans Administration, Indian Health Service and state pharmaceutical assistance programs. The employer subsidy is not paid in these cases. Our estimates are presented in Table 1.

As a validity check, we compared our enrollment estimates to the actual enrollment rates reported by the Department of Health and Human Services (HHS), also shown in Table 1. The HHS estimates show that, as of January 2007, and excluding dual-eligibles, 36 million beneficiaries were eligible for Medicare Part D. Of these, 21 million were estimated to have no creditable coverage prior to Part D.⁷ The remaining 15 million had creditable coverage from employer/union or from other sources such as Veterans Administration, Indian Health Service and state pharmaceutical assistance programs (Kaiser Family Foundation, 2007). These numbers are quite similar to the estimates we derived from analysis of the MEPS.

Static Benefits

The next step is to compute the static benefit enjoyed by enrollees in Part D. For both static and dynamic benefits, prices and expenditures are for branded drugs only, due to the lack of monopoly power in generic drugs. Using a linear approximation to demand, the benefit associated with a particular change in price and quantity for branded drugs is simply the reduction in the size of deadweight loss “triangle,” or

$$\frac{1}{2} (p_{nd} - mc) (q_{nd} - q_c) - abs \left(\frac{1}{2} (p_d - mc) (q_d - q_c) \right).$$

In this expression, p_{nd} is the price of drugs without Part D, mc is the marginal cost of producing drugs, p_d is the price of drugs under Part D, q_c is the quantity of drugs consumed under perfect competition, q_{nd} is the quantity of drugs without Part D, and q_d is the quantity of drugs consumed with Part D. Overall, this yields the new level of the deadweight loss triangle subtracted from the original level of dead weight loss. This benefit can be equivalently written using the anticipated percentage changes in price and quantity, along with the elasticity of demand. Appendix A derives the formal conditions under which the anticipated percentage change in co-insurance rate and elasticity of demand are sufficient predictors of the change in utilization, even with a nonlinear benefit design.

Assuming that the price paid to the manufacturer does not change, some simple algebra yields the equivalent formulation of the static benefit for an enrolling consumer⁸:

⁷Of the 21 million beneficiaries, 17 million enrolled in Part D and the remaining 4 million continued to have no creditable coverage. We assume that, over the long-run, these remaining 4 million respondents will switch into the more generous coverage afforded by the Part D program. If not, this incomplete take-up rate would lower the welfare benefits of the program.

⁸The baseline simulation assumes that prices do not change. The policy simulations section presented later considers the welfare effects of changing manufacturer prices.

$$\begin{aligned}
SB = & \frac{1}{2} (\sigma_{ND} - MC) (Expenditures_c - Expenditures_{ND}) \\
& - abs \left(\frac{1}{2} (\sigma_D - MC) \right. \\
& \left. * \left(\left(\left[\frac{(\sigma_{ND} - \sigma_D)}{\sigma_{ND}} e \right] + 1 \right) (Expenditures_{ND}) - Expenditures_c \right) \right) \quad (10)
\end{aligned}$$

The terms σ_D and σ_{ND} are the average share of price paid by the consumer with and without Part D, respectively. $Expenditures_{ND}$ measures expenditures under the status quo; $Expenditures_c$ measures them under perfect competition. The term e is the elasticity of demand. To calculate the static welfare impact of Medicare Part D, we need empirical estimates of: (1) The percentage change in branded drug price to the consumer induced by Medicare Part D, (2) the elasticity of demand for prescription drugs, and (3) the expenditures on branded prescription drugs, (4) the marginal cost of production, (5) expenditures under perfect competition.

Percentage Change in Price—We calculate the percentage price change that enrolling consumers would enjoy if they took up the program by computing — for each elderly consumer in MEPS — the difference in average coinsurance between: (1) status quo insurance, and (2) the most generous of the top 5 Part D insurance plans. We calculate this percentage change in price for each MEPS respondent estimated not to have creditable coverage. Respondents with creditable coverage are assumed not to enroll in Part D and thus experience no change in price. Based on these calculations the average percentage change in coinsurance for branded drugs for those without creditable coverage due to the standard Medicare Part D benefit was estimated to be 25%.

Price Elasticity of Demand—Long-run generic prices (assumed to be equal to marginal cost) are approximately 20% of the prices charged for the corresponding on-patent drug (Caves et al., 1991, Grabowski and Vernon, 1992, Berndt et al., 1996). Thus we assume that the monopoly mark-up over marginal cost is 400%. The standard theory of monopoly would then imply a price elasticity of uninsured demand around 1.25, or $\frac{1}{1-0.2}$. However, the above elasticity is not the relevant one for insured patients who face copayments, rather than manufacturer prices (Chandra et al., 2007). Thus, for the insured consumers we use elasticity estimates that rely on changes in patient cost sharing among the insured elderly population. For example, Chandra et al. (2007) estimate the price elasticity of prescription drugs among the elderly by studying a policy change that raised patient cost-sharing for retired public employees in California. Their estimates of price elasticity range from 0.5 to 1.5; these elasticities do not vary significantly by age, income, or health status. We take the midpoint of their range, and assume that the price elasticity is 1.0 among the insured elderly population. Based on these estimates of the elasticity of demand and percentage change in price, the average percentage change in number of prescriptions for those without creditable coverage was estimated to be 29%.

Out-of-Pocket Costs—The out-of-pocket costs of purchasing branded drugs are available directly from MEPS. For those without creditable coverage, expenditures are estimated to be \$1,190.

Results—Based on these estimates, we estimate the aggregate static benefit of Medicare Part D to be \$5.11 billion or \$236 per eligible beneficiary. There is wide variation in the per capita benefit enjoyed by beneficiaries depending on insurance coverage, or lack thereof, prior to the introduction of Medicare Part D. Since private insurance coverage is highly correlated with income, the poor enjoy greater benefits than the rich. For example, we estimate the per capita benefits to be \$270 for those with incomes less than \$15,000 per year, \$207 for those with income between 15,000 and 50,000, and \$222 for those with incomes greater than \$50,000. Similarly, beneficiaries in poor self-reported health and those with higher prescription drug costs also enjoy greater benefits. Those reporting their general health to be “poor” enjoy per capita benefits of \$394, those reporting “good” health enjoy per capita benefits of \$247 and those reporting “excellent” health only receive \$157 in per capita benefits.

Dynamic Benefits

Since Medicare Part D likely increases pharmaceutical company profits, it has the dynamic benefit of inducing additional innovation. We can estimate the value of this induced innovation just as we estimated the static value of the program.⁹ First, we maintain the assumption (inherent in the original MMA legislation) that Part D continues to forbid price-negotiation, and that pharmaceutical firms will continue to receive the monopoly prices set before Medicare Part D (p_m). However, firms do experience an increase in demand for their products due to the reduction in price for consumers after the introduction of Medicare Part D.

Step 1: Change in Pharmaceutical Revenues

For a given consumer, the percentage change in total drug expenditures is equal to the percentage increase in the quantity of drugs consumed, $\frac{(\sigma_{ND} - \sigma_D)}{\sigma_{ND}}e$, which is calculated as above. Assuming manufacturer prices have so far been unaffected by Part D, the percentage change in quantity is equal to the percentage change in revenues for innovators. The average percentage change in price for all eligible beneficiaries was estimated to be 25%. This estimate combined with the elasticity estimates, also discussed earlier, implies an increase in drug expenditures of \$9 billion, or 6% of branded revenues.

Duggan and Scott-Morton (2008) find an increase of 33% for branded pharmaceutical revenues for drugs with 100% Medicare market share. Translated using MEPS estimates of the share of branded revenues from Medicare Part D recipients (19.7%), this would be a 6.5% increase in the revenue of branded drugs overall. Our estimate is thus quite close to, if slightly smaller than, the Duggan and Scott-Morton estimate. Lichtenberg and Sun (2007) find an increase in expenditures from Medicare part D of \$9 billion (5.5% of branded drug revenues) using a differences in differences approach utilizing data from a retail pharmacy chain. Yin et al (2008) also find smaller effects on utilization than in our baseline, again using data from a pharmacy chain, they find a reduction in price of 17% (as compared with

⁹We are proceeding under the standard assumption that there is too little innovation, because innovators cannot capture full social surplus. In our sensitivity analysis, we discuss how to interpret our results if in fact there is over-innovation in the status quo.

25% in our estimation). Our estimation may be higher than these two estimates, because we assign enrollees to their best plan, thereby giving them the lowest possible price.

Step 2: Creation of New Chemical Entities

The increase in pharmaceutical revenue will induce more R&D and innovation. The number of new drug introductions induced by Part D will depend on the elasticity of new drug introductions with respect to pharmaceutical revenues. Acemoglu and Linn (2004) estimate that the elasticity of non-generic drug approvals with respect to revenues is roughly 3.5. We use this elasticity and the estimate of change in pharmaceutical revenues to calculate the percentage change in the number of new chemical entities (NCEs). This estimate is consistent with Blume-Kohout and Sood (2009) who estimate the effects of Medicare Part D on pharmaceutical R&D. The baseline rate of NCE introduction is assumed to be 32 NCEs per year. This is the average number of NCEs introduced per year during the period 1995 to 2004 as reported in the FDA Orange Book. Applying the estimated percentage change to this baseline level yields the absolute number of new drugs projected from the passage of Part D.

Step 3: Innovator's Private Value of New Chemical Entities

The next step is to compute the annual private value of these additional drugs to their innovators. In general, it is quite difficult to compute the expected value of the *marginal* drug directly, because it is hard to identify the marginal drug and just as hard to identify *expected* value. However, it is easier to calculate the actual marginal cost of bringing an additional drug to market. Theory suggests that this marginal cost ought to be equal to the expected marginal private value of an additional drug; Grabowski et al (2002) provide empirical evidence that the theory is consistent with the data in the pharmaceutical industry. Di Masi et al. (2003) estimate that the marginal research and development cost of bringing an NCE to market is \$939 million in 2005 dollars. To annualize this cost, we use a standard empirical estimate of the annual cost of capital in the pharmaceutical industry, of 12% per year, calculated from annual estimated costs of capital in the pharmaceutical industry (<http://pages.stern.nyu.edu/~adamodar/>). This estimated cost is similar to estimates of private rates of return on R&D investments in the pharmaceutical industry (Grabowski et al., 2002). Therefore, the annualized marginal cost of bringing an NCE to market is expected to be $(0.12) * (\$939\text{m}) = \113 million. This then yields our estimate of the annualized marginal expected private benefit.

Step 4: Marginal Social Value of New Chemical Entities

The last step is to infer the marginal social value, which theory predicts will exceed the private value to the innovator (although see the caveat in footnote 9). To estimate the social return, we must estimate the fraction of social surplus captured by the innovator. Several estimates are available from the literature. Based on data from 1948 to 2001, for example, Nordhaus (2004) estimates that innovators capture just 2.2% of the total present value of social returns to innovation. In a pharmaceutical context, Philipson and Jena (2006) use data from over 200 published studies of healthcare innovations to estimate the distribution of surplus-appropriation by innovators. They find that the median producer share of social

surplus is 17%, the first quartile is roughly 10% and the third quartile is roughly 25%. To be conservative, we assume that innovators are able to capture as much as a quarter of the social surplus from pharmaceutical innovation. This parameter yields an estimated social rate of return on pharmaceutical R&D investments of 48% per year, four times the estimated private return. This suggests that the annual social value of the marginal drug is equal to $(\$113 \text{ million})/(0.25) = \452 million .

This approach presumes that innovators should capture the full social value of their inventions. As discussed in Section III, there exists a great deal of controversy about this issue. The impact of this assumption on our results is discussed in our sensitivity analysis, later in this section.

Gross Static and Dynamic Benefit of Part D—Using the methods described in Step 1 we estimate that Medicare Part D would increase pharmaceutical sales by \$9 billion per year. Given baseline branded pharmaceutical sales of \$162 billion in the U.S. in 2005 (as estimated in MEPS), this corresponds to a 6% increase. The 3.5 innovation elasticity from Acemoglu and Linn (2004) then implies that the number of new drugs per year would increase by roughly 21%, or 6.6 NCEs. Earlier, we calculated an annual social value of \$452 million for the marginal additional drug, which yields a gross dynamic benefit of \$3.0 billion annually. Combining the dynamic with the static benefit yields a gross risk-neutral welfare benefit for Medicare Part D of \$8.1 billion annually.

Deadweight Costs of Financing Medicare Part D

It remains to compare the aggregate benefits of Part D with its social cost. The program itself is just a costless transfer. However, since it is publicly financed, there are deadweight costs associated with its financing.

The actuarial cost of the Medicare Part D insurance for a beneficiary who enrolls in the standard Part D plan is simply:

$$s \left[Total_Exp (1 - \sigma_D) + (1 - \sigma_D) Total_Exp \frac{(\sigma_{ND} - \sigma_D)}{\sigma_{ND}} e \right] \quad (11)$$

s is the subsidy provided by Medicare Part D and is estimated to be 75%. The first term in the square brackets is the actuarial cost of the benefit under the initial demand for pharmaceuticals and is simply the total cost of prescription drugs times the plan share of costs. The second term is the actuarial cost of the additional demand induced by Medicare Part D and is equal to the change in total drug costs times the plan share of costs. As

discussed earlier, the percentage change in total drug costs, $\frac{(\sigma_{ND} - \sigma_D)}{\sigma_{ND}} e$, is simply the percentage change in price to consumers induced by Part D times the elasticity of demand. All the above quantities can be easily estimated from available data. Using data from the MEPS, we estimate average costs of covered drugs (both branded and generic) for MEPS respondents without creditable coverage who are likely to enroll in Medicare Part D to be \$1,520. As discussed earlier, we can also calculate the price change consumers would enjoy if they took up the program; price-elasticities of demand for pharmaceuticals (taken from the

literature) then imply the associated increase in drug costs. Similarly, the costs of providing the employer subsidy (28% of costs between \$250 and \$5,000) can be estimated easily using data on prescription drug expenditures for those with creditable employer/union provided insurance. The results show that for those receiving the premium subsidy, Medicare costs are \$1,109 per enrollee and for those receiving the employer subsidy, Medicare costs are \$546 per enrollee.

The true social cost of the program is the deadweight cost associated with paying the actuarial cost out of public funds. While there is debate in the public finance literature on the magnitude of deadweight loss, we use a conventional estimate — that each additional dollar spent on Medicare Part D generates 30 cents of deadweight costs due to increased taxation (Jorgenson and Yun, 2001).

Based on these estimates, we estimate the deadweight costs of financing Medicare Part D to be \$8.5 billion per year, 95% of which is covered by the risk-neutral benefits of the program. This analysis reveals that conventional estimates of demand, dynamic benefit, and deadweight loss yield the surprising result that Part D insurance is nearly “break-even” for a society of risk-neutral and self-interested consumers. The baseline estimates for static and dynamic benefits, as well as deadweight costs, are summarized in Table 2.

Sensitivity Analysis

We perform two sets of sensitivity analyses. Figure 1 shows the effect of changing the assumption on the elasticity of innovation. This assumption only has an effect on the dynamic benefit, not on static benefit or social cost. Increasing the elasticity of innovation proportionately increases the number of new drugs for a given change in revenues, and through this mechanism the dynamic benefit. The estimates show that even if we assume a very conservative elasticity of innovation of 1, the benefits of Part D are sizeable and would cover 70% of the social costs of the program. However, note that if the optimal reward for innovation is lower than social surplus, increases in manufacturer revenues may even be welfare-reducing from a dynamic point of view. In this case, a program that holds manufacturer revenues fixed – for instance, through government price-negotiation -- while reducing consumer copays, would be optimal (Lakdawalla and Sood, 2009).

In Table 3 we perform a sensitivity analysis on the elasticity of demand for drugs for the insured. We estimate the social benefits and costs of the program using estimates of the demand elasticity for the insured from -0.2 to -1.5 , a slightly wider range than estimated by range consistent with Goldman et al. (2007) and Chandra et al. (2007). Reducing the elasticity of demand reduces the effect of Medicare Part D's change on prices on the quantity of drugs consumed. For example, reducing the elasticity of demand from -1.25 to -0.2 reduces the percentage change in drugs from 31% to 21%. This change is smaller than one might expect because only the elasticity of insured users is altered, the elasticity for the uninsured remains at -1.25 . This in turn reduces the static benefit, dynamic benefit (through lower revenues) and program costs. The overall benefit of the program is relatively stable under the alternative parameter estimates, with changes in program costs largely off-setting changes in static and dynamic benefits.

V. Policy Simulations

The discussion above takes a very conservative view of the welfare benefits associated with Part D. It is useful to consider some commonly proposed Part D reforms from this perspective, which emphasizes just static deadweight loss and dynamic incentives to innovate. We consider reductions in consumer cost-sharing requirements, as well as changes in the prices paid to producers. The latter might occur if the government were to alter its stance on price-negotiation by the Part D program.

Changes in Consumer Prices

In Table 4 we consider a publicly financed reduction in copayment or coinsurance for Part D beneficiaries. We assume that the government mandates lower copayment or coinsurance rates, and finances 100% of the marginal cost associated with this reduction.

In this simulation, we reduce or increase the present formularies copays (or co-insurance depending on the formulary) by particular percentages. Thus, in the simulation where we change reduce copays by -50%, we would take a \$5 copayment and make it \$2.50. Similarly, if the co-insurance rate had previously been 25%, we make it 12.5% under this scenario. Then, using these adjusted formularies we assign to each person their optimal plan. Overall, reducing consumer prices yields higher static and dynamic benefits. Consider reducing copays by 50%, as compared with the baseline estimate, which in this case is a change of 0%. This reduction in consumer price entices an additional 3 million people (25 million versus 22 million) to enroll in Medicare Part D. Reducing copayment or coinsurance also results in a much larger average price change, of 40%, and a corresponding increase in the average change in quantity of 44%. Through increases in quantity and plan participation reducing the copayment by 50% increases the static benefit from \$5.1 to 6.0 billion. The same mechanism also increases the change in pharmaceutical revenues (from \$9.4 billion to \$13.7 billion), resulting in a change in the dynamic benefit of \$1.35 billion (\$4.3 billion – \$3.0 billion). However, this reduction in price is not free. The social cost of the program (from increased usage and lower prices) increases from a baseline of \$8.5 to \$11.2 billion under this scenario. The benefit cost ratio was 95% under the baseline scenario, and is only 93% when copays are reduced by 50%. Reductions in consumer prices of this form generally decrease the net social return of the program as the increase in social costs of financing the program more than outweigh the increase in static and dynamic benefits. The reason is that reducing copays also increases the use of generics that do not add to the static or dynamic benefits of the program.

Changing Producer Prices

Finally, we simulate the effect of changing producer prices for branded drugs, and through this consumer prices (Table 5). As prices increase, Medicare Part-D becomes less attractive. A 25% increase in the price paid to manufacturers of drugs in Medicare Part D is associated with a reduction of 2 million enrollees (from 22 million to 20 million). Increasing prices paid to manufacturers also means that consumers pay higher prices when they are in the donut hole or when they face co-insurance. A 25% increase in price to the manufacturer implies that Medicare Part D only reduces prices for consumers by 18%, consequently

increasing utilization by only 21%. This reduction in the quantity also changes the dynamic benefit. While there is a decrease in the quantity demanded, the price paid for these drugs increases, resulting in a small reduction in the dynamic benefit of \$0.15 billion. Similarly, program costs remain largely unchanged (a change of \$0.22 billion) as the increase in price is offset by reduced enrollment in the program. The net effect of increasing the producer price by 25% is a change in the benefit cost ratio from 95% to 85%. Similarly, were producer prices on brand name drugs to decrease by 25%, the benefit-cost ratio would increase from 95% to 111%. This suggests that some level of price negotiation on behalf of Part D may be welfare enhancing.

VI. Conclusion

The static benefits of Part D could be considerable. While controversy exists surrounding the relative efficiency of dynamic investments in pharmaceutical innovation; it remains possible that the dynamic benefits are equally important. Regardless, our exercise demonstrates that the net social value of Part D extends well beyond the usual calculus of altruism and insurance that is typically associated with Medicare and other public health insurance schemes.

In the design of the benefit, a great deal of attention was paid to traditional “insurance” issues of adverse selection and moral hazard, but less effort was devoted to understanding the risk-neutral efficiency effects on utilization and innovation. Our analysis suggests that these might be quite important. In particular, any evaluation of alternate benefit design or price negotiations with manufacturers should take into account its effect on deadweight loss from monopoly and innovation. At a minimum, the economic case for Part D appears quite a bit broader and more complex than it may initially appear.

Appendix A

Consider a health insurance plan that has a deductible of X dollars and offers a coinsurance of c for expenditures above the deductible. Consider an uninsured consumer with total expenditure E_1 , where $E_1 > X$. Assume that the elasticity of demand is e .

The objective is to predict total expenditures, E_2 , for this consumer when he or she enrolls in the health insurance plan with this non-linear benefit structure. First, note that the change in expenditures is the same as the change in quantity, because we assume prices paid to the manufacturer do not change. The consumer price does change, and it does so in a non-linear fashion, because it depends on the level of expenditures. Following the standard theory of demand, total expenditure when the consumer enrolls in this health insurance plan is given by:

$$E_2 = X + (E_1 - X) + (E_1 - X)(1 - c)e$$

The above equation shows that for the first X dollars in expenditures there is no change in demand as the consumer is below his or her deductible and therefore does not experience any change in price. For the next $E_1 - X$ dollars the consumer faces a percentage price

reduction of $1-c$. Therefore, the percentage change in demand or expenditures for this region is simply the percentage change in price times the elasticity of demand.

In the paper, we argue that the percentage change in coinsurance and elasticity of demand are sufficient predictors of the percentage change in utilization. In other words, we argue that the percentage change in total expenditures in this scenario can also be calculated by simply multiplying the percentage change in coinsurance times the elasticity of demand. Calculated this way, expenditures when the consumer enrolls in the health plan are given by:

$$E'_2 = E_1 + E_1 e \left(\frac{1 - \bar{c}}{1} \right)$$

Where $\bar{c}$ is the average coinsurance when enrolled in the health plan?

$$\bar{c} = \frac{X + c(E_1 - X)}{E_1}$$

After substituting for $\bar{c}$ in the above equation, some simple algebra yields:

$$E'_2 = X + (E_1 - X) + (E_1 - X)(1 - c)e$$

Hence, we get that $E'_2 = E_2$.

A corollary of the above result is that the percentage change in coinsurance is a sufficient predictor of whether the consumer would benefit from insurance. A negative percentage change in average coinsurance or decrease in coinsurance implies an increase in use and thus an increase in static welfare.

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Figure 1. Sensitivity to Elasticity of Innovation

Notes: Estimation of the sensitivity of baseline estimates of the welfare effects of Medicare Part D to changes in the elasticity of innovation using 2005 MEPS data. The elasticity of innovation has no effect on present consumption of drugs, and thus has no effect on the static benefit or social cost of the program. The elasticity of innovation changes the number of new drugs associated with a particular change in branded drug revenues and through this the dynamic benefit. 3.54 (from Acemoglu and Lin (2004)) represents our baseline scenario.

Table 1

Prescription Drug Coverage Sources Among Medicare Beneficiaries

	HHS Estimates		MEPS Estimates	
	Population (mil)	Percent	Population (mil)	Percent
Coverage Type				
Enrolled/No Creditable				
Coverage	21	59%	22	61%
Creditable Employer Coverage	10	28%	8	21%
Others with Creditable				
Coverage	5	13%	6	18%
Total	36	100%	36	100%

Table 2**Baseline Estimates of Benefits and Costs of Medicare Part D**

Description	Value
Plan Participation	
No Creditable Coverage (millions of people)	21.7
Creditable Employer Coverage (millions of people)	7.7
Other Creditable Coverage (millions of people)	6.4
Total (millions of people)	35.8
Static Benefit	
Change in Price for Enrollees (%)	25%
Change in Quantity for Enrollees (%)	29%
Branded OOP Expenditures – Enrollees Pre-Part D (\$s)	958
Branded Drug Expenditures – Enrollees Pre-Part D (\$s)	1190
Static Benefit Per Enrollee (\$s)	236
Total Static benefit (\$ billions)	5.11
Dynamic Benefit	
Change in Branded Drug Revenues (\$ billions)	9.42
Change in Branded Drug Revenues (%)	5.81%
Change in Number of New Drugs (%)	21%
Number of New Drugs	6.58
Private Return per New Drug (\$ millions)	113
Social Return per New Drug (\$ millions)	451
Total Dynamic Benefit (\$ billions)	2.97
Social Cost	
Average Covered Drug Expenditures for Enrollees Pre-Part D (\$)	1520
Change in Quantity for Enrollees (%)	61%
Actuarial Cost of Part D Benefit (\$ billions)	24.06
Costs of Employer Subsidy (\$ billions)	4.19
Total Costs of Part D Insurance and Employer Subsidy (\$ billions)	28.25
Dead Weight Costs of Part D Insurance and Employer Subsidy (\$ billions)	8.48
Ratio of Social Benefit to Cost of Medicare Part D	0.95

Notes: Baseline estimate of the welfare benefits and costs of Medicare Part D using 2005 MEPS data.

Table 3

Sensitivity to Demand Elasticity

Demand Elasticity	−0.20	−0.50	−0.75	−1.00	−1.25	−1.50
Plan Participation						
No Creditable Coverage (millions of people)	22	22	22	22	22	22
Static Benefit						
Change in Price for Enrollees (%)	25%	25%	25%	25%	25%	25%
Change in Quantity for Enrollees (%)	21%	24%	26%	29%	31%	33%
Branded OOP Expenditures – Enrollees Pre-Part D (\$s)	958	958	958	958	958	958
Branded Drug Expenditures – Enrollees Pre-Part D (\$s)	1190	1190	1190	1190	1190	1190
Static Benefit Per Enrollee (\$s)	224	228	232	236	240	243
Total Static benefit (\$ billions)	4.86	4.95	5.03	5.11	5.19	5.27
Dynamic Benefit						
Change in Branded Drug Revenues (\$ billions)	5.51	6.98	8.20	9.42	10.64	11.85
Change in Branded Drug Revenues (%)	3.40%	4.31%	5.06%	5.81%	6.56%	7.32%
Change in Number of New Drugs (%)	12%	15%	18%	21%	23%	26%
Number of New Drugs	3.85	4.88	5.73	6.58	7.44	8.29
Private Return per New Drug (\$ millions)	113	113	113	113	113	113
Social Return per New Drug (\$ millions)	451	451	451	451	451	451
Total Dynamic Benefit (\$ billions)	1.74	2.20	2.58	2.97	3.35	3.74
Social Cost						
Average Covered Drug Expenditures for Enrollees Pre-Part D (\$)	1520	1520	1520	1520	1520	1520
Change in Quantity for Enrollees (%)	32%	43%	52%	61%	70%	79%
Actuarial Cost of Part D Benefit (\$ billions)	19.66	21.31	22.69	24.06	25.44	26.81
Costs of Employer Subsidy (\$ billions)	4.19	4.19	4.19	4.19	4.19	4.19
Total Costs of Part D Insurance and Employer Subsidy (\$ billions)	23.85	25.50	26.88	28.25	29.63	31.00
Dead Weight Costs of Part D Insurance and Employer Subsidy (\$ billions)	7.16	7.65	8.06	8.48	8.89	9.30
Ratio of Social Benefit to Cost of Medicare Part D	0.92	0.93	0.94	0.95	0.96	0.97

Notes: Estimation of the sensitivity of baseline estimates of the welfare effects of Medicare Part D to changes in the elasticity of demand for the insured using 2005 MEPS data. The elasticity of demand effects the change in drugs consumed for the price change given in Medicare Part D. This change in consumption alters the static benefit, dynamic benefit, and social cost. −1.00 represents the baseline scenario.

Table 4**Simulation of Changes in Copayment or Coinsurance**

Percentage Change in Copayment or Coinsurance	–75%	–0.50%	–0.25%	0%	25%	50%	75%
Plan Participation							
No Creditable Coverage (millions of people)	26	25	23	22	20	19	18
Creditable Employer Coverage (millions of people)	5	6	7	8	8	9	10
Other Creditable Coverage (millions of people)	5	6	6	6	7	7	8
Total (millions of people)	36	36	36	36	36	36	36
Static Benefit							
Change in Price for Enrollees (%)	51%	40%	32%	25%	19%	12%	6%
Change in Quantity for Enrollees (%)	55%	44%	36%	29%	23%	16%	9%
Branded OOP Expenditures – Enrollees Pre-Part D (\$)	878	900	927	958	974	994	1005
Branded Drug Expenditures – Enrollees Pre-Part D (\$)	1219	1213	1191	1190	1166	1162	1156
Static Benefit Per Enrollee (\$)	245	245	245	236	226	209	186
Total Static benefit (\$ billions)	6.33	6.04	5.64	5.11	4.63	4.05	3.42
Dynamic Benefit							
Change in Branded Drug Revenues (\$ billions)	16.73	13.71	11.34	9.42	8.09	6.69	5.38
Change in Branded Drug Revenues (%)	10.32%	8.46%	7.00%	5.81%	5.00%	4.13%	3.32%
Change in Number of New Drugs (%)	37%	30%	25%	21%	18%	15%	12%
Number of New Drugs	11.70	9.59	7.93	6.58	5.66	4.68	3.76
Private Return per New Drug (\$ millions)	113	113	113	113	113	113	113
Social Return per New Drug (\$ millions)	451	451	451	451	451	451	451
Total Dynamic Benefit (\$ billions)	5.27	4.32	3.58	2.97	2.55	2.11	1.70
Social Cost							
Average Covered Drug Expenditures for Enrollees Pre-Part D (\$)	1516	1517	1510	1520	1504	1507	1505
Change in Quantity for Enrollees (%)	74%	68%	64%	61%	58%	55%	53%
Actuarial Cost of Part D Benefit (\$ billions)	39.56	33.68	28.26	24.06	20.33	17.34	14.80
Costs of Employer Subsidy (\$ billions)	3.21	3.47	3.92	4.19	4.46	4.72	4.84
Total Costs of Part D Insurance and Employer Subsidy (\$ billions)	42.77	37.15	32.18	28.25	24.79	22.06	19.63
Dead Weight Costs of Part D Insurance and Employer Subsidy (\$ billions)	12.83	11.15	9.66	8.48	7.44	6.62	5.89
Ratio of Social Benefit to Cost of Medicare Part D	0.90	0.93	0.95	0.95	0.97	0.93	0.87

Notes: Estimation of the effect of changing co-copays on the welfare effects of Medicare Part D using 2005 MEPS data. Reducing the co-pays for prescription drugs makes Medicare Part D more attractive to more people, increasing enrollment. It also reduces the prices people pay, increasing the quantity of drugs demanded. These two effects lead to changes in the static benefit, dynamic benefit, and social cost of the program. 0% represents the baseline scenario.

Table 5**Changes to Producer Branded Drug Prices**

Percent of Original Price	150%	125%	100%	75%	50%
Plan Participation					
No Creditable Coverage (millions of people)	18	20	22	24	26
Creditable Employer Coverage (millions of people)	10	9	8	6	5
Other Creditable Coverage (millions of people)	8	7	6	6	5
Total (millions of people)	36	36	36	36	36
Static Benefit					
Change in Price for Enrollees (%)	11%	18%	25%	34%	44%
Change in Quantity for Enrollees (%)	14%	21%	29%	38%	48%
Branded OOP Expenditures – Enrollees Pre-Part D (\$s)	930	950	958	952	927
Branded Drug Expenditures – Enrollees Pre-Part D (\$s)	1071	1134	1190	1269	1351
Static Benefit Per Enrollee (\$s)	159	198	236	271	284
Total Static benefit (\$ billions)	2.92	3.94	5.11	6.45	7.45
Dynamic Benefit					
Change in Branded Drug Revenues (\$ billions)	8.58	8.95	9.42	11.13	14.64
Change in Branded Drug Revenues (%)	5.29%	5.52%	5.81%	6.87%	9.04%
Change in Number of New Drugs (%)	19%	20%	21%	24%	32%
Number of New Drugs	6.00	6.26	6.58	7.78	10.24
Private Return per New Drug (\$ millions)	113	113	113	113	113
Social Return per New Drug (\$ millions)	451	451	451	451	451
Total Dynamic Benefit (\$ billions)	2.70	2.82	2.97	3.51	4.62
Social Cost					
Average Covered Drug Expenditures for Enrollees Pre-Part D (\$)	1876	1713	1520	1309	1061
Change in Quantity for Enrollees (%)	55%	57%	61%	65%	70%
Actuarial Cost of Part D Benefit (\$ billions)	19.58	21.83	24.06	26.41	27.45
Costs of Employer Subsidy (\$ billions)	5.00	4.67	4.19	3.49	2.17
Total Costs of Part D Insurance and Employer Subsidy (\$ billions)	24.57	26.50	28.25	29.91	29.62
Dead Weight Costs of Part D Insurance and Employer Subsidy (\$ billions)	7.37	7.95	8.48	8.97	8.89
Net Social Benefit of Medicare Part D	0.76	0.85	0.95	1.11	1.36

Notes: Simulation of the effect of changing producer prices on the welfare effects of Medicare Part D using 2005 MEPS data. Under this scenario, there changing producer prices changes consumer prices, enrollment, and drug revenues and thus the static and dynamic benefits, but this also changes the social cost of the program. 100% represents the baseline scenario