Static and Dynamic Incentives in Selection Markets *

Juan Pablo Atal[†] Eduardo Azevedo[‡] Sebastian Fleitas[§]

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Abstract

We study the optimal combination of static and dynamic incentives in community-rated markets. We use a simple two-period model to derive general lessons. Overall, under worsening health, prices are generally increasing over time, pointing to the desirability of dynamic (late-enrollment) penalties as used in markets like Medicare Part D. However, the desirability of dynamic incentives is reduced when consumers fail to internalize them due to a lack of understanding or forward-looking behavior. To provide policy lessons, we calibrate a multiple-period version our model to the context of Medicare Part D. Under our preferred assumptions, the optimal late enrollment penalty in Medicare Part D is positive but lower than the level currently set by the regulation

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*We would like to thank Hanming Fang, Igal Hendel and seminar participants at the University of Pennsylvania, Northwestern University and UW Madison for helpful comments and suggestions. [†]Department of Economics, University of Pennsylvania. Email: ataljp@econ.upenn.edu. [‡]The Wharton School, University of Pennsylvania. Email: eazevedo@wharton.upenn.edu. [§]KU Leuven: sebastian.fleitas@kuleuven.be.

1 Introduction

Limiting insurers' ability to price discriminate is an increasingly popular policy tool in US health insurance markets. By 2016, almost 100M US individuals bought health insurance from a private insurer not allowed to price discriminate or to reject applicants, up from 20 million in 2003 (Geruso and Layton, 2017). Although premium rating restrictions may be justified on the grounds of fairness or by their ability to reduce premium uncertainty over the lifecycle ("reclassification risk"), they introduce information asymmetries leading to adverse selection and potential market unraveling (Akerlof, 1970). As such, premium restrictions are normally compounded with other policies aimed at mitigating adverse selection, like subsidies for enrollment, and/or penalties for uninsurance or delayed enrollment.

In practice, regulators have opted for different combinations of these policies in different contexts. As an example, while the individual market created by the Affordable Care Act originally featured subsidies and penalties for non-enrollment, Medicare Part-D features subsidies as well as penalties for individuals who postpone enrollment, just like in private health insurance markets in Australia and Ireland. Although there is a vast literature analyzing in isolation the different policy options to mitigate adverse selection, little is known about when should different policy options be used and whether a combination of policies is preferable to a single one.

In this paper, we study what is the optimal combination of static and dynamic financial incentives in community-rated markets. We start by deriving optimality conditions for community-rated prices —which include premiums as well as potential subsidies and penalties— in a simple but general two-period model for insurance demand. In the model, the health risk is heterogeneous and evolves stochastically over time, and individuals face the option of either enrolling in an insurance plan or delaying enrollment. An individual who enrolls immediately gains insurance coverage at the cost of paying a (potentially subsidized) premium and preserves the option to stay covered in the future at a non-penalized premium. In contrast, an individual who delays enrollment pays no premium but has no insurance

coverage, and faces a premium penalty if he or she enrolls in the future.

The model allows us to derive conditions for the optimal path of community-rated premiums. It highlights that, in the absence of selection, the optimal path of premiums is likely increasing the same way as quantity discounts are optimal Maskin and Riley (1984). Moreover, evolving health status generates differential selection and price sensitivity over time, which generally reinforces the desirability of an increasing priced schedule.

A central aspect of the workings of dynamic incentives is the degree to which individuals consider the option value of cheaper future enrollment created by them. Our model highlights that the lack of forward-looking behavior reduces the desirability of dynamic incentives. When individuals do not internalize the incentives created by increasing prices (e.g. those of late enrollment penalties) these do not help in curbing adverse selection. Moreover, in this case, dynamic penalties can generate an undesirable *lock-out* effect: An individual who has delayed coverage but becomes unhealthy may remain uninsured due to the penalties. However, dynamic price discrimination forces still exist such that dynamic penalties may be optimal even in the absence of forward-looking behavior.

To provide a real-world example and practical policy lessons, we evaluate the financial incentives for enrollment embedded in Medicare Part D, which combine static incentives in the form of subsidies with dynamic incentives in the form of a late enrollment penalty (LEP) aimed at encouraging early take-up. Specifically, Part D beneficiaries pay, *add eternum*, a premium penalty for each year they defer enrollment after becoming eligible.[1] The LEP aims to encourage individuals –particularly the healthy– to take up insurance as soon as they become eligible.

As highlighted by our theoretical model, the desirability of the LEP depends on the extent to which the target population of Part D understands and internalizes the incentives

[1]Individuals who wait more than 63 days to enroll after becoming eligible, and who do not have other sources of creditable drug coverage or are classified as low income, are subject to the LEP. The LEP amounts to one percent (1%) of the annual national base Medicare Part D monthly premium for each month without creditable prescription drug coverage. The penalty is permanent and is paid as long as the individual has Medicare drug coverage.

created by it; which amounts to analyzing an intertemporal trade-off between the current benefits of postponing enrollment versus the future costs induced by the penalty. These dynamic incentives are generally hard to understand, particularly for the potential enrollees of the Part-D program due to aging-related declines in cognitive ability. In practice, we allow for three types of consumers: a set of forward-looking individuals who are aware and respond to the LEP, a set of "unaware fully updating" consumers that do not respond to the LEP when they first become eligible for the program but immediately learn about it in the following year and a set of "unaware and non-updating" individuals who never internalize the LEP.

To quantify the desirability of the LEP in Medicare Part D, we calibrate the aforementioned model using empirical transition matrices and costs for a representative sample of Part D enrollees and assuming that coverage is equivalent to Medicare Part D's standard benefit plan. We calibrate the extent of forward-looking behavior from a survey designed by us to elicit individuals' understanding of the LEP.

Under the current subsidy levels, we find that the effects and desirability of the dynamic incentives in Medicare Part D crucially depend on the degree of forward-looking behavior of consumers. If consumers are all forward-looking or if they are unaware but learn quickly, the LEP increases welfare. When there is a significant share of consumers that are myopic or do not learn about the LEP, there are welfare losses associated with the presence of the LEP. This result comes from the combination of effects that the LEP introduces. On one hand, the LEP creates incentives to early take-up. On the other hand, the LEP introduces lock-out effects, as individuals who do not buy insurance early remain uninsured because of the presence of the penalty. When a large fraction of consumers do not learn quickly about the LEP, the lock-out effect dominates, creating welfare losses from the utilization of dynamic incentives in community-rated insurance markets.

We then turn to discuss the optimal level of the LEP for different levels of the subsidy, for scenarios with different types of consumers. For markets with only forward-looking

consumers, the levels of subsidies are in general complementary to the LEP, so that higher subsidies make larger penalties more desirable. For markets with a significant share of consumers that are myopic or do not learn about the LEP, the relationship between the optimal LEP and the level of subsidies is not monotonic. Higher levels of subsidies also imply higher optimal levels of LEP, for levels of subsidies below 70%. However, from higher levels of subsidies, the optimal LEP drops to 0% of premiums. This is because, with subsidies at higher levels, the LEP does not change the marginal behavior of consumers and, therefore, increasing the LEP, only hurts consumers. Additionally, for the benchmark situation where subsidies are 74.5% of total costs of insurance, the optimal LEP is smaller than the current level of 12% existing in the market for all scenarios. In this sense, the current level of the LEP in Medicare Part D is higher than the optimal.

Finally, we also consider simulations where an individual's type regarding forward-looking behavior is correlated with health risk (Fang et al. 2008; Finkelstein and McGarry 2006). In particular, We assume that the forward-looking agents are healthier than the myopics. With this heterogeneity the LEP decreases average premiums more than in the baseline case, there is less room for *lock-out* and less uninsurance. However, there are still welfare losses from introducing a LEP.

This paper contributes to several strands of the literature in health insurance. First, we contribute to the literature on dynamic incentives in health insurance. Pauly et al. (1995) and Ghili et al. (2019) propose risk-rated long term contracts. Atal et al. (2020) and Fleitas et al. (2018) show the workings of these long-term contracts in practice. We complement those studies by analyzing dynamic incentives in community-rated markets, which are prone to selection but not to reclassification risk.

We also complement previous studies that have specifically evaluated the determinants of enrollment in Medicare Part D. Previous studies analyzing take up decisions at the beginning of the program found that older individuals were less likely to take up benefits, being more likely to lack drug coverage, and provide evidence that less cognitively able individuals were

less likely to take up (Levy and Weir (2010) and Heiss et al. (2010). Also, previous studies suggest that individuals fail to understand rather complex incentive structure of the LEP raising concerns about its effectiveness and desirability (Heiss et al. (2010))[2]

We also complement previous studies analyzing late enrollment penalties in other contexts. Palangkaraya and Yong (2005) and Palangkaraya and Yong (2007) study the introduction of late enrollment penalties in Australia, while Keegan (2020) studies the introduction of late enrollment penalties in Ireland. We complement those studies by providing a more general treatment of dynamic penalties and providing a welfare analysis.

2 Model

2.1 Consumers

Consider a dynamic model where consumers can enroll into a health insurance program. Time periods are denoted $t = 0, 1, \ldots, T$. Consumers have discounted expected utility preferences over consumption with discount factor δ and constant absolute risk aversion with parameter γ. That is, the utility of a random consumption flow $(C_t)_{t=0}^T$ is

$$\mathbb{E} \sum_{t=0}^{T} \delta^t \cdot u(C_t)$$

where $u(c) = (-1/\gamma)e^{-\gamma c}$. Consumers have constant income w per period and cannot save or borrow.

A consumer has stochastic health status K_t at time t. We use upper case K_t for the random variable and lower case k for realizations. Let $\boldsymbol{K} = (K_t)_{t=0}^T$. K_0 has distribution π_0

[2]Other related papers study choice frictions in the context of plan choice with Medicare Part D (see Ketcham et al. 2012, 2015; Abaluck and Gruber 2011, 2016; Heiss et al. 2021) and drug usage (see Abaluck et al. 2018; Dalton et al. 2020).

and afterwards follows a discrete Markov process

$$\Pr\{K_{t+1} = k' | K_t = k\} = \pi(k'|k).$$

Consumers choose a stopping time τ adapted to $\boldsymbol{K}$ when to enroll in the program. Once enrolled in the program, the consumer stays in the program. The premium per period p_t depends on the period t in which the consumer *first enrolls* in the program. In period t, a consumer who is not enrolled suffers a stochastic health loss with certain equivalent $l(k_t)$. A consumer who is enrolled suffers a loss with certain equivalent $l(k_t) - v(k_t)$ so that the insurance program has value $v(k_t)$. Therefore, realized utility given the health process $(k_t)_{t=0}^T$ and stopping time τ is

$$U(\boldsymbol{k}, \boldsymbol{p}, \tau) = \sum_{0 \le t < \tau} \delta^t u(w - l(k_t)) + \sum_{t \ge \tau} \delta^t u(w - l(k_t) + v(k_t) - p_\tau).$$

2.2 Consumer Behavior

We will consider three different possibilities for consumer behavior.

A rational consumer uses a stopping time τ^r that maximizes expected utility.

An unaware non-updating consumer enrolls in the first period where $v(k_t) \ge p_t$ so that it is myopically optimal to enroll. We denote this stopping time as τ^n.

An unaware fully-updating consumer behaves as follows. In the first period, she is not aware of late enrollment penalties, and so enrolls iff $v(k_1) \ge p_1$. If she does not enroll in period 1, she faces a different price p_2 in period 2. At this point the consumer becomes fully informed, and chooses the stopping time to maximize expected utility.

2.3 Government Objective

We assume that insurance is provided by competitive firms with cost $c(k)$ of insuring a consumer with health status k. Therefore government revenue is

$$R(\boldsymbol{k}, \boldsymbol{p}, \tau) = \sum_{t \geq \tau} \delta^t (p_\tau - c(k_t)).$$

Define welfare as the following weighted sum of consumer welfare and government revenue:

$$W(\boldsymbol{p}, \tau) = g\left(\mathbb{E}\left[U(\boldsymbol{K}, \boldsymbol{p}, \tau)\right]\right) + \lambda \mathbb{E}\left[R(\boldsymbol{K}, \boldsymbol{p}, \tau)\right].$$

The government's objective is to choose $\boldsymbol{p}$ to maximize welfare subject to consumers choosing the stopping time given $\boldsymbol{p}$ and one of the behavioral assumptions above.

2.4 Simple example

This example illustrates the key tradeoffs of having a late enrollment penalty. There are two periods. At time $t = 1$, half of the consumers are healthy and half are sick. Healthy consumers value insurance at $v(k) = l(k) = 1/3$ and sick consumers value insurance at $v(k) = l(k) = 2$. The costs of insuring healthy consumers is $c(k) = 0$ and the cost of insuring the sick is $\bar{c} = 3/2$. In period $t = 2$, all consumers are sick. The coefficient of absolute risk aversion $\gamma = 1$, the function $g(\cdot)$ is the identity, and $\lambda = 2$.

To understand the key tradeoffs, consider first a one-period model, with the distribution of types as in $t = 1$. If the government sets prices lower than $1/3$, all consumers purchase insurance. The resulting welfare is

$$u(-p) + \lambda p - \frac{1}{2}\lambda \bar{c},$$

the blue curve in Figure 1. This curve is always increasing because λ is greater than $u'(-p)$ for $p \leq 1/3$.

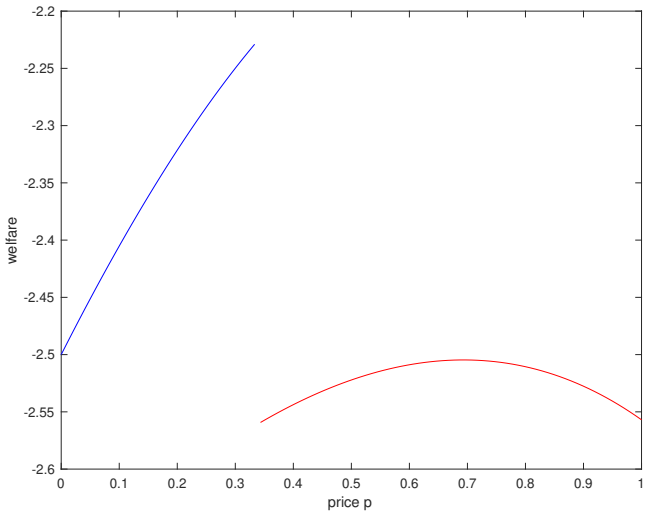


Figure 1: Welfare in the one-period example as a function of price.

Alternatively, the government can set $1/3 < p \leq 1$, so that only sick consumers buy insurance. The resulting welfare is

$$\frac{1}{2}u(-1/3) + \frac{1}{2}u(-p) + \frac{1}{2}\lambda p - \frac{1}{2}\lambda\bar{c},$$

the red curve in Figure 1. Welfare is maximized at the price p^* solving $u'(-p^*) = \lambda$, which is $p^* \approx 0.69$. The government could also set $p > 1$, so that no consumers purchase insurance, but that results in disastrously low welfare.

Figure 1 illustrates the key tradeoff facing the government. On one hand, the government wants to subsidize insurance to get healthy consumers to purchase. However, due to the value of public funds, the government would like to set a higher price of $p^* \approx 0.69$ to extract revenue. The optimal price is $p = 1/3$, which is the highest price at which healthy consumers still purchase insurance. At this price the government runs a deficit of $(1/2) \cdot \bar{c} - 1/3 \approx 0.42$.

Consider now the two-period model. The main point is that the government can use a late enrollment penalty to raise prices in period 1 while guaranteeing that all consumers buy insurance right away. Consider period 2. Any remaining unenrolled consumers are sick. So they purchase insurance at any price $p \leq 2$. If the government ignored period 1, it would be

optimal to set the period 2 price at $p_2 = p^*$. However, the government can raise p_2 above p^* to get more consumers to enroll in period 1. Healthy consumers enroll in period 1 as long as

$$u(-p_1) + u(-p_1) \geq u(-1/3) + u(-p_2).$$

The harshest possible penalty is $p_2 = 2$. The highest p_1 at which healthy consumers enroll in period 1 is then approximately 1.48, which is greater than p^*. Therefore, an optimal solution is to set $p_1 = p^*$ and $p_2 = 2$. At this price, all consumers enroll in period 1. Moreover, the government can charge the preferred price of p^*, instead of having to charge 1/3 as in the static model. The threat of the late enrollment penalty gets all consumers to enroll while saving a considerable amount of public funds. With this late enrollment penalty the deficit in period 1 is only $(1/2)\bar{c} - p^* \approx 0.06$. Because no consumers actually enroll in period 2, any price $p_2 \geq 2$ is also optimal, even prices that are so high as to essentially ban enrollment in period 2.

In this simple example, there is no social cost of imposing a late enrollment penalty because all consumers enroll immediately. However, under alternative assumptions where some consumers never enroll, a late enrollment penalty can have costs. The costs of the late enrollment penalty are particularly pronnounced with unaware consumers. Consider the optimal solution $p_1 = p^*$ and a strict penalty $p_2 = 2$. Unaware consumers only enroll in period 1 when they are sick. And, in period 2, they do not enroll due to the strict penalty. The late enrollment penalty achieves the poor welfare of

$$\frac{1}{2}(u(-1/3) + u(-2)) + \frac{1}{2}(2u(-p^*) + 2\lambda p^* - 2\lambda\bar{c}) \approx -8.01.$$

If instead unaware consumers faced constant prices $p_1 = p_2 = p^*$, they obtain higher welfare of

$$\frac{1}{2}(u(-1/3) + u(-p^*) + \lambda p^* - \lambda\bar{c}) + \frac{1}{2}(2u(-p^*) + 2\lambda p^* - 2\lambda\bar{c}) \approx -6.11.$$

3 Calibrations for Medicare Part D

In this section, we extend the model to provide lessons for the workings of Medicare Part D. We start by discussing the main institutional features of Part D, and then we present the model and results.

3.1 Institutional Background

3.1.1 Premiums and Subsidies

Medicare Part D is subsidized and privately provided health insurance program for prescription drugs for the elderly and disabled in the United States that was introduced in the year 2006. Premiums in Medicare Part D are community rated and beneficiaries receive different types of subsidies. Regular beneficiaries have the ability of actively choose a plan, and they receive a subsidy on the premium that is determined by the Center of Medicare and Medicaid Services (CMS, hereafter) through a complex annual mechanism [3]. First, all insurers submit bids for each plan they want to offer, which should reflect how much revenue the insurer "needs" to cover an average risk beneficiary in an SDB plan. The CMS calculates a weighted average of all the bids, using the previous enrollment shares as weights, which is called *CMS average bid* and is used as a basis to determine the subsidy. For regular enrollees with the average risk and a plan with standard benefits, the government subsidy for beneficiaries is set at 74.5% of the CMS average bid, and the other 25.5% is set as the premium of the plan[5].

[3]There are two types of beneficiaries in Part D that receive different subsidies: regular, and low-income subsidy (LIS) beneficiaries. Low-Income Subsidy (LIS) beneficiaries are beneficiaries with low income and assets, who are eligible for assistance with Part D plan premiums and cost-sharing. To qualify, individuals have to earn less than 150% of the poverty line and have modest assets (less than $14,390 for individuals and $28,720 for couples in 2019). Beneficiaries who receive the Low-Income Subsidy are automatically assigned to a set of plans that only offer the standard benefits and whose premiums are lower than those paid by regular enrollees.[4] For LIS enrollees, the subsidy is determined using a weighted average of the same bids as for regular beneficiaries, but using the previous share of LIS beneficiaries for each plan as weights. Each year, the exact amount of the subsidy for LIS enrollees (*LIS benchmark*) is determined based on fiscal considerations by CMS. In 2019, nearly 13 million Part D enrollees—roughly 3 in 10—received premium and cost-sharing assistance through the Part D Low-Income Subsidy (LIS) program.

[5]On top of this, CMS adjusts the per capita subsidy by the risk score of each enrollee and adjusts the premiums for any additional benefits that the plan may offer compared to the standard benefit plan designed by CMS. Thus, the premium paid by the regular enrollee is 25.5% of the *CMS average bid*, plus adjustments

Among regular beneficiaries, higher-income beneficiaries have a differential subsidy of their Part D benefits. A beneficiary whose income exceeds certain thresholds pays an income-related monthly adjustment amount in addition to the Part D premium paid to a plan. In 2017, these extra payments applied to individuals with an annual adjusted gross income greater than $85,000 and to couples with an adjusted gross income greater than $170,000. Therefore, about 7% of Part D enrollees were subject to this extra premium, with the adjustment amount ranging from $13.00 to $74.80 per month, depending on income.

3.1.2 Late Enrollment Penalty

In Medicare Part D, individuals are subject to a Late Enrollment Penalty ("LEP", hereafter).[6] The role of the LEP is to reduce adverse selection, increasing the incentives for healthy individuals to enroll early.[7] A beneficiary enrolled in a Medicare drug plan may owe the LEP if she stayed without Part D or other "creditable coverage" for any continuous period of 63 days or more after the end of her Initial Enrollment Period for Part D coverage. By "creditable coverage" it is understood to have coverage that in expectation insures at least as much as Medicare's SDB prescription drug coverage.[8]

Generally, the LEP is added to the person's monthly Part D premium. The person will continue to owe a penalty for as long as she is enrolled in a Medicare drug plan. This means that even if the person decides to join another Medicare drug plan, she will still have to pay the penalty once enrolled in this new plan.

for additional benefits.

[6]Medicare also uses penalties for Part B (Hospitalizations), where beneficiaries pay 10% more for each full 12-month period they were eligible for Part B but did not take it up. In most cases, beneficiaries will have to pay this penalty each time they pay premiums, for as long as they have Part B.

[7]Despite this intention, some adverse selection is still present in the program. Polyakova (2016) explores interactions among adverse selection, switching costs, and regulation in Medicare Part D. She finds that switching costs are large and have quantitatively important implications for the sorting of individuals among contracts. In particular, switching costs help sustain an adversely-selected equilibrium with large differences in risks between more and less generous contracts.

[8]Most plans that offer prescription drug coverage, like plans from employers or unions, must send their members a yearly notice explaining how their prescription drug coverage compares to Medicare prescription drug coverage and if it is "creditable coverage". If a person with Medicare does not get a separate written notice, the person's plan may provide this information in its benefits handbook. If the person does not know if the prescription drug coverage she has is creditable, the person should contact the plan.

The amount of the LEP depends on how long the person went without Part D or other creditable prescription drug coverage. The LEP amount typically is 1% of the national base beneficiary premium for each full, uncovered month that the person did not have Part D or creditable coverage. The monthly penalty is rounded to the nearest $0.10 and added to the monthly Part D premium. For example, the national base beneficiary premium for 2019 is $33.19, so delaying enrollment one year would imply an increase of $4, added to the monthly premium.

Medicare calculates the LEP when a person subject to the penalty first joins a Medicare drug plan by reviewing her enrollment history.[9] If the person does not agree with the late enrollment penalty, she may be able to ask Medicare to review its decision.[10]. Individuals who qualify for the Low-Income Subsidy under Part D are not charged a late enrollment penalty when they enroll in a Medicare drug plan, even if they had uncovered months before qualifying for Low Income Subsidy[11].

Information about the LEP is available on the official webpages of Medicare and the CMS. Additionally, all individuals that receive Social Security benefits, receive a welcome page to Medicare in which the options about drug coverage and the existence of the LEP are explained.[12]

[9]Once enrolled, the drug insurance plan will review Medicare's systems to see if the person had a potential break in creditable coverage for 63 days or more in a row. If so, the Medicare drug plan will send the person a notice asking for information about prior prescription drug coverage. The information provided helps the plan tell Medicare whether there was a gap in creditable coverage, otherwise using only the data in the Medicare system. Then, Medicare (not the plan) determines the late enrollment penalty amount.

[10]The procedure is called a "reconsideration." The individual should submit a form listing the reasons for the reconsideration, explaining for example, that she had drug coverage from an employer or union plan and providing evidence of this drug coverage. In general, Medicare's contractor makes reconsideration decisions within 90 days.

[11]Nevertheless, if this individual unrolls from her Medicare drug plan and goes 63 days or more in a row without other creditable coverage, Medicare may charge a late enrollment penalty if she later joins a Medicare drug plan and is no longer eligible for the Low-Income Subsidy.

[12]The booklet informs the beneficiary with the following text *"If you don't have other creditable prescription drug coverage, you'll have to pay a monthly Part D late enrollment penalty if you join later. In most cases, you'll have to pay the penalty as long as you have Medicare prescription drug coverage. The penalty goes up the longer you go without Part D or creditable drug coverage. Your non-Medicare plan must tell you each year if your drug coverage is creditable coverage."* The same booklet explains in detail how the LEP is computed, also using simple examples to explain its amount.

3.1.3 Take-up and enrollment Patterns

In 2019, 45 million out of the more than 60 million people covered by Medicare were enrolled in Part D plans. Medicare beneficiaries may also have other sources of drug coverage instead of Part D. For example, individuals that had insurance through a current or former employer or union, can stay in that plan and choose not to enroll in a Medicare Part D plan.

Therefore, on top of the 45 million beneficiaries enrolled in Part D, there are another 1.4 million beneficiaries who are estimated to have drug coverage through employer-sponsored retiree plans.[13]. There are also several million beneficiaries who are estimated to have other sources of drug coverage, for example via Veterans Affairs (VA). Even summing up all of these multiple sources, 12% of Medicare beneficiaries had no drug coverage or had coverage that was less generous than Part D's defined standard benefit.

Figure 2 uses data from the Medical Expenditure Panel Survey (MEPS) to show the pattern of enrollment in Medicare Part D at different ages. We use data from the 2013-2014 survey and check reported coverage in Medicare Part D, as well as other sources of coverage for prescription drugs.

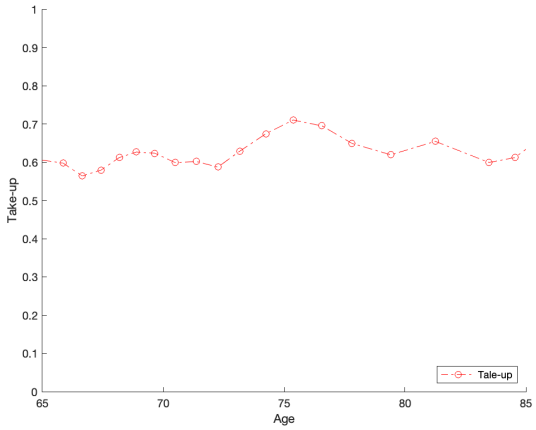


Figure 2: Part D Take-up (Source: MEPS)

This analysis reflects that still a significant amount of the population does not have Medicare Part D coverage. Additionally, when other sources of coverage are included, still

[13]These employers receive subsidies between $435 and $8,950 per retiree in 2020

a large percentage of individuals lack a creditable source of prescription drug coverage and, therefore, there are subjects to the LEP in case they want to enroll in Medicare Part D.

Finally, in MEPS data take-up of Medicare Part D is relatively flat by age. This pattern arises even when health status deteriorates over time and drug expenditure increases moderately by age also measured in MEPS. As we will discuss below, this pattern of flat enrollment by age is consistent with the presence of *lock-out* effects in the setting.

3.2 Calibrated Model

We now extend the model to approximate the Medicare Part D environment. In particular, we extend the model by 1) allowing more than two periods (and intertemporal discounting), 2) allowing partial insurance (with coverage resembling the Standard Benefits of Medicare Part D), and 3) allowing for a mixture of forward-looking and myopic individuals.

We assume that there are perfectly competitive private firms providing insurance so that the government revenue is just price minus cost

$$R(\boldsymbol{K}, \boldsymbol{p}, \tau) = \sum_{t \geq \tau} \delta^t (p_\tau - c(k_t)).$$

With exponential discounting, individuals realized utility given stopping time τ is:

$$U(\boldsymbol{k}, \boldsymbol{p}, \tau) = \sum_{0 \leq t < \tau} \delta^t u(w - l(k_t)) + \sum_{t \geq \tau} \delta^t u(w - l(k_t) + v(k_t) - p_\tau)$$

Therefore, social welfare is:

$$\mathbb{E}\left[U(\boldsymbol{K}, \boldsymbol{p}, \tau) + \lambda R(\boldsymbol{K}, \boldsymbol{p}, \tau)\right]$$

To construct $l(k)$ and $v(k)$ we use a CARA assumption for utility and the benefit structure of a representative Medicare Part D plan. We discuss the assumptions on the health expenditures process in section 3.2.1

3.2.1 Health Types and Health Transitions

Discrete Risk Categories First we decompose the distribution of health expenditures into risk types. We model risk types as a discrete state since the model should be parsimonious enough to allow for modeling health dynamics with a reasonable number of parameters. As in previous literature (Ghili et al. (2019) and Atal et al. (2020)) to ensure meaningful support when we estimate transition matrices, we partition the health statuses into seven mutually exclusive and exhaustive bins.

We proceed as Atal et al. (2020) and define these seven categories by clustering. Using an equal share of individuals by type will, for example, underestimate the importance of the high-risk types, because it fails to reflect the severity and cost of these categories. From these categories, we estimate transition matrices.

Risk aversion We use CARA utility with risk aversion $\gamma = 10^{-4}$, following Ghili et al. (2019).

Choice frictions To quantify the extent of choice frictions concerning the late enrollment penalty, we surveyed 507 individuals aged 65-68 years old between August and September 2020, from the Understand America Survey (UAS) respondents. Three main questions allow to gauge respondents' understanding of the LEP. We provide details of the questions and answers in the Appendix.

Overall, the results show a mixed picture with regards to individuals' understanding of the late enrollment penalty. On the one hand, out of 7 options, less than 10% of the respondents answer correctly the amount of late enrollment penalty of a hypothetical individual who delays coverage for one year (note that the rate of correct answers is lower than if individuals have picked at the answer at random). On the other hand, when we ask respondents to pick the two correct statements about Part D among 7 options, 40% picked the one stating the presence and explaining the workings of the late enrollment penalty.

4 Calibration results

The theoretical model shows that both zero and positive LEP could be optimal. In this section, we discuss the results of calibrating the model to understand the effects of the LEP on take-up, equilibrium premiums, and welfare in Medicare Part D. We start by setting the subsidy level of the market at 74.5% and discuss the optimal LEP *given* the current level of the subsidy in sections 4.1-4.3. We then return to the analysis of the optimal combination of LEP and subsidy in section 4.4.

4.1 Forward Looking Consumers

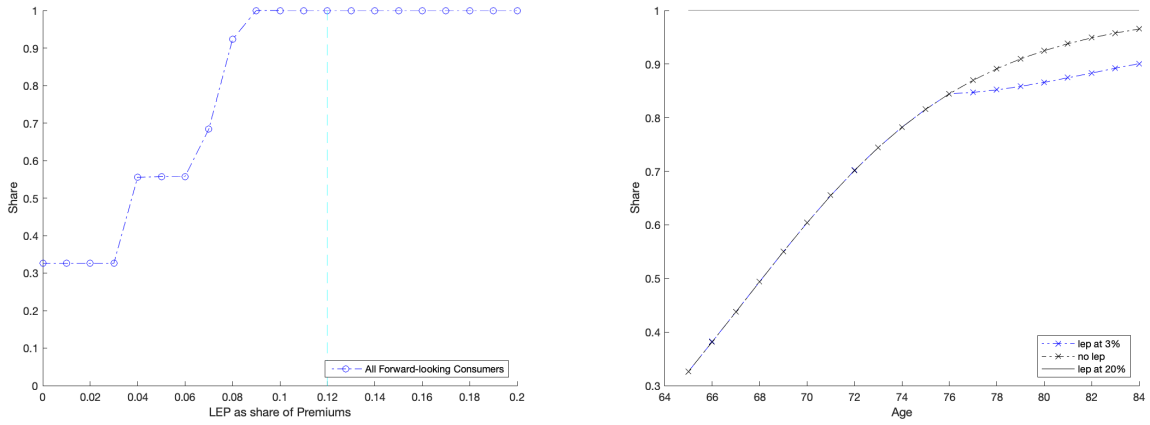
We start by analyzing the desirability of the LEP with the current level of subsidy under the assumption that all consumers are forward-looking. Figure 3a shows the share of consumers that take up Medicare Part D at age 65 as a function of the LEP, expressed as a share of the equilibrium premium. The dashed vertical line at 12% reflects the current level.

There are three conclusions from this graph. First, as expected with forward-looking consumers, larger levels of LEP as a share of equilibrium premiums increase the share of consumers that enroll as soon as they become eligible (at age 65). As consumers are forward-looking, they internalize the option value of enrolling early and avoiding the LEP in the future. Second, at the baseline level of LEP (12% of equilibrium premiums), the model with only forward-looking consumers predicts full take up at age 65.

Figure 3b shows the share of individuals that are enrolled in Medicare Part D by age for three levels of LEP as a share of premiums: 0% (no LEP), 3%, (low LEP) and 20% (high LEP).

Without LEP, forward-looking consumers would take up Medicare Part D only gradually. Therefore, in our simulations, the LEP of 12% (the benchmark case) increases the level of take-up at all ages. When the LEP is small (3% of equilibrium premiums) it does not change take-up at age 65. Moreover, enrollment patterns are the same as in the scenario without

LEP until age 76. At that age, even a small LEP accumulated over years starts creating the *lock-out* effect. Although the LEP is small period by period, by the age of 76 some consumers that have not enrolled before would have accumulated a large enough LEP to change their decisions and remain uninsured. Therefore, in a scenario with no LEP people at age 76 or more would have higher take-up rates than in a scenario with a small LEP. Finally, just like in the benchmark case, a LEP of 20% induces complete takeup at age 65.



(a) Take-up at 65 **(b)** Cumulative Enrollment

Figure 3: Take Up with Forward Looking Consumers

Enrollment patterns change with different LEP levels due to the direct effect of increasing the penalty on an individual's intertemporal maximization problem, but also indirectly through the endogenous changes in equilibrium premiums. Figure 4 show equilibrium premiums as a function of the LEP.

Several patterns emerge. First, the relationship between equilibrium premiums and the LEP is non-monotonic. For example, for small levels of the LEP, increases in the LEP *increase* equilibrium premiums. This is because the small increases of the LEP do not change the enrollment decision of marginal consumers in the first periods but it increases the *lock-out*, which, in turn, increases the average risk in the market and, consequently, the premiums. At intermediate levels, increases in the LEP incentivize early take-up, decreasing

adverse selection and therefore reducing equilibrium premiums. Finally, for large enough levels of the LEP, equilibrium premiums remain constant when the LEP is increased. At those levels, all consumers are already taking up insurance, so increases in the LEP do not affect equilibrium premiums.

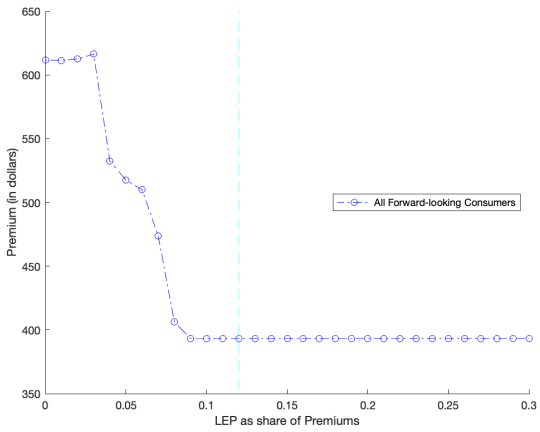


Figure 4: Equilibrium Consumer Premium

4.2 Results with Mixed Types of Consumers

In this subsection, we discuss the results when we introduce a mix of different types of consumers in our calibrations, aimed to capture different extents to which consumers respond to dynamic incentives.

In Figure 5 we present the take up at age 65 for three scenarios. To allow easier comparisons, in the first scenario all consumers are forward-looking, as assumed in the previous section. In the second scenario, 25% of consumers are forward-looking while 75% of consumers are unaware of the LEP at 65 but realize its existence at age 66. In the third scenario, 25% of consumers are forward-looking and 75% of consumers are fully myopic or do not learn of its existence over time.[14]

At lower levels of the LEP there are no differences between the take up under the second

[14]It is likely that, in reality, a fraction of individuals become aware of the LEP over time. We view scenarios 2 and 3 as covering both extremes possible and therefore provide a bound for the results that are possible when an arbitrary fraction of individuals become aware of the LEP over time.

and third scenarios, compared to the benchmark. Moreover, and because of the assumption that unaware consumers learn at age 66, the take-up under the second scenario and the third scenario at age 65 are the same for all levels of LEP. However, higher levels of LEP trigger some differences between the scenarios with all forward-looking consumers and the others with choice frictions. In the scenario where all consumers are forward-looking, the take-up increases rapidly while it remains much lower (although increasing) for the scenarios with choice frictions. From LEPs higher than 9% of premiums, the scenario with all forward-looking consumers stabilizes in full take-up while the scenarios with choice frictions also stabilize but at a much lower enrollment of about 50%.

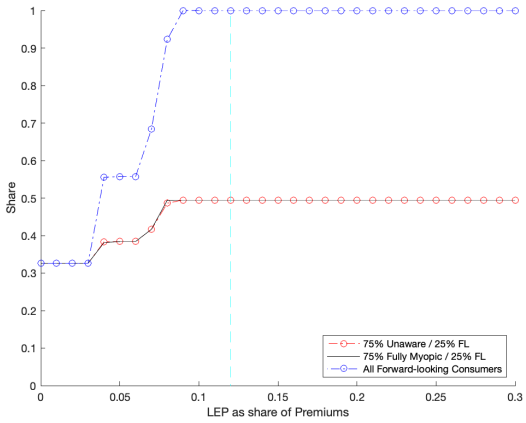
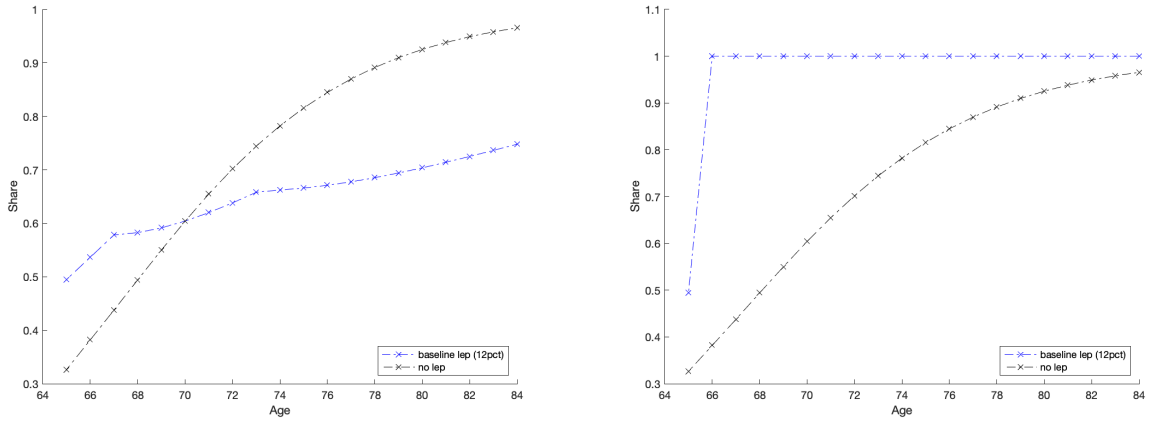


Figure 5: Take-up at 65 with Mixed Types

To provide further insights behind the mechanisms that determine take-up over the life-cycle, we discuss the enrollment by age for the second and the third scenario. Figure 6a shows the cumulative enrollment by age when unaware individuals do not learn (fully myopic), in situations with the benchmark LEP and without LEP. Without LEP, the cumulative enrollment increases gradually by age, as individuals evolve to health states that make it profitable to buy insurance. Without LEP, the forward-looking individuals do not help the myopic individuals: they take up insurance also when the current period utility makes it profitable. In contrast, the pattern with the baseline LEP shows higher take-up for younger

ages and lower take-up for later ages. The reason for the higher initial takeup is that the LEP leads some of the forward-looking consumers to take up insurance earlier. This further reduces the equilibrium premiums and changes the decisions of the marginal myopic consumers. In our simulations, these effects predominate up to age 70 and therefore take up is larger than in absence of LEP. However, from age 70 onwards the *lock-out*, the existence of the LEP prevents the take-up of individuals that in absence of the LEP would take up insurance. Note that the presence of the LEP makes the pattern of enrollment flatter than in the absence of LEP and more similar to the pattern described in Figure 2.



(a) 25% FL, 75% Myopic **(b)** 25% FL, 75% Unaware

Figure 6b shows the pattern of cumulative enrollment by age. The results are similar to the case of all forward-looking agents. Unaware consumers learn at age 66, so their enrollment patterns at age 65 are the same as the patterns from the market with myopic consumers. However, from age 66 onwards unaware consumers behave as forward-looking consumers. At all ages, the level of enrollment with LEP is larger than the level of enrollment without LEP. Therefore, under this scenario, the LEP increases the take-up and does not create *lock-out* effect.

Finally, we consider the equilibrium premiums. In Figure 7 we present the equilibrium premium over different levels of LEP as a share of premiums for the different scenarios. We repeat the equilibrium premiums for the market with only forward-looking consumers

(first scenario) as a benchmark. The equilibrium premiums for the scenario with unaware consumers follow the equilibrium premiums for the first scenario closely. However, and because these unaware consumers only learn after age 66, the equilibrium prices move with one year lag relative to the results for the market with only forward-looking, consumers.

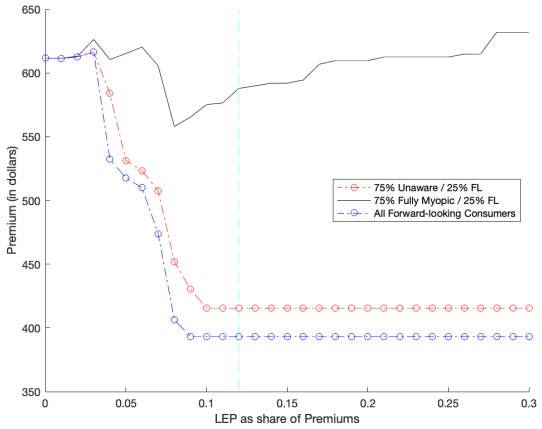


Figure 7: Equilibrium Consumer Premium

The equilibrium premiums for the market with 25% of forward-looking consumers and 75% of myopic consumers are different. Because of the lower enrollment, the premiums remain higher than in the case of the other scenarios. Additionally, the premiums do not vary monotonically with the LEP. The reason is that, given the underlying risk characteristics of the population and parameters of the market, different levels of the LEP change the trade-off between incentives to take up and the *lock-out* effect. For some levels of LEP the take-up incentives dominate while for others the *lock-out* effects dominate.

4.3 Welfare Effects with Benchmark LEP

In this section, we summarize the performance of the market under the three different scenarios. Table 1 presents the results in terms of premiums, take-up at age 65, percentage of total potential years enrolled, and certainty equivalent (CE) as a measure of consumer welfare. In Column (I) we present the results for these variables for the situation without LEP, which is the same under the three scenarios.

Columns (II) and (III) present the results for the scenario with only forward-looking behavior in the market. The introduction of the benchmark LEP reduces the premiums by approximately 36% and increases the enrollment at age 65 by more than 200% reaching full enrollment in the first period. The percentage of years enrolled also increases from approximately 74% to 100%. The certainty equivalent summarizes in terms of welfare the effects of premiums and take-up of consumers. Under this market setting, the LEP increases welfare. The average certainty equivalent increases by 1.32% with the introduction of a 12% LEP over premiums.

Table 1: Calibration Results with LEP = 12%

	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)
		All forward looking		**75% myopic 25% FL**		**75% unaware 25% FL**	
	No LEP	LEP	% LEP effect	LEP	% LEP effect	LEP	% LEP effect
Premium ($)	613	394	-35.69	591	-3.56	417	-32.03
Enrolled at 65 %	32.64	100.00	206.35	49.49	51.61	49.49	51.61
% Enrolled Yrs.	73.72	100	35.65	64.94	-11.91	97.48	32.22
CE (1000s)	35.93	36.40	**1.32**	35.60	**-0.91**	36.30	**1.04**

Columns (IV) and (V) present the results for the scenario with a mixed type of agents, where 25% of agents are forward-looking and 75% of consumers are fully myopic or do not learn about the LEP over time. Under this scenario premiums also drop, but now by only approximately 4%. Take up at age 65 also increase but now only by 52%. The reduction of premiums, while smaller, still helps marginal consumers to take up insurance earlier. As discussed before, forward-looking consumers "help" myopic consumers by taking up insurance earlier because of the presence of the LEP and then reducing premiums. However, the percentage of enrolled years is reduced compared with the scenario without LEP. This reflects the fact that while take-up effects dominate for younger ages, the lock-out effects dominate for older ages. The certainty equivalent is reduced by 0,91%, because of the presence of

the LEP. Overall, this indicates that for this composition of the market, the LEP has a welfare-decreasing effect.

Columns (VI) and (VII) present the results for the scenario with mixed types of agents, where 25% of agents are forward-looking and 75% of consumers are unaware and learn about the LEP at age 66. The results are very similar to the results for forward-looking agents in terms of premiums and enrollment (both at age 65 and as a share of enrollment years), although the effects are generally smaller. Overall, the LEP is still welfare increasing as certainty equivalent increases by 1.04% with the introduction of the LEP.

4.4 Optimal LEP and Subsidies

Until this section, we have discussed the effects of the LEP in markets with different combinations of consumer types. However, for all the previous calibrations we have set the subsidy to its benchmark level (74.5%) of premiums. In this section, we discuss the optimal level of the LEP for different levels of the subsidy for all the scenarios discussed before.

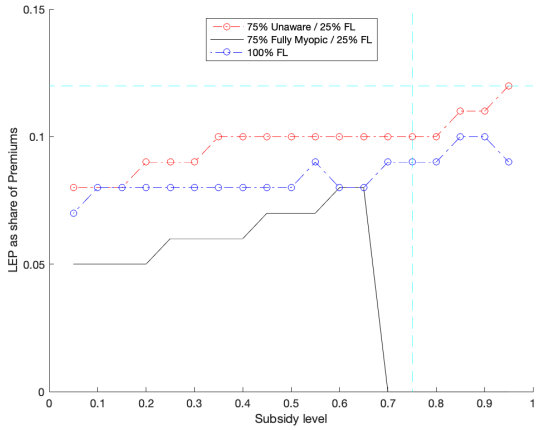


Figure 8: Optimal LEP for different levels of subsidy

Figure 8 presents the results. For the markets with only forward-looking consumers, the levels of subsidies are in general complementary to the LEP. Besides some small variations, for larger levels of subsidies higher LEPS are the optimal response (in the sense of providing higher utility). By increasing the subsidies, consumers are less responsible for their premiums

and therefore they are more likely to take up insurance. In this context, it is optimal to increase the LEP more to incentivize consumers to adopt earlier. For example, in a scenario where subsidies are close to 100%, it is optimal to have a LEP of 7%.

We now discuss the results when we have mixed types of consumers. For markets with 25% of forward-looking consumers and 75% of consumers unaware but fully updating, the results follow closely the results of the market with only forward-looking consumers. For markets with 25% of forward-looking consumers and 75% of myopic consumers, the relationship between LEP and subsidies is not monotonic. Higher levels of subsidies also imply higher optimal levels of LEP, for levels of subsidies below 70%. However, from higher levels of subsidies, the optimal LEP drops to 0% of premiums. This is because with subsidies at higher levels than 70% the LEP has no possibility of changing the marginal behavior of consumers. Therefore, positive LEPs only hurt consumers that enrolled later, increasing *lock-out* without changing the marginal take-up behavior of consumers.

Finally, it is worth noticing that for the baseline situation, where subsidies are 74.5% of total costs of insurance, the optimal LEP is smaller than the current level of 12% existing in the market. So the current level of the LEP in Medicare Part D is higher than the optimal one.

4.5 Correlation between risk and types

So far, we have considered the results in simulations where the distribution of health status at age 65 is the same for all consumers. In this section, We assume that the forward-looking are healthier than the myopic. This fact has been highlighted before in the literature (see e.g. Finkelstein and McGarry (2006); Levy and Weir (2010); Heiss et al. (2010); Fang et al. (2008)).

This analysis is interesting because late enrollment penalties provide incentives for the forward-looking to enroll. If these consumers are healthier than average, then the LEP is likely to help with adverse selection even more. For this analysis, we assume that the forward-

looking consumers have expected claims 25% lower than the myopic at 65 (preserving the net present value of expenditure).

Table 2: Calibration Results with LEP = 12%

	75% myopic, 25% FL					
	$E(c_{65}\|FL) = E(c_{65}\|MY)$			$E(c_{65}\|FL) = 0.75 \times E(c_{65}\|MY)$		
	no lep	lep	% lep effect	no lep	lep	% lep effect
Cons. premium ($)	613	591	-3.57	666	548	-17.67
Enrolled at 65 %	32.64	49.49	51.61	13.89	54.18	290.00
% Enrolled Years	73.72	64.94	-11.91	64.58	71.42	10.59
CE (1000s)	35.93	35.60	**-0.91**	36.09	35.78	**-0.87**

The results of this analysis are presented in Table 2. Compared to the baseline case, when the healthier respond more than the unhealthy to dynamic incentives the LEP decreases average premiums more. Additionally, there is less room for *lock-out* and fewer individuals remaining uninsured (higher share of enrolled years). However, there are still welfare losses, measured by certainty equivalent, when a large share of consumers are myopic or do not learn about the presence of the LEP in the market.

5 Final Remarks

Regulators have opted for different combinations of static and dynamic incentives to reduce adverse selection in community-rated insurance settings. In this paper, we study what combination of these instruments is optimal. We derive optimality conditions for community-rated prices —which include premiums as well as potential subsidies and penalties— in a simple but general two-period model for insurance demand, where health risk is heterogeneous and evolves stochastically over time.

We then evaluate the financial incentives for enrollment embedded in the design of Medicare Part D. Specifically we develop and calibrate a model to understand the effects of static and dynamic incentives inspired by the Medicare Part D "late-enrollment penalty".

We show that dynamic incentives like the Medicare Part-D LEP could introduce two types of incentives. On one hand, the LEP creates incentives for early take-up. On the other hand, the LEP introduces lock-out effects, introducing uninsurance from individuals who do not buy because of the penalty. Which of these effects predominate depends crucially on the degree of forward-looking behavior and knowledge of consumers.

We then discuss the optimal level of the Medicare Part D LEP for different levels of the subsidy, for scenarios with different types of consumers. For markets with significant shares of consumers that are myopic or do not learn about the LEP, the relationship between LEP and subsidies is not monotonic. For lower levels of subsidies, higher levels of LEP might be optimal. However, optimal LEP might be zero with higher levels of subsidies.

Finally, for the baseline levels of subsidies, we find that the optimal LEP is smaller than the current level of 12% independently of the mixture of agents in the market. In this sense, the current level of the LEP in Medicare Part D is higher than the optimal.

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