Pricing Regulations in Individual Health Insurance: Evidence from Medigap

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Abstract

In individual health insurance markets, consumers wish to insure long-term risks but may only buy one-year contracts. In the market for Medicare supplemental insurance ("Medigap"), states have adopted two regulatory solutions: (1) to prohibit price discrimination, and (2) to effectively create long-term contracts: the regulator establishes an initial open enrollment period and guarantees renewal at the same price offered to all other renewers. This paper is the first to leverage individual-level panel data on the entire Medigap market. I compare consumers living within 25 miles of a regulatory boundary, who are observationally equivalent but experience different pricing regulations. I find that insurance take-up is substantially higher under initial open enrollment with guaranteed renewal. When price discrimination is prohibited, insurance take-up drops by 9 percentage points (28 percent) and new Medigap buyers have insurer costs that are $138 (9 percent) higher per year. I find that when initial open enrollment with guaranteed renewal is in place, insurance take-up is higher for healthy and sick consumers alike. Prohibiting price discrimination eliminates the incentive for consumers to buy Medigap prior to the onset of chronic health conditions. The results suggest that initial open enrollment with guaranteed renewal may be a viable alternative to prohibiting price discrimination, a pricing regulation recently adopted in the exchanges established by the Affordable Care Act.

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1. Introduction

In individual health insurance markets, consumers wish to insure long-term risks but may only buy one-year contracts. This problem arises in unregulated private health insurance markets because it is difficult for insurers to accurately forecast future health-care spending and to offer long-term contracts. As a result, consumers are exposed to the risk that their health insurance premiums may rise in the future if they develop costly health conditions. Economists refer to this as "reclassification risk." Policymakers have experimented with two regulatory solutions. The first solution is to prohibit price discrimination. The second solution is to effectively create long-term contracts: the regulator establishes an initial open enrollment period and guarantees renewal at the same price offered to all other renewers. This paper provides a side-by-side empirical comparison of these two regulatory solutions.

The first regulatory solution – prohibiting all forms of price discrimination – has most recently been implemented in the individual exchanges established in 2014 under the Affordable Care Act (ACA). This ACA provision, which requires health insurance companies to offer coverage to people with pre-existing health conditions, enjoys broad public support.[1] While the ACA mandates that all individuals buy health insurance, this mandate is weakly enforced.[2] Without a strongly enforced individual mandate, prohibiting price discrimination may exacerbate adverse selection, leading to lower enrollment.

The second regulatory solution – an initial open enrollment period combined with guaranteed renewal of contracts – has been touted by some economists (Herring and Pauly, 2006; Pauly et al., 1995) but seldom investigated empirically. During the initial open enrollment period, the insurer must sell to all consumers at a uniform price. The regulator guarantees that those who buy during the initial open enrollment period may

[1] In a Reuters/Ipsos online poll of 1,043 Americans conducted June 19-23, 2012, 82 percent favor banning insurance companies from denying coverage to people with pre-existing conditions ((Zengerle, 2012)). In a CNN/Opinion Research Corporation telephone poll of 1,008 Americans conducted December 17-19, 2010, 64 percent say they support the ACA provision that prevents insurance companies from denying coverage for people with pre-existing conditions ((CNN Political Unit, 2010)).

[2] In 2015, the tax penalty for a single individual was the maximum of 2 percent of income above the filing threshold and \$325. For a single individual with \$40,000 income, his filing threshold was \$10,300; thus, the tax penalty was the maximum of (\$40,000 - \$10,300) $\times$ 2% = \$594 and \$325, which is equal to \$594. This is much less than \$2,484, the annual national average premium for the cheapest plan available through the ACA exchanges.

always renew their contracts at the same price offered to other renewers. After the initial open enrollment period, consumers may still buy contracts but face full price discrimination. This pricing regulation provides a strong incentive for consumers to enroll during the initial open enrollment period. By locking themselves into the common insurance pool of early buyers, consumers mitigate exposure to reclassification risk.

It is rare to find a setting where these two regulatory solutions can be credibly compared. In this paper, I take advantage of a nearly ideal setting for this comparison: the market for Medicare supplemental insurance, or "Medigap." In this market, states have adopted these two pricing regulations. In addition, the Medigap market has several convenient features: there is a fixed set of available contracts,[3] all consumers receive the same healthcare benefits and have access to the same network of healthcare providers,[4] and all other market characteristics are uniform.[5] Thus, it is possible to isolate the impacts of the pricing regulations from other confounding factors.

The Medigap market is also large and important in its own right, serving 10 million consumers per year, each of whom may spend $46,000 on Medigap premiums.[6] Total revenues in the Medigap market are $23 billion per year.

This is the first paper to leverage a new source of data on Medicare supplemental insurance, collected by the Centers for Medicare and Medicaid Services (CMS) starting in 2007. These confidential CMS administrative data capture the Medigap enrollment decisions of approximately 30 million aged Medicare beneficiaries per year. The data also contain individual-level healthcare claims, geographic identifiers, health insurance, and demographics. Prior Medigap studies have relied on the Medicare Current Beneficiary Survey (MCBS), an annual survey of 14,000 Medicare beneficiaries. The MCBS, which is well suited for many questions, is ill suited for a cross-state comparison of pricing regulations.

[3]During the time period that I study, which is 2006 through 2010, the government only permitted insurers to offer 10 standardized plans; thus, one can think of the set of available contracts as fixed, in the spirit of Akerlof (1970).

[4]The health insurance in this market is relatively homogeneous - all Medicare enrollees have access to the same healthcare benefits and the same network of healthcare providers; therefore, one can regard Medigap as a purely financial product. This is in contrast to other healthcare settings where insurers vary plan characteristics as well as provider networks.

[5]Because of federal regulations, which are discussed in Section 2, the Medigap market is relatively standardized at the national level

[6]A consumer who enrolls in a Medigap contract at age 65 for $2,300 per year (the average annual premium) and renews the contract for 20 years would spend $46,000.

Using these new data, I do a side-by-side empirical comparison of pricing regulations in the Medigap market. I use a boundary regression discontinuity design, comparing individuals who live within 25 miles of a regulatory boundary. These individuals are observationally similar but experience different pricing regulations. I show that Medigap enrollment is substantially higher under initial open enrollment with guaranteed renewal. Prohibiting price discrimination leads to a drop in Medigap enrollment of 9.3 percentage points relative to a baseline level of 32.8 percentage points, which is a 28.0 percent drop.

Next, I use the individual-level data on healthcare claims to estimate how these pricing regulations impact selection into Medigap enrollment. I find that prohibiting price discrimination leads to new Medigap buyers who are much more adversely selected: their healthcare costs paid by the Medigap insurer are $138 (9 percent) higher per year, relative to a mean of $1,491. I confirm this finding using several other measures of selection, including total healthcare spending, age at first Medigap purchase, and predicted healthcare spending based on a detailed set of health conditions. However, selection into the entire pool of Medigap buyers does not differ by nearly as much; initial open enrollment with guaranteed renewal leads to higher Medigap enrollment among the healthy and sick.

These findings can be reconciled. When initial open enrollment with guaranteed renewal is in place, many more consumers enroll during the initial open enrollment period, when they are relatively homogeneous in terms of health risk. These consumers renew their contracts year after year, even as some are revealed over time to be unhealthy. This results in higher Medigap enrollment for healthy and sick consumers alike. Prohibiting price discrimination eliminates the incentive for consumers to buy Medigap prior to the onset of chronic health conditions. Without this incentive, many consumers wait to see whether they will develop health conditions. Those who eventually develop health conditions select into Medigap enrollment. I expand on this intuition by laying out a simple theoretical framework in Section 6.

This study speaks to the policy debate surrounding longer-term viability of the ACA exchanges. As of 2016, about 12.7 million people are signed up through the ACA exchanges, approximately half as many enrollees as projected when the ACA passed (Blase

(2016)).[7] Several large insurers, including UnitedHealth, Humana, and Aetna, have announced plans to withdraw from some exchanges (Mathews, Anna Wilde and Armour, Stephanie (2016)). Health insurance executives have proclaimed that "the marketplace has been and continues to be unsustainable"[8] and that "we have to get a healthier pool of people in the market."[9] These statements reflect a view that a potential remedy to the ACA exchanges' problems is to attract a broader set of consumers.

In this paper, I find that Medigap markets where price discrimination is prohibited show evidence of market "unraveling": the healthiest consumers do not enroll. In the ACA exchanges, where price discrimination is prohibited,[10] one would also expect to see evidence of market "unraveling."[11] Although data on the ACA are limited, this is consistent with anecdotes reported by major news media outlets (Mathews, Anna Wilde and Armour, Stephanie (2016)). The results from this paper suggest a viable alternative to prohibiting price discrimination: an initial open enrollment period with guaranteed renewal. For example, the regulator might establish initial open enrollment periods at ages 25, 35, 45, and 55. Those who enroll during initial open enrollment periods could renew their contracts, locking in prices common to the insurance pool of early buyers. The optimal design of such a system is beyond the scope of this paper. However, this paper shows that this pricing regulation functions well to mitigate reclassification risk in a large health insurance market.[12]

This paper is most closely related to a literature on long-term contracts in private insurance markets. Early theoretical work includes Pauly et al. (1995), who examine guaranteed renewability in insurance, and Cochrane (1995), who proposes lump sum

[7]The RAND Corporation predicted 27 million by 2016 (RAND Corporation (2010)), the Centers for Medicare and Medicaid Services predicted 24.8 million by 2016 (Foster, Richard S. (2010)), the Urban Institute predicted 23.1 million (Buettgens, Matthew et al. (2010)), and the Congressional Budget Office predicted 21 million by 2016 (Congressional Budget Office (2010)).

[8]This was said by Joseph R. Swedish, chief executive of Anthem, in testimony for a U.S. House of Representatives committee during fall 2015 (Abelson, 2016).

[9]This was said by Kurt Kossen, an executive at Health Care Service Corporation, which operates Blue Cross plans in several states and lost $1.5 billion in 2015 (Abelson, 2016).

[10]Within geographic markets, age-based pricing that conforms to a 3:1 ratio is permitted, but price discrimination is otherwise prohibited and there is no initial open enrollment period.

[11]Another realistic possibility is that healthy consumers end up in plans with narrow networks and low costs.

[12]Media coverage for remedies to low enrollment has focused on two solutions that would be very costly to implement: 1) enforcing the individual mandate more strictly, such as via wage garnishment, or 2) a public option such as Medicare for all. In contrast, an alternative pricing regulation – instituting an initial open enrollment period with guaranteed renewal – would be relatively easy to implement.

payments for those diagnosed with long-term illnesses. Empirical work on this topic includes Hendel and Lizzeri (2003), who examine long-term contracts in life insurance;[13] Finkelstein et al. (2005), who examine the market for long-term care insurance;[14] and Herring and Pauly (2006), who find that actual premium paths are similar to the optimal guaranteed renewable path. More recently, Handel et al. (2015) use healthcare claims from a large employer to examine the welfare trade-offs associated with allowing insurers to vary prices based on individual-level characteristics. My contribution to this literature is a detailed empirical study of guaranteed renewal in a real-world setting. To my knowledge, no other empirical paper features a side-by-side comparison of guaranteed renewal and community rating regulations.

This paper is also related to a literature on the welfare consequences of adverse selection in insurance markets, e.g., Cutler and Reber (1998), Cardon and Hendel (2001), Einav et al. (2010), Bundorf et al. (2012), Handel (2013), and Hackmann et al. (2015). More specifically, prior studies disagree on whether selection into Medigap is "adverse" or "advantageous" (Wolfe and Goddeeris (1991); Fang et al. (2008); Starc (2014)). This paper contributes empirical evidence to help resolve this disagreement.

Finally, this paper relates to an extensive literature examining other aspects of the Medigap market, including Starc (2014),[15] Maestas et al. (2009), and Lin and Wildenbeest (2013).[16] Studies of regulations in the Medigap market include Finkelstein (2004), who examines plan standardization; and Bundorf and Simon (2006), who examine community rating regulations. Methodologically, this paper uses a boundary regression discontinuity design, as in Black (1999) and Dell (2010). A recent study by Cabral and Mahoney (2014) also examines Medigap coverage for healthcare markets along state borders; however, their strategy differs from mine as they construct an instrument for premiums in order to estimate the fiscal externality associated with Medigap.

The rest of the paper is structured as follows. Section 2 provides background information about the Medigap market and my data. In Section 3, I present summary statis-

[13]They show that the properties and lapsation rates associated with life insurance contracts are consistent with the theoretical predictions of a model with symmetric learning and one-sided commitment, in the spirit of Harris and Holmstrom (1982).

[14]They find that individuals are not fully insured against reclassification risk; those who are ex post revealed to be lower risk are more likely to drop their contracts.

[15]This paper examines adverse selection and high mark-ups in the Medigap market.

[16]These two papers examine price variation and search costs.

tics and several novel stylized facts. In Section 4, I discuss the main empirical strategy – a boundary regression discontinuity design – and present the main results. I discuss additional results and robustness checks in Section 5. In Section 6, I describe a theoretical framework to compare equilibrium enrollment and prices under different pricing regulations. I discuss my findings and conclude in Section 7.

2. Setting and Data

2.1 Setting

Medicare covers most but not all healthcare spending for those ages 65 and over in the United States. Medicare coverage is divided into Part A, which covers hospital spending, and Part B, which covers outpatient and physician spending. Figure A.1 shows the cost-sharing requirements for Medicare Part A. The first subfigure shows cost sharing for inpatient hospital stays for 2010, the last year of the sample period. For each benefit period, there is an inpatient deductible of $1,100 the first time an individual is admitted to the hospital. All additional costs are covered by Medicare for days 0 - 60 of the hospital stay. For days 61 - 90, an individual must pay a daily coinsurance rate of $275. Beyond day 60, an individual must pay a daily coinsurance rate of $550 for up to 60 lifetime reserve days. Beyond these 60 lifetime reserve days, the individual is responsible for all costs. The second subfigure shows cost sharing for Skilled Nursing Facility (SNF) days for 2010. Days 1-20 are covered by Medicare. For days 21 - 100, an individual must pay a daily coinsurance rate of $137.50. An individual is responsible for all costs beyond day 100. Figure 1 shows cost sharing in Medicare Part B for 2010. There is a Part B deductible of $155. Beyond that, the individual must pay 20 percent of all costs.

There is no limit on annual or lifetime out-of-pocket spending in Parts A or B. As a result, those with standard Medicare coverage face significant tail risk. Figure 2 shows the distribution of annual Medicare uncovered costs for Parts A and B in 2010. The annual uncovered costs are obtained by summing all out-of-pocket costs for Parts A and B. If a Medicare beneficiary has Medigap or employer-sponsored supplemental insurance (ESI), then these out-of-pocket costs are partially or fully paid by the Medigap or ESI insurer. Otherwise, the Medicare beneficiary is liable for these out-of-pocket costs.

More than 2 percent of Medicare beneficiaries in any given year face uncovered costs of at least $10,000.

Individuals can purchase plans from private insurers in order to cover their Medicare out-of-pocket costs. About 25 percent of Medicare beneficiaries purchase these plans from large private insurers such as UnitedHealth, Aetna, or BlueCross BlueShield. Average out-of-pocket costs are approximately $1,600 per year and the average Medigap premium is approximately $2,100, implying mark-ups of 31 percent. Thus, there is a segment of consumers with relatively high willingness-to-pay for this financial product.

2.2 Pricing and Enrollment Regulations

For the remainder of the paper, I will use shorthand for the three pricing regulations I study. "Community Rating" (CR) refers to prohibiting all forms of price discrimination. "Guaranteed Renewal" (GR) refers to the regulation that combines an initial open enrollment period with guaranteed renewal of contracts. "Community Rating with Rejections" (CRR) refers to prohibiting price discrimination, but allowing insurers to reject consumers outside of an initial open enrollment period. In this section, I will describe how these regulations arose in the Medigap market.

Figure 3 shows a timeline of regulations in the Medigap market. Federal requirements for Medigap policies were established in Section 1882 of the Social Security Act. Starting in July 1992, Medigap policies were required to conform to one of ten regulated plans, Plans A through J. Firms are not required to offer all plans. Three states have waivers and regulate plans on their own: Minnesota, Massachusetts, and Wisconsin. These states allow fewer plans than the federal limits.

Under federal regulations, during the 6 months after a person turns age 65 and enrolls in Medicare Part B, he is guaranteed the ability to purchase a Medigap policy. This is known as an initial open enrollment period. After that, Medigap insurers may exercise the right to reject applications or charge higher premiums to applicants who have health conditions. All contracts in this market are guaranteed renewable, which means that an insurer must continue to renew a contract as long as the enrollee continues to pay monthly premiums. Premiums are renewed for the entire set of consumers within the same rating class, meaning that premiums can go up for the entire class of consumers on the basis of aging or rising healthcare costs, but no one consumer can be singled out for a rate increase. I refer to the baseline federal regulatory regime as Guaranteed Renewal (GR).

The logic behind this regulatory approach is similar to that behind the "annual enrollment period" in employer-sponsored health insurance plans.[17] In these plans, employees typically have an open enrollment period during one month each year.[18] If an employee does not join a health insurance plan during this open enrollment period, then he cannot join later in the year. This annual open enrollment period prevents an employee from waiting until he incurs healthcare costs and then enrolling in health insurance ex post. The pricing regulation that combines an initial open enrollment period with guaranteed renewal is similar but operates on a longer time horizon. The initial open enrollment period prevents an individual from waiting until he develops a chronic health condition and then enrolling in health insurance ex post.

From 1990 through 2009, twenty-eight states enacted some form of additional pricing regulation in the Medicare supplemental insurance market. In this paper I study six states that enacted community rating laws. These bans occurred throughout the 1990s, and are shown in Figure 3. Premiums may vary within a market (zip code-year) across insurers and plans, but insurers are not allowed to base prices on age, health status, or other consumer characteristics.

Three states enacted community rating laws but still allow insurers to reject consumers outside of the initial open enrollment period. These states are Arkansas (1990), Vermont (1997), and Washington (1996). This means that insurers cannot charge different premiums to different consumers. It eliminates not only health-based but also age-based pricing. I refer to this policy as Community Rating with Rejections (CRR). Three other states enacted a stronger version of community rating laws: insurers are not permitted to reject consumers even outside of the initial open enrollment period. These states are Connecticut (1994), Maine (1993), and New York (1993). Consumers can enroll in Medigap at any time without restriction and without facing different prices. I refer to this policy as Community Rating (CR).

[17]Annual open enrollment periods exist in other health insurance settings as well, such as the ACA exchanges or Medicare Advantage.

[18]This may correspond to the month an employee joined the firm or to a specific calendar month.

2.3 Data

In this section, I describe the data sources that I combine for the empirical analysis. Please see Appendix Section B for additional details.

2.3.1 CMS Administrative Data

I use a novel piece of administrative data, which is a file that CMS collected relatively recently containing individual-level information for all enrollees with a source of supplemental insurance coverage. CMS started collecting this information from insurers in 2007. Previously, it was not possible to identify Medigap enrollees in the Medicare administrative data. I do a number of checks against Medicare Current Beneficiary Survey data and National Association of Insurance Commissioners (NAIC) data to verify that the CMS supplemental insurance information is quite complete and consistent with other sources.

I also use confidential enrollment and claims data on the universe of Medicare beneficiaries enrolled between 2006 and 2010. From these data, I can construct the entire sample of Medicare beneficiaries enrolled during the years of interest. For each Medicare beneficiary, I can construct his zip code, age, whether he is enrolled in Medicare Advantage, whether he is enrolled in Medicaid, etc. From the claims data, I can construct each beneficiary's out-of-pocket liability as well as health conditions.

2.3.2 Weiss Ratings Data

My second data source is proprietary data from Weiss Ratings on Medigap premiums from 1997 through 2013. These data are collected by a private firm, Weiss Ratings, and contain premiums at the most granular level at which they are offered (year-zip-firm-plan-age-gender). Because I can observe each consumer's location, age, and gender, for the vast majority of consumers I can exactly impute the average premiums in his market. I use the NAIC data (discussed in the next section) to construct state-insurer market shares and construct an average Plan F premium for each market (Plan F is by far the most popular plan).

2.3.3 NAIC Data

I use data from the National Association of Insurance Commissioners (NAIC) to construct annual state-level insurer market shares. I obtained reports from 2004 to 2014 on Medicare Supplement Loss Ratios. These reports contain information on Medigap insurers, including the number of covered lives for the top 10 insurers in each state. I use this information to create state-level insurer market shares for my observation period from 2006 to 2010. The top 3 insurers for each state are shown in Appendix Table 1.

2.3.4 MCBS Data

I use data from the Medicare Current Beneficiaries Survey (MCBS), an annual survey of Medicare beneficiaries with a nationally representative sample of approximately 16,000 individuals. I use these data to validate the indicator for Medigap coverage that I construct from the CMS administrative data on supplemental insurance. In order to do this, I obtained a crosswalk that links the individual-level identifiers in the CMS administrative data to the individual-level identifiers in the MCBS. This allows me to compare the indicator for Medigap coverage from the CMS administrative data to the survey-based indicator of Medigap coverage from the MCBS; these two indicators coincide nearly 90 percent of the time.

2.3.5 ACS Data

I use the American Community Survey to create zip-code level measures of demographic characteristics for households where the head of the household is at least 65 years old. The exact variables and definitions used are given in Appendix Section B.2.

3. Summary Statistics

In this section, I present summary statistics and several novel stylized facts on the Medigap market and its consumers.

Table 1 provides summary statistics for the overall sample of Medicare beneficiaries as well as the main analysis samples used to study the impacts of CRR and CR, relative to GR. I show the sample means of demographic characteristics as well as descriptive characteristics related to healthcare spending. Because I study the impact of pricing regulations on the timing of Medigap enrollment, I focus on Medicare beneficiaries who enter at age 65 (i.e., I exclude the disabled and ESRD populations, and further restrict to those who originally qualified for Medicare on the basis of age; please see Appendix Section B for further details on sample construction). This sample is slightly healthier than the Medicare population as a whole. Column 2 shows sample means for the CR analysis sample, which consists of Medicare enrollees who live in a CR state or GR state within 25 miles of a regulatory boundary. Relative to the population as a whole, those in the CR analysis sample are more likely to be White, slightly older, slightly higher income, less likely to enroll in Medicare Advantage, and more likely to live in urban areas. Those in the CR analysis sample also live in areas with higher overall Medicare spending, but have similar mortality rates, and are therefore representative of the population as a whole in terms of overall health. Similarly, Column 4 shows sample means for the CRR analysis sample, which is constructed analogously. Those in the CRR analysis sample are more likely to be White, lower income, and less likely to live in urban areas. They tend to live in areas with lower overall Medicare spending but have mortality rates similar to the population as a whole.

Columns 3 and 5 of Table 1 show summary statistics for the samples of Medigap buyers in the CR and CRR analysis samples. Relative to the CR and CRR analysis samples as a whole, Medigap buyers are substantially less likely to be male, more likely to be White, have similar income, tend not to enroll in Medicare Advantage[19], and tend to have lower healthcare spending. Medigap buyers have lower risk scores and much lower mortality rates. This is consistent with the "advantageous" selection into Medigap enrollment documented in Fang et al. (2008). I will return to this point in discussing Figure 6.

Figure 4 provides a descriptive summary of age at first purchase among Medigap buyers. A large percentage of Medigap buyers–approximately 25 percent–first enter the Medigap market at age 65. Thus, many consumers in this market take advantage of the initial open enrollment period upon first entering Medicare. However, a sizable percentage–nearly 75 percent–enter the market later. This indicates that there is signif-

[19]Simultaneous enrollment in Medicare Advantage (MA) and Medigap is prohibited by regulators but still sometimes occurs. In this table, if a consumer is enrolled in MA during any part of the observation year and then switched to Medigap during the observation year, this appears as enrolled in both MA and Medigap.

icant scope for pricing regulations to play an important role in market outcomes. This figure also shows how the distribution in age at first purchase differs across regulatory regimes. Most notably, there is a sizable rightward shift in CR states, compared to either GR or CRR. In other words, among those who eventually purchase Medigap, many fewer purchase early; this is consistent with the fact that CR eliminates the option value of the Medigap contract.

One statistic that is often considered in the literature on guaranteed renewal contracts is the lapsation rate–i.e., the percentage of those enrolled in the insurance contract who drop out of the contract in the subsequent year. I examine this directly in Figure 5. This figure shows the lapsation rate among Medigap buyers for each age. I find that the annual lapsation rate is surprisingly low, at well under 4 percentage points. It is sometimes hypothesized in the literature on long-term or guaranteed renewal contracts that consumers who are revealed to be healthy will be more likely to exit contracts. I examine this possibility in Figure A.2, where I plot the lapsation rate by risk decile. However, the lapsation rate again looks quite low and similar across risk deciles, so this does not appear to be the case. In summary, the vast majority of Medigap buyers renew their contracts from year to year. Thus, the main statistic that characterizes this market is not the lapsation rate but when Medigap consumers buy their contracts. For this reason, in the empirical analysis and in the conceptual framework, I simply the analysis by thinking of Medigap enrollment as an absorbing state. I focus on how the pricing regulations affect a consumer's decision to enroll in Medigap earlier rather than later.

In Figure 6, I examine a descriptive measure of selection into Medigap enrollment, which is in the spirit of Fang et al. (2008). That paper established the fact that the population of Medigap buyers tends to be healthier, on average, than the population of non-Medigap buyers. In this figure, I plot the coefficient from a regression of total Medicare spending on an indicator for enrolling in Medigap. I also restrict the sample to those previously not enrolled in Medigap. Thus, this measure captures selection into Medigap enrollment among new buyers. Most of the coefficients are large and negative, which confirms the stylized fact from Fang et al. (2008) that Medigap buyers are healthier on average. However, the figure reveals a pattern of further interest. The degree to which there is selection into Medigap increases with age in GR states, whereas this does not occur to nearly the same extent in CR states. This suggests that in GR states, insurers deter high-risk individuals from enrolling in Medigap, mostly likely via higher premiums or rejections. Finally, this figure also reveals that in all three regulatory regimes, Medigap consumers are age 65 are still adversely selected. Thus, although Medigap buyers as a whole are "advantageously" selected, as described in Fang et al. (2008), this does not necessarily reflect a positive correlation between low health risk and willingness-to-pay for Medigap insurance.

4. The Impact of Pricing Regulations

In this section, I describe my empirical strategy to quantify the impacts of the three pricing regulations – CR, GR, and CRR – on equilibrium enrollment and prices.

4.1 Boundary Regression Discontinuity

My main empirical strategy is a boundary regression discontinuity, where I compare individuals living in close geographic proximity to one another but on different sides of a regulatory boundary. The main specification is

$$y_{istb} = \alpha + \delta \cdot \text{Community Rating}_s + \phi_b + \epsilon_{istb} \tag{1}$$

where y_{istb} is the outcome of interest for individual i in state s in year t along segment b of the regulatory boundary. I do two parallel sets of analyses: (1) I compare those in CR states to those in GR states; and (2) I compare those in CRR states to those in GR states. The variable $\text{Community Rating}_s$ is an indicator for Community Rating (CR) or Community Rating with Rejections (CRR). According to the conceptual framework laid out in Section 6, there are a few key predictions. First, when the outcome y is Medigap enrollment, then we should have $\delta^{CR} < 0$ and $\delta^{CRR} > 0$. Second, when the outcome y is the average Medigap premium, we should have $\delta^{CR} > 0$ and $\delta^{CRR} < 0$.

In my main specification, I restrict to the sample of individuals who live within 25 miles of a regulatory boundary. Figure 7 shows these zip codes for Arkansas, which is a Community Rating with Rejections (CRR) state. Other natural specifications might include individual-level demographic controls or $f(\text{Geographic Location}_i)$, a flexible function of geographic location; in practice, this does not have any effect on the results, so I omit these variables from the main specifications.

In the Medicare enrollment data, I observe each individual's zip code. In order to implement this empirical strategy, I assign each zip code to a border segment. I use a geocoded data set to identify all zip codes that are along a state border, which I will refer to as "border zip codes".[20] I assign border segments state by state (I randomize the order of states). For each state, I start with the border zip code that is furthest north and furthest west (the border zip code whose centroid has the highest value for latitude and the lowest value for longitude). I call this the "initial border zip code." Next, I find the nearest border zip code within the same state; then I find the nearest border zip code still within the same state, and so on. I compute a running total distance from the "initial border zip code." Then, I divide the border zip codes into border segments of length 25 miles. I do this by grouping together the border zip codes whose running totals fall within 25 miles, fall between 25 miles and 50 miles, and so on. In this manner, I divide the regulatory boundary into border segments of approximate length 25 miles. For each border zip code z_i in the adjacent states, I find the closest zip code z_j in the state in which I have already assigned border segments. I assign the border segment associated with z_j to z_i. Finally, I turn to the non-border zip codes. For each non-border zip code z_i, I find the closest same-state border zip code z_j. I assign the border segment associated with z_j to z_i. In this way I exhaustively assign every zip code to a border segment.

Figure 7 shows a map of the zip codes used in the main specification for Arkansas, one of the CRR states. The border segments for Arkansas and its surrounding states are shown in Figure 8. I do several robustness checks to verify that the main results are not sensitive to the definition of border segments or to clustering the standard errors by border segment. In Table 9, I include specifications where I instead use Hospital Service Area (HSA) or Hospital Referral Region (HRR) fixed effects. These are two standard geographic definitions of a healthcare market that are widely used in the health economics literature.

[20] I determine border zip codes using a zip code adjacency data set that is part of project data created by the Center for Geographic Analysis at Harvard University. I am extremely grateful to Jeffrey Blossom for sending me these data and to Nate Hilger for granting permission to share these data with me.

4.2 Tests for Balance on Predetermined Covariates

Table 2 shows tests for balance on exogenous covariates. The first column shows estimates from an OLS regression of an indicator for Medigap enrollment on a set of exogenous covariates. The first three variables (male, age, Medicaid) come from the CMS individual-level data and the remaining variables come from American Community Survey zip-code-level data for age 65 and over (see Appendix Section B.2 for details). The p-value from an F test for joint significance is approximately 0.000, indicating that these variables are predictors of Medigap enrollment. The second column shows estimates from an OLS regression of an indicator for living in a CR state on a set of exogenous covariates. The sample is the entire sample of individuals living in CR and GR states (CRR states are excluded). Several of the coefficients are statistically significant and the p-value from an F test for joint significance is approximately 0.000, indicating that there is imbalance on these covariates in the entire U.S. sample. The third column shows the same estimates as in the second column, but the sample is restricted to those living in CR and CR-adjacent states. There is still substantial imbalance between the CR and GR samples. Finally, the fourth column restricts the sample to those living within 25 miles of the regulatory boundary, and also includes boundary fixed effects. In this column, most of the differences on the covariates are relatively small, and the p-value from an F test for joint significant is 0.216. Thus, in this sample, which is used in the main analysis, CR and GR residents are comparable on observable characteristics. Table 3 shows the results of the same exercise for the CRR states; again, in the main analysis sample in the fourth column, the CRR and GR residents are balanced on these exogenous covariates.

4.3 Tests for Balance on Health

In Table 4, I compare the CR (CRR) and GR samples on proxies for health and predicted spending. Although these characteristics are potentially endogenous, since they may be directly affected by the Medigap regulations, it is nevertheless useful to examine them. In the CMS administrative data, I observe a set of seventy health conditions for each individual in each year. In this table, I examine an indicator for whether an individual has any health conditions; I also examine the total number of health conditions. The table also shows the risk score, which is a measure of predicted health expenditures that CMS created in order to make risk-adjusted payments to Medicare Advantage plans. Finally, I examine one-year mortality. Interestingly, those in CR states are quite different in terms of underlying health than those in all GR states, as is shown in Column (1); they tend to be sicker on average. However, these differences in health vanish in Column (3), where the CR and GR comparison populations are quite similar in terms of underlying health. Column (5) shows that those in CRR states appear to be healthier than those in all GR states. However, these differences disappear once the sample is restricted to those living within 25 miles of the regulatory boundary, as is shown in Column (7). Overall, the CR (CRR) and GR comparison samples are balanced on these proxies for underlying health (and predicted Medigap insurer costs).

4.4 Medigap Enrollment

In Table 5, I show estimates of the impacts of CR and CRR on Medigap enrollment. In turning to these results, it is important to keep in mind the predictions from Section 6. I show two parallel sets of estimates: one compares CR to GR, and one compares CRR to GR. This is because GR is a convenient reference point, since it is the default federal regulation present in these states. It is also a convenient reference point in the conceptual framework. In that framework, enrollment should be lower under CR relative to GR; it should be higher under CRR relative to GR. In other words, the prediction from the model is that the coefficient on CR is negative and the coefficient on CRR is positive.

The results for Medigap enrollment align with the theoretical predictions. CR leads to a 9.3 percentage point decrease in Medigap enrollment, which is statistically significant at the 1 percent level. Compared to a mean in the GR comparison sample of 32.8 percent, this is equivalent to a 28 percent decrease in enrollment. In contrast, CRR leads to a 5.0 percentage point increase in Medigap enrollment, which is statistically significant at the 1 percent level. Compared to a mean in the GR comparison sample of 19.0 percent, this is equivalent to a 26 percent increase in enrollment. In summary, CR and CRR have large estimated impacts on enrollment, which also align with the theoretical predictions.

I next examine whether the impacts on CR and CRR are driven by any particular age group. The model does not have any predictions about this, other than that the predictions for enrollment should hold for any age group. This is because the “first period” versus “second period” in the model can be more generally regarded as capturing the trade-off between the current period and future periods, which is relevant at every age. The impacts of CR on enrollment are similar across all ages and not driven by any particular age group; they range from 21 percent for ages 75-79 to 42 percent for ages 65-69. Similarly, I examine the CRR impacts by age. Again, the increase in enrollment is similar across all ages, ranging from 17 percent for ages 65-69 to 31 percent for ages 75-79 and 80-84.

4.5 Heterogeneity in Impacts on Medigap Enrollment

One feature that distinguishes this study from other papers that examine Community Rating regulations is that I compare these to a regulation that combines an initial open enrollment period with guaranteed renewal. This comparison policy allows Medicare beneficiaries the opportunity to enroll in a Medigap contract early on and insure themselves against reclassification risk. In a typical static setting, CR will lead to higher enrollment for high risks and lower enrollment for low risks. In this setting, this is not necessarily the case. For instance, if many consumers enroll at age 65 and renew their contracts year after year, and if adverse selection under Community Rating is sufficiently severe to deter high risks from enrolling later on, then Medigap enrollment could actually be higher for both low and high risks who live in GR states.

I examine the heterogeneity in impacts on Medigap enrollment in Figure 9. This figure shows the estimated impacts of CR (CRR) on Medigap enrollment, with a separate coefficient for each health condition. The health conditions are the 70 hierarchical condition categories (HCC) that are used in CMS’s Medicare Advantage risk adjustment model. These health conditions correspond to clinically meaningful health diagnoses that are predictive of health care spending. Interestingly, I find that CR leads to lower Medigap enrollment for nearly all of these health conditions. Thus, it is not the case that CR leads to higher Medigap enrollment among high risks. Similarly, I find that CRR leads to higher Medigap enrollment for nearly all health conditions. In a similar exercise, I examine results by risk score decile in Figure 10. Again, I find that the impacts on

Medigap enrollment hold for healthy and sick individuals.

4.6 Selection into Medigap Enrollment

Because I observe individual-level data on Medigap enrollment, I can directly estimate the impact of Community Rating on selection into Medigap enrollment. These results are shown in Table 6. I estimate Equation 1 for measures of an individual's predicted healthcare costs, restricting to the sample of Medigap buyers. Thus, the coefficient on Community Rating captures the impact on the costliness of the pool of Medigap buyers. Because I observe all healthcare claims, I can also directly construct healthcare costs, as well as break these down into the components that are covered and not covered by Medicare.[21] Several interesting findings emerge from this analysis. First, CR leads to a large increase in the age at first Medigap purchase, raising it by 1.4 years. Second, the costliness of the overall pool of Medigap buyers is not significantly different in CR versus GR states. Third, the costliness of new Medigap buyers is much higher under CR. When CR is in place, new Medigap buyers are 2.0 years older when they first purchase Medigap; their healthcare spending not covered by Medicare is $138 higher; they are 4.8 percentage points more likely to have a health condition; and their risk scores are 0.082 higher. Each of these estimates is statistically significant at the 1 percent level.

I repeat the same exercise for CRR, and the results are shown in Table 7. In this table, the opposite pattern emerges. The overall pool of Medigap buyers is more positively selected, relative to GR. Furthermore, new Medigap buyers are also more positively selected, relative to GR. When CRR is in place, new Medigap buyers are 0.371 years younger; their healthcare spending not covered by Medicare is $37 lower; they are 3.1 percentage points less likely to have a health condition; and their risk scores are 0.033 lower. Thus, enforcing a single price but allowing insurers to exercise rejections results in more positive selection into Medigap enrollment, compared to GR.

[21] Because I do not observe healthcare claims for individuals enrolled in Medicare Advantage, they are excluded from the regressions where the outcomes are healthcare costs. However, I do observe health conditions, risk scores, demographic information, and mortality for all Medicare enrollees, including those in Medicare Advantage, so these individuals are present in each of the other regressions.

5. Additional Results and Robustness Checks

5.1 Premiums

Table 8 shows the impacts of CR and CRR on premiums. Recall that from the conceptual framework laid out in Section 6, one would expect CR to lead to an increase in premiums due to adverse selection; one would expect CRR to lead to a decrease in premiums due to positive selection. The table shows specifications similar to those in Table 5, except that observations are at the market (zip code-year) level. This is because insurers are permitted to vary premiums at the market level, so this is the relevant unit of analysis for premiums. I find that CR leads to a $138 increase in annual premiums. Relative to the mean in the GR comparison sample of $2,600, this corresponds to a 5 percent increase in premiums. I find that CRR leads to a $615 decrease in annual premiums. Relative to the mean in the GR comparison sample of $2,148, this corresponds to a 29 percent decrease in premiums. The signs of these coefficients are consistent with the theoretical predictions.

Next, I examine whether these differences in premiums are driven by particular age groups. Before turning to the results, it is worth recalling that under GR, insurers may increase premiums with age. This is because when an individual enrolls in a Medigap contract and renews the contract from one year to the next, the insurer is permitted to raise premiums for all individuals in the same rating class, so long as no individual is singled out for a rate increase. Thus, in practice, most insurers raise premiums as Medigap enrollees age. In effect, this means that GR allows for price discrimination on the basis of age. As a result, the young subsidize the old. We see that under CR, the increase in premiums is about $390 for ages 65-69, which corresponds to an increase of 17 percent. There is an increase in premiums of about $212 for ages 70-74, which corresponds to an increase of 8 percent. For most of the other age groups, the overall level of premiums is approximately the same as under GR. Under CRR, most of the decrease in premiums is enjoyed by older individuals. Those at ages 65-69 experience only a $281 decrease, or 16 percent decrease, in premiums; those at age 90 and above experience a $917 decrease, or 38 percent decrease, in premiums.

5.2 Robustness Checks

Table 9 shows a number of robustness checks. In each row, I show the estimated impacts of CR and CRR on Medigap enrollment. The first row shows the baseline specification, in which CR leads to a 9.3 percentage point decrease in enrollment and CRR leads to a 5.0 percentage point increase in enrollment. In the second specification, I use the entire sample of individuals in the border states and include boundary fixed effects. The estimated impacts are similar to those in the baseline specification. In the next four specifications, I vary the bandwidth used to restrict the sample; I use bandwidths of 100 miles, 50 miles, 10 miles, and 5 miles. I also include boundary fixed effects. The estimated impacts are again very similar to those obtained with the baseline specification.

Next, I show three specifications intended to check that the results do not rely on the specific definition of the boundary fixed effects. In the "No border segment FEs" specification, I omit the boundary fixed effects. In the "HSA FEs" specification, I omit the boundary fixed effects and instead use a full set of Hospital Service Area (HSA) fixed effects. HSAs are an alternative geographic definition of a healthcare market, often used in the health economics literature. Similarly, I also include a specification using Hospital Referral Region (HRR) fixed effects; this is another geographic definition of a healthcare market used in the health economics literature. The main difference between HSAs and HRRs is that HRRs are substantially larger. As is shown in Column (3) of the table, in moving from boundary fixed effects to HRR fixed effects, the number of clusters goes from 46 to 25; nevertheless, the estimated impacts are still significant at the 10 percent level. In Column (6) of the table, one can see that in moving from boundary fixed effects to HRR fixed effects, the number of clusters goes from 82 to 23; estimated impacts are still significant at the 1 percent level. In summary, robustness to various methods for controlling for boundary fixed effects lends credibility to the main estimates.

5.3 Balance on Medicare Advantage Quality

I examine a possible state-level threat to the identification strategy in Table 10. Medicare beneficiaries have access to three possible options for their health insurance coverage: traditional Medicare only, traditional Medicare with Medigap, and Medicare Advantage (MA). Medicare beneficiaries who enroll in MA plans receive their health benefits through a private insurer; these plans typically offer more generous coverage of Medicare cost sharing, but also restrict provider networks. In my main analysis, I assume that value of the "outside option" to choosing Medigap, which includes both traditional Medicare and MA, is the same for individuals living with 25 miles of a regulatory boundary.

I assess the plausibility of this assumption in Table 10. In this table, I construct three measures of MA quality, i.e., proxies for the quality of the MA outside option. These are the number of MA insurers, the number of MA contracts, and the number of MA plans. I find that these proxies for MA quality are balanced in the Community Rating and comparison samples, and the magnitude of the differences is quite small. In the main analysis sample, those in CR states have access to 0.9 more MA insurers (compared to a mean of 9.4 MA insurers in the GR comparison sample), 0.1 more MA contracts (compared to a mean of 10.9 MA contracts in the GR comparison sample), and 1.6 fewer MA plans (compared to a mean of 28.5 in the GR comparison sample). None of these differences is economically meaningful. A comparison of the MA quality in CRR versus GR leads to a similar conclusion. Thus, this comparison should assuage concerns that differences in MA quality would pose a threat to this identification strategy.

5.4 Geographic Mobility

In Table 11, I also examine two indicators of geographic mobility. I look at these in order to address the potential concern that individuals could move in response to the Medigap regulations. First of all, note that this possibility is unlikely to be a first-order concern. In this setting, all individuals in the market have access to standard Medicare and its extensive network of healthcare providers. Medigap insurance is a purely financial product that does not affect the healthcare providers that an individual can see. Furthermore, all individuals in this market have the option to purchase Medigap insurance during the initial open enrollment period at age 65. It is unlikely that an individual would incur large costs to move in response to the Medigap regulations when she could simply enroll at age 65. In any case, I construct two variables to examine geographic mobility, which are shown in this table. The first, which is labeled "Moved prior to age 65," is an indicator for whether an individual lives in a different state at age 65 than where he lived at birth. In the CMS administrative data, I observe each individual's Social Security Number, and the Social Security Administration has published a mapping from the first 3 digits of the SSN to the state where the SSN was issued, which is almost always the birth state. I use this to construct each individual's birth state. In the CMS administrative data, I observe every zip code the individual has had, including the one he had at age 65. I can therefore construct a variable indicating whether the state at birth differs from the state at age 65. Similarly, I can construct a variable indicating whether the state at age 65 differs from the current state.

In Panel A, I show tests for balance on geographic mobility. In these tests, it is clear that there are no differences in geographic mobility in the baseline samples in Columns (1) and (4). The first row of Panel B shows the estimated impacts of Community Rating (CR) and Community Rating with Rejections (CRR) on Medigap enrollment for the baseline specification. The second row of Panel B shows these impacts using a 2SLS specification. The birth state instrument is an indicator for whether the individual was born in a CR (CRR) state. This is used as an instrument for the indicator for whether the individual currently lives in a CR (CRR) state. The main results are robust to the use of this birth state instrument.

5.5 Descriptive Evidence of Selection: Event Study

In this section, I study the onset of chronic health conditions. This is meant to capture how pricing regulations impact a consumer's ability to purchase coverage in response to learning new information about his health. I focus on severe cancers, including those of the lung and upper digestive tract.

My estimating equation is

$$y_{it} = \sum_{t=-4}^{4} \lambda_t + \theta_i + \epsilon_{it}. \tag{2}$$

I first restrict the sample to the set of individuals who were diagnosed with this health condition at any time during 2006 through 2010. I define year 0 as the year when an individual is diagnosed with the health condition. I estimate the equation above, which includes yearly coefficients and a set of individual fixed effects. Standard errors are clustered at the individual level. Thus, the yearly coefficients capture within-individual changes over time. The main outcomes of interest are annual Medicare uncovered costs and Medigap enrollment. I plot separate coefficients for individuals in states with CR, GR, and CRR. The goal of this exercise is to examine whether Medigap enrollment is more likely to be triggered under CR than under either of the other two regulations.

Figure 11 shows annual uncovered costs during the years around the diagnosis of a chronic health condition. At the beginning of the window, annual uncovered costs are approximately $1,700 per year. Throughout the window, costs gradually rise, peaking during the year when the condition is diagnosed at about $4,500 per year. Even three years after the initial diagnosis, annual uncovered costs remain persistently higher at approximately $3,800 per year. Thus, one can interpret this as an event where the consumer is learning information about his healthcare costs from year -2 on, i.e., the measured health event does not occur precisely at year 0. The pattern of information revelation, as measured by annual uncovered costs, is strikingly similar across regulatory regimes.

The main results from the event study are presented in Figure 12, which plots coefficients where the dependent variable is an indicator for Medigap enrollment. There is a clear divergence between CR and the other two regimes. In the GR and CRR regimes, Medigap enrollment stays relatively flat throughout the onset of the health condition, despite the fact that consumers' predicted healthcare costs have risen substantially. Recall that in these states, insurers can reject these consumers or charge them higher premiums if they were not already enrolled in a Medigap plan. In contrast, Medigap enrollment rises much more quickly in the states with CR. These results provide descriptive evidence of greater adverse selection under CR for a particular subsample of the population.

6. Theoretical Framework

In this section, I present a stylized theoretical framework to rationalize the main results. The main emphasis is to use a two-period framework to generate predictions for the impacts of instituting an initial open enrollment period with guaranteed renewal ("Guaranteed Renewal (GR)"), prohibiting all forms of price discrimination ("Community Rating (CR)"), and prohibiting price discrimination but allowing insurers to exercise rejections outside of an initial open enrollment period ("Community Rating with Rejections (CRR)").

6.1 Timing and Set-Up

Consider a healthcare market with 2 types of individuals: "young" (Y) and "old" (O). An individual enters this market when he is "young," becomes "old" after a period of time, and then leaves the market (dies). In each period there is a realization of health costs denoted C^Y for the young and C^O for the old. Without insurance, individuals would have to pay these costs from their endowments. In case of a higher cost realization their consumption would be low, and in case of a lower cost realization their consumption would be high. Due to risk aversion, this creates demand for health insurance. The timing of the model is summarized in Figure 13.

Insurance contracts work in the following way. Before each health shock realization, individuals can choose a health insurance contract z from the set of available contracts. For simplicity, I assume only two contracts are possible: a "low coverage" contract L and a "high coverage" contract H. Contracts determine how costs are distributed between the individual and the insurer:

$$C_P^a(z^a) + C_I^a(z^a) = C^a \tag{3}$$

where C_P^a denotes costs for an individual of age $a \in \{Y, O\}$ (or "out-of-pocket costs") and C_I^a denotes the insurer's costs. Under contract L, out-of-pocket costs are higher and insurer's costs are lower than under contract H for any given health shock realization.

Assumption 1. *(Positive correlation)* $\mathbb{E}[C_I^O(H)|C^Y]$ *is non-decreasing in* C^Y.

Contracts L and H are one-period contracts, and long-term contracts are not available. Theoretically, being able to write a long-term insurance contract would improve the outcome. However, I assume long-term contracts are not available because this reflects the reality in health insurance markets. There are several potential reasons for this. Rapid technological innovation in health care makes writing long-term insurance contracts difficult. As new medical procedures become available, they must be integrated into existing contracts, and these increases in healthcare expenditures are difficult to forecast. In addition, other explanations that hinder the existence of long-term contracts in other insurance markets may also apply. One possibility is lack of commitment on the side of insurers. Short-term contracts give insurers the opportunity to increase premiums for those people who are revealed over time to be unhealthy. Even if insurer commitment is possible via regulation or reputation, there is also limited commitment on the side of buyers. If a buyer wishes to exit a contract early, it may be difficult or costly to enforce commitment through litigation. Finally, even in the case where commitment might be encouraged through front-loaded premiums, as in Hendel and Lizzeri (2003), this is only realistic if consumers have sufficient access to liquidity to pay large premiums upfront. In this model, I take the inability to write long-term insurance contracts as given. Later on, I will discuss the regulations that aim to fix the problem of short-term contracts.

In this market, the contract L represents Medicare, which is supplied at a fixed price nationwide. Hence, I simplify notation and normalize the price of L to zero. The price of contract H for young individuals is denoted P^Y. The price of H for old individuals is denoted $P^O(C^Y, z)$, as it can potentially depend on the health shock realization in the first period as well as the contract chosen in the first period.

To keep the model tractable, I do not model competition between insurers explicitly. Instead, I assume they do not face any competition as long as they do not exceed some mark-up M. One implication of this assumption is that prices of all contracts are equal to the average cost in the insurance pool (multiplied by a mark-up term). Another important implication of this assumption is that there is no market unraveling. Consider a scenario with perfect competition. An individual who has a low health shock realization in the first period would always be offered a lower premium in the second period by some competitor. Hence, any pooling of heterogeneous individuals would be impossible. Given that the Medigap market is highly concentrated and most local healthcare markets have only a couple of players, this assumption is reasonable. Also, it reflects the reality of the Medigap insurance market, where there is little lapsation and where insurance pools have heterogeneous individuals.

6.2 Pricing Regulations

I study three regulatory regimes: Guaranteed Renewal (GR), Community Rating (CR), and Community Rating with Rejections (CRR).

6.2.1 Guaranteed Renewal (GR)

Under the GR regime, individuals have the option to renew their contracts. If they do so, insurers cannot price discriminate based on the first-period health shock realization:

$$P^O(C^Y, H) = P^{O,GR}. \tag{4}$$

If an individual does not purchase H in the first period but decides to purchase it in the second period, he can always do so at the “fair” price:

$$P^F(C^Y) = \mathbb{E}[C_I^O(H)|C^Y](1 + M). \tag{5}$$

6.2.2 Community Rating (CR)

Under CR, all individuals can purchase H at the same price and no one is rejected:

$$P^O(C^Y, H) = P^O(C^Y, L) = P^Y = P^{CR}. \tag{6}$$

6.2.3 Community Rating with Rejections (CRR)

Under CRR, there is only price for H:

$$P^O(C^Y, H) = P^O(C^Y, L) = P^Y = P^{CRR}. \tag{7}$$

However, if an individual does not purchase H in the first period but wishes to purchase it in the second period, the insurer either offers P^{CRR} or rejects the individual. The insurer cannot offer the fair price $P^F(C^Y)$, and the insurer retains the right to reject the individual.

Now that I have described the conceptual framework set-up and regulations, I will focus on the predictions for first-period enrollment and overall prices. Please see Section C for additional details.

6.3 Predictions

The predictions from this conceptual framework are summarized in Figure 14. The diagram shows demand curves and equilibrium prices. Prices are on the vertical axis and quantities are on the horizontal axis. The demand curve for CR is to the left of the demand curve for GR. Under CR, consumers automatically have the option to enroll in the next period, regardless of whether or not they purchase the contract in the current period. In contrast, under GR, consumers only have the option to renew a contract in the next period if they purchase the contract in the current period. Holding price fixed, purchasing the contract in the current period under CR is less valuable relative to the outside option than under GR. The demand curve for CRR is to the right of the demand curve for GR. Under CRR, individuals without insurance who get sick are most likely to be rejected by the insurer and be left without any insurance. This makes purchasing the contract in the current period more valuable under CRR than under GR. The equilibrium price for CR is above the equilibrium price for GR. The reason is due to adverse selection: individuals who get sick are most likely to buy the contract in the next period, which raises the overall price for everyone. The equilibrium price for CRR is below the equilibrium price for GR. The reason is due to positive selection: only individuals who are relatively healthy are permitted to buy the contract in the next period, since insurers will reject those who are sick. This lowers the overall price for everyone. With these pieces in place, the diagram shows that enrollment is lower under CR than under GR, and enrollment is higher under CRR than under GR.

7. Conclusion

In this paper, I use novel and detailed administrative data to do a side-by-side comparison of prohibiting price discrimination ("Community Rating" (CR)), and a regulation that combines an initial open enrollment period with guaranteed renewal ("Guaranteed Renewal" (GR)). This paper is the first to leverage individual-level panel data on the entire Medigap market. Using a boundary regression discontinuity design, I compare individuals who are observationally equivalent but experience different pricing regulations. I examine individuals living within 25 miles of a regulatory boundary. I find that

Medigap enrollment is substantially higher under GR. When CR is instituted, Medigap enrollment drops by 9.3 percentage points (28.0 percent) and new Medigap buyers are 9 percent more adversely selected, with Medigap insurer costs that are $138 higher per year. A simple theoretical framework clarifies two important consequences of prohibiting price discrimination: increased adverse selection and elimination of the Medigap contract's option value. Thus, community rating regulations have quantitatively important impacts on enrollment that are consistent with the economic intuition laid out in the paper.

The results from this paper contribute to a literature on guaranteed renewal contracts as a policy solution to regulating a market where consumers face risks over the long term, such as in health insurance. For example, Herring and Pauly (2006) and Pauly et al. (1995) study the theoretical properties of guaranteed renewable contracts in the under-65-year-old market and discuss how guaranteed renewal contracts can alleviate adverse selection in these settings. This paper contributes to the literature on guaranteed renewal by examining this pricing regulation in a large and important healthcare market where it is possible to do a plausible direct comparison with the leading policy alternative, community rating regulations.

It is also worthwhile to contrast my results with those in Bundorf and Simon (2006), who also examine community rating regulations in the Medigap market. Bundorf and Simon (2006) use the MCBS survey for 1992 to 1999, which covers approximately 12,000 individuals per year during the time period they study. They use a differences-in-differences strategy to estimate the impact of community rating regulations on enrollment. They find that community rating has little effect on the overall rate of Medigap enrollment, but that enrollment decreases by 2.8 percentage points among low risks and increases 2.5 percentage points among high risks. These effects are much smaller than what I find. There are a couple of possible reasons for this, beyond the fact that I use a different research design and different data. One reason is that I study this market approximately 10 years after the community rating laws went into place, so that the market has had an opportunity to settle into a new equilibrium. A second reason is that in Bundorf and Simon (2006), the community rating regulations are pooled into one estimated effect, whereas in this paper I estimate separate effects depending on whether or not the state still allows insurers to reject consumers outside of the initial open enrollment period. As I discuss in the conceptual framework in Section 6, this distinction leads to opposite predictions for equilibrium enrollment; indeed, I find opposite-sign effects for CR and CRR in the empirical analysis.

The differences in enrollment under CR and GR may be of interest to policymakers considering alternative regulatory designs for the ACA exchanges. An alternative pricing regulation in the spirit of GR would be relatively easy to implement in the exchanges. I show that in a large and important long-term healthcare market, GR functions relatively well in balancing the policy objectives of equitable access to health insurance and mitigation of adverse selection. There are several potential ways in which these principles could be incorporated into the ACA exchanges. For instance, one could imagine offering enrollment periods at ages 25, 35, 45, and 55; insurers would be permitted to offer lower prices to those who enroll during these windows, something that they are currently not able to do. The exact policy remedy is beyond the scope of this paper, but this type of regulation could have quantitatively large effects on enrolling a broader and more stable population of consumers.

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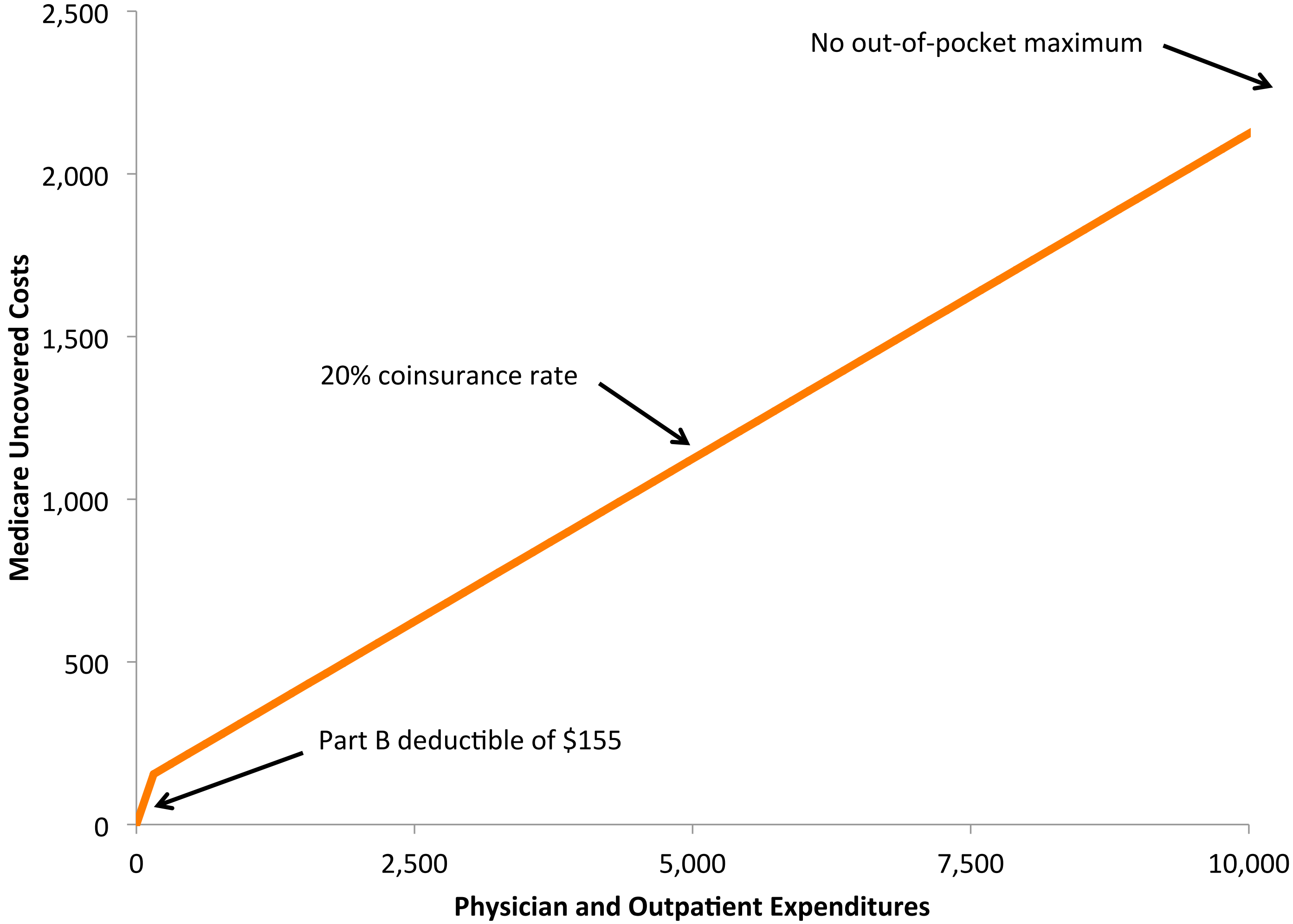
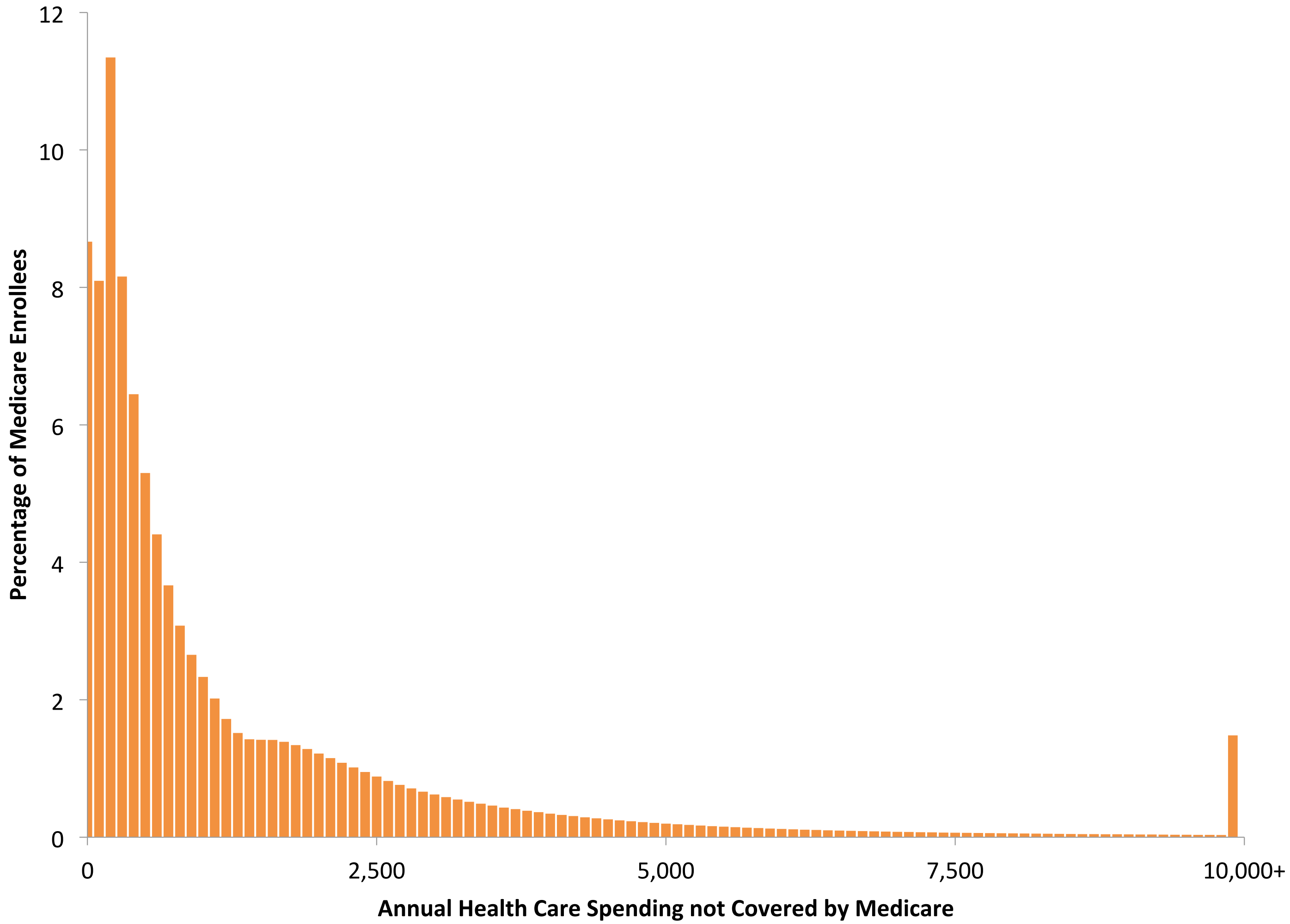
Figure 1: Cost Sharing in Medicare Part B



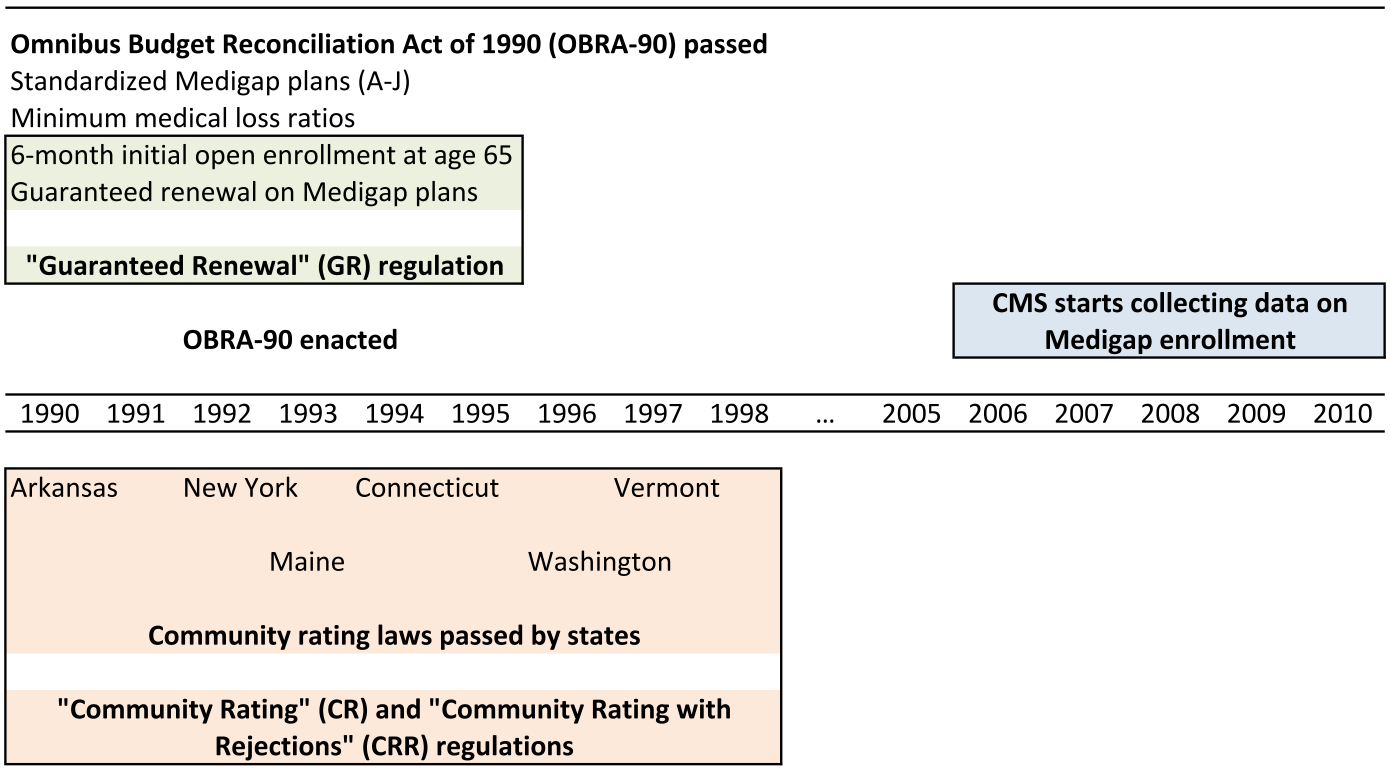
Notes: The figure shows the cost sharing requirements in 2010, the last year of the observation period, for standard Medicare coverage for Part B. Part B covers outpatient and physician expenditures. There is a Part B deductible of $155. Past the deductible, Medicare beneficiaries are liable for 20 percent of additional physician and outpatient expenditures. There is no out-of-pocket maximum with standard Medicare coverage.

Figure 2: Distribution of Uncovered Costs



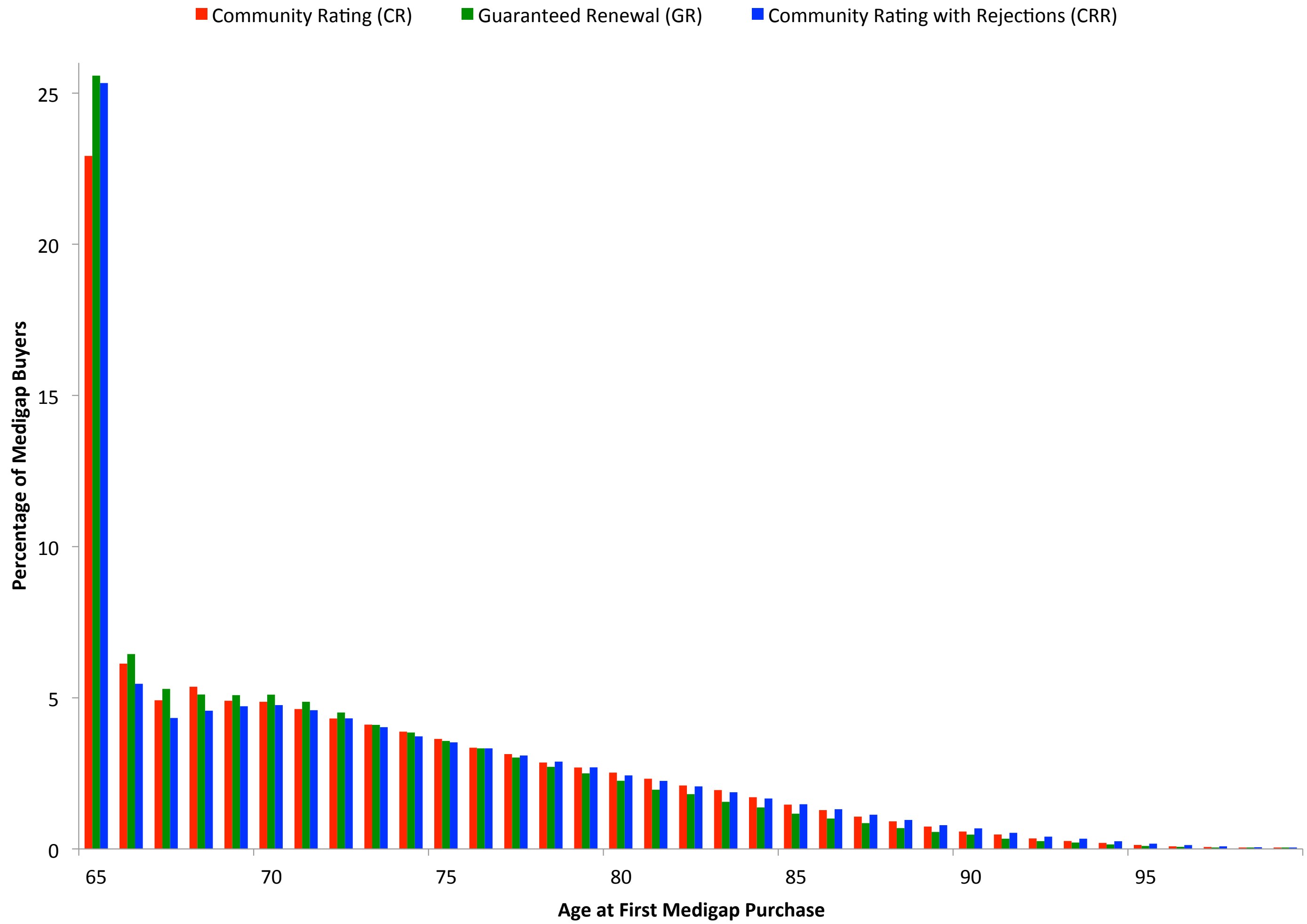
Notes: The figure shows the distribution of annual health care spending not covered by Medicare. This is based on the author's calculations from Medicare claims data using all aged Medicare beneficiaries enrolled in Parts A and B in 2010, the last year of the observation period. The annual uncovered costs are obtained by summing all out-of-pocket costs for Parts A and B. If a Medicare beneficiary has Medigap or employer-sponsored supplemental insurance (ESI), then these out-of-pocket costs are paid by the Medigap or ESI insurer. Otherwise, the Medicare beneficiary is liable for these out-of-pocket costs.

Figure 3: Timeline of Regulations in Medigap



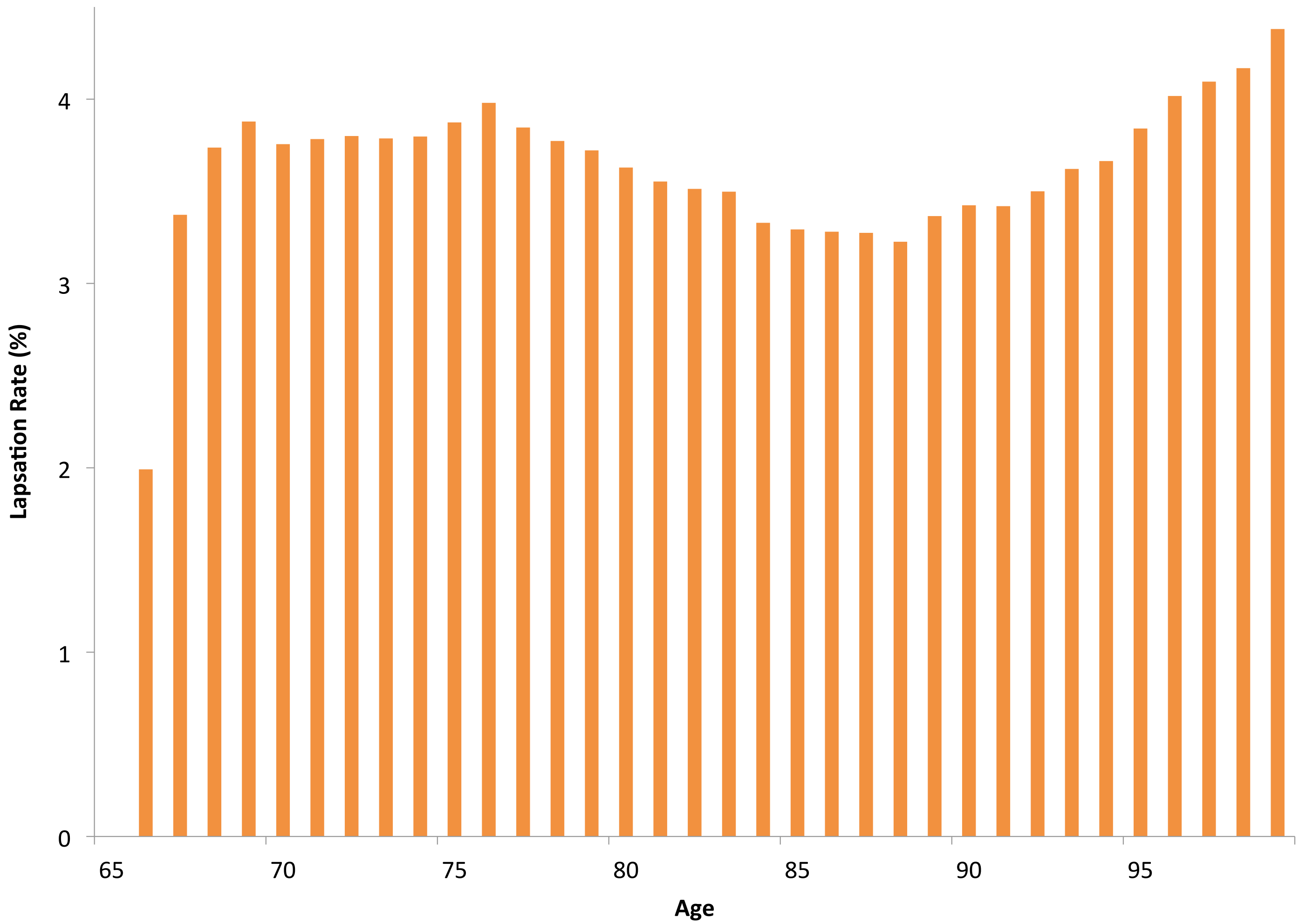
Notes: This figure shows a timeline of regulations in the Medigap market. The first regulation was a federal regulation called the Omnibus Budget Reconciliation Act of 1990 (OBRA-90), which was passed in 1990 and enacted in 1992. This established standardized Medigap plans, minimum medical loss ratios, a 6-month initial open enrollment period, and guaranteed renewal for all Medigap plans. The latter two regulations (open enrollment and guaranteed renewal) are referred to in the paper as the "Guaranteed Renewal" regulation. From 1990 through 1997, six states passed community rating laws, which are classified in the paper as either "Community Rating" or "Community Rating with Rejections" depending on whether insurers are still permitted to reject consumers outside of the initial open enrollment period. The CMS administrative data on Medigap enrollment that are used in the paper were collected starting in 2007; the sample period used in the paper is 2006 through 2010.

Figure 4: Age at First Purchase among Medigap Buyers



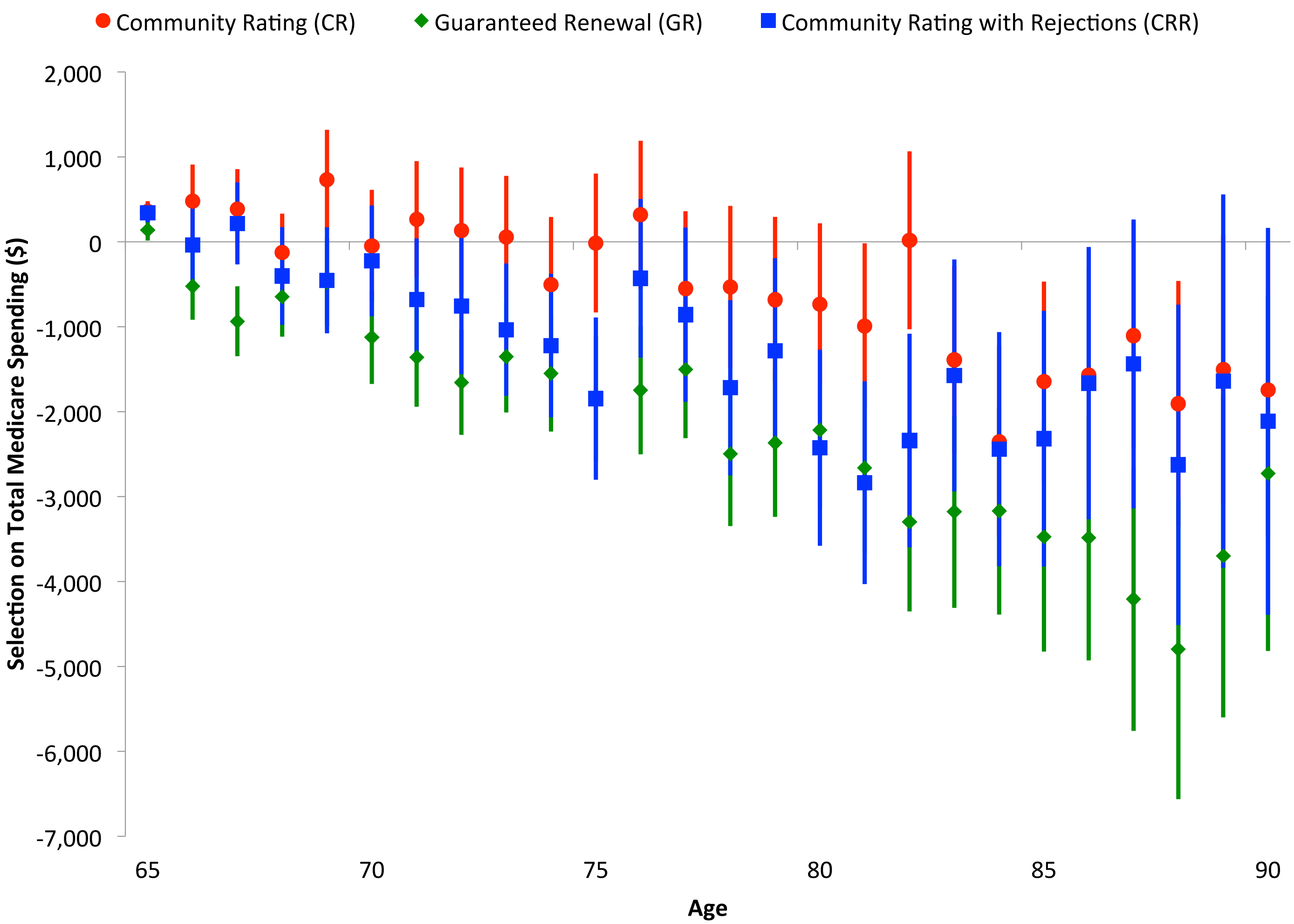
Notes: This figure shows a histogram of age at first Medigap purchase among Medigap buyers. The sample is restricted to individuals living in Community Rating (CR) states, Community Rating with Rejections (CRR) states, and Guaranteed Renewal (GR) states that border CR or CRR states.

Figure 5: Lapsation among Medigap Buyers, by Age



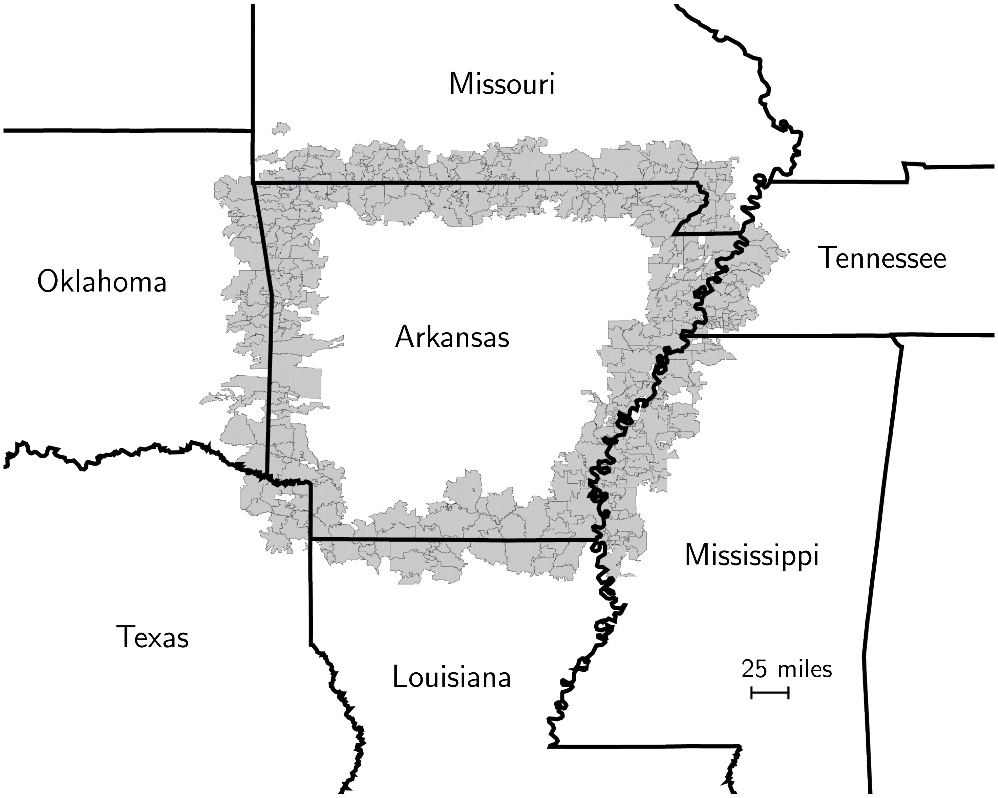
Notes: This figure shows the annual lapsation rate among Medigap buyers. The sample is restricted to individuals living in Community Rating (CR) states, Community Rating with Rejections (CRR) states, and Guaranteed Renewal (GR) states that border CR or CRR states. The lapsation rate for each age is computed by restricting to the set of individuals who are enrolled in Medicare (and alive) during the observation year and were enrolled in Medigap during the previous year, and computing the percentage who are also enrolled during the observation year. The lapsation rates are computed by age.

Figure 6: Selection into Medigap among New Buyers, by Age and Regulation



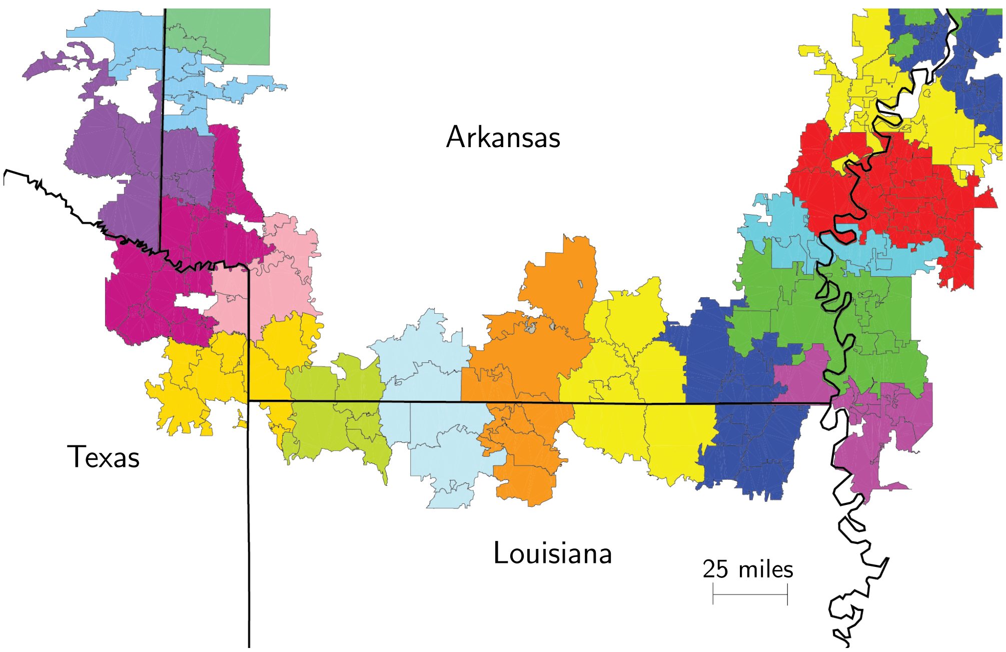
Notes: This figure shows a measure of selection into Medigap, by age. For each age, the figure shows the plotted coefficient from a regression of total Medicare spending on an indicator for being enrolled in Medigap; the sample is restricted to new Medigap buyers. The sample is also restricted to individuals living in Community Rating (CR) states, Community Rating with Rejections (CRR) states, and Guaranteed Renewal (GR) states that border CR or CRR states.

Figure 7: Map of Zip Codes within 25 Miles of Arkansas Border



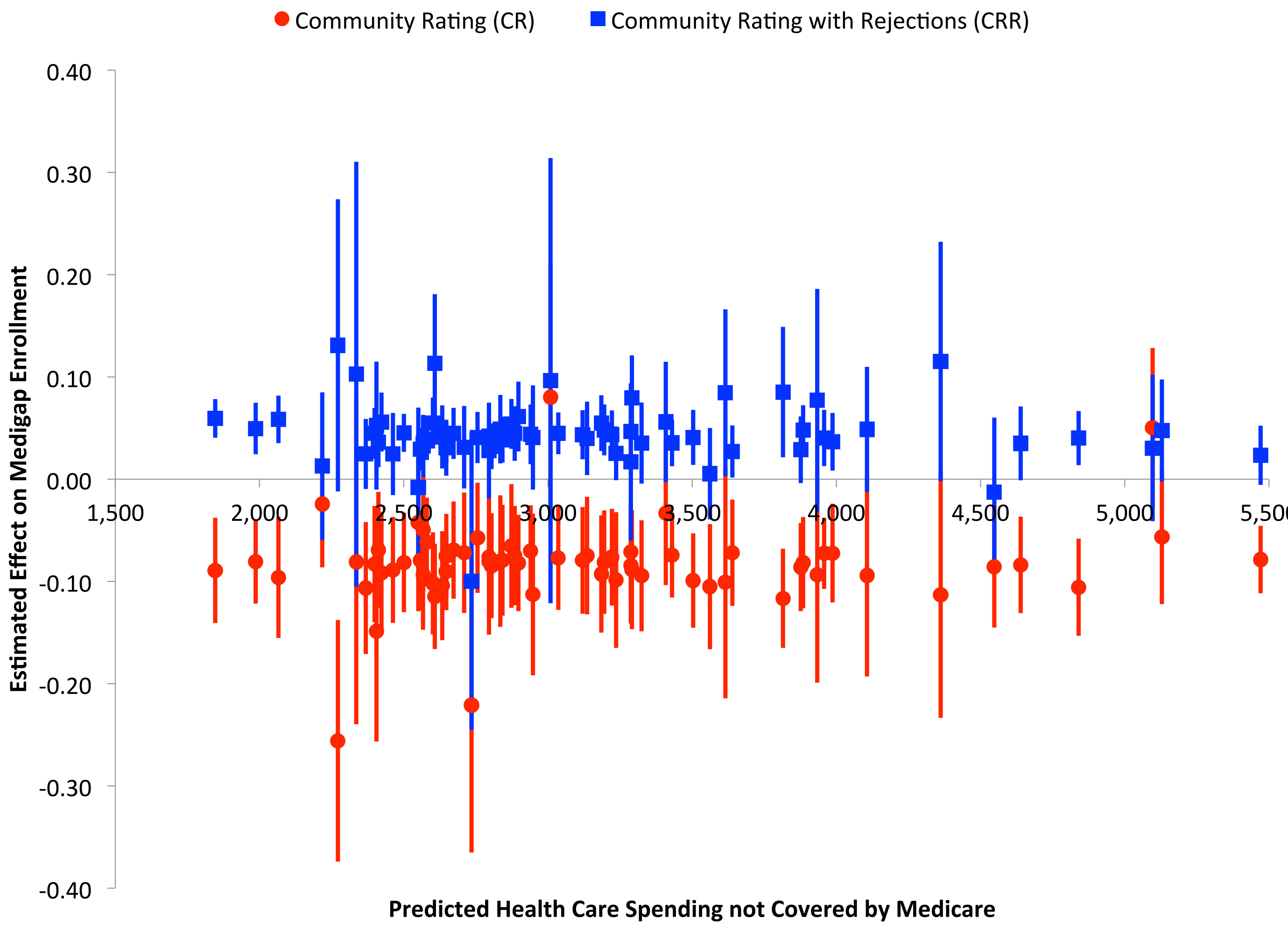
Notes: This figure shows a map of the zip codes within 25 miles of the Arkansas border, which is one of the regulatory boundaries. Arkansas has Community Rating with Rejections (CRR). Each adjacent state has Guaranteed Renewal (GR). Zip codes within 25 miles of the Arkansas border are shaded in gray. See Section 4 for further details.

Figure 8: Map of Border Segments along Arkansas Border



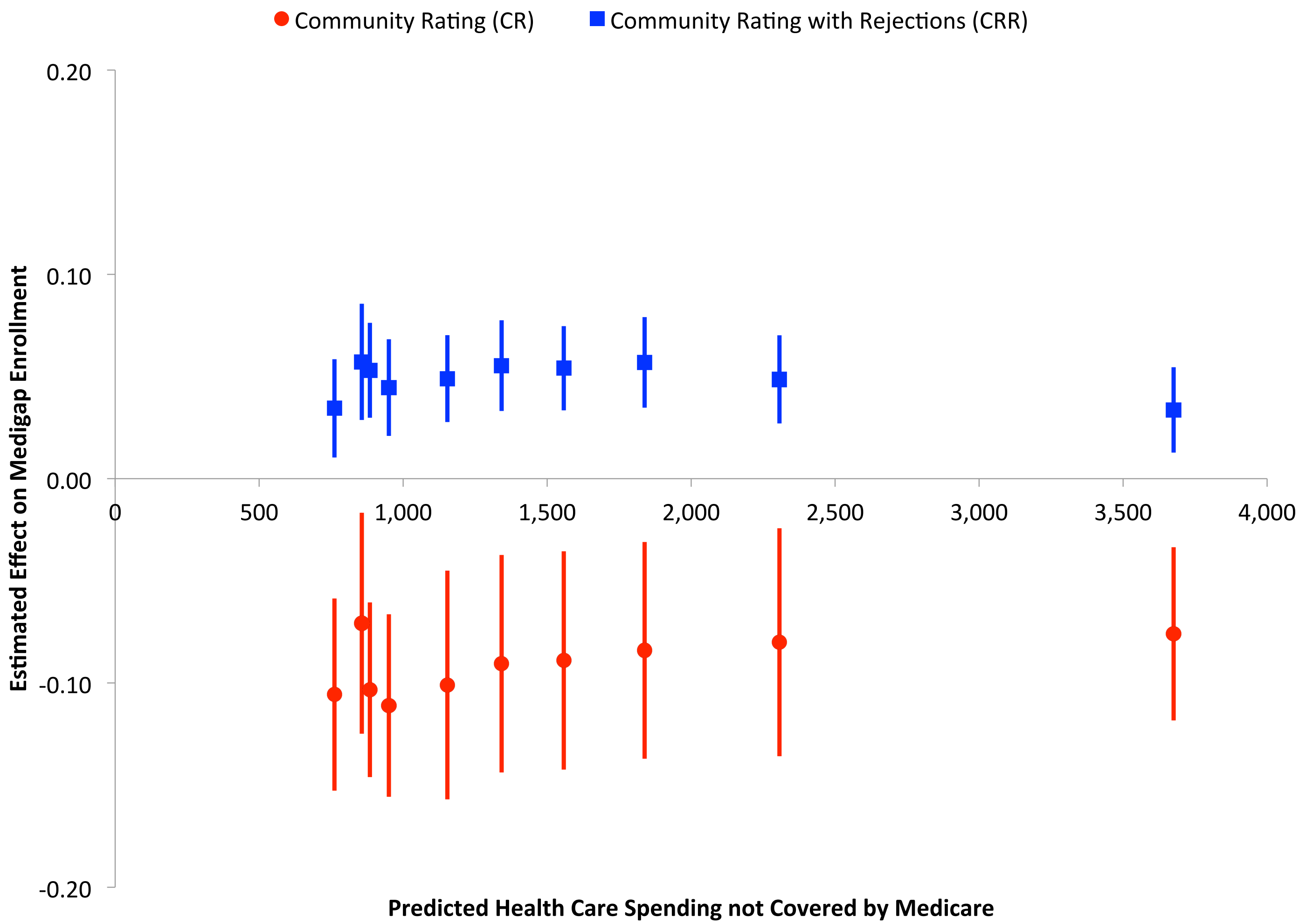
Notes: This figure shows a map of the border segments along the Arkansas border, which is one of the regulatory boundaries. Arkansas has Community Rating with Rejections (CRR). Each adjacent state has Guaranteed Renewal (GR). Each zip code is assigned to exactly one border segment of approximate length 25 miles. Each border segment is represented by a different color. Zip codes within 25 miles of the Arkansas border are shown in color. See Section 4 for further details.

Figure 9: Heterogeneity in Impact of Community Rating on Medigap Enrollment, by Health Condition



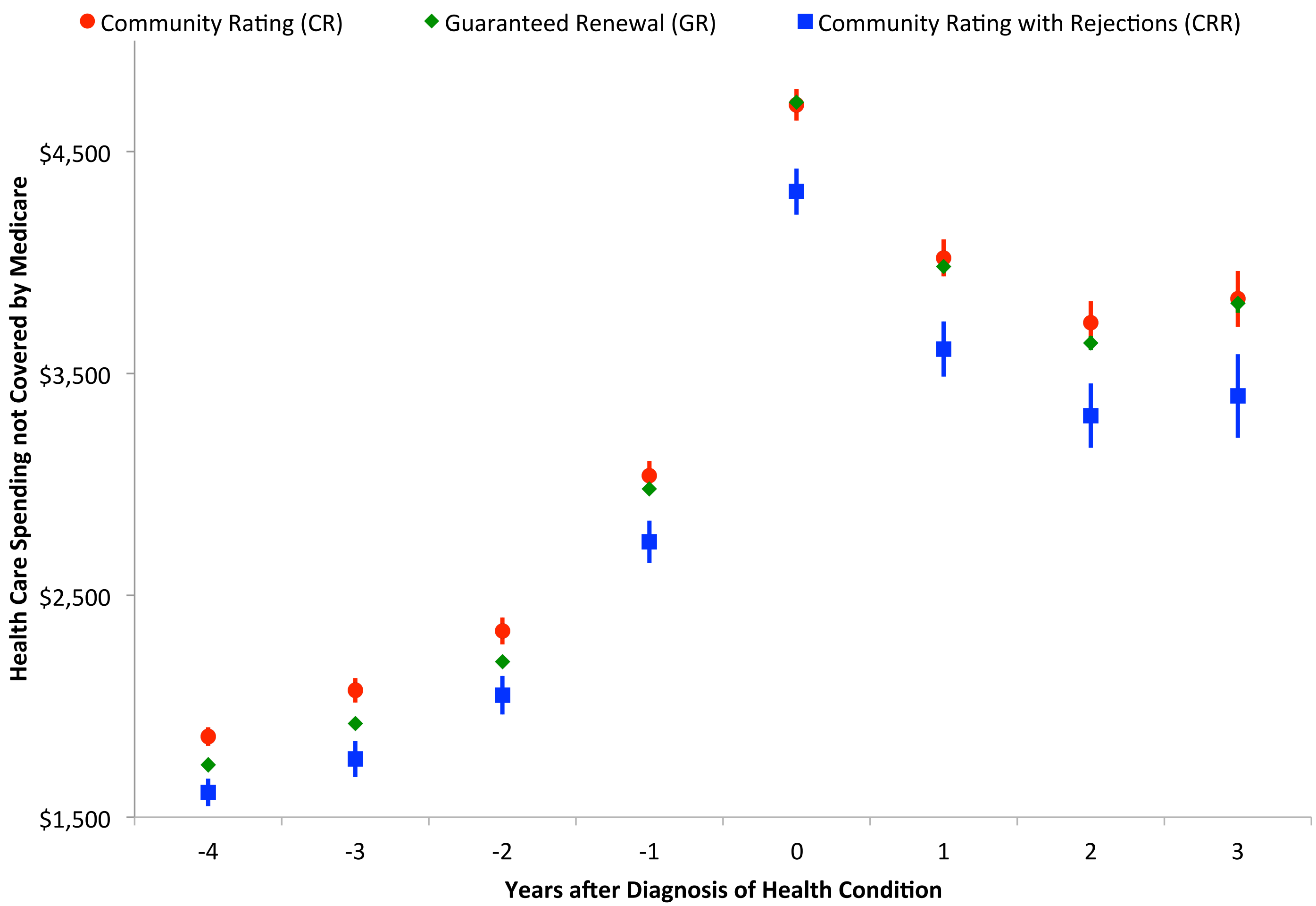
Notes: This figure shows estimates of estimated impacts of Community Rating (CR) and Community Rating with Rejections (CRR) on Medigap enrollment, by health condition. The health conditions are the 70 hierarchical condition categories (HCC) that are used in CMS's Medicare Advantage risk adjustment model. These health conditions correspond to clinically meaningful health diagnoses that are predictive of health care spending. Each point in the figure corresponds to a different health condition, and shows the estimated impact of CR (CRR) on Medigap enrollment for Medicare enrollees with the particular health condition. The horizonal axis shows the predicted annual health care spending for the health condition. The sample is those who live in a CR (CRR) or CR (CRR)-adjacent state, and within 25 miles of the state border. Standard errors are clustered by border segment. The specification includes border segment fixed effects. The bars show 95 percent confidence intervals.

Figure 10: Heterogeneity in Impact of Community Rating on Medigap Enrollment, by Risk Score Decile



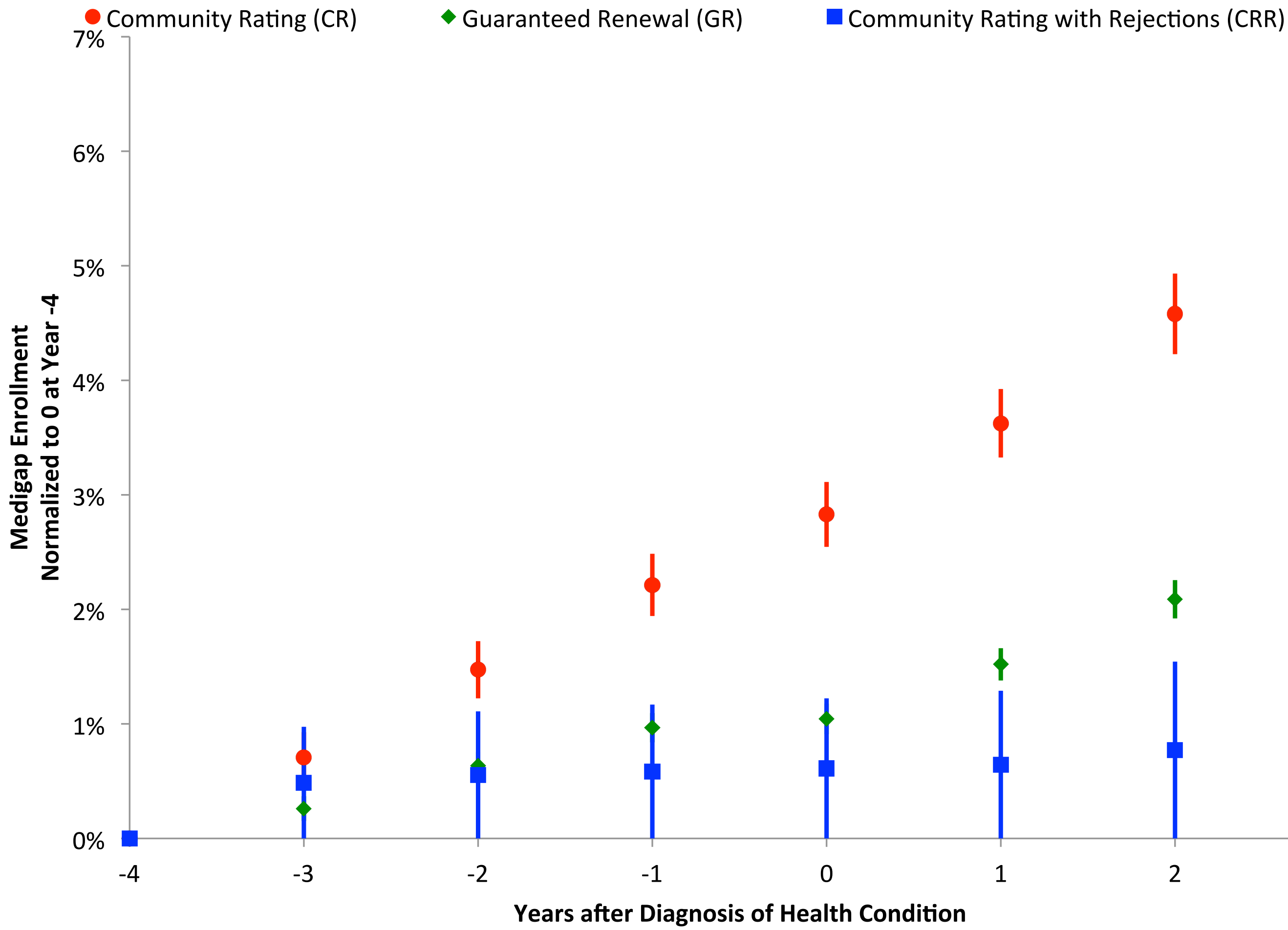
Notes: This figure shows estimates of estimated impacts of Community Rating (CR) and Community Rating with Rejections (CRR) on Medigap enrollment, by risk score decile. The risk score decile is based on the risk score from CMS's Medicare Advantage risk adjustment model. Each point in the figure corresponds to a different risk score decile, and shows the estimated impact of CR (CRR) on Medigap enrollment for Medicare enrollees with the particular risk score decile. The horizonal axis shows the predicted annual health care spending for the risk score decile. The sample is those who live in a CR (CRR) or CR (CRR)-adjacent state, and within 25 miles of the state border. Standard errors are clustered by border segment. The specification includes border segment fixed effects. The bars show 95 percent confidence intervals.

Figure 11: Spending during Onset of Chronic Health Condition



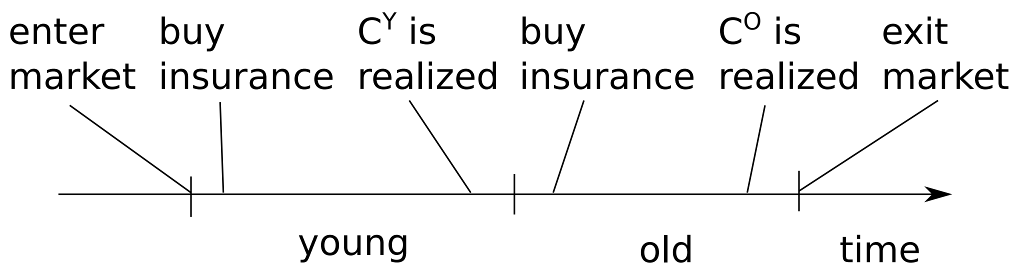
Notes: This figure shows estimates of annual Medicare uncovered costs for each of the years prior to and after the onset of a chronic health condition. The chronic health conditions examined are severe cancers including those of the lung and upper digestive tract. The sample is all aged Medicare beneficiaries ever diagnosed with this health condition between 2006 and 2010. Year 0 is defined as the first year the health condition was diagnosed. Estimated coefficients are obtained from a regression of annual Medicare uncovered costs on yearly indicators and individual fixed effects. The bars show 95 percent confidence intervals.

Figure 12: Medigap Enrollment during Onset of Chronic Health Condition



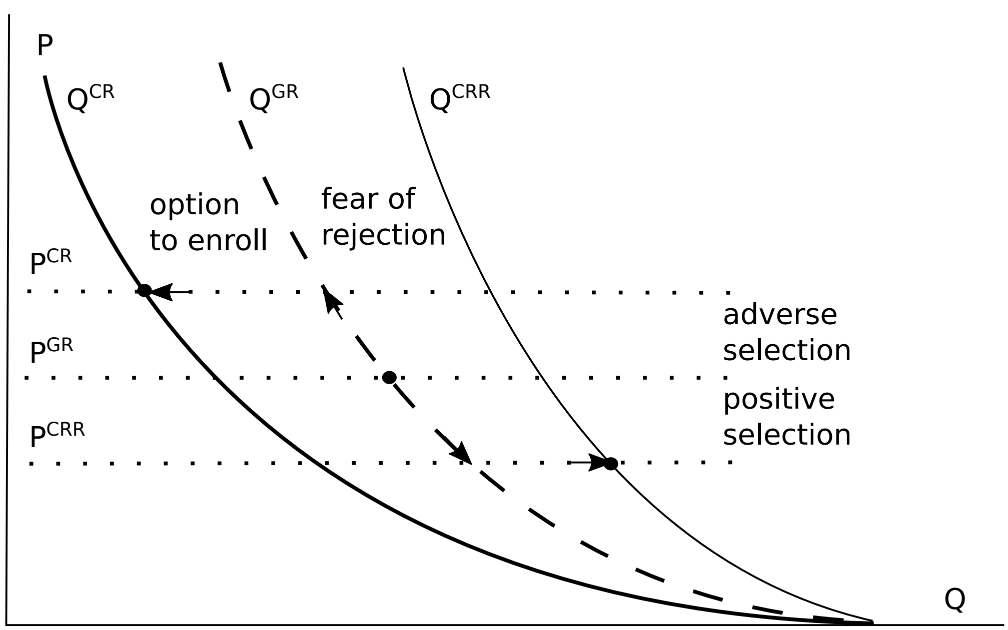
Notes: This figure shows estimates of Medigap enrollment for each of the years prior to and after the onset of a chronic health condition. The chronic health conditions examined are severe cancers including those of the lung and upper digestive tract. The sample is all aged Medicare beneficiaries ever diagnosed with this health condition between 2006 and 2010. Year 0 is defined as the first year the health condition was diagnosed. Estimated coefficients are obtained from a regression of Medigap coverage on yearly indicators and individual fixed effects. The bars show 95 percent confidence intervals.

Figure 13: Timeline from Theoretical Framework



Notes: The figure shows the timing from the theoretical framework in Section 6. An individual enters this market when he is "young," becomes "old" after a period of time, and then leaves the market (dies). In each period there is a realization of health costs denoted C^Y for the young and C^O for the old. Without insurance, individuals would have to pay these costs from their endowments. In case of a higher cost realization their consumption would be low, and in case of a lower cost realization their consumption would be high. Due to risk aversion, this creates demand for health insurance.

Figure 14: Summary of Predictions from Theoretical Framework



Notes: This figure shows a summary of the model's predictions for equilibrium enrollment and prices under Community Rating (CR), Guaranteed Renewal (GR), and Community Rating with Rejections (CRR). The diagram shows demand curves and equilibrium prices. Prices are on the vertical axis and quantities are on the horizontal axis. Equilibrium enrollment is lower under CR than under GR, and equilibrium enrollment is higher under CRR than under GR. See Section 6 for further details.

Table 1: Summary Statistics

	All States	Community Rating (CR) Sample: Within 25 Miles of Regulatory Boundary		Community Rating with Rejections (CRR) Sample: Within 25 Miles of Regulatory Boundary	
	All	All	Medigap Buyers	All	Medigap Buyers
	Mean	Mean	Mean	Mean	Mean
	(1)	(2)	(3)	(4)	(5)
Men	0.418	0.409	0.378	0.419	0.396
White	0.871	0.910	0.960	0.913	0.972
Black	0.073	0.048	0.021	0.059	0.014
Hispanic	0.017	0.013	0.003	0.003	0.001
Age	75.822	76.488	76.931	75.732	76.220
Household income	40,576	46,127	49,087	37,056	36,518
Education: < HS	0.227	0.212	0.195	0.210	0.216
Education: HS grad	0.345	0.370	0.361	0.337	0.347
Education: college grad	0.248	0.274	0.290	0.260	0.267
Poverty rate	0.092	0.076	0.069	0.097	0.095
Veteran	0.527	0.518	0.523	0.562	0.562
Labor force participation	0.159	0.182	0.190	0.151	0.156
Homeownership rate	0.795	0.774	0.790	0.788	0.801
Traditional Medicare	0.769	0.839	0.993	0.755	0.991
Medicare Advantage	0.254	0.180	0.013	0.270	0.021
Part D	0.569	0.516	0.637	0.591	0.680
Part D low-income subsidy	0.136	0.121	0.051	0.141	0.065
Medigap	0.233	0.268	1.000	0.223	1.000
Medicaid	0.114	0.094	0.032	0.116	0.049
Urban	0.774	0.872	0.872	0.596	0.476
Medicare insurer spending	8,643	9,505	8,403	7,668	7,114
Medicare OOP liability	1,478	1,595	1,529	1,347	1,345
Medicare total spending	10,121	11,101	9,931	9,015	8,459
Any health condition	0.549	0.581	0.601	0.513	0.532
Number of health conditions	1.295	1.400	1.366	1.149	1.135
Risk score	1.001	1.049	1.002	0.940	0.907
Died during observation year	0.042	0.042	0.013	0.044	0.025
Lives in birth state	0.585	0.676	0.664	0.491	0.509
No. of observations	156,132,182	5,736,273	1,538,236	3,140,675	700,310

Notes: Observations are at the enrollee-year level. The table shows summary statistics for the sample of all aged Medicare beneficiaries in the United States (the 50 states and the District of Columbia), for Medicare beneficiaries in the Community Rating (CR) and Community Rating with Rejections (CRR) analysis samples, and for Medigap buyers in those analysis samples. The variables household income - homeownership rate are constructed from American Community Survey zip-code-level data for age 65 and over (see Appendix Section B.2 for details). All other variables are at the individual level and constructed from the CMS administrative data.

Table 2: Test for Balance, Community Rating (CR)

	Medigap[a]	Community Rating (CR)[b]		
	Full Sample	Full Sample	Border States[c]	Within 25 Miles[d]
	(1)	(2)	(3)	(4)
Male	-0.031 ***	-0.001	0.001	-0.001
	(0.001)	(0.001)	(0.002)	(0.001)
Age	0.002 ***	0.000	-0.001	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Medicaid	-0.171 ***	0.012 *	0.056 ***	0.023 **
	(0.006)	(0.007)	(0.011)	(0.010)
Urban	-0.078 ***	0.015	0.040	0.113
	(0.008)	(0.017)	(0.091)	(0.177)
HH income / $10,000	0.002	0.041 **	-0.002	0.013
	(0.003)	(0.020)	(0.025)	(0.014)
Education: < HS	-0.083 **	0.091	-0.438	0.363 **
	(0.035)	(0.079)	(0.271)	(0.165)
Education: HS grad	-0.051	0.531 ***	-0.768 **	-0.233
	(0.041)	(0.170)	(0.287)	(0.166)
Education: College grad	0.012 ***	0.049 ***	0.008	0.000
	(0.003)	(0.011)	(0.040)	(0.029)
Poverty	-0.048	-0.113	-0.007	-0.806 *
	(0.048)	(0.119)	(0.275)	(0.447)
Veteran (among men)	0.055 *	-0.252	-0.260	-0.070
	(0.029)	(0.167)	(0.161)	(0.111)
Labor force participation	0.296 ***	-0.103	-1.184 *	-0.138
	(0.077)	(0.140)	(0.590)	(0.160)
Homeowner	0.033	-0.589 **	0.029	-0.060
	(0.020)	(0.258)	(0.150)	(0.096)
Joint F test p-value	0.000	0.000	0.000	0.216
No. of states	46	46	8	8
No. of clusters	810	810	46	46
No. of observations	147,337,337	147,337,337	16,265,614	5,736,273

Notes: Observations are at the enrollee-year level. The "Full Sample" is all Medicare beneficiaries age 65 and over. The first three variables (male, age, Medicaid) come from CMS administrative individual-level data and the remaining variables come from American Community Survey zip-code-level data for age 65 and over (see Appendix Section B.2 for details). Standard errors, clustered by border segment, are shown in parentheses. $*p < 0.1$, $**p < 0.05$, $***p < 0.01$. [a] This column shows coefficients from an OLS regression of an indicator for Medigap enrollment on the covariates listed. [b] These columns show coefficients from an OLS regression of an indicator for living in a CR state on the covariates listed. [c] The sample is as in "Full Sample" but restricted to those in a CR or CR-adjacent state. [d] The sample is as in "Border States" but restricted to those within 25 miles of the state border. The specification includes border segment fixed effects.

Table 3: Test for Balance, Community Rating with Rejections (CRR)

	Medigap[a]	Community Rating with Rejections (CRR)[b]		
	Full Sample	Full Sample	Border States[c]	Within 25 Miles[d]
	(1)	(2)	(3)	(4)
Male	-0.031 ***	0.001 *	0.005 **	0.001
	(0.001)	(0.000)	(0.002)	(0.002)
Age	0.002 ***	0.000 **	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Medicaid	-0.177 ***	0.004 ***	0.036 **	0.029 **
	(0.007)	(0.002)	(0.015)	(0.012)
Urban	-0.078 ***	-0.036 ***	0.000	0.182
	(0.008)	(0.011)	(0.116)	(0.199)
HH income / $10,000	0.002	-0.006 **	0.110 **	0.003
	(0.003)	(0.003)	(0.046)	(0.021)
Education: < HS	-0.080 **	-0.146 *	0.290	-0.020
	(0.036)	(0.075)	(0.544)	(0.255)
Education: HS grad	-0.025	-0.170 **	0.203	0.093
	(0.046)	(0.075)	(0.363)	(0.231)
Education: College grad	0.015 ***	0.005 *	0.028	0.015
	(0.003)	(0.003)	(0.023)	(0.027)
Poverty	-0.069	0.011	-0.065	-0.249
	(0.051)	(0.039)	(0.366)	(0.277)
Veteran (among men)	0.035	0.083 ***	0.122	0.140
	(0.034)	(0.029)	(0.177)	(0.230)
Labor force participation	0.283 ***	-0.174	-0.427	-0.464
	(0.080)	(0.106)	(0.361)	(0.578)
Homeowner	0.023	-0.048	-0.242	-0.037
	(0.023)	(0.041)	(0.255)	(0.251)
Joint F test p-value	0.000	0.001	0.000	0.112
No. of states	46	46	13	13
No. of clusters	807	807	85	82
No. of observations	139,804,502	139,804,502	8,571,974	3,140,675

Notes: Observations are at the enrollee-year level. The "Full Sample" is all Medicare beneficiaries age 65 and over. The first three variables (male, age, Medicaid) come from CMS administrative individual-level data and the remaining variables come from American Community Survey zip-code-level data for age 65 and over (see Appendix Section B.2 for details). Standard errors, clustered by border segment, are shown in parentheses. $*p < 0.1$, $**p < 0.05$, $***p < 0.01$. ^{a} This column shows coefficients from an OLS regression of an indicator for Medigap enrollment on the covariates listed. ^{b} These columns show coefficients from an OLS regression of an indicator for living in a CRR state on the covariates listed. ^{c} The sample is as in "Full Sample" but restricted to those in a CRR or CRR-adjacent state. ^{d} The sample is as in "Border States" but restricted to those within 25 miles of the state border. The specification includes border segment fixed effects.

Table 4: Balance on Health

	Community Rating (CR)				Community Rating with Rejections (CRR)			
	Full Sample	Border States[a]	Within 25 Miles[b]	Mean in GR Comparison Sample[c]	Full Sample	Border States[a]	Within 25 Miles[b]	Mean in GR Comparison Sample[c]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Any health conditions	0.038 ***	-0.001	0.009	0.596	-0.047 ***	-0.004	0.006	0.521
	(0.007)	(0.006)	(0.009)		(0.006)	(0.007)	(0.005)	
No. of health conditions	0.151 ***	0.000	0.034	1.501	-0.195 ***	-0.015	0.016	1.200
	(0.049)	(0.029)	(0.043)		(0.023)	(0.031)	(0.019)	
Risk score	0.078 ***	0.011	0.016	1.090	-0.081 ***	-0.005	0.008	0.966
	(0.029)	(0.013)	(0.025)		(0.011)	(0.013)	(0.008)	
Mortality	0.000	-0.002 ***	0.000	0.048	0.000	-0.001 *	0.000	0.048
	(0.001)	(0.001)	(0.001)		(0.001)	(0.001)	(0.001)	
No. of states	51	8	8		51	13	13	
No. of clusters	819	46	46		819	85	82	
No. of observations	156,132,182	16,410,430	5,794,415		156,132,182	8,757,964	3,205,828	

Notes: Observations are at the enrollee-year level. The "Full Sample" is all Medicare beneficiaries age 65 and over. In Columns (1) - (3) and (5) - (7), each row shows the coefficient from an OLS regression of the variable listed on an indicator for living in a CR state. Standard errors, clustered by border segment, are shown in parentheses. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$. [a] The sample is as in "Full Sample" but restricted to those in a CR (CRR) or CR (CRR)-adjacent state. [b] The sample is as in "Border States" but restricted to those within 25 miles of the state border. The specification includes border segment fixed effects. [c] Each row shows the sample mean of the variable listed. The sample is as in "Within 25 Miles" but restricted to those in GR states.

Table 5: Impact of Community Rating on Medigap Enrollment

	Community Rating (CR)			Community Rating with Rejections (CRR)		
	Impact of Pricing Regulation[a] (1)	Mean in GR Comparison Sample[b] (2)	% Change w/ Pricing Regulation[c] (3)	Impact of Pricing Regulation[a] (4)	Mean in GR Comparison Sample[b] (5)	% Change w/ Pricing Regulation[c] (6)
Enrollment	-0.093 *** (0.026)	0.328	-28	0.050 *** (0.011)	0.190	26
Enrollment: Ages 65-69	-0.122 *** (0.020)	0.293	-42	0.031 *** (0.012)	0.178	17
Enrollment: Ages 70-74	-0.092 *** (0.027)	0.326	-28	0.051 *** (0.011)	0.196	26
Enrollment: Ages 75-79	-0.072 ** (0.028)	0.341	-21	0.061 *** (0.012)	0.196	31
Enrollment: Ages 80-84	-0.083 *** (0.030)	0.361	-23	0.060 *** (0.011)	0.195	31
Enrollment: Ages 85-89	-0.087 *** (0.030)	0.349	-25	0.052 *** (0.010)	0.194	27
Enrollment: Ages 90+	-0.091 *** (0.023)	0.293	-31	0.050 *** (0.014)	0.176	29
No. of states	8			13		
No. of clusters	46			82		
No. of observations	5,068,912			2,769,460		

Notes: This table shows estimated impacts of Community Rating (CR) and Community Rating with Rejections (CRR) on Medigap enrollment, overall and separately by age group. Observations are at the enrollee-year level. The sample is those who live in a CR (CRR) or CR (CRR)-adjacent state, and within 25 miles of the state border. Standard errors, clustered by border segment, are shown in parentheses. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$. [a] Each row shows the coefficient from an OLS regression of the outcome listed on an indicator for living in a CR (CRR) state. The specification includes border segment fixed effects. [b] Each row shows the mean of the outcome listed for the comparison sample living in Guaranteed Renewal (GR) states. [c] Each row shows percent change as measured by the coefficient on CR (CRR) divided by the mean in GR.

Table 6: Impact of Community Rating on Selection into Medigap Enrollment

	All Medigap Buyers		New Medigap Buyers	
	(1)	(2)	(3)	(4)
Age at first Medigap purchase	1.352 ***	1.203 ***	2.046 ***	0.744 ***
	(0.371)	(0.374)	(0.617)	(0.262)
Age	0.348 *	0.000	1.352 ***	0.000
	(0.202)	(0.000)	(0.442)	(0.000)
Healthcare spending not covered by Medicare	15.363	0.384	138.227 ***	82.773 **
	(31.632)	(33.020)	(47.159)	(38.988)
Healthcare spending covered by Medicare	154.509	58.802	939.072 ***	465.060 *
	(174.149)	(169.146)	(320.189)	(265.577)
Healthcare spending (total)	169.872	59.186	1077.299 ***	547.833 *
	(200.703)	(197.850)	(363.807)	(300.160)
Any health condition	0.019 **	0.006	0.048 ***	0.017 *
	(0.009)	(0.007)	(0.010)	(0.009)
Number of health conditions	0.048	0.017	0.172 ***	0.079 **
	(0.029)	(0.026)	(0.042)	(0.039)
Risk score for predicted healthcare spending	0.015	0.003	0.082 ***	0.031
	(0.016)	(0.012)	(0.023)	(0.019)
Died during observation year	-0.003 ***	-0.003 ***	0.004 ***	0.002 **
	(0.001)	(0.001)	(0.001)	(0.001)
Boundary segment FEs	x	x	x	x
Demographic controls		x		x
No. of states	8	8	8	8
No. of clusters (boundary segments)	46	46	46	46
No. of observations (enrollee-years)	1,279,762	1,279,762	70,826	70,826

Notes: This table shows estimated impacts of Community Rating (CR) on selection into Medigap enrollment. Observations are at the enrollee-year level. The sample is those who live in a CR or CR-adjacent state, and within 25 miles of the regulatory boundary. Each row shows the coefficient from an OLS regression of the outcome listed on an indicator for living in a CR state. All specifications includes boundary segment fixed effects. Columns 1 and 2 show estimates for the entire sample of Medigap buyers. Columns 3 and 4 restrict to the sample of Medigap buyers who were not Medigap buyers during the previous year. Standard errors, clustered by border segment, are shown in parentheses. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 7: Impact of Community Rating with Rejections on Selection into Medigap Enrollment

	All Medigap Buyers		New Medigap Buyers	
	(1)	(2)	(3)	(4)
Age at first Medigap purchase	-0.482	-0.541	-0.216	0.147
	(0.531)	(0.412)	(0.293)	(0.138)
Age	0.134	0.000	-0.371	0.000
	(0.261)	(0.000)	(0.288)	(0.000)
Healthcare spending not covered by Medicare	-68.043 **	-73.769 ***	-37.419	-27.921
	(25.900)	(21.870)	(38.189)	(35.737)
Healthcare spending covered by Medicare	-403.961 **	-439.187 ***	-274.952	-195.745
	(202.905)	(165.869)	(228.508)	(217.590)
Healthcare spending (total)	-472.004 **	-512.957 ***	-312.371	-223.666
	(226.041)	(184.526)	(260.249)	(246.113)
Any health condition	-0.003	-0.007	-0.031 **	-0.019 **
	(0.010)	(0.006)	(0.013)	(0.008)
Number of health conditions	-0.030	-0.038 *	-0.078 **	-0.051 **
	(0.031)	(0.021)	(0.035)	(0.024)
Risk score for predicted healthcare spending	-0.017	-0.021 **	-0.033 *	-0.020 *
	(0.016)	(0.010)	(0.018)	(0.010)
Died during observation year	-0.002	-0.002	-0.001	-0.001
	(0.002)	(0.002)	(0.001)	(0.001)
Boundary segment FEs	x	x	x	x
Demographic controls		x		x
No. of states	13	13	13	13
No. of clusters (boundary segments)	82	82	82	82
No. of observations (enrollee-years)	588,864	588,864	29,839	29,839

Notes: This table shows estimated impacts of Community Rating with Rejections (CRR) on selection into Medigap enrollment. Observations are at the enrollee-year level. The sample is those who live in a CRR or CRR-adjacent state, and within 25 miles of the regulatory boundary. Each row shows the coefficient from an OLS regression of the outcome listed on an indicator for living in a CRR state. All specifications includes boundary segment fixed effects. Columns 1 and 2 show estimates for the entire sample of Medigap buyers. Columns 3 and 4 restrict to the sample of Medigap buyers who were not Medigap buyers during the previous year. Standard errors, clustered by border segment, are shown in parentheses. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 8: Impact of Community Rating on Medigap Premiums

	Community Rating (CR)			Community Rating with Rejections (CRR)		
	Impact of Pricing Regulation[a]	Mean in GR Comparison Sample[b]	% Change w/ Pricing Regulation[c]	Impact of Pricing Regulation[a]	Mean in GR Comparison Sample[b]	% Change w/ Pricing Regulation[c]
	(1)	(2)	(3)	(4)	(5)	(6)
Premium	138 *	2,600	5	-615 ***	2,148	-29
	(80)			(156)		
Premium: Ages 65-69	390 ***	2,318	17	-281 *	1,800	-16
	(57)			(155)		
Premium: Ages 70-74	212 ***	2,527	8	-524 ***	2,037	-26
	(70)			(152)		
Premium: Ages 75-79	28	2,707	1	-756 ***	2,268	-33
	(96)			(163)		
Premium: Ages 80-84	-63	2,789	-2	-882 ***	2,408	-37
	(109)			(159)		
Premium: Ages 85-89	-80	2,798	-3	-930 ***	2,475	-38
	(111)			(157)		
Premium: Ages 90+	-70	2,632	-3	-917 ***	2,390	-38
	(103)			(150)		
No. of states	8			13		
No. of clusters	46			82		
No. of observations	7,219			5,715		

Notes: This table shows estimated impacts of Community Rating (CR) and Community Rating with Rejections (CRR) on Medigap premiums, overall and separately by age group. Observations are at the zip code-year level. The sample is zip codes in a CR (CRR) or CR (CRR)-adjacent state, and within 25 miles of the state border. Standard errors, clustered by border segment, are shown in parentheses. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$. ^{a} Each row shows the coefficient from an OLS regression of the outcome listed on an indicator for living in a CR (CRR) state. The specification includes border segment fixed effects. ^{b} Each row shows the mean of the outcome listed for the comparison sample living in Guaranteed Renewal (GR) states. ^{c} Each row shows percent change as measured by the coefficient on CR (CRR) divided by the mean in GR.

Table 9: Robustness Checks: Impact of Community Rating on Medigap Enrollment

	Community Rating (CR)				Community Rating with Rejections (CRR)			
	Impact of Pricing Regulation[a]		Mean in GR Comparison Sample[b]	No. of Clusters / Obs.[c]	Impact of Pricing Regulation[a]		Mean in GR Comparison Sample[b]	No. of Clusters / Obs.[c]
	(1)		(2)	(3)	(4)		(5)	(6)
Baseline specification	-0.093	***	0.328	46	0.050	***	0.190	82
	(0.026)			5,068,912	(0.011)			2,769,460
Border states	-0.135	***	0.326	46	0.061	***	0.195	85
	(0.014)			13,534,330	(0.014)			7,658,021
Within 100 miles	-0.114	***	0.326	46	0.061	***	0.199	85
	(0.022)			10,376,206	(0.013)			5,755,181
Within 50 miles	-0.100	***	0.329	46	0.062	***	0.201	85
	(0.024)			8,071,691	(0.013)			3,858,537
Within 10 miles	-0.063	***	0.353	45	0.052	***	0.196	78
	(0.017)			1,514,954	(0.010)			1,134,283
Within 5 miles	-0.050	***	0.348	38	0.069	***	0.203	54
	(0.018)			517,449	(0.024)			350,290
No border segment FEs	-0.072	***	0.328	46	0.104	***	0.190	82
	(0.018)			5,068,912	(0.031)			2,769,460
HSA FEs[d]	-0.101	***	0.328	154	0.051	***	0.190	132
	(0.030)			5,068,912	(0.013)			2,769,460
HRR FEs[e]	-0.089	*	0.328	25	0.057	***	0.190	23
	(0.048)			5,068,912	(0.015)			2,769,460

Notes: This table shows estimated impacts of Community Rating (CR) and Community Rating with Rejections (CRR) on Medigap enrollment. Observations are at the enrollee-year level. Standard errors, clustered by border segment, are shown in parentheses. $*p < 0.1$, $**p < 0.05$, $***p < 0.01$. [a] Each row shows the coefficient from an OLS regression of the outcome listed on an indicator for living in a CR (CRR) state. The specification includes border segment fixed effects. [b] Each row shows the mean of the outcome listed for the comparison sample living in Guaranteed Renewal (GR) states. [c] For each specification, the first row shows the number of clusters and the second row shows the number of enrollee-years (observations). [d] Standard errors are clustered by Hospital Service Area (HSA). [e] Standard errors are clustered by Hospital Referral Region (HRR).

Table 10: Balance on Medicare Advantage Quality

	Community Rating (CR)			Community Rating with Rejections (CRR)		
	Full Sample	Within 25 Miles[a]	Mean[b]	Full Sample	Within 25 Miles[a]	Mean[b]
	(1)	(2)	(3)	(4)	(5)	(6)
Number of MA insurers	2.239	0.887	9.402	0.222	-0.899	9.224
	(1.489)	(0.874)		(0.834)	(0.890)	
Number of MA contracts	2.321	0.082	10.909	-0.384	-1.174	10.701
	(1.717)	(1.470)		(0.876)	(0.921)	
Number of MA plans	9.342 **	-1.646	28.496	1.308	-2.375	27.765
	(4.149)	(5.316)		(2.683)	(2.061)	
No. of states	51	8		51	13	
No. of clusters	819	46		819	82	
No. of observations	156,132,182	5,794,415		156,132,182	3,205,828	

Notes: Observations are at the enrollee-year level. The "Full Sample" is all Medicare beneficiaries age 65 and over. In Columns (1) - (2) and (4) - (5), each row shows the coefficient from an OLS regression of the variable listed on an indicator for living in a CR state. Standard errors, clustered by border segment, are shown in parentheses. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$. [a] The sample is as in "Full Sample" but restricted to those within 25 miles of the state border. The specification includes border segment fixed effects. [b] Each row shows the sample mean of the variable listed. The sample is as in "Within 25 Miles" but restricted to those in GR states.

Table 11: Geographic Mobility

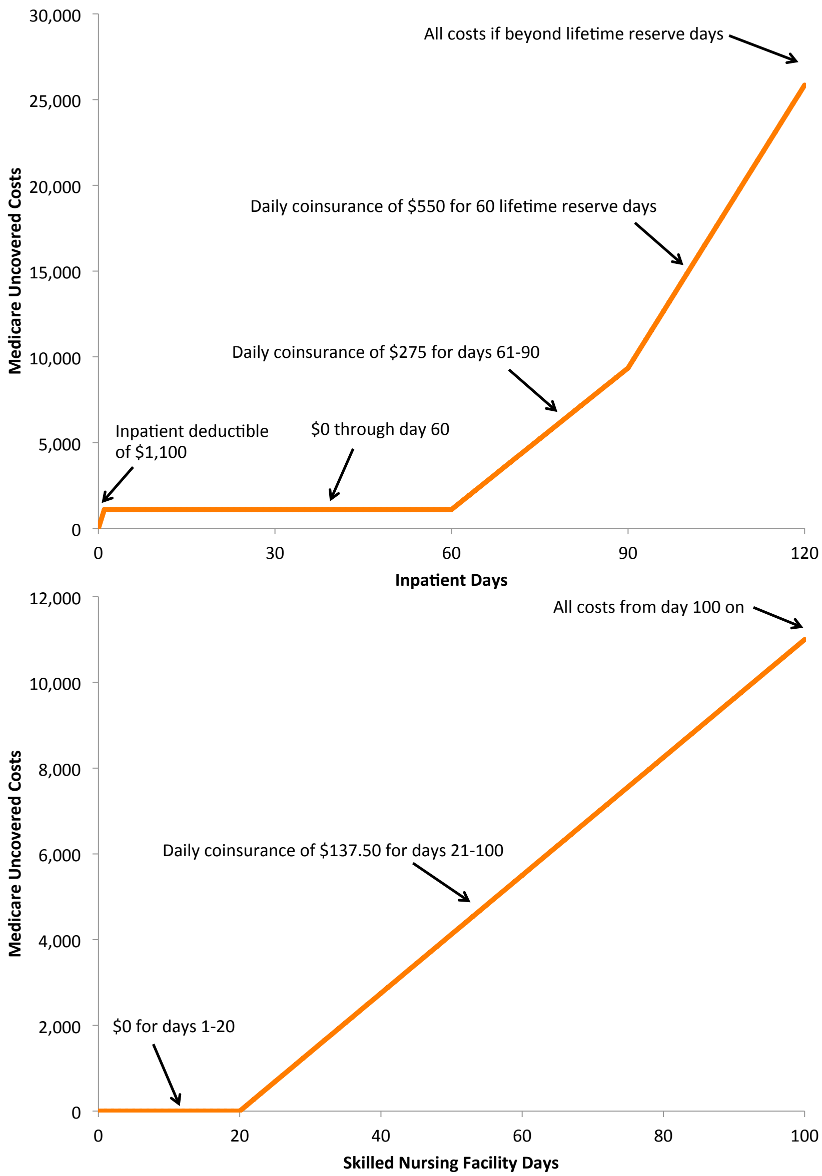
	Community Rating (CR)			Community Rating with Rejections (CRR)		
	Within 25 Miles[a]	Mean in GR Comparison Sample[b]	No. of Clusters / Obs.[c]	Within 25 Miles[a]	Mean in GR Comparison Sample[b]	No. of Clusters / Obs.[c]
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Balance on geographic mobility						
Moved prior to age 65[d]	0.008	0.373	46	0.041	0.486	82
	(0.045)		5,794,415	(0.036)		3,205,828
Moved after age 65[e]	-0.003	0.036	46	0.009	0.058	82
	(0.004)		5,794,415	(0.011)		3,205,828
Panel B: Impact on enrollment using birth state instrument						
Baseline specification	-0.093 ***	0.328	46	0.050 ***	0.190	82
	(0.026)		5,068,912	(0.011)		2,769,460
Birth state instrument	-0.069 ***	0.328	46	0.188 ***	0.190	82
	(0.023)		5,068,912	(0.034)		2,769,460

Notes: This table shows tests for balance on geographic mobility as well as an alternative specification for the estimated impact of CR (CRR) on Medigap enrollment. Observations are at the enrollee-year level. Panel A shows tests for balance on geographic mobility. The first row of Panel B shows the estimated impacts of Community Rating (CR) and Community Rating with Rejections (CRR) on Medigap enrollment for the baseline specification. The second row of Panel B shows these impacts using a 2SLS specification. The birth state instrument is an indicator for whether the individual was born in a CR (CRR) state. This is used as an instrument for the indicator for living in a CR (CRR) state. Standard errors, clustered by border segment, are shown in parentheses. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$. [a] The sample is those who live in a CR (CRR) or CR (CRR)-adjacent state, and within 25 miles of the state border. [b] Each row shows the mean of the outcome listed for the comparison sample living in Guaranteed Renewal (GR) states. [c] For each specification, the first row shows the number of clusters and the second row shows the number of enrollee-years (observations). [d] Indicator for whether enrollee's state of birth is same as enrollee's state of residence upon entry into Medicare at age 65. [e] Indicator for whether enrollee's state of residence upon entry into Medicare at age 65 is same as enrollee's state of residence during observation year.

Appendix

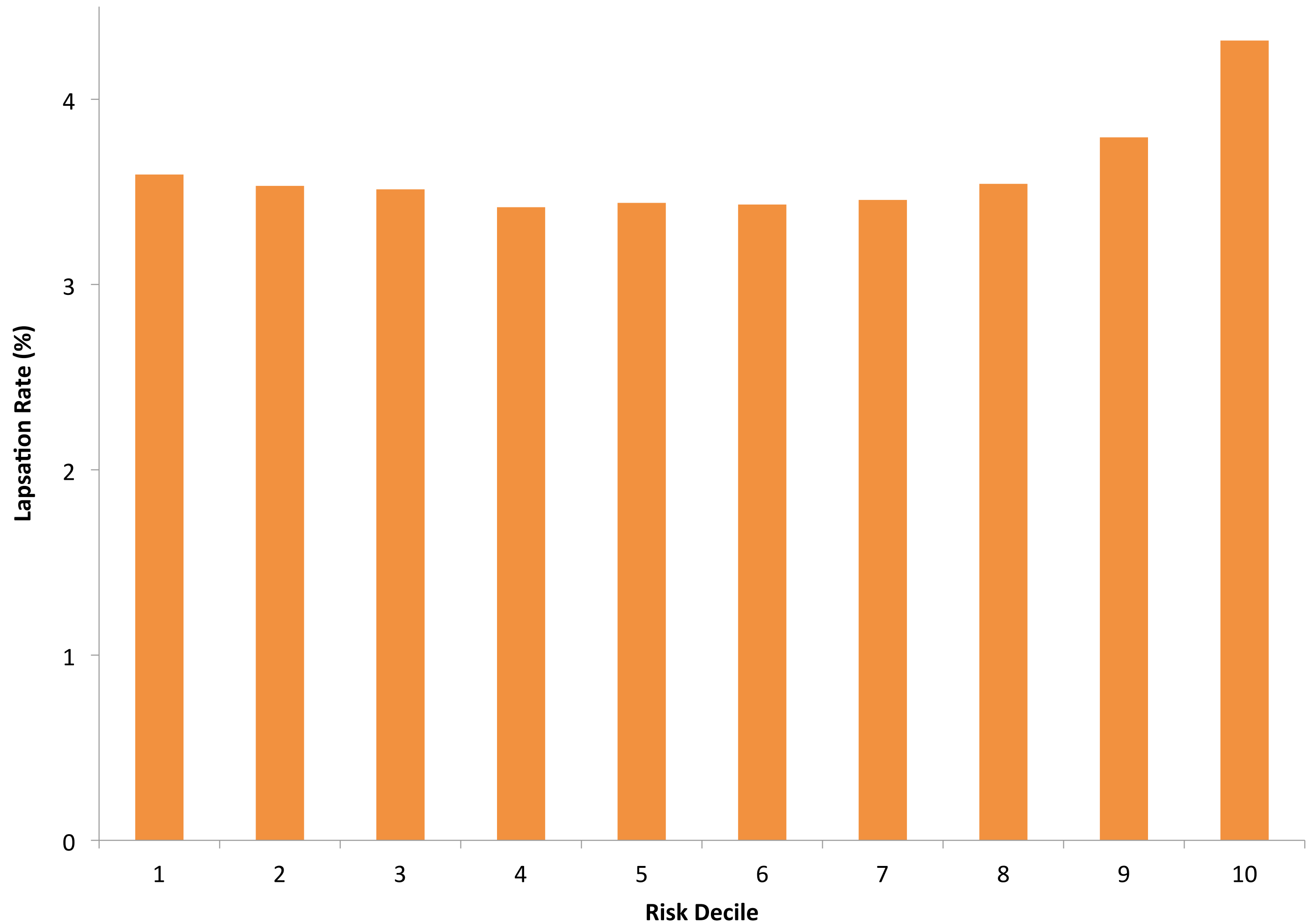
A. Additional Figures and Tables

Figure A.1: Cost Sharing in Medicare Part A



Notes: This figure shows the cost sharing requirements in 2010, the last year of the observation period, for standard Medicare coverage for Part A. Part A covers inpatient and Skilled Nursing Facility (SNF) expenditures.

Figure A.2: Lapsation among Medigap Buyers, by Risk Decile



Notes: This figure shows the annual lapsation rate among Medigap buyers. The sample is restricted to individuals living in Community Rating (CR) states, Community Rating with Rejections (CRR) states, and Guaranteed Renewal (GR) states that border CR or CRR states. The lapsation rate for each age is computed by restricting to the set of individuals who are enrolled in Medicare (and alive) during the observation year and were enrolled in Medigap during the previous year, and computing the percentage who are also enrolled during the observation year. The lapsation rates are computed by risk decile (deciles for predicted Medicare spending based on risk score).

Table A.1: Medigap Insurer Market Shares in Community Rating States and Adjacent States

Company Name (1)	Market Share (2)
Connecticut	
UnitedHealthcare Ins Co	45
Anthem Hlth Plans Inc	45
Bankers Life & Cas Co	2
Massachusetts	
BCBS of MA	84
UnitedHealthcare Ins Co	13
Bankers Life & Cas Co	2
Maine	
UnitedHealthcare Ins Co	47
Anthem Hlth Plans of ME Inc	38
Order of United Commerical Travelers	7
New Hampshire	
Anthem Hlth Plans of NH	40
UnitedHealthcare Ins Co	36
Bankers Life & Cas Co	15
New Jersey	
UnitedHealthcare Ins Co	57
Horizon Hlthcare Serv Inc	29
Bankers Life & Cas Co	6
New York	
United Hlthcare Ins Co Of NY	63
Empire Healthchoice Assur Inc	17
Excellus Hlth Plan Inc	6
Pennsylvania	
Highmark Inc	35
UnitedHealthcare Ins Co	18
Independence Blue Cross	9
Vermont	
UnitedHealthcare Ins Co	48
BCBS of VT	20
Bankers Life & Cas Co	12

Notes: This table shows Medigap insurer market shares for Community Rating states and adjacent states. The market share is the average state-level market share for the years 2006 through 2010. This is based on the author's calculations using reports of covered lives obtained from the National Association of Insurance Commissioners (NAIC).

B. Data Construction

B.1 CMS Data

B.1.1 Sample Definition

I have data from CMS on the universe of individuals enrolled in Medicare since 1994. I use this to construct a denominator file of individuals enrolled in Medicare from 2006 through 2010, the years for which I also have claims data. This includes those enrolled in traditional Medicare as well as Medicare Advantage. The main administrative files I use to construct the denominator file are called the enrollment data base (EDB) and the common Medicare enrollment file (CME). These two enrollment files allow me to observe for every enrollee: exact date of birth, date of death (if applicable), gender, and zip code. They also include monthly data on whether the individual is enrolled in TM Part A, enrolled in TM Part B, enrolled in MA, and whether the individual is dually covered by Medicare and Medicaid. Using this file, I create a data set where each observation is a person-year.

Because I wish to focus on individuals who entered Medicare at age 65, for whom the Medigap pricing regulations I study are most relevant, I make the following restrictions to my main analysis sample:

1. I restrict to individuals who are enrolled in Part A and Part B or in Part C during any month of the observation year.

2. I restrict to individuals who qualify for Medicare on the basis of age (i.e., I drop the disabled and ESRD populations).

3. I restrict to individuals who did not originally qualify for Medicare on the basis of disability or End-Stage Renal Disease (ESRD).

4. I drop a person-year if the person had a non-Medicare primary payer.

5. I restrict the sample to those residing in the 50 states or the District of Columbia.

B.1.2 Additional Variables

I construct the risk score for each individual using an administrative file called the Risk Adjustment Processing System (RAPS). The RAPS file has a risk score and indicators for each health indicator (HCC) that goes into the calculation of the risk score used for Medicare Advantage risk adjustment. These HCCs are used, along with demographic variables, as a predictor of a Medicare enrollee's healthcare spending in the subsequent year. I observe this information for all Medicare enrollees (including Medicare Advantage enrollees).

For traditional Medicare enrollees, I observe all healthcare claims from 2006 through 2010. I observe the seven different types of claims: inpatient, outpatient, SNF, home health, durable medical equipment, physician, and hospice. I sum all the out-of-pocket costs from these claims (deductibles and coinsurance) to construct the total out-of-pocket costs for each person-year. I do not observe whether the out-of-pocket costs were paid by the individual or by an insurer (such as a Medigap insurer). Thus, this variable is a person's out-of-pocket liability. This out-of-pocket spending may be covered by supplemental private insurance, such as Medigap or an employer-sponsored supplemental insurance plan.

B.2 Zip Code Characteristics from American Community Survey

I use the 2011 American Community Survey (ACS) 5-Year Estimates by 5-digit Zip Code Tabulation Area (ZCTA), downloaded from the United States Census Bureau's American FactFinder website on May 12, 2016. Because my study sample is from 2006 through 2010, this is the most appropriate year to use (the 2010 ACS 5-Year Estimates are not available by ZCTA). I construct zip code-level variables as follows:

- *Household Income* I use table B19049, which is called "MEDIAN HOUSEHOLD INCOME IN THE PAST 12 MONTHS (IN 2011 INFLATION-ADJUSTED DOLLARS) BY AGE OF HOUSEHOLDER." I define this variable as $\text{HD01\_VD06} \cdot 1.06$. This is the median household income in the past 12 months among households where the head of household is at least 65 years old (in 2016 inflation-adjusted dollars).
- *Educational Attainment* I use table B15001, which is called "SEX BY AGE BY EDUCATIONAL ATTAINMENT FOR THE POPULATION 18 YEARS AND OVER."
  - *Less Than High School* I define this variable as $(\text{HD01\_VD36} + \text{HD01\_VD37} + \text{HD01\_VD77} + \text{HD01\_VD78})/(\text{HD01\_VD35} + \text{HD01\_VD76})$. This is the proportion with less than a high school education among those ages 65 and over.

- *High School Graduate* I define this variable as (HD01_VD38 + HD01_VD79)/(HD01_VD35 + HD01_VD76). This is the proportion of high school graduates among those ages 65 and over.
- *College Graduate* I define this variable as (HD01_VD40 + HD02_VD41 + HD01_VD42 + HD01_VD81 + HD01_VD82 + HD01_VD83)/(HD01_VD35 + HD01_VD76). This is the proportion of college graduates among those ages 65 and over.

- *Poverty* I use table B17001, which is called "POVERTY STATUS IN THE PAST 12 MONTHS BY SEX BY AGE." I define this variable as (HD01_VD15 + HD01_VD16 + HD01_VD29 + HD01_VD30)/(HD01_VD15 + HD01_VD16 + HD01_VD29 + HD01_VD30 + HD01_VD44 + HD01_VD45 + HD01_VD58 + HD01_VD59). This is the proportion with income in the past 12 months below the poverty level among those ages 65 and over.

- *Veteran (among Men)* I use table B21001, which is called "SEX BY AGE BY VETERAN STATUS FOR THE CIVILIAN POPULATION 18 YEARS AND OVER." I define this variable as (HD01_VD20 + HD01_VD23/HD01_VD19 + HD01_VD22. This is the proportion who are veterans among men ages 65 and over.

- *Labor Force Participation* I use table B23004, which is called "WORK STATUS IN THE PAST 12 MONTHS BY AGE BY EMPLOYMENT STATUS FOR THE CIVILIAN POPULATION 65 YEARS AND OVER." I define this variable as (HD01_VD04 + HD01_VD09 + HD01_VD15 + HD01_VD18)/HD01_VD01. This is the labor force participation rate among those ages 65 and over.

- *Homeowner* I use table B25007, which is called "TENURE BY AGE OF HOUSEHOLDER." I define this variable as (HD01_VD09 + HD01_VD10 + HD01_VD11)/(HD01_VD09 + HD01_VD10 + HD01_VD11 + HD01_VD19 + HD01_VD20 + HD01_VD21). This is the proportion in owner-occupied housing among those ages 65 and over.

B.3 Medigap Premiums

In this section, I describe my procedure for constructing market-level Medigap premiums. In this setting, a market is a zip code-year, because insurers are allowed to vary their premiums at the zip code level and to change them on a yearly basis.

My source for the Medigap premiums is the Weiss Ratings Data. I use data from 2006 through 2010. These data contain premiums for each age and gender at the year-zip code-carrier level.

In this setting, the "carrier" and "company" are often but not always identical. A "company" is a firm such as United Healthcare or Mutual of Omaha, each of which can have multiple carriers within a given market. For instance, United Healthcare often has one carrier that offers a discounted rate to consumers who are age 67 and under and a different carrier that offers a higher rate to older consumers who cannot pass a health questionnaire. Thus, each "carrier" sells the contract at a different price. The major insurers in each state, along with their market shares (calculated using annual reports from the National Association of Insurance Commissioners), is shown in Table A.1. Only Community Rating and adjacent states are included in this table.

I multiply premiums by the following conversion factors in order to convert to 2016 dollars (year shown in parentheses): 1.09 (2010), 1.11 (2009), 1.11 (2008), 1.15 (2007), and 1.18 (2006). These conversion factors were obtained from the Bureau of Labor Statistic's CPI Inflation Calculator at http://data.bls.gov/cgi-bin/cpicalc.pl on May 12, 2016.

For each zip code-year, and for each insurer, I construct the "minimum offer" ("maximum offer") premium by taking the "minimum" ("maximum") across carriers for that insurer. Then, I compute the average "minimum offer" ("maximum offer") across insurers, weighting by the insurer's state-level market share.

C. Additional Details on Conceptual Framework

C.1 Individuals

In this section, I describe individual preferences. I assume that when individuals enter the market, they are homogeneous in health and heterogeneous in risk aversion. Heterogeneity in risk aversion is captured in a unidimensional parameter θ. Individuals with higher θ value contract H over L more so than individuals with lower θ. To state this formally, I need to introduce some notation.

Valuations of H and L contracts by the young are denoted $v_H^Y(\theta, P)$ and $v_L^Y(\theta)$, where P is the price of contract H. Valuations of these contracts by the old, who have already observed C^Y, are denoted by $v_H^O(\theta, C^Y, P)$ and $v_L^O(\theta, C^Y)$. When a young individual needs to make a decision with a long-term time horizon (e.g., when he chooses between H and L under GR), I assume that he compares expected values in both periods. For example, the expected value of choosing H in both periods in all states under CR is $v_H^Y(\theta, P^{CR}) + \mathbb{E}[v_H^O(\theta, C^Y, P^{CR})]$. Later on, I will introduce additional notation for comparing long-term choices.

Using the notation above, I introduce the following natural restrictions on individual preferences:

Assumption 2. *(Higher types value H more)* $v_H^Y(\theta, P) - v_L(\theta)$ *and* $v_H^O(\theta, C_Y, P) - v_L^O(\theta, C_Y)$ *are increasing in* θ *for all* C^Y *and* P.

Assumption 3. *(Sick value insurance more)* $v_H^O(\theta, C^Y, P^F(C^Y) - v_L^O(\theta, C^Y)$ *is increasing in* C^Y *for all* θ.

Assumption 4. *(Risk aversion)* $\mathbb{E}[v_H^O(\theta, C_Y, \bar{P})] \geq \mathbb{E}[v_H^O(\theta, C^Y, P^F(C^Y))] \ \ \forall\ \theta$*, where* $\bar{P} = \mathbb{E}[P^F(C^Y)]$.

In order to consider choices with long-term effects, it is necessary to introduce additional notation. Let $V_H^{GR}(\theta, P^Y, P^O)$ be the total expected value for an individual who chooses H in the first period under GR and chooses the optimal contract in the second period, where P^Y and P^O are the premiums that he pays. Similarly, let V_L^{GR} be the total expected value for an individual who chooses L in the first period under GR and chooses the optimal contract in the second period. Then the set of individuals who choose H in the first period is

$$\Omega^{GR}(P^Y, P^O) = \{\theta : V_H^{GR}(\theta, P^Y, P^O) \geq V_L^{GR}(\theta)\}. \tag{8}$$

Analogously, I define $V_z^R(\theta, P^R)$ as the expected value for those choosing contract $z \in \{L, H\}$ in the first period under regime $R \in \{CR, CRR\}$.

To keep the analysis simple, I assume that those who purchase contract H in the first period do not drop out of that contract in the second period. Due to Assumption 3, stating this for the lowest health realization, denoted $\underline{C}^Y$, is sufficient.

Assumption 5. *(No dropouts under GR) For P^Y and P^O, if $\theta \in \Omega^{GR}(P^Y, P^O)$, then $v_H^O(\theta, \underline{C}^Y, P^O) > v_L^O(\theta, \underline{C}^Y)$.*

Assumption 6. *(No dropouts under CRR) For all P^{CRR}, if $\theta \in \Omega^{CRR}(P^{CRR})$, then $v_H^O(\theta, \underline{C}^Y, P^{CRR}) > v_L^O(\theta, \underline{C}^Y)$.*

Assumption 7. *(No dropouts under CR) For all P^{CR}, if $\theta \in \Omega^{CR}(P^{CR})$, then $v_H^O(\theta, \underline{C}^Y, P^{CR}) > v_L^O(\theta, \underline{C}^Y)$.*

These assumptions that no one drops out of the contract H in the second period simplify the comparison of the different regulatory regimes. Furthermore, this corresponds well to what I see in the data: the lapsation rate in Medigap contracts is negligibly small. Intuitively, this is an assumption that older people value supplemental insurance more. Expected medical costs rarely go down with age because most health conditions are chronic in nature. However, it is not possible to state this elegantly in a two-period model because under GR and CRR, the first period decision affects the second period whereas in the second period, there are no periods to follow. I believe this is an artifact of a two-period model, and that Assumptions 5 and 6 would have more intuitive forms in a more realistic infinite-horizon model.

Finally, with the next two assumptions I state formally that younger consumers have lower average costs and I also wish to abstract from the effects of back-loading payments on utility.

Assumption 8. *(Younger means healthier)* $\mathbb{E}[C_I^Y(H)] < \mathbb{E}[C_I^O(H)]$

Assumption 9. *(Postponing payments has no effect on values) $V_H^{GR}(P^Y, P^O) = V_H^{GR}(P, P)$, where $P = \frac{1}{2}(P^Y + P^O)$.*

C.2 Guaranteed Renewal (GR)

I start by analyzing equilibria under GR. Under GR there are two important pools: the young who choose H and the old who renew H. Due to Assumption 5, the pools are identical. Hence, one can view them as a single pool, where people pay the average of P^Y and P^O in both periods. This simplifies the notation and allows for a straightforward comparison with other regimes:

$$P^{GR} = \frac{1}{2}(P^Y + P^O). \tag{9}$$

Given my assumption about the supply side of the market, the equilibrium condition is:

$$AC^{GR}(P^{GR})(1+M) = P^{GR}. \tag{10}$$

Since individuals have the same health when they enter this market and they never drop out, their average cost is always

$$AC^{GR}(P^{GR}) = \frac{1}{2}\mathbb{E}[C_I^Y(H) + C_I^O(H)]. \tag{11}$$

Hence, the equilibrium under GR is unique and we must have

$$P^{GR} = \frac{1}{2}\mathbb{E}[C_I^Y(H) + C_I^O(H)] \cdot (1+M). \tag{12}$$

To analyze the set of people who enroll in H in the first period, I consider separately the values of $V_L^{GR}(\theta, P^{GR})$ and $V_H^{GR}(\theta, P^{GR})$. One can see that $V_L^{GR}(\theta, P^{GR})$ does not depend on P^{GR} because those who do not purchase H in the first period will be offered the fair price in the second period, so P^{GR} is irrelevant. Obviously, $V_H^{GR}(\theta, P^{GR})$ is decreasing in P^{GR} for all θ. Together, this means that $P_1 > P_2 \implies \Omega^{GR}(P_1) \subset \Omega^{GR}(P_2)$. If we define

$$Q^{GR}(P^{GR}) = \int_{\Omega^{GR}(P^{GR})} dF(\theta) \tag{13}$$

where $F(\theta)$ is the cumulative distribution function of θ, then we can say that $Q^{GR}(P^{GR})$ is decreasing in P^{GR}.

C.3 Community Rating (CR)

Due to Assumption 7, those who purchase H in the first period also keep H in the second period. Hence, one can also see buying H in the first period as a long-term contract.

To understand how price is determined in this case, consider individuals in the second period. Conditional on C^Y, they can either buy H for P^{CR} or opt out for L. Since individuals with a higher value of C^Y value insurance more, for each θ there is some $C^*(\theta, P^{CR})$ such that below this threshold individuals buy L and above this threshold individuals buy H. One can also say that the threshold is increasing in P^{CR}.

An important implication of this is adverse selection. I use the superscript $+H$ to denote new enrollees and the superscript $=H$ to denote continuing enrollees. For all θ, the average cost for those enrolling in the contract must be above the unconditional average: $AC^{+H}(P^{CR}) \geq \mathbb{E}[C_I^O(H)]$. The average cost for those who renew contract H is the same as under GR: $AC^{=H}(P^{CR})(1+M) = P^{GR}$. Together with the assumption that the old cost more than the young, this implies that the total average cost under CR is above that under GR:

$$AC^{CR}(P^{CR})(1+M) \geq P^{GR}. \tag{14}$$

This means that the equilibrium price under CR must be above that under P^{GR}:

$$P^{CR} \geq P^{GR}. \tag{15}$$

Now I want to compare the sets of people who choose H in the first period in equilibrium under CR and GR. To do so, I analyze the values $V_H^{CR}(\theta, P^{CR})$ and $V_L^{CR}(\theta, P^{CR})$. First, note that we can write $V_H^{CR}(\theta, P^{CR}) = V_H^{GR}(\theta, P^{CR}) = V_H(\theta, P^{CR})$ because those who purchase H in both periods receive the same total expected value under both regimes.

Under CR, $V_L^{CR}(\theta, P^{CR})$ is decreasing in P^{CR} because those who select H in the second period must pay it. In this case, it is more convenient to consider choices of the contract for each period separately. Since the choice of contract in the first period does not affect the available choices in the second period, only the first period values need to be considered. For higher values of P^{CR}, there are fewer types θ that choose H in the first period. In other words, $Q^{CR}(P^{CR})$ is decreasing in P^{CR}.

It is left to show how Q^{CR} and Q^{GR} compare at P^{GR}. Let $\bar{P} = \mathbb{E}[C_I^O(H)](1+M)$. I want to show that

$$V_L^{CR}(\theta, P^{GR}) \geq V_L^{CR}(\theta, \bar{P}) \geq V_L^{GR}(\theta). \tag{16}$$

The first inequality is trivial and follows from the fact that $P^{GR} < \bar{P}$. The second inequality is more complicated. If there were no outside option in the second period, i.e., if the contract L were not available, then this inequality would follow from risk aversion. Under GR, individuals would have to pay $\mathbb{E}[C_I^O(H)|C^Y]$ in the second period, whereas under CR they would have to pay the average of this, which is $\mathbb{E}[C_I^O(H)]$. This relationship is formalized in Assumption 4. The presence of the outside option L does not change this relationship. To see this, it is sufficient to show that the availability of L

benefits individuals more under CR than under GR.

To see this, consider $\underset{\sim}{C}$ such that $\mathbb{E}[C_I^O(H)|\underset{\sim}{C}](1+M) = \bar{P}$. Define $C^{Y*}(\theta)$ as the threshold value such that under GR individuals with a higher health shock realization choose H and individuals with a lower health shock realization choose L. Define $C^{Y**}(\theta)$ as the analog for CR. Only two cases are possible.

Case 1. $\underset{\sim}{C} > C^{Y**}(\theta)$: Consider an individual of type θ and health shock realization $C^{Y**}(\theta)$. If this individual is under CR, he buys H. Under CR, his price is $\bar{P}$ (by assumption). Under GR, his price is the fair price

$$P^F(C^{Y**}(\theta)) = \mathbb{E}[C_I^O(H)|\tilde{C}^{Y**}(\theta)] < \mathbb{E}[C_I^O(H)|\underset{\sim}{C}] = \bar{P}. \tag{17}$$

Since we have established that he buys H under CR at price $\bar{P}$, it follows that he must also buy H under GR. It follows that $C^{Y*}(\theta) < C^{Y**}(\theta)$.

Case 2. $\underset{\sim}{C} < C^{Y**}(\theta)$: Consider an individual of type θ and health shock realization $C^{Y**}(\theta) + \epsilon$, where $\epsilon > 0$. Under CR, he does not buy H. Under CR, his price is $\bar{P}$ (by assumption). Under GR, his price is the fair price

$$P^F(C^{Y**}(\theta)+\epsilon) = \mathbb{E}[C_I^O(H)|\tilde{C}^{Y**}(\theta)+\epsilon] > \mathbb{E}[C_I^O(H)|\tilde{C}^{Y**}(\theta)] > \mathbb{E}[C_I^O(H)|\underset{\sim}{C}] = \bar{P}. \tag{18}$$

Since we have established that he does not buy H under CR at price $\bar{P}$, it follows that he must also not buy H under GR. Because this holds for any ϵ arbitrarily close to zero, it follows that $C^{Y*}(\theta) > C^{Y**}(\theta)$.

All that remains is to show that in each of the two cases above, the availability of L in the second period benefits individuals more under CR than under GR. First, consider Case 1, where we have shown that $\underset{\sim}{C} > C^{Y**}(\theta) > C^{Y*}(\theta)$. Consider an individual with type θ. Consider the range where he would switch from H to L under either regime, which corresponds to health shock realizations in $(-\infty, C^{Y*}(\theta)]$. In this region, H is more expensive under CR than under GR. Therefore, the gain in utility in switching from H to L is greater under CR. Consider the range where he would switch from H to L only under CR, which corresponds to health shock realizations in $(C^{Y*}(\theta), C^{Y**}(\theta))$. In this case, he gains utility by switching from H to L under CR but not under GR. For any other health shock realization, there is no gain in utility of switching from H to L under either regime. In summary, the gain in utility of switching from H to L is always weakly greater under CR, for any health shock realization. Therefore, the value of the outside option L is weakly greater under CR.

Next, consider Case 2, where we have shown that $\underline{C} < C^{Y**}(\theta) < C^{Y*}(\theta)$. In this case, for all of the health shock realizations for which an individual switches from H to L under GR but not under CR, the price under GR is greater than $\bar{P}$. Next, consider Case 2, where we have shown that $\underline{C} < C^{Y**}(\theta) < C^{Y*}(\theta)$. Consider an individual with type θ. I will show that in this case, an individual is always weakly better off under CR than under GR. For a health shock realization in the range $(-\infty, C^{Y**}(\theta)]$, an individual will choose L under either regime, so his utility is the same under both regimes. For a health shock realization in the range $(C^{Y**}(\theta), C^{Y*}(\theta))$, an individual will choose L under GR and H under CR; since L is also in his choice set under CR, this means he is weakly better off under CR. Finally, in the range $[C^{Y*}(\theta), \infty)$, an individual will choose H under both regimes. Under CR, he pays $\bar{P}$, and under GR, he pays $P^F > \bar{P}$, so again he is better off under CR.

This proves that at P^{GR} more people would choose H in the first period under GR than under CR, i.e., that $Q^{CR}(P^{GR}) \leq Q^{GR}(P^{GR})$. Together with the fact that the equilibrium price under CR is higher and the fact that $Q^{CR}(P^{CR})$ is a decreasing function, this implies that in equilibrium, more people choose H in the first period under GR than under CR:

$$Q^{CR}(P^{CR}) \leq Q^{CR}(P^{GR}) \leq Q^{GR}(P^{GR}). \tag{19}$$

C.4 Community Rating with Rejections (CRR)

Under CRR, individuals who decide to buy contract H in the second period are rejected if their expected costs are higher than the average in the pool. Hence, their total average costs must be lower than P^{CRR}:

$$AC^{+H}(P^{CRR})(1+M) \geq P^{CRR}. \tag{20}$$

Due to Assumption 6, no one drops out of contract H in the second period. Thus, the average cost for those who choose H in both periods is

$$AC^{=H}(P^{CRR}) = \frac{1}{2}\mathbb{E}[C_I^Y(H) + C_I^O(H)]. \tag{21}$$

The total average cost in the pool of people who get H is the weighted average of the two groups described above. This implies that the equilibrium price in this market, defined as $AC^{CRR}(P^{CRR})(1+M) = P^{CRR}$, can only be lower than the price without positive selection:

$$P^{CRR} \leq \frac{1}{2}\mathbb{E}[C_I^Y(H) + C_I^O(H)] \cdot (1+M) = P^{GR}. \tag{22}$$

Now I want to compare enrollment under CRR and GR. To compare the two, I show that for all P and for all θ, the value of the outside option is better under GR, where $P = P^{GR} = P^{CRR}$ (i.e., where we consider a fixed value of P). Consider an individual who does not purchase H when young and has health shock realization C^Y. If $P^F(C^Y) = \mathbb{E}[C_I^O(H)|C^Y](1+M) \leq P$, this individual can get contract H for P^F under GR and for P under CRR. Clearly, he is better off under GR. If $P^F(C^Y) > P$, then he can get contract H for P^F under GR and is rejected under CRR. Again, he is better off under GR. Hence,

$$V_L^{CRR}(\theta, P) \leq V_L^{GR}(\theta, P) \quad \forall \theta, P. \tag{23}$$

Since, for a given price P, $V_H^{GR}(\theta, P) = V_H^{CRR}(\theta, P)$, and the outside option of not choosing H in the first period is worse under CRR, it follows that more people choose H under CRR than under GR for any given P:

$$Q^{CRR}(P) \geq Q^{GR}(P) \quad \forall P. \tag{24}$$

Together with the fact that $\Omega^{GR}(P)$ is non-increasing in P and that $P^{CRR} \leq P^{GR}$, it follows that

$$Q^{CRR}(P^{CRR}) \geq Q^{GR}(P^{CRR}) \geq Q^{GR}(P^{GR}). \tag{25}$$

In this framework, the first period represents when an individual is healthy and faces the possibility of becoming sick. This uncertainty is modeled by the health cost realization at the end of the first period, and its implications for costs in the second period.