CONSUMER DECISION-MAKING IN THE HEALTH INSURANCE MARKETPLACE

by

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Abstract

Objectives: Not much is known about consumer decision-making in the state Health Insurance Marketplaces established by the Affordable Care Act (ACA). This dissertation consists of three papers that explore this topic. In Paper 1, I explore how consumers value non-financial plan attributes in their choice of Marketplace plans. In Paper 2, I examine enrollee plan switching decisions in response to changes in the attributes of their chosen plans over time. In Paper 3, I simulate the expected effects of hypothetical minimum network adequacy and plan quality rating requirements on consumer welfare.

Methods: The studies utilize discrete choice models on individual-level Marketplace enrollment data from California, Colorado, and Washington. Paper 1 uses conditional and mixed logit models of plan choice to estimate willingness-to-pay (WTP) amounts for key non-financial attributes, notably provider network size and plan quality ratings. Paper 2 uses logit models to explore consumer plan switching decisions as a function of changes in the attributes of chosen plans over time as well as choice set and household-level characteristics. Paper 3 applies the "log-sum" approach to Paper 1's models to calculate changes in expected consumer welfare under different policy proposals.

Results: In Paper 1, I find that consumers are very responsive to network size and plan quality in their choice of Marketplace plans. Individual enrollees exhibit an annual WTP of \$200-\$300 for a 10 percentage-point (25 percentile) increase in provider

network size and a WTP of $1,200-$2,800 for a high quality plan relative to a low quality plan. In Paper 2, I find that changes in the premium, provider network size, and plan quality of chosen plans over time are significantly associated with the probability that enrollees switches plans in the subsequent enrollment period in the expected directions. In Paper 3, I find that minimum network adequacy restrictions may reduce expected consumer welfare, while the welfare effects of plan quality restrictions are more ambiguous.

Policy Implications: Policymakers should take consumer responsiveness to provider network size and plan quality into account in their efforts to facilitate consumer decision-making in the Marketplaces. Given the finding that plan quality is highly valued, the implementation of quality ratings in other health exchange settings (such as the Federally Facilitated Marketplace) could be beneficial to enrollees. Moreover, consumer responsiveness to levels and changes in plan quality and network size could inform insurers' decisions to invest in these attributes to attract Marketplace enrollees. Policymakers should also carefully consider the unintended consequences, as well as the balance between plan benefits and affordability, when considering the implementation of requirements related to network adequacy and plan quality ratings.

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Dedicated to my grandfather,

for his unconditional love and for his cultivation, by example, of my intellectual curiosity and passion,

and to my grandmother,

a humble, mighty woman of God, whose legacy of faith I live in and hope to pass on.

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Chapter 1: Introduction

Health plans sold through insurance marketplace settings have become increasingly popular in recent years (Barnett and Vornovitsky, 2016; Cohen et al., 2018). However, relatively little is known about enrollee decision-making in these contexts. On the public insurance side, nearly three quarters of all Medicare beneficiaries (over 16% of the US population) have chosen and enrolled in health plans competing in the Medicare Advantage (managed care) and/or Medicare Part D (prescription drug plan) markets (Jacobson et al., 2016; Hoadley et al., 2016). On the private side, small but growing share of employers are now offering employer-sponsored insurance through private health exchanges. Beneficiaries in these settings choose from plans offered by different insurers with a variety of plan designs and a relatively higher degree of plan transparency. In the midst of growing trends towards consumer choice and plan transparency, the most prominent shift has occurred through the implementation of the Affordable Care Act (ACA) Marketplaces/Exchanges, which covered 4% of the US population (over 12 million) in 2017.

By providing information transparency, standardizing certain plan features, and offering support services for the choice of health insurance, the Marketplace can assist enrollees in improving their selection of health insurance. In theory, they are able to potentially deliver lower prices and better plan selections for enrollees by fostering competition between private health plans on price and quality.

However, not much is currently known about enrollee decision-making in the state Health Insurance Marketplaces established by the ACA. The ACA Marketplace differs from other insurance exchange settings with respect to its population, plan

standardization requirements, and the degree of choice available to enrollees.

In this three-paper dissertation, I address three research questions related to consumer decision-making in the ACA Health Insurance Marketplaces. First, how do enrollees value different plan attributes on the Marketplace? Second, how to changes to chosen plans and the available choice set affect enrollees' subsequent plan switching decisions? Third, how might policies that regulate provider network size and plan quality ratings impact consumer welfare?

In the first paper (Chapter 2), I examine how Marketplace enrollees value different plan attributes in their choice of plans. Specifically, I estimate consumer willingness-to-pay (WTP) amounts for key non-financial attributes, notably provider network size and plan quality ratings. Not much is currently known about how enrollees value the non-financial attributes of their health insurance plans in the context of the ACA Marketplaces. I run conditional and mixed logit models of plan choice using individual-level enrollment data from California, Colorado, and Washington. In addition, I run stratifications by enrollment channel, choice set size, and newness of enrollment to explore the potential heterogeneity in WTP valuations across different consumer choice set experiences.

In the second paper (Chapter 3), I examine how changes in the plan attributes of chosen plans may affect enrollees' subsequent decisions to switch plans or disenroll from California's Marketplace. Though plan switching rates remain quite high among returning Marketplace enrollees relative to other insured populations, not much is known about the specific plan and choice set level factors contributing to these switching decisions. Using logit models, I estimate Marketplace re-enrollment and plan switching (conditional on re-enrollment) as a function of changes in the plan attributes of chosen plans (with a focus on changes in network size, plan quality, and premium) as well as choice set and household-level characteristics.

In the third paper (Chapter 4), I simulate the expected effects of hypothetical

minimum network adequacy and plan quality rating requirements on consumer welfare in the Marketplaces. Minimum network adequacy and plan quality requirements have been considered by policymakers as ways to ensure adequate access to care and standards of care to consumers in the Marketplace. However, it is unclear how consumer welfare on net would be affected by these policies when balanced against potential additional costs to enrollees. Using mixed logit plan attribute valuation estimates from the first paper, I simulate the effects of two minimum network size requirements (to cover at least 10% and 20% of all regional physicians) and a plan quality requirement for plans to have a quality rating exceeding two stars (out of five). I use the "log-sum" approach to calculate changes in expected consumer welfare due to the changes in the choice sets consumers face under hypothetical these policy proposals.

Together, these three papers provide an empirical analysis of consumer dynamics in the Health Insurance Marketplace. At the conclusion of this dissertation (Chapter 5), I synthesize the results and policy implications relevant to policymakers and insurers.

References

Barnett, J. and Vornovitsky, M. (2016). Health Insurance Coverage in the United States: 2015. Technical report, United States Census Bureau.

Cohen, R., Zammitti, E., and Martinez, M. (2018). Health Insurance Coverage: Early Release of Estimates From the National Health Interview Survey, 2017.

Hoadley, J., Cubanski, J., and Neuman, T. (2016). Medicare Part D in 2016 and Trends over Time.

Jacobson, G., Casillas, G., Damico, A., Neuman, T., and Gold, M. (2016). Medicare Advantage 2016 Spotlight: Enrollment Market Update. Technical report, The Henry J. Kaiser Family Foundation.

Chapter 2: Health Plan Choice and the Valuation of Plan Attributes in the ACA Marketplaces*

Abstract

Not much is known about how consumers value the non-financial attributes of health insurance plans. Using individual-level enrollment data from the California, Colorado, and Washington Health Insurance Exchanges/Marketplaces established by the Affordable Care Act, I examine how enrollees value provider network size and plan quality using conditional and mixed logit plan choice models. Overall, health plan choices by consumers are very responsive to network size and plan quality. Individuals have an annual willingness-to-pay (WTP) of $200-$300 for a 10 percentage-point (25 percentile) increase in network size, and a WTP of $1,200-$2,800 for a high quality plan (4-5 stars) relative to a low quality plan (1-2 stars). Moreover, consumers who are newly enrolled, face smaller choice sets, or make their enrollment decisions without a Navigator tend to be even more responsive to these plan attributes.

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1 Introduction

Health plans sold through insurance marketplace settings have covered a significant and growing share of the US population in recent years (Barnett and Vornovitsky, 2016; Cohen et al., 2018), but relatively little is known about how these enrollees make their plan choices. For instance, more employers now offer employer-sponsored insurance through private health exchanges, allowing employees to select from a broader set of choices. At the same time, almost 75% of all Medicare beneficiaries (16.3% of the US population in total) have made plan choices in insurance marketplaces for either Medicare Advantage (managed care) plans or Medicare Part D prescription drug plans (Jacobson et al., 2016; Hoadley et al., 2016). Beneficiaries in both settings choose from plans offered by a several different insurers with a variety of plan designs and payout structures, coupled with attempts to make these plan attributes more transparent to consumers. However, the most prominent shift has occurred through the implementation of the Affordable Care Act (ACA) Exchanges, which covered 4% of the US population (12.2 million) in 2017.

Policymakers have seen insurance Exchanges as a way to empower consumer choice and offer a better selection of plans. By providing information transparency, standardizing measurement of certain plan features, and offering support services for the choice of health insurance, the Exchanges can assist enrollees in improving their selection of health insurance. In addition, they can potentially deliver lower prices and a better plan selection for enrollees by fostering competition between private health plans on price and quality. Given the selection of plans and competition on price and quality (as the average enrollee is able to choose from over 30 plans), enrollees should theoretically be able to better select plans that matches their insurance and risk preferences (Polyakova, 2016).

However, not much is currently known about how enrollees value different plan attributes in their choice of ACA Exchange plans. The need for knowledge

on the ACA's Exchanges, in particular, is also relevant as the context differs from other insurance settings due to the enrollee population, plan standardization, and generally large amount of choice available to enrollees (further described in Section 3). The ACA's Exchanges enrollees mostly consist of relatively lower-income individuals, many who were previous uninsured and recently brought into the "mainstream of health care" (DeLeire et al., 2017; McGuire, 2011).

Furthermore, with plan standardization (i.e., the metal tiers for different actuarial values) and marketplace competition limiting the extent to which plans can compete on premiums alone, plans have increasingly begun to compete on key non-financial attributes. Some insurers offer narrow network plans to be able to further reduce premiums, while others have put more focus on improving plan quality ratings at attract enrollees (Dafny et al., 2017).

The paper analyzes how enrollees make plan choices in the ACA Exchanges by examining conditional and mixed logit plan choice models using individual-level enrollment data from California, Colorado, and Washington for 2016. Specifically, I explore how consumers respond to two key non-financial plan attributes in their choice of plans: provider network size and plan quality ratings. A better understanding of how enrollees make plan choices in the ACA marketplace and which attributes are highly valued could help policymakers in their efforts to improve the information conveyed on the marketplace and quantify the benefits of insurance choice.

I find that consumers are highly responsive to these two non-financial attributes on the ACA Exchange. Individual enrollees have a willingness-to-pay (WTP) of \$200-\$300 a year for a 10 percentage-point (p.p.) increase in network size (corresponding to a 25 percentile increase in provider network size) and an annual WTP of \$1,200-\$2,800 for a high quality plan relative to a low quality plan (corresponding to a shift from the 10^{th} to 90^{th} percentile of plan quality). The ranges for these estimates are due to variations in household size, tax credit amount, and cost-sharing reductions

faced by different enrollees. Consumers who are newly enrolled, face smaller choice sets, or are self-enrolled without the assistance from a Navigator tend to be even more responsive to network size and plan quality.

The rest of the paper is structured as follows. Section 2 discusses the related literature, and Section 3 provides additional institutional context of the ACA Exchanges. Section 4 describes the underlying theoretical and empirical methods for examining plan choice. Section 5 describes the data used for this study, and Section 6 describes the analysis plan and specific models used in the context of the study data. Section 7 presents the main plan choice results. Section 8 concludes.

2 Related Literature

Related ACA Literature

The body of literature exploring plan choice in the context of the ACA marketplaces is relatively limited and has chiefly focused on financial attributes of plans. To date, there are only a couple working papers that explore individual plan choice and the valuation of plan attributes in the ACA marketplaces. A few studies (Saltzman, 2017; Tebaldi, 2017; Abraham et al., 2017) have found rather large demand elasticities and consumer responsiveness to premium (with magnitudes that are higher than those found in other insurance contexts). Tebaldi (2017) and Saltzman (2017) then use their respective demand estimates to then assess alternative subsidy designs and simulate impacts of the subsidy and individual mandate policy changes, respectively. DeLeire et al. (2017) has also found that consumers are also highly sensitive to cost-sharing reductions (CSRs) that the ACA provides to low-income enrollees on certain eligible plans. Overall, consumers in the ACA might be more sensitive to plan attributes, notably premium, due high churning rates along with a high degree of plan

standardization and close plan substitutes available DeLeire and Marks (2015).[1]

This relatively-limited literature on ACA plan choice has likely primarily focused on different "financial" plan attributes, including premium elasticities for demand estimation and responses to cost-sharing, due to several data limitations. The lack of individual level enrollment data has constrained the extent to which researchers could explore consumer choice at the individual and household levels. Consequently, there seems to be a significant gap in the literature regarding how enrollees make plan choices when considering important non-financial plan attributes, including network size and quality.

Other Contexts

It is relatively well-established that consumers value a range of different financial attributes when choosing a health plan (Scanlon et al., 1997; Atherly et al., 2004; Abaluck and Gruber, 2016), including the plan's premium, deductible, and other cost-sharing. Earlier studies (Royalty and Solomon, 1999; Feldman et al., 1989) have estimated demand in different employer-sponsored insurance settings and generally find that employees are fairly sensitive to plan premium costs. In the context of employer-sponsored insurance, others have found that the more recent phenomenon of switching employees from traditional employer-sponsored plan offerings to private health Exchanges leads to significant consumer welfare gains due to employees being able to select from a larger set of choices and, in turn, better match their risk preferences to the plan characteristics (Dafny et al., 2010, 2013).

Much of the related previous work exploring how consumers respond to non-financial plan attributes has focused on focused on the Medicare Advantage, Medicare Part D (prescription drug plans), and the Massachusetts Connector settings.[2] Ben-

[1]Previous research has also found that enrollees in the ACA tend to be relatively more "active shoppers" and have higher rates of plan switching than in other contexts such as employer-sponsored insurance (ESI) and Medicare Part D prescription drug plans.

[2]The Massachusetts Connector, established in 2006, was widely seen as the predecessor to the

eficiaries in Medicare Advantage managed care plans were found to be responsive not only to premiums and cost-sharing, but also to the quality of care under a plan, freedom of referral, and (in particular) plan quality star ratings (Buchmueller, 2006; Darden and McCarthy, 2015).

Ericson and Starc (2015) found that consumers on the Massachusetts Connector have a willingness-to-pay (WTP) of $600-1,400 for the broadest hospital network relative to the narrowest network available to them. They also examine how product standardization affects plan choice and find that consumers chose more generous plans post-standardization but were not more price sensitive post-standardization (Ericson and Starc, 2016). Consumers also more likely to respond to a "cheapest plan heuristic" (Ericson and Starc, 2012) by being more likely to choose the lowest premium plan available after controlling for other attributes.

Contributions

This paper makes several contributions to the understanding of plan choice in the ACA. While prior studies mainly focused on how consumers choose plans with respect to premiums, this study aims to address a gap in understanding with respect to how consumers respond to non-financial plan attributes, notably network size and plan quality. To my knowledge, this is the first paper to specifically explore how consumers consider non-financial attributes in their choice of ACA plans. It is the only study, to my knowledge, exploring plan quality ratings in plan choice and one of perhaps two studies (working papers) exploring provider networks in the context of plan choice in the ACA (Sen and DeLeire, 2018; Tebaldi and Cuesta, 2018).

In addition, this study is one of only a handful of studies that leverages individual enrollment data from the ACA Exchanges to explore plan choice decisions in-depth. Relative to the most related prior studies, this paper uses newer state-based

ACA state-based marketplaces, though there are some key differences between the two.

Exchange data from more states, with individual level enrollment data from California, Washington, and Colorado. The use of this data to answer these open questions can shed light on previously unexplored decision-making factors.

3 The Context of the ACA

The Patient Protection and Affordable Care Act (ACA), passed in 2010, established private health insurance Exchange at the state level (and began operations in the 2014 enrollment period).[3] These Exchanges were established to facilitate the regulation of the individual health insurance market, to sell qualified health plans through a web based portal, and to subsidize plan premiums and costs with respect to enrollee income.[4] Twelve states (including those explored in this paper) run their own state-based health benefits Exchanges called State-Based Marketplaces (SBM), while the rest of the states use the Federally-Facilitated Marketplace (FFM) platform.[5] The SBM states uniquely establish their own marketplaces, websites, insurer negotiations, and requirements for plans to be sold on-Exchange.[6]

ACA plans are standardized with respect to actuarial value (the average proportion of the cost of care that the health plan would pay), with plans sorted into five "metal tiers", or actuarial value levels: Catastrophic, Bronze, Silver, Gold, and Platinum respectively corresponding to <60%, 60%, 70%, 80%, and 90% actuarial value.[7] The premium and cost-sharing subsidies are applied on a sliding scale for

[3]They were established primarily to provide affordable individual market plans to those where were ineligible for reasonably priced employer-sponsored insurance or other forms of public coverage (Medicaid in particular).

[4]All Qualified Health Plans available on the Exchanges cover federally defined "essential benefit packages."

[5]`kff.org/health-reform/state-indicator/total-marketplace-enrollment`

[6]34 states use the FFM which have the federal government run their Exchange and use the Healthcare.gov platform. The remaining states have adopted a hybrid state-partnership approach that use the federal Healthcare.gov platform but maintain some of their own regulations with respect to Exchange plan offerings and listings.

[7]Note that Catastrophic plans are only available primarily to enrollees under age 30 or (more rarely) for people with a hardship or affordability exemption (if their employer-based or Marketplace

families and individuals with income up to 400% of the Federal Poverty Level (FPL). Advanced Premium Tax Credits (APTC, or "tax credits") are available for those within 100-400% of the FPL and ensure that consumers spend no more than a certain percentage of their income on their health insurance premium. The Appendix provides information on how tax credits are calculated. Cost-Sharing Reductions (CSR) are eligible to those within 100-250% FPL. In addition to receiving tax credit subsidies, eligible consumers also receive plans with lower cost-sharing requirements (lower deductibles, copayments, coinsurance, and/or maximum out-of-pocket costs) applied to Silver plans.

One institutional difference among SBM states is that some states (e.g., California) operate through an "active purchaser" model while others (e.g., Colorado and Washington) operate through a "clearinghouse" model.[8,9] Additionally, the markets have different decision support tools in place to help enrollees with plan selection. The most notable of these are ACA plan "Navigators" who assist enrollees in-person in discussing their preferences and helping enrollees choose their plans and navigate the Marketplace.

Provider Network and Plan Quality Information

Provider network size is generally measured as the share of physicians in a state rating region covered in a plan's network. Consumers do not see this direct measure of network size when they choose between plans. Instead, they can use provider look-up tools ("doctor finders") along with more detailed provider directory information

insurance is deemed unaffordable).

[8]The clearinghouse model occurs where the SBM sets certain restrictions and thresholds (such as premium limits within metal tiers) and allows all plans meeting the requirements to be sold on the Exchange. In the active purchasing model, the SBM actively negotiates with insurers to select which insurers and plans are allowed to be listed on the Exchange, thereby restricting the number of plans that might otherwise be listed in Exchange for more favorable prices/benefits for consumers. California uses the latter approach and has smaller average choice sets than Colorado and Washington, which use the former approach.

[9]States with a clearinghouse model have been found to have lower adjusted average premiums for all plans within each metal tier compared to active purchaser states (Krinn et al., 2015).

that are provided for each plan on the SBM websites to obtain information on plan network sizes.

Plan quality, available for California and Colorado plans, are star ratings (out of five stars) given to each plan contract. They are calculated using clinical measure data along with various dimensions of enrollees' reported plan experiences.[10] A five-star plan means the health plan scored among the top plans nationwide; a three-star rating is assigned to plans that scored in the middle, and so forth.[11] Plan quality is unavailable for some plans because the Exchange does not have enough data on the insurer or plan from previous years with respect to the dimensions of the quality measures. These quality measures are not themselves missing from the data, but rather show up to enrollees as having no quality rating available when viewed on the SBMs. It is also worth noting that plan quality ratings are only available in a couple of SBM states and are not generally available on the Federally-Facilitated Marketplace (FFM).[12]

4 Methods

I examine the choice of Exchange plans using conditional and mixed logit plan choice models on individual-level data from the California, Washington, and Col-

[10]Consumers are provided an overall quality rating ("plan quality") and individual ratings for three major aspects of health plan performance: getting the right care, care experience, and plan services for members. These quality measures are constructed using: a) health records of a sample of members from each plan (checked to compare their medical care with national standards for care and treatments that are proven to help patients and whether they got unnecessary care), b) multiple aspects of health care quality checked by patient medical charts and billing (for issues like proper controls for high blood pressure, lowering cholesterol, getting the right medications), and c) a survey of members' experiences with their providers and care along with their experiences in getting information from the health plan's customer service staff. While the SBMs implement their own star ratings, the criteria and components used to generate star ratings are fairly consistent across states.

[11]Information about California and Colorado's plan quality ratings can be found at `www.coveredca.com/individuals-and-families/quality-ratings` and at `www.connectforhealthco.com/faq/what-does-the-quality-rating-of-a-health-plan-indicate-3`.

[12]As of 2016, they were available in 6 (out of 12) SBMs including CA and CO, and not available on the FFM. As of 2018, they were available in a few more SBMs and the federal Exchange is piloting them in VA and WI.

orado SBMs.[13] This section (Section 4) discusses the underlying empirical models, while Sections V and VI respectively describe the data and analysis plan in more detail.

Random Utility Model Applied to Health Plan Choice

This study's empirical models are based on the random utility model used to derive the conditional and mixed logit models (McFadden, 1973; Train, 2009). This overall structure has been utilized by several other plan choice studies (Sen and DeLeire, 2018; Tebaldi, 2017). For completeness, the main points of the theoretical framework are presented in this section. To model plan choice, suppose a decision maker i faces J alternative plans. The utility that the decision maker obtains from choosing a particular plan j can be decomposed into two parts: a systematic component V_{ij} that is dependent on a set of observable health plan attributes and a random component ε_{ij} unobserved by the outside observer.[14] Thus, an individual's utility for each plan can be treated as independent random variables and can be written as:

$$U_{ij} = V_{ij} + \varepsilon_{ij} \tag{1}$$

where U_{ij} represents the value or utility of the j^{th} plan choice for the i^{th} individual. Assume that individuals are utility maximizers, so that the decision maker i will choose plan j if
$U_{ij} = \max(U_{i1}, \ldots, U_{ij})$. Thus, for Y_i representing a discrete choice among J alternatives, the probability that the decision maker i chooses alternate j is:

$$\pi_{ij} = P(Y_i = j) = P(V_{ij} + \varepsilon_{ij} > V_{ik} + \varepsilon_{ik}) = P(\varepsilon_{ik} < \varepsilon_{ij} + V_{ij} - V_{ik}) \quad \forall k \neq j \tag{2}$$

[13] These were the states for which I could obtain access to individual-level plan choice data.

[14] The distribution of the unobserved, random component could represent the effect of bounded rationality on the part of the decision maker when faced with limited information, time, and evaluation capacity (Train, 2009).

Assume that each ε_{ij} is independently, identically distributed extreme value Type I, so that the density for each unobserved utility component is

$$f(\varepsilon_{ij}) = \exp\left(-\varepsilon_{ij} - \exp(-\varepsilon_{ij})\right) \tag{3}$$

With this distribution, it can then be shown that

$$\pi_{ij} = \frac{\exp V_{ij}}{\sum_k \exp V_{ik}} \tag{4}$$

so that the theoretical probabilities for i's choice of plan j follow the equation defining the multinomial logit model (Maddala, 1986). The expected utilities V_{ij} can be modeled in terms of the characteristics of alternative choices rather than attributes of individuals. If z_j represents a vector of the attributes of the j^{th} alternative plan, then the nonrandom portion of i's utility for plan j can be written as follows:

$$V_{ij} = z_j'\gamma \tag{5}$$

Substituting equation (5) into equation (4) then yields the conditional logistic (conditional logit) model and is equivalent to the log-linear model in which the main effect of the dependent variable is represented in terms of plan attributes z_j.

The probabilities derived in Equation (4) require that the odds of choosing choice j over alternative choice k should be independent of the choice set for every pair (j, k) (Independence of Irrelevant Assumptions, or IIA). The alternatives can also be modeled using a mixed logit extension of the conditional logit model which allows for "random taste variation, correlation in unobserved factors over time, and unrestricted substitution patterns" so that the IIA assumption can be relaxed. The derivation of the mixed logit models from utility-maximizing behavior is similar as

before, and the decision maker's utility is written as:

$$U_{ij} = \beta_i' V_{ij} + \varepsilon_{ij} \tag{6}$$

The main difference is that β_i is a vector of coefficients for the observable attributes V_{ij} of the choice that vary for each person i, representing their tastes (as opposed to being fixed in the previous equations). Thus, the probability of choosing an alternative j conditional on β_i is

$$\pi_{ij}(\beta_i) = \frac{\exp \beta_i' V_{ij}}{\sum_k \exp \beta_i' V_{ik}} \tag{7}$$

However, one cannot obtain the conditional probability in Equation 8 because β_i is unobserved. As such, the unconditional choice probability is utilized. This is the integral of π over the range of β_i:

$$\pi_{ij} = \int \left(\frac{\exp \beta' V_{ij}}{\sum_k \exp \beta' V_{ik}} \right) f(\beta) d\beta \tag{8}$$

which is the probability for a mixed logit specification.[15] The random coefficient for each individual represents the variations in tastes related to the relevant plan attribute.

Empirical Analysis of Health Plan Choice

As indicated above, a conditional logistic regression (conditional logit) can be used to explore consumers' relative valuation of plan attributes based on an underlying random utility model. The specification for the conditional logit model in this setting of health plan choice is:

$$Logit(Plan_{ij}) = X_{ij}' \beta + S + B + \varepsilon_{ij} \tag{9}$$

[15]The normal distribution of the coefficients is typically assumed and used in the related literature.

with i, j indexing person and plan, respectively. X is a vector of observable plan attributes (e.g. plan quality, premium), S is a set of enrollee fixed effects (included in the conditional logit model by definition), and B is a set of insurer brand fixed effects.[16] The dependent variable is the log odds (or the logit of the probability) for whether plan j was chosen by person i. The inclusion of insurer brand fixed effects account for unobserved plan characteristics that might be correlated to the observed plan attributes such as insurer brand reputation and other unobserved non-financial characteristics (Ketcham et al., 2016).

All coefficients are exponentiated to be presented as odds ratios (OR). The coefficients (for the attributes other than the premium) can also be transformed into willingness-to-pay (WTP) estimates in dollar terms by comparing the effect size to that for the premium.[17] For instance, the WTP for a 10 p.p. increase in a plan's network size is the increase in the net annual plan premium paid by the consumer that would make them indifferent between choosing the original plan versus the new plan with a 10 p.p. increase in network size. The results for the main non-financial attributes, network size and quality, are presented in terms of WTP. The result for the premium is also presented as an elasticity to facilitate comparisons to the prior literature.

The mixed logit relaxes the IIA assumption and also estimates a distribution around the relevant coefficients, allowing one to observe a range of valuations for plan attributes of interest. The mixed logit specification in the context of health plan

[16] This controls for and differences out individual characteristics (with the exception of income level and individual/family enrollment, which the models will stratify by). The model instead focuses on within-individual differences which are of interest in this paper, namely the different choices faced by each enrollee.

[17] The willingness-to-pay (WTP) of a plan attribute k is measured as: $WTP_k = -\frac{\beta_k}{\beta_{Prem}}$ where β_k, β_{Prem} are the respective model coefficients for attribute k and annual net premium. The net premium services is a price coefficient as it is essentially the price that the consumer faces for a plan. Dividing the coefficient of any attribute k (such as network size) by the price coefficient essentially yields a dollar estimate (annual) for a unit change that plan attribute (10 p.p. increase in network size). The Delta method is used to construct the confidence intervals in all results. A parametric bootstrap using the Krinsky-Robb method also provided very similar confidence intervals.

choice is:

$$Logit(Plan_i) = f(X'_{n,i}(\tilde{b}_{n,i} + \beta_n), X'_{m,i}\beta_m, S, B, \varepsilon_i) \tag{10}$$

with n indexing the attributes which are modeled with random coefficients and m indexing the attributes which are modeled without random effects (plan indices not included for concision). For variables with random coefficients, $\tilde{b}_{n,i}$ (normally distributed around 0) are values from the vector $\tilde{b}$ representing the person-level deviation from the relevant overall coefficient estimated for the sample. Specifically, these mixed logit models will be helpful in exploring the heterogeneity of WTP estimates for network size and quality.

5 Data

The analyses of health plan choice use individual-level enrollment data for 2016 from the from California, Washington, and Colorado Marketplaces along with additional data from the Robert Wood Johnson Foundation Health Insurance Exchange (HIX) Compare on SBM plan characteristics (e.g., deductible, plan type) and from Vericred on provider networks.[18] The states' enrollment data includes plans selected by each enrollee (or family) along with demographic information including age, family income as a percent of the federal poverty limit (FPL), Advanced Premium Tax Credit (APTC) amount, gender, subsidy eligibility, and smoking status. These individual-level data are then collapsed to the household level to examine household plan choice. The three states represent a large share of total Exchange enrollees (16% of all Marketplace enrollees in 2016).

The final analytic file for this paper is constructed by merging these three data sets (i.e., Exchange, RWJF HIX and Vericred) at the region-county level for

[18]The individual-level enrollment data from the SBM states were each separately obtained from the California Health Benefits Exchange, the Washington Health Benefits Exchange, and the Colorado Health Benefits Exchange, respectively. The HIX Compare data can be found at: `www.hixcompare.org`

each state along with some additional plan and insurer information, notably plan star ratings from California and Colorado.[19] The exclusion restrictions are shown in Table A1 in the Appendix. The final sample has information from 1,301,841 households (1,061,153 from California, 99,098 from Colorado, and 141,590 from Washington). The distribution of insurer brands by state is shown in Table A2.

Plan Attributes

The plan attributes used in the analysis include both non-financial and financial attributes. The main non-financial attributes are network size and plan quality. The main financial attribute is the premium, while secondary financial attributes relate to actuarial value and cost sharing (and are listed further below). The relative valuation of the premium is critical in serving both as an important control and in forming the basis for constructing the WTP estimates for network size and plan quality.

Provider Network Size

Provider network size for a given plan is measured as the proportion of physicians in an area covered by that plan.[20] The Vericred data lists all of the providers covered by each plan. To calculate the provider network size for each plan, I calculate the number of physicians in the rating region within the provider network and divide it by the total number of physicians within the counties of the respective rating region where that plan is actually sold (rather than the entire rating area). I create physician network measures for each plan in the subset (if applicable) of counties in each rating region that the plan is offered in, as not all plans sold in each region are offered in each county within that region.[21] A plan not entering into a particular set of counties

[19]The reason why the merge is done for each county-region as opposed to the rating region level is because not all SBM plans offered in a region are offered in each county within that region, if a region spans multiple counties in a state. While virtually all counties are contained completely within a rating region, an exception is California's Los Angeles County, which is composed of two rating regions that together span the county.

[20]This distinction is made because not all plans sold in a state rating region is sold in every county within that rating region.

[21]The unit of observation in the raw provider network data is either an individual physician or a

would thus have no need to network with the providers in those counties. Since the data provides information on both individual and group providers by specialty, I adjust for the group size of group providers by physician specialty when constructing the provider network size measures.[22]

Quality

I create a quality measure based on four categories: low quality (1-2 stars), medium quality (3 stars), and high quality (4-5 stars), and "no quality."[23] A continuous plan quality measure from 1-5 stars cannot be constructed because 23% of plans have "no quality" as their plan quality rating. These cutoffs in the plan quality variable are selected to roughly delineate the plan choices in three similarly sized categories among plans with available quality ratings. While quality ratings are generally given at the insurer level, some insurers have different quality ratings pertaining to different plan types.[24]

Premium

The net household premium measure is calculated as the household's total annual premium for each plan minus that household's tax credit (based on the second-cheapest silver plan in the region). Examples of the Marketplace website interface seen by consumers for each of the three states are shown in Figures A5-A7. As seen in those figures, consumers observe the net premium and cost-sharing when comparing and choosing between plans, as the Exchange websites automatically display the net post-tax credit premiums and applicable cost-sharing adjustments for CSRs to Silver plans

group physician practice (with the specialty denoted in both cases). The majority of physicians in the data are listed as an individual physician. The physician groups are categorized by physician specialty but are not given an exact group size. To address this issue, I multiply each group practice by the average number of physicians in a group practice of that specialty from sources including Bloniarz (2016) and Kane (2017). More physician specialty information can be found at `aamc.org/data/workforce/reports/457712/2016-specialty-databook.html`

[22]This would confirm that my calculated adjustments to provider network sizes by multiplying each specialty physician group by the respective specialty group size are not driving the results.

[23]Lin and McCarthy (2018) used this high quality plan cutoff definition.

[24]Some insurers may only have quality ratings for one type of plan but not another (e.g. for their HMOs but not their PPOs).

following from the pertinent information entered by each enrollee (e.g. income, household size). I also include indicators for the cheapest premium plans for each metal tier.[25] The effects on these heuristics (notably for the cheapest bronze and silver plans) may give insight as to whether consumers utilize lowest premium heuristics in their decision-making (Ericson and Starc, 2012).

Other Financial Attributes

The models control for each plan's deductible, maximum out-of-pocket (OOP) limit, and metal tier (actuarial value). In addition, the copayments and coinsurance for primary care physician, inpatient facility, and outpatient physician categories are included in the model to capture variations in cost-sharing. These represent three of the most salient types of services, and enrollees have been shown to respond to cost-sharing across these categories (Manning et al., 1987). I specify low and high values of copayments and coinsurance for each of the 3 different service types and include these in the regression models (with low coinsurance as the reference category for each service type).

Other Non-Financial Attributes

The models also include plan network type (PPO or HMO).[26] Other non-financial plan attributes included in the models without brand fixed effects include: indicators for whether an insurer is a regional (rather than national) operator and if an insurer is a non-profit organization.

[25] Except for catastrophic plans, because tax credits cannot be used towards these plans

[26] "HMO" refers to both HMO and EPO plans in this paper. A very small share Exchange plans are EPO plans. They tend to me very similar to HMOs, particularly with respect to their reimbursement of in network and out of network services.

6 Analysis Plan

Main Models

The main models use the conditional logit regression (Equation 9) to model plan choice with insurer brand fixed effects pooled for all three states. I then estimate models including the measures for plan quality. One reason for this is that the sample for plan quality data only includes California and Colorado, as Washington did not have plan quality ratings until 2017. The other reason for this is that plan quality are given at the insurer level and thus do not vary within insurer brands; the specification for the models with plan quality therefore cannot include brand fixed effects. Across these two specifications, the results are relatively similar and robust as the models contain a relatively rich set of plan attribute controls and person fixed effects (Abaluck and Gruber, 2011).[27] All models are run separately for six subsamples based on individual versus family enrollment and by three income groups (under 250% FPL, 250-400% FPL, and over 400% FPL). The income groups are created to match the cut-offs for CSR eligibility (up to 250% FPL) and tax credit eligibility (up to 400% FPL) which affect the net premiums faced by enrollees.[28,29]

[27] This justification is used by Abaluck and Gruber (2011) in their analysis of plan choice among the elderly for Medicare Part D prescription drug plans.

[28] Both of these cutoffs are "strict" cutoffs. CSRs and tax credit subsidies abruptly stop for individuals over 250% and 400% FPL, respectively. Tax credits adjustments are made to account for the difference in the actual annual income versus the income declared when an enrollee signs up for an SBM plan, but no similar adjustments are made for CSRs. More information on CSRs can be found at `healthcare.gov/glossary/cost-sharing-reduction`

[29] The family income brackets (FPL levels) are presented in different ways across the three states. Washington has a continuous measure percent FPL. California has six categories of percent FPL (under 138, 138-150, 150-200, 200-250, 250-400, and over 400% FPL). Colorado does not have an FPL category, but I am able to construct a continuous FPL measure from the premium tax credit formula (see Figure A1). To pool the states and have meaningful yet concise FPL measures, I delineate the three broad income categories: under 250%, 250-400% and over 400% FPL. The 250% and 400% FPL cutoffs respectively match the cutoffs for cost-sharing reductions (CSRs) and tax credits.

Stratifications

I also run several stratified models to explore the heterogeneous effects of network size, plan quality, and premium across plan choices. First, the process through which a consumer enrolls onto the Exchange may impact their choice of plans, so I run a set of models stratifying by the enrollment channel; i.e., if a consumer self-enrolled or the assistance from a Navigator.[30] Second, there is literature suggesting that decision making factors may differ between new and old enrollees, and so I also stratify the models by new versus enrollees. Third, there is a literature suggesting that enrollment decisions may be affected by the size of one's choice set, so I stratify by larger versus smaller choice sets (above or below the median choice set size) (Heiss et al., 2016; Bundorf and Szrek, 2010).[31] Additionally, I interact network size with plan type to explore how the valuation of network size varies across plan types.

I also run the models separately for each state to see if the results are relatively consistent across states. For the individual state stratifications, I run the models with and without plan quality. While the three state sample would be limited in its inference to distinguish between how consumers valuations may be shaped by the active purchasing (CA) versus clearinghouse models (CO, WA), these results shed some light on the variation in the valuations of plan attributes across the two models.

Identification and Robustness Checks

I also conduct two sets of robustness checks for the main model. The first set of robustness checks deals with identification issues. The primary identification assumption for the conditional logit plan choice models is that unobserved plan characteristics are uncorrelated with plan attributes, with premiums in particular. However, plan premiums and other attributes may be endogenous due to unobserved demand fac-

[30] The use of plan navigators is the main source of assisted enrollment.

[31] Consumers who face more choices may more strongly rely on price heuristics (cheapest bronze or silver plans) when they are "overloaded" by too many options.

tors. The current approach already controls for a rich set of observed information from the perspective of the consumer when comparing across respective plans, which has been utilized in related plan choice literature (Abaluck and Gruber, 2011; Heiss et al., 2013). Even with the brand fixed effects specification and a rich set of controls, premiums may still be endogenous. I therefore estimate additional models where I instrument for plan premiums in each region with the average premium of that plan offered in other regions in each given state.[32]

Another related concern is the that the IIA assumptions might not hold, particularly since individuals might not proportionally substitute across different metal tiers with the influence of CSRs for enrollees below 250% FPL. To address this, I estimate the main model using mixed logit regressions which are robust to the IIA assumptions and allow for unobserved individual heterogeneity in the valuations of premium and provider network size.

A second set of robustness checks operationalize plan quality and network size in different ways to check that the results are robust to variable definitions. For plan network size, I run models that define network size in two different ways. First, I use a specification of region-level provider network size that includes in the numerator and denominator all physicians in every county of each state rating region a plan is available in, regardless of whether the plan is sold in the county or not. A second specification does not "adjust" for group size of group providers by physician specialty and instead treat groups and individual physicians the same in the data.[33] For plan quality, I run a specification with quality as three categories (lower, higher, unavailable) instead of the four used in the main model. Higher quality is still defined as 4 stars or above, while lower quality is defined to be under 4 stars.

[32]This approach has been previous used to identify plan attribute coefficients by variations across plans offered by the same brands in a region. However, the exclusion restriction may not necessarily be satisfied for the instrument, as noted by Abaluck and Gruber (2011). Thus, the main models will not use the instrumented premium (though the results are quite comparable).

[33]This would confirm that my calculated adjustments to provider network sizes by multiplying each specialty physician group by the respective specialty group size are not driving the results.

7 Results

Summary Statistics

Table 1 shows the descriptive statistics for chosen plans and all plans faced by enrollees living in California, Colorado, and Washington who selected an Exchange plan in 2016. Table 2 shows the demographic characteristics of the sample. Consumers tend to enroll in higher quality plans relative to the distribution of plan quality across choice sets. Meanwhile, the average network size of chosen plans and all plans are similar. Given that almost 70% of enrollees have income levels under 250% FPL (as seen in Table 2), it makes sense that average net annual premiums (after APTC) tend to be significantly lower than total (pre-APTC) annual premiums and that consumers are disproportionately more likely to enroll into Silver plans (with the CSRs), relative to plans in other metal tiers. Note also that a majority (62%) of enrollees (from California) had assistance in their enrollment. Table A3 provides more detailed information on the characteristics of chosen plans and demographics by income bracket and individual versus family status.

Main Plan Choice Results

Table 3 shows the results of the main plan choice model with insurer brand fixed effects pooled across all three states. The coefficients are presented here as odds ratios, while demand elasticities are also presented for net annual plan premium. (The results are shown as WTP estimates further below.) Consumers across all groups are negatively responsive to premium and positively responsive to plan network size, with a premium elasticity of around 2.6 across all groups and enrollees having around 1.2 times higher odds of choosing a plan for a 10 percentage point increase in the plans' provider network size. (A 10 percentage point increase corresponds to a 25 percentile change across the overall distribution of network size.)

The results also point to the influence of CSRs, as enrollees under 250% FPL are much more likely to select Silver plans (relative to Bronze plans), compared to higher income enrollees. In addition, enrollees who do not qualify for CSRs have 2-2.7 times higher odds of choosing the cheapest bronze plan (usually the cheapest premium plan in an enrollees' choice set), all else equal. This suggests that they may be at least somewhat responsive to the cheapest premium heuristic.[34]

Provider Network Size Results

The results for network size from both the main model and the different stratifications are respectively shown in Figure 1 and Figures 2a-2d and presented as WTP estimates for a 10 percentage-point increase in a plan's provider network size (including 95% confidence intervals).[35] Figure 1 shows the coefficients for network size from the main plan choice models in Table 3 converted into WTP estimates. Overall, individuals and families have respective WTP ranges of \$200-\$320 and \$370-\$760 for a 10 percentage point increase in provider network size; these increase with income, though only up the 250% FPL level, as the WTP values are rather similar for households above 250% FPL. For reference, these WTP ranges represent 4-7% and 6-12% of pre-APTC and post-APTC annual premiums, respectively.

Figure 2a shows that the WTP for network size remains highly consistent when comparing consumers who self-enrolled versus those who had assistance in enrollment (mainly through plan navigators).[36,37] On one hand, consumers going through assisted

[34]The main exception is for households that qualify to enroll in Catastrophic plans. However, ACA premium tax credit subsidies cannot be used towards Catastrophic plans. So, the Catastrophic (rather than Bronze) plans might have the lowest premiums for some consumers on the upper end of the income distribution across all enrollees.

[35]Unless otherwise noted, all coefficients from results tables henceforth have been transformed into WTP values.

[36]Assisted enrollment mainly consists of the use of either an insurance navigator or an insurance agent. The results for enrollees who used a plan navigator are very similar to those for the more general "assisted" enrollment group. A higher proportion of lower income enrollees used assisted enrollment, relative to relatively higher income enrollees.

[37]The six categories available in the data are: certified enrollment counselor (plan navigator), certified insurance agent, certified plan-based enroller, county eligibility worker, service center rep-

enrollment might not be able to browse provider network size proxies (provider look up tools and directories) as freely as the self-enrolled could. On the other hand, navigators and insurance agents might be able to take into account the enrollees' network size or provider preferences and refer enrollees to a subset of plans they may be more interested in.

In contrast, new enrollees have much higher WTP values for network size than returning enrollees, shown in Figure 2b. This makes sense in light of previous research showing that returning enrollees may experience plan inertia (or plan switching costs) and inattention with respect to changes in the attributes of their previously selected plan and other plans in their choice set (Heiss et al., 2016; Handel and Kolstad, 2015).

A similar pattern is observed when the results are stratified by the size of the choice set, shown in Figure 2c. Enrollees facing smaller choice sets (under 31 plans, the median number of choices) tend to have significantly larger WTP values for network size compared to those who face larger (above median) choice sets. This could be due to the additional search costs required to browse through a larger choice coupled with the added effort needed to explore provider network size (unlike other directly labeled attributes like premium and plan quality).

Figure 2d shows the WTP results for a model that includes a network size-plan type interaction term to explore how enrollees value network size differentially across HMOs versus PPOs. In general, enrollees have a significant valuation of network size for both PPO and HMO plans, with the exception of PPO network size for enrollees over 400% FPL. Enrollees under 250% FPL value network size for HMO and PPO plans similarly. However, those over 250% FPL have a significantly higher valuation for HMO network size related to PPO plan network size. These results make sense given that a larger network size would be relatively more valuable for an HMO plan, as HMO plans tend to have much more limited out of network coverage of services.

resentative, or unassisted.

Plan Quality Results

Table 4 presents the premium, plan quality, and network size results for the plan choice model with plan quality for California and Colorado combined (as Washington did not have quality ratings in 2016). The full set of results for this model are shown in Table A4.[38] Figures 3 and 4a-4c respectively show the WTP estimates for plan quality from the main plan quality model and additional stratifications, focusing primarily on the WTP for high quality plans (4-5 stars) relative to low quality plans (1-2 stars). For reference, the WTP coefficients for all plan quality categories (high, medium, and no quality plans) relative to low quality plans are displayed side by side in Table A5.

Across all models and all stratified groups, enrollees are significantly more likely to pick high quality plans (4-5 stars) relative to low quality plans (1-2 stars). As seen in Figure 3, enrollees have a valuation for high quality plans of between $1,200-$2,800 a year relative to low quality plans. For context, this estimate represents around 24-40% of an enrollee's annual premium for an approximate increase from the 10th percentile to the 90th percentile of the distribution of plan quality.[39] In addition, consumers also exhibit significantly positive WTP for medium quality plans relative to low quality plans, while the preference for unavailable versus low quality plans are more mixed; see Table A5). As with network size, families and higher income households have higher WTP values for plan quality.

The enrollment channel stratifications in Figure 4a indicate that self-enrolled consumers (in California) are more responsive to plan quality than those who had assistance in enrollment. This is in contrast to the similarity in WTP for network size across these two groups. Self-enrollees may give more weight to plan quality ratings

[38]The other coefficients not present in Table 4 from the models with plan quality are otherwise consistent with those of the main models with brand fixed effects from Table 3.

[39]This is assuming that plans with no quality rating are ranked in between low and high quality plan.

as signals for their potential plan experience, unlike assisted enrollees whose plan navigators may provide additional insight on the experiences with different insurers.

Similarly, new enrollees have higher WTP for plan quality compared to returning enrollees, shown in Figure 4b. Plan quality may be more salient for new enrollees, who are for the most part necessarily actively shopping on the Exchange, in contrast to returning enrollees who might not experience plan inertia given their default plan choice from the previous enrollment. On the other hand, there is a less discernible pattern of differences in responsiveness to plan quality for enrollees facing smaller versus larger choice sets, as seen in Figure 4c. This stands in contrast to the finding that enrollees facing smaller choice sets are relatively more responsive to network size.

Across all stratifications, plan quality WTP estimates are both higher and more consistently significant compared to those found in prior studies on plan quality (Kolstad and Chernew, 2009). One possible explanation for this is that the plan quality ratings are saliently displayed in the online Exchange websites for the two states examined here.[40] Another possibility is that consumers may have become more familiar with using and giving 1-5 star ratings for various online services in recent years, as these ratings have proliferated in numerous other settings include online shopping, restaurant reviews, and mobile phone applications.[41] As consumers become more familiar with these rating systems, they may place a greater emphasis on star ratings in the context of health plan choices too. A third possibility is that previous research has shown that consumers are better able to understand and utilize health plan quality information when clear symbols (such as stars) and only the most relevant measures are presented, as in the case of the SBMs' aggregate plan quality

[40]For example, quality ratings are displayed in a somewhat bright, orange color for the California marketplace website (Figure A5) in contrast to other plan information displayed in conventional black and blue fonts on a white backdrop. A similar case may be true for Colorado (Figure A6), though here the green banner on the left might also attract the viewer's initial attention.

[41]Having an aversion to "low quality ratings" could also partly explain why consumers may be willing to pay such a significant amount for non-low quality plans in this setting.

star ratings (Taylor et al., 2016).[42]

Other Plan Choice Results and Robustness Checks

Premium Elasticity Results

Table 5 shows the magnitudes of these results for premium as elasticities. Across income groups, individuals and families have elasticity ranges of 2.3-2.8 and 2.5-3.2, respectively. Unlike the case for network size and plan quality, there are less discernible patterns of premium responsiveness across the enrollment channel, new vs. returning enrollee, and small vs. large choice set stratifications.

Stratifications by State

The last set of stratifications show results for the main plan choice models with and without plan quality stratified by state in Tables A6 and A7. In the main plan choice results by state (Table A6), network size and premium elasticity estimates are generally in line with the pooled results, though Washington has higher premium elasticities for enrollees above 250% FPL.

A few patterns emerge when comparing California and Colorado plan quality model results in Table A7. While enrollees from both California and Colorado value high quality plans over lower quality plans, the preference for high quality plans in California is significant and increasing with income, while the effect is much smaller (yet still significant) in Colorado without a noticeable trend across income categories. Colorado enrollees also exhibit higher odds of choosing plans with unavailable quality scores compared to California enrollees. One potential explanation for these discrepancies is the difference in the salience of the quality information presented to enrollees in each state. California's SBM website presented star ratings directly next to each plan's premium. California also has an option of sorting plans by plan quality star

[42]This stands in contrast to other settings which have tried to provide detailed plan quality information to consumers from sources such as the Consumer Assessment of Healthcare Providers and Systems (CAHPS).

ratings. In contrast, plan quality on Colorado's SBM website was not directly displayed in the search set in 2016. Enrollees had to click an additional link to find each plan's quality information.[43]

Robustness Checks

Overall, the results a robust to using instrumented premiums instead of actual premiums in the main models. (These alternative model's results are shown in Table A8). Again, each plan's premium is instrumented with the average of the plan's premiums from other rating regions in the same state. Similarly, the results are for the mixed logit plan choice models are quite similar to those from the main model, as seen in Table A9. The bottom segment of Table A9 shows the heterogeneity of the premium and network size coefficients (exponentiated as odds ratios) for various points in the distribution. Relatively lower income enrollees seem to have a much wider range of their responsiveness to network size compared higher income enrollees, with respective odds ratio ranges of 1.0-1.8 and 1.2-1.3 for individuals below 250% FPL versus those over 400% FPL.

In addition, the results are robust to alternative definitions of network size and plan quality (the results are respectively shown in Tables A10 and A11). Specifically, the results are similar with respect to: 1) network size measures that do not scale up physician group practices by the average specialty group sizes and 2) network size measures constructed at the state rating region level (rather than counties in each rating region in which a plan is sold). Plan quality results are robust to an alternate definition of plan quality that classifies plans into three categories (high quality: 4-5 stars, low quality: 1-3 stars, and no quality) instead of four.

[43]Starting in 2017, Colorado has had star ratings directly displayed for each plan on their SBM website. Figure A6 in (the screenshot of the Colorado user interface) is from 2017, not 2016.

8 Conclusion

Enrollees in the ACA marketplaces are quite responsive to provider network size and plan quality ratings. Individuals have a WTP of $200-$300 for a 10 percentage point increase in network size (equal to about 4-7% of the average annual premium) and a WTP of $1,200-$2,800 for a high quality plan relative to a low quality plan (equal to about 24-40% of the average annual premium). Enrollees' valuations of plan quality and network size are generally increasing with income and are larger for families than for individuals. Moreover, new enrollees and enrollees facing smaller choice sets have even higher WTP values for both network size and plan quality, likely due the fact that these attributes are more salient to the enrollees in these circumstances. Meanwhile, self-enrolled consumers are more responsive to plan quality (but not network size) relative to assisted enrollment consumers.

A key limitation of this paper is that the data consists of only three states (CA, CO, WA) in the western US. Consumers in these three states have more plans and insurers to choose from compared to the nationwide average. While this is advantageous because it provides more detail in the trade-offs between various plan attributes, it may limit the generalizability of the findings to the FFM marketplace and the ACA Exchanges as a whole. However, these states covered about one sixth of all ACA enrollees in 2016. Given the relatively good "health" of the Exchanges in the three states in having several plans and insurers for enrollees to choose from, the results are useful in elucidating the consumer dynamics and valuations of non-financial plan attributes under settings as intended at the ACA's implementation.

Another limitation is that this study only uses one year of data to explore enrollee plan choice and is therefore unable to compare how enrollees' valuations of plan attributes change over time. In addition, I cannot explore the relationship between plan choice health utilization and outcomes in the absence of claims data. Nevertheless, this study is still one of the first to use individual level ACA enrollment

data and is unique in combining plan quality and network information with this data to explore the responsiveness to these non-financial attributes in detail.

Despite these limitations, the results from these analyses contribute to the broader understanding of how individuals value and make trade-offs between non-financial plan attributes, notably provider network size and plan quality, in their choice of plans in marketplace settings. The responsiveness to quality and network size may also inform insurers' decisions to invest in and compete on these plan attributes, especially when they have to standardize essential plan features and have a more limited ability to compete on premiums in the Exchanges. They may also be helpful to policymakers who want to clarify the presentation of plan information and to improve the design of the Exchange marketplace to better facilitate consumer decision-making.

Given that consumers consistently value the breadth of provider network size, policymakers may also have a greater incentive to provide better provider network information for marketplace plans. For example, they could provide "T-shirt sizes" (i.e., small, medium, etc.) or other categorical measures of network size as relatively easy-to-understand summary measures. As enrollees utilize this information when selecting plans, it would also be especially important to make sure that plan quality ratings are accurately measured and that provider network information (including provider directories and provider search tools) is accurate and up to date. Moreover, given that enrollees strongly value plan quality ratings when the information is provided, it seems that enrollees would benefit from the implementation of plan quality ratings on the federally-facilitated marketplace and other state-based marketplaces which currently lack them. This could help improve consumer decision-making by providing them with useful, summarized measures of plan quality that may otherwise be hard to assess.

References

Abaluck, J. and Gruber, J. (2011). Choice Inconsistencies among the Elderly: Evidence from Plan Choice in the Medicare Part D Program. *American Economic Review*, 101(4):1180–1210.

Abaluck, J. and Gruber, J. (2016). Evolving Choice Inconsistencies in Choice of Prescription Drug Insurance. *American Economic Review*, 106(8):2145–2184.

Abraham, J., Drake, C., Sacks, D. W., and Simon, K. (2017). Demand for Health Insurance Marketplace Plans was Highly Elastic in 2014-2015. *Economics Letters*, 159:69–73.

Atherly, A., Dowd, B. E., and Feldman, R. (2004). The Effect of Benefits, Premiums, and Health Risk on Health Plan Choice in the Medicare Program. *Health Services Research*, 39(4 Pt 1):847–864.

Barnett, J. and Vornovitsky, M. (2016). Health Insurance Coverage in the United States: 2015. Technical report, United States Census Bureau.

Bloniarz, K. (2016). Physician Affiliation and Practice Size. Technical report, MedPAC.

Buchmueller, T. (2006). Price and the Health Plan Choices of Retirees. *Journal of Health Economics*, 25(1):81–101.

Bundorf, M. K. and Szrek, H. (2010). Choice Set Size and Decision-Making: The Case of Medicare Part D Prescription Drug Plans. *Medical Decision Making*, 30(5):582–593.

Cohen, R., Zammitti, E., and Martinez, M. (2018). Health Insurance Coverage: Early Release of Estimates From the National Health Interview Survey, 2017.

Dafny, L., Ho, K., and Varela, M. (2010). An Individual Health Plan Exchange: Which Employees Would Benefit and Why? *American Economic Review*, 100(2):485–489.

Dafny, L., Ho, K., and Varela, M. (2013). Let Them Have Choice: Gains from Shifting Away from Employer-Sponsored Health Insurance and toward an Individual Exchange. *American Economic Journal: Economic Policy*, 5(1):32–58.

Dafny, L. S., Hendel, I., Marone, V., and Ody, C. (2017). Narrow Networks On The Health Insurance Marketplaces: Prevalence, Pricing, And The Cost Of Network Breadth. *Health Affairs*, 36(9):1606–1614.

Darden, M. and McCarthy, I. M. (2015). The Star Treatment Estimating the Impact of Star Ratings on Medicare Advantage Enrollments. *Journal of Human Resources*, 50(4):980–1008.

DeLeire, T., Chappel, A., Finegold, K., and Gee, E. (2017). Do Individuals Respond to Cost-Sharing Subsidies in their Selections of Marketplace Health Insurance Plans? *Journal of Health Economics*, 56(Supplement C):71–86.

DeLeire, T. and Marks, C. (2015). Consumer Decisions Regarding Health Plan Choices, in the 2014 and 2015 Marketplaces. Technical report.

Ericson, K. M. and Starc, A. (2012). Heuristics and Heterogeneity in Health Insurance Exchanges: Evidence from the Massachusetts Connector. *American Economic Review*, 102(3):493–497.

Ericson, K. M. and Starc, A. (2015). Measuring Consumer Valuation of Limited Provider Networks. *American Economic Review*, 105(5):115–119.

Ericson, K. M. M. and Starc, A. (2016). How Product Standardization Affects

Choice: Evidence from the Massachusetts Health Insurance Exchange. *Journal of Health Economics*, 50(Supplement C):71–85.

Feldman, R., Finch, M., Dowd, B., and Cassou, S. (1989). The Demand for Employment-Based Health Insurance Plans. *Journal of Human Resources*, 24(1):115–142.

Handel, B. R. and Kolstad, J. T. (2015). Health Insurance for Humans: Information Frictions, Plan Choice, and Consumer Welfare. *American Economic Review*, 105(8):2449–2500.

Heiss, F., Leive, A., McFadden, D., and Winter, J. (2013). Plan selection in Medicare Part D: Evidence from administrative data. *Journal of Health Economics*, 32(6):1325–1344.

Heiss, F., McFadden, D., Winter, J., Wuppermann, A., and Zhou, B. (2016). Inattention and Switching Costs as Sources of Inertia in Medicare Part D. Working Paper 22765, National Bureau of Economic Research.

Hoadley, J., Cubanski, J., and Neuman, T. (2016). Medicare Part D in 2016 and Trends over Time.

Jacobson, G., Casillas, G., Damico, A., Neuman, T., and Gold, M. (2016). Medicare Advantage 2016 Spotlight: Enrollment Market Update. Technical report, The Henry J. Kaiser Family Foundation.

Kane, C. K. (2017). Updated Data on Physician Practice Arrangements: Physician Ownership Drops Below 50 Percent.

Ketcham, J. D., Kuminoff, N. V., and Powers, C. A. (2016). Choice Inconsistencies among the Elderly: Evidence from Plan Choice in the Medicare Part D Program: Comment. *American Economic Review*, 106(12):3932–3961.

Kolstad, J. T. and Chernew, M. E. (2009). Quality and Consumer Decision Making in the Market for Health Insurance and Health Care Services. *Medical Care Research and Review*, 66(1 Suppl):28S–52S.

Krinn, K., Karaca-Mandic, P., and Blewett, L. A. (2015). State-Based Marketplaces Using Clearinghouse Plan Management Models are Associated with Lower Premiums. *Health Affairs*, 34(1):161–169.

Lin, H. and McCarthy, I. M. (2018). Multimarket Contact in Health Insurance: Evidence from Medicare Advantage. Working Paper 24486, National Bureau of Economic Research.

Maddala, G. S. (1986). Limited-Dependent and Qualitative Variables in Econometrics. Cambridge Books, Cambridge University Press.

Manning, W. G., Newhouse, J. P., Duan, N., Keeler, E. B., and Leibowitz, A. (1987). Health Insurance and the Demand for Medical Care: Evidence from a Randomized Experiment. *American Economic Review*, 77(3):251–277.

McFadden, D. L. (1973). Conditional Logit Analysis of Qualitative Choice Behavior. In *Frontiers in Econometrics*. Wiley, New York.

McGuire, T. G. (2011). Chapter Five - Demand for Health Insurance. In Pauly, M. V., Mcguire, T. G., and Barros, P. P., editors, *Handbook of Health Economics*, volume 2 of *Handbook of Health Economics*, pages 317–396. Elsevier.

Polyakova, M. (2016). Risk Selection and Heterogeneous Preferences in Health Insurance Markets with a Public Option. *Journal of Health Economics*, 49(Supplement C):153–168.

Royalty, A. B. and Solomon, N. (1999). Health Plan Choice: Price Elasticities in a Managed Competition Setting. *Journal of Human Resources*, 34(1):1–41.

Saltzman, E. (2017). Demand for Health Insurance: Evidence from the California and Washington ACA Marketplaces.

Scanlon, D. P., Chernew, M., and Lave, J. R. (1997). Consumer Health Plan Choice: Current Knowledge and Future Directions. *Annual Review of Public Health*, 18:507–528.

Sen, A. and DeLeire, T. (2018). Consumer Choice and Learning in Private Insurance Markets: Evidence from the ACA Marketplaces.

Taylor, E., Carman, K., Lopez, A., Muchow, A., Roshan, P., and Eibner, C. (2016). Consumer Decisionmaking in the Health Care Marketplace. Research Report, RAND Corporation.

Tebaldi, P. (2017). Estimating Equilibrium in Health Insurance Exchanges: Price Competition and Subsidy Design under the ACA.

Tebaldi, P. and Cuesta, J. (2018). Distance to Physicians and Value of Choice in Individual Health Insurance.

Train, K. E. (2009). *Discrete Choice Methods with Simulation*. Cambridge University Press, Cambridge ; New York, 2 edition edition.

Tables and Figures

Table 1: Summary Statistics

N = 46,426,138	Chosen Plans		All Plans	
Plan Network Attributes	Mean	SD	Mean	SD
Network Size (% of Physicians)	20%	0.12	21%	0.14
PPO	44%	0.50	35%	0.48
HMO/EPO	56%	0.50	65%	0.48
*Quality Attributes**				
High Quality Rating (4-5 Stars)	30%	0.46	24%	0.43
Middle Quality (3 stars)	28%	0.45	22%	0.41
Low Quality Ratings (1-2 Stars)	28%	0.45	31%	0.46
No Quality Rating	14%	0.35	23%	0.42
Financial Attributes				
Total Premium, Individual	$4,994	2,423	$5,531	2,941
Net Premium, Individual	$2,137	1,888	$3,100	2,280
Total Premium, Family	$11,094	4,505	$12,362	5,612
Net Premium, Family	$3,979	3,904	$6,099	4,735
Total Premium, (Age 27 Ind.)	$2,982	674	$3,308	953
Bronze	28%	0.45	31%	0.46
Silver	62%	0.49	30%	0.46
Gold	5%	0.22	23%	0.42
Platinum	3%	0.18	14%	0.35
Catastrophic**	1%	0.12	3%	0.16
Deductible (Individuals)	$2,526	2,512	$2,556	2,617
Deductible (Families)	$4,556	4,694	$4,886	5,126
Max OOP (Individuals)	$4,334	2,091	$5,161	1,809
Max OOP (Families)	$8,530	4,143	$10,402	3,491

* Plan quality rating variables only for CA, CO (N = 35,562,421)

** Catastrophic Plans are only shown when available to household

Table 2: Demographics

Under 250% FPL	68%
250-400% FPL	20%
Over 400% FPL	12%
Individual	69%
Family	31%
Assisted Enrollment (CA)	62%
Age (Head of Household)	43
Qualify for Catastrophic Plan	28%
California	78%
Colorado	12%
Washington	10%

Table 3: Main Plan Choice Model

DV: Odds Plan is Chosen	Under 250% FPL		250-400% FPL		Over 400% FPL	
Coefficients: Odds Ratios	Individual	Family	Individual	Family	Individual	Family
Premium ($100)	0.889***	0.923***	0.948***	0.967***	0.945***	0.976***
Elasticity	*2.43*	*3.13*	*2.33*	*2.51*	*2.77*	*2.76*
	(0.0004)	(0.0004)	(0.0005)	(0.0003)	(0.0007)	(0.0004)
Network Size (10%)	1.211***	1.299***	1.154***	1.255***	1.134***	1.176***
	(0.0028)	(0.0050)	(0.0054)	(0.0068)	(0.0056)	(0.0088)
Silver	3.2500***	3.4094***	0.5330***	0.6278***	1.1328***	0.7250***
	(0.0834)	(0.1488)	(0.0123)	(0.0193)	(0.0316)	(0.0310)
Gold	0.9115***	1.6125***	0.1190***	0.1324***	0.8762***	0.3953***
	(0.0236)	(0.0743)	(0.0045)	(0.0066)	(0.0412)	(0.0286)
Platinum	1.0276	2.2948***	0.0710***	0.1106***	1.3820***	0.4072***
	(0.0271)	(0.1055)	(0.0040)	(0.0080)	(0.0929)	(0.0425)
Cheapest Bronze Plan	0.608***	0.388***	2.760***	1.864***	2.575***	2.734***
	(0.0276)	(0.0575)	(0.0446)	(0.0624)	(0.0417)	(0.0758)
Cheapest Silver Plan	1.347***	1.254***	1.639***	1.486***	1.185***	1.214***
	(0.0077)	(0.0104)	(0.0192)	(0.0212)	(0.0190)	(0.0310)
Cheapest Gold Plan	0.9465***	0.9286***	1.2279***	1.1974***	0.7147***	0.7305***
	(0.0177)	(0.0266)	(0.0283)	(0.0315)	(0.0191)	(0.0300)
Cheapest Platinum Plan	0.9097***	1.1089***	1.1537***	1.1638***	0.9028***	0.9636
	(0.0182)	(0.0364)	(0.0319)	(0.0408)	(0.0250)	(0.0456)
HMO	0.3681***	0.3320***	0.4676***	0.4034***	0.4539***	0.3861***
	(0.0030)	(0.0045)	(0.0071)	(0.0069)	(0.0076)	(0.0101)
Deductible ($100)	0.9967***	0.9953***	0.9722***	0.9823***	0.9951***	0.9901***
	(0.0004)	(0.0004)	(0.0005)	(0.0003)	(0.0007)	(0.0005)
Maximum Out-of-Pocket	0.9896***	0.9913***	0.9877***	0.9951***	0.9958***	0.9967***
($100)	(0.0006)	(0.0005)	(0.0008)	(0.0005)	(0.0008)	(0.0006)
Inpatient Physician						
High Coinsurance	1.4126***	1.1593***	0.7829***	1.2679***	0.5392***	0.6220***
	(0.0370)	(0.0639)	(0.0351)	(0.0731)	(0.0173)	(0.0291)
Low Copay	1.4402***	1.2143***	0.9571*	1.1915***	0.5407***	0.8252***
	(0.0099)	(0.0148)	(0.0242)	(0.0369)	(0.0116)	(0.0288)
High Copay	0.8077***	1.0834***	0.6039***	0.7931***	0.5340***	0.7102***
	(0.0144)	(0.0319)	(0.0126)	(0.0187)	(0.0100)	(0.0195)
Outpatient Facility						
High Coinsurance	0.5219***	0.5119***	0.9054**	0.5717***	1.1353***	0.9801
	(0.0134)	(0.0274)	(0.0403)	(0.0328)	(0.0357)	(0.0442)
Low Copay	0.4470***	0.3080***	1.3405***	0.9934	1.2753***	1.2230***
	(0.0101)	(0.0119)	(0.0442)	(0.0425)	(0.0420)	(0.0697)
High Copay	0.8120***	0.5661***	2.0554***	1.5503***	1.7410***	1.4715***
	(0.0199)	(0.0212)	(0.0619)	(0.0536)	(0.0570)	(0.0773)
Primary Care						
High Coinsurance	0.4949***	0.3663***	0.3153***	0.3405***	0.7623***	0.6329***
	(0.0062)	(0.0093)	(0.0066)	(0.0097)	(0.0161)	(0.0229)
Low Copay	2.4874***	2.8676***	2.4874***	2.5073***	1.6130***	1.6152***
	(0.0193)	(0.0434)	(0.0413)	(0.0595)	(0.0276)	(0.0425)
High Copay	2.0687***	2.3661***	1.8479***	2.7996***	1.5207***	1.5969***
	(0.0173)	(0.0410)	(0.0276)	(0.0623)	(0.0169)	(0.0330)
Insurer Brand FE	Y	Y	Y	Y	Y	Y
Observations	22,540,279	8,510,218	5,532,135	3,379,746	4,760,561	1,764,824

Reference categories: Bronze Plans, PPO Plans, Low coinsurance (for each service type)
*** p<0.01, ** p<0.05, * p<0.1

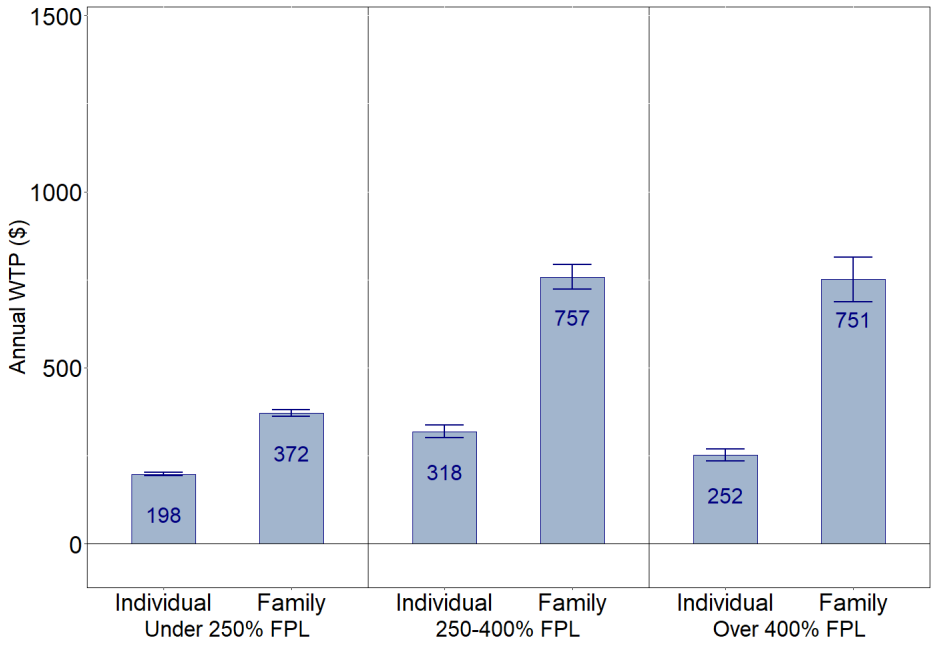
Table 4: Plan Choice Model with Plan Quality (CA, CO)

DV: Odds Plan is Chosen	Under 250% FPL		250-400% FPL		Over 400% FPL	
Coefficients: Odds Ratios	Individual	Family	Individual	Family	Individual	Family
Net Premium ($100)	0.891***	0.920***	0.947***	0.968***	0.944***	0.976***
Elasticity	1.70	3.29	2.20	2.43	2.40	2.78
	(0.0004)	(0.0004)	(0.0005)	(0.0003)	(0.0007)	(0.0004)
Network Size (10 p.p.)	1.14***	1.17***	1.19***	1.22***	1.13***	1.14***
	(0.003)	(0.004)	(0.005)	(0.006)	(0.005)	(0.008)
High Quality (4-5 stars)	4.16***	5.87***	4.69***	5.21***	5.10***	4.54***
	(0.025)	(0.059)	(0.059)	(0.080)	(0.074)	(0.113)
Medium Quality (3 stars)	1.28***	3.10***	1.74***	2.34***	1.22***	1.83***
	(0.016)	(0.067)	(0.045)	(0.074)	(0.028)	(0.063)
Low Quality (1-2 stars)	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
No Quality	1.272***	2.001***	0.784***	0.870***	0.966**	1.048*
	(0.007)	(0.017)	(0.011)	(0.014)	(0.016)	(0.029)
Observations	17,204,835	6,739,632	3,670,039	2,565,249	3,865,758	1,412,825

*** p<0.01, ** p<0.05, * p<0.1

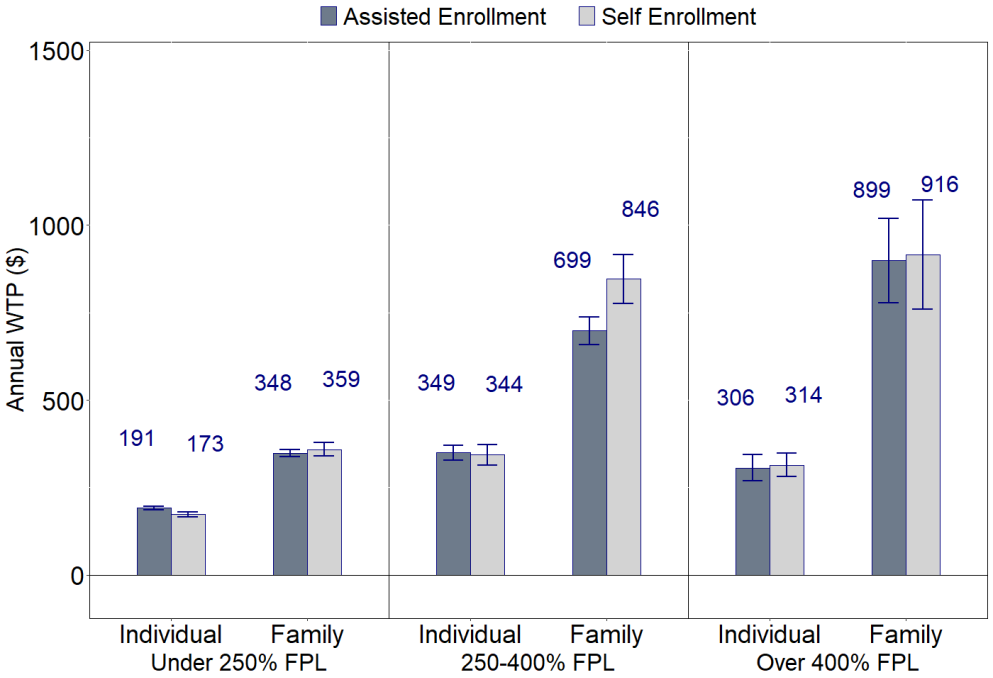
Full results for this model are shown in Appendix Table A4

Figure 1: Willingness-to-Pay (WTP) for Network Size (10 p.p. increase)



Notes: These WTP results coefficients in Figures 1-2d are for a 10 percentage-point (p.p.) increase in network size. The results in Figures 1-2d are from the model specification of Table 3. The error bars in all figures show the 95% confidence intervals.

Figure 2a: WTP for Network Size by Enrollment Channel (California)



Note: Results are for the California data (where enrollment channel information was available).

Figure 2b: WTP for Network Size for New and Returning Enrollees

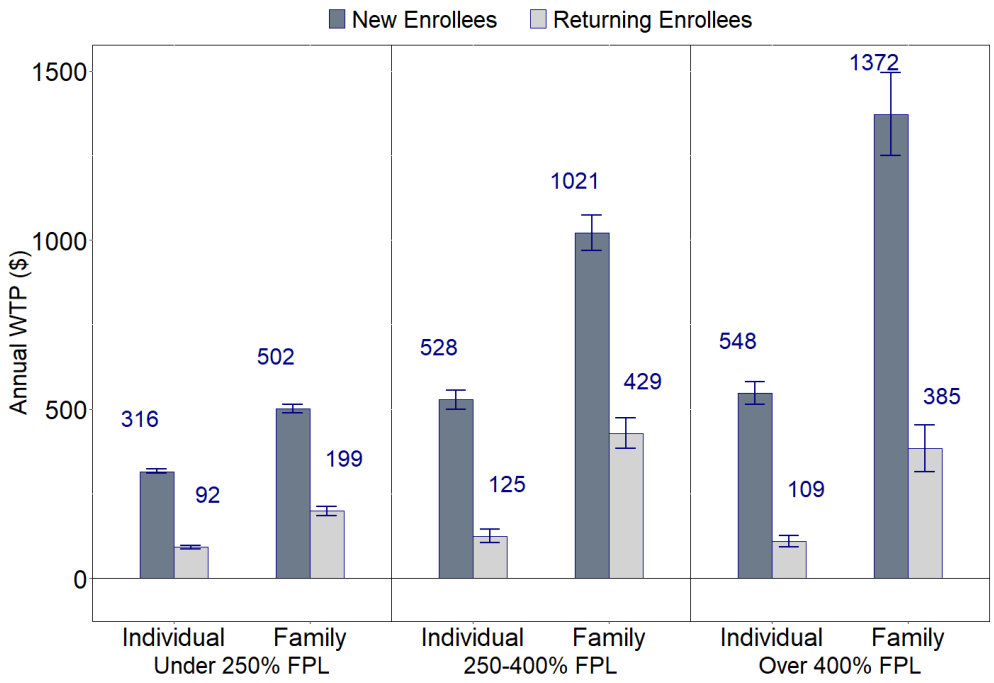
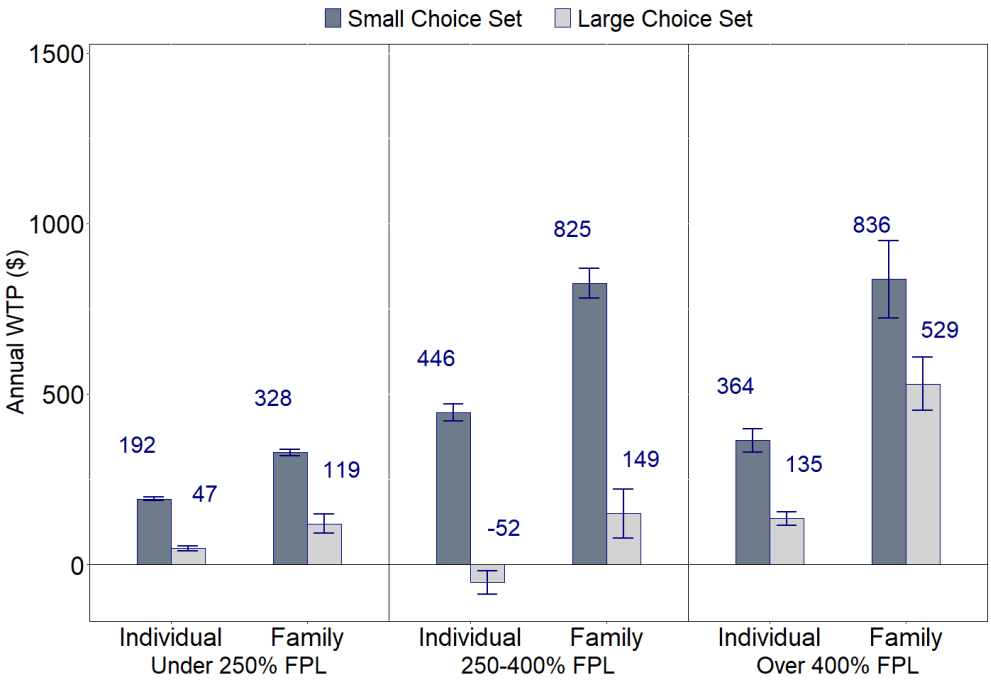


Figure 2c: WTP for Network Size by Enrollee Choice Set Size



Note: "Small" vs "Large" choice sets are defined as being under vs above/equal to the median choice set size from the sample (31 plans).

Figure 2d: WTP for Network Size by Plan Type

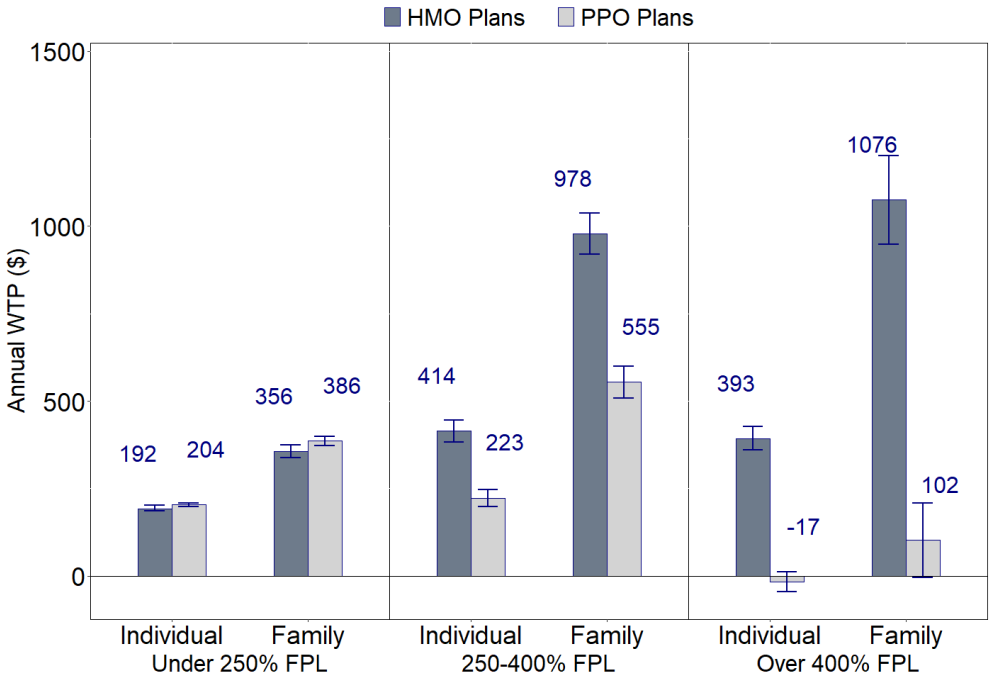
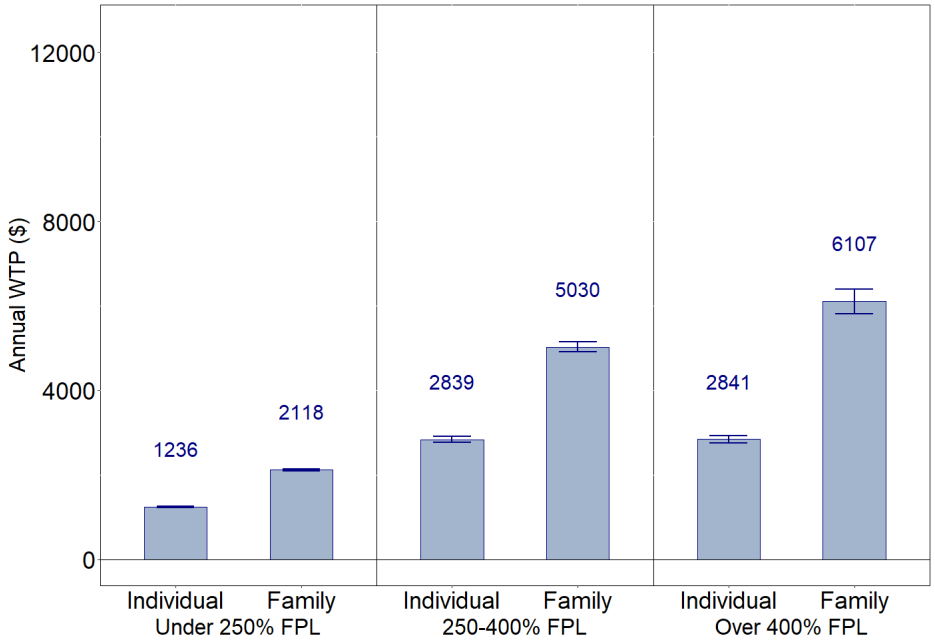
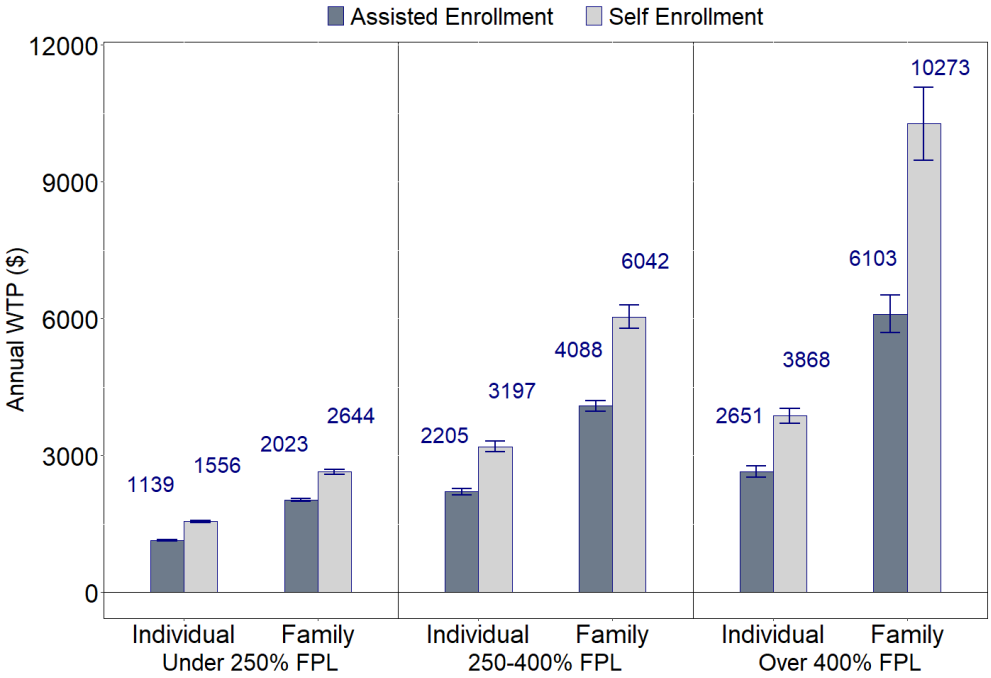


Figure 3: WTP for High Quality Plan (Relative to Low Quality Plan)



Notes: High and low quality plans respectively have 4-5 stars and 1-2 stars (out of 5). The values in Figures 3-4c are WTP estimates for high quality plans relative to low quality plans from models with the same specification as that of Table A4.

Figure 4a: WTP for a High Quality by Enrollment Channel (California)



Note: Results are for California (where enrollment channel information was available).

Figure 4b: WTP for a High Quality Plan for New and Returning Enrollees

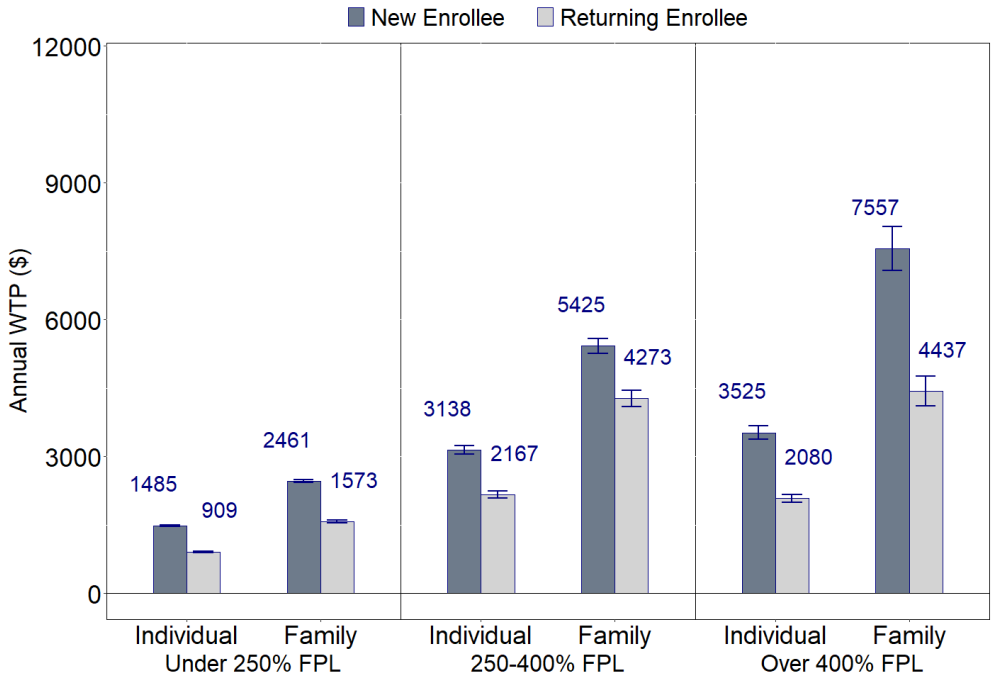
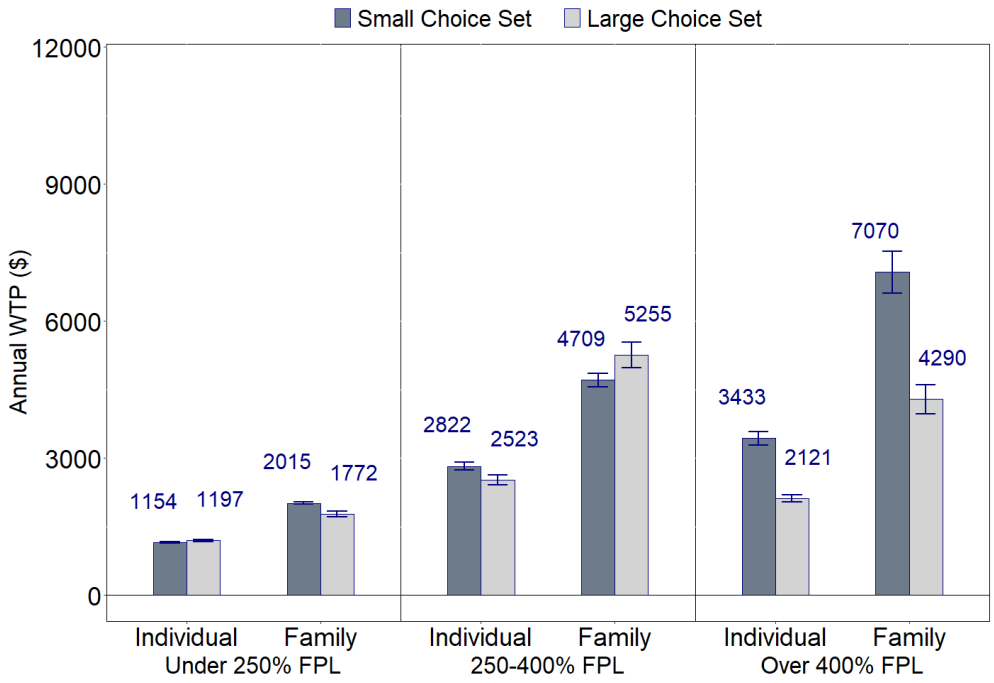


Figure 4c: WTP for a High Quality Plan by Enrollee Choice Set Size



Note: "Small" vs "Large" choice sets are respectively defined as being under vs above/equal to the median choice set size from the sample (31 plans).

Table 5: Premium Elasticities

	Under 250% FPL		250-400% FPL		Over 400% FPL	
Model	Individual	Family	Individual	Family	Individual	Family
Main Model						
Net Annual Premium ($100)	2.45***	3.18***	2.28***	2.48***	2.75***	2.70***
Enrollment Channel$^{\nabla}$						
Assisted	2.65***	3.38***	2.31***	2.5***	2.70***	3.03***
Unassisted	2.59***	3.14***	1.02***	2.45***	0.19***	0.42***
New vs. Returning						
New Enrollees	2.23***	3.25***	2.15***	2.47***	1.95***	2.49***
Returning Enrollees	1.34***	3.57***	2.65***	2.49***	3.20***	3.18***
By Choice Set Size$^{\Delta}$						
Small Choice Sets	0.84***	3.10***	2.20***	2.56***	2.72***	3.15***
Large Choice Sets	1.93***	2.13***	2.18***	2.12***	2.97***	2.68***

*** p<0.01, ** p<0.05, * p<0.1. Models control for covariates and brand FEs from Table 3

$^{\nabla}$ Results are for the California data (where the information was available)

$^{\Delta}$ Small vs large choice sets are defined as being below vs above the median number of plans (31)

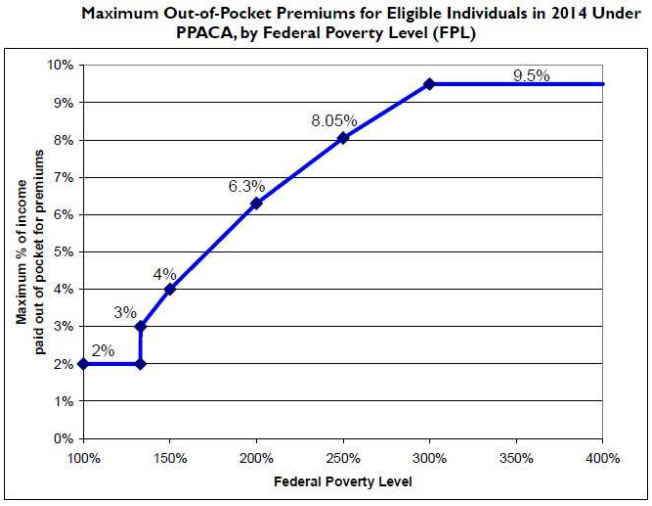
Appendix

Additional ACA Context

Advanced Premium Tax Credit (APTC) and Colorado FPL Calculations

Figure A1 below shows the relationship between the maximum out-of-pocket (OOP) for premiums and income as a percentage of the Federal Poverty Level (FPL).

Figure A1: Maximum Out-of-Pocket by Income Level



Let S_i denote the premium of the second cheapest Silver plan available to enrollee i and let $M(FPL_i)$ denote the maximum OOP (as a percent of total income) price allowed for an enrollee as a function of their FPL. Equation 17 is used to determine each enrollee's tax credit amount (TC):[44]

$$S_i - TC = FPL_i \times M(FPL_i) \tag{11}$$

for enrollees in 100-400% of the FPL. Note that individuals outside of this income range do qualify to receive tax credit subsidies.

[44]If $S_i < FPL_i \times M(FPL_i)$, then the $TC = 0$ for the enrollee, and the equality in Equation 16 would not hold However, this very rarely occurs in the data.

State Rating Regions

Figures A2-A4 show the state geographical rating regions for each state. Households with similar age and smoking status characteristics will pay the same premium for each plan within a rating region.

Figure A2: California Rating Regions

Figure A3: Colorado Rating Regions

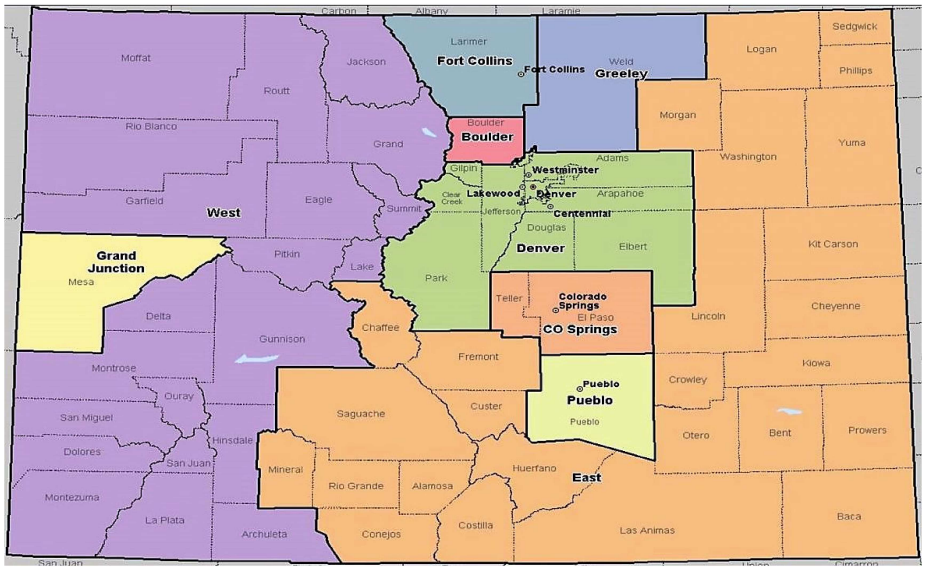


Figure A4: Washington Rating Regions

Marketplace Website Interfaces

Figures A5-A7 show what the Marketplace website interfaces look like for consumers browsing on the California, Colorado, and Washington Exchange websites. These are for the 2017-2018 enrollment period and are similar to what was shown in the 2016-2017 enrollment period used in this data, with the main difference being that Washington added plan quality ratings starting with the 2017-2018 enrollment period.

Figure A5: California Marketplace Website

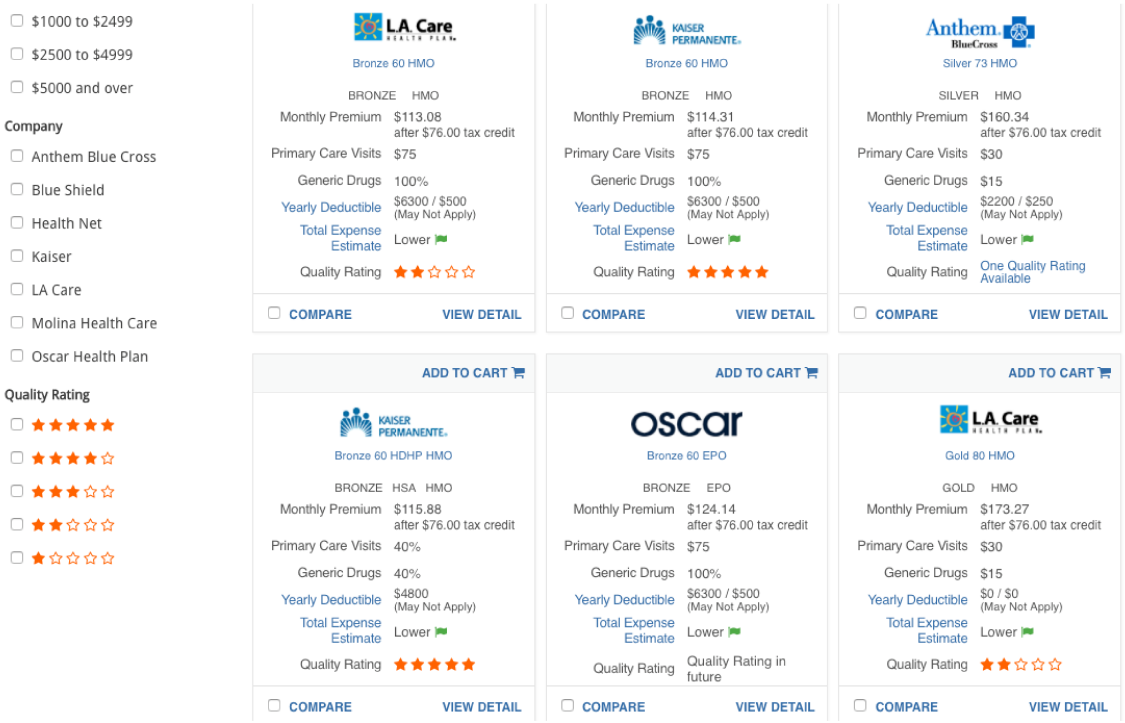


Figure A6: Colorado Marketplace Website

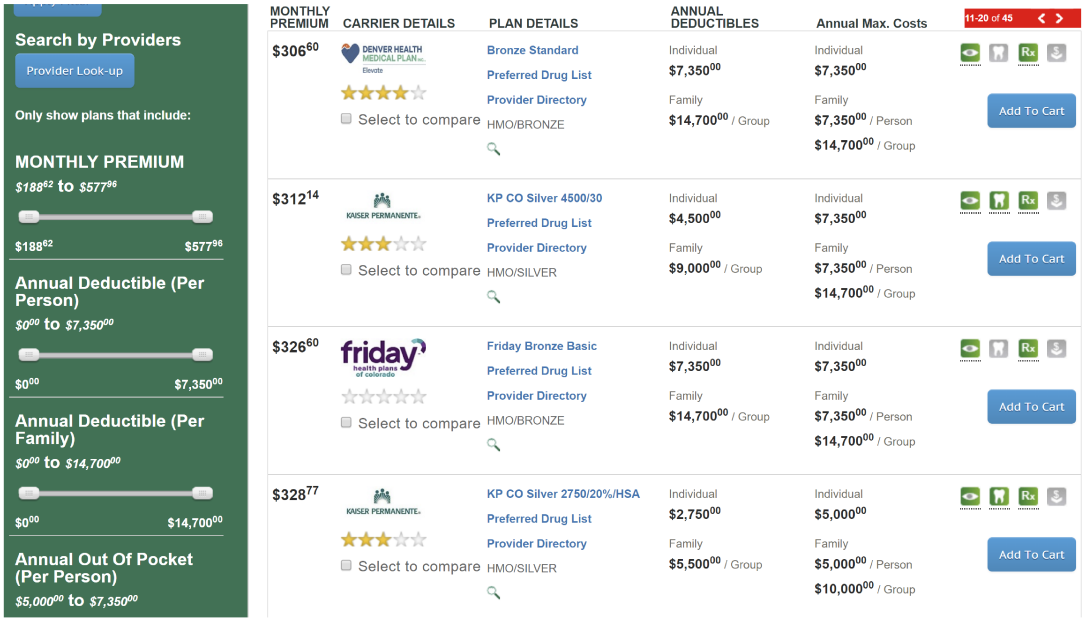
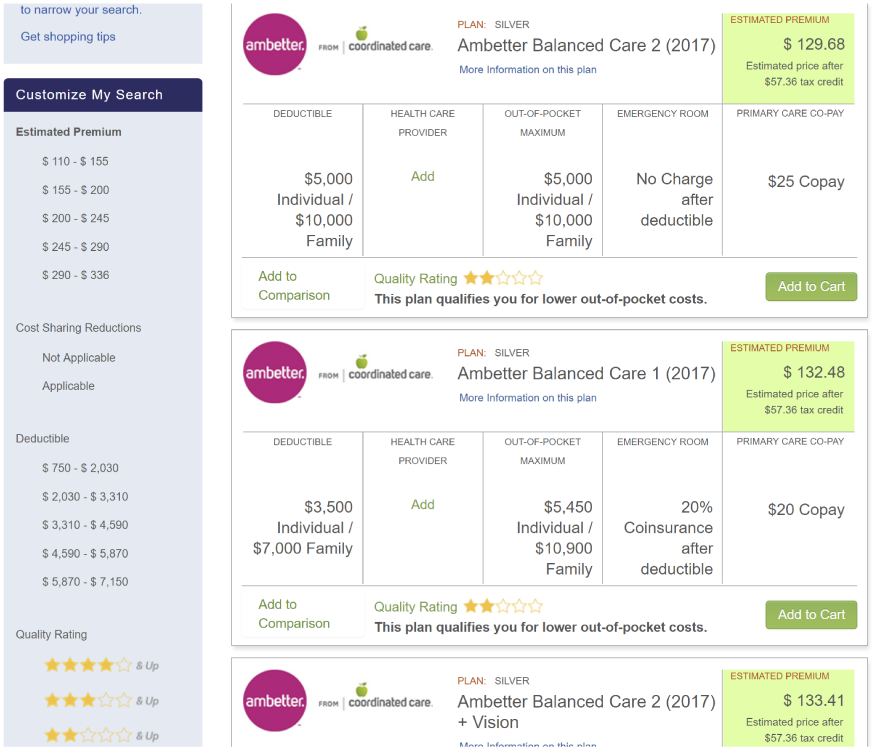


Figure A7: Washington Marketplace Website



Exclusion Restrictions and Additional Summary Statistics

Table A1 below shows the difference exclusion restrictions and the process by which the final plan choice analytic file is obtained.

Table A1: Exclusion Restrictions

California	N	Dropped	% Dropped
Initial Data (Individual Level)	1,715,442		
Missing County Information	1,577,160	139,346	8.12%
Family Missing Any Person ID	1,576,534	626	0.04%
Premium, CSR, or FPL Varies in Family	1,550,969	25,621	1.63%
Collapse to Family Level	*1,061,153*		
Colorado	N	Dropped	% Dropped
Initial Data (Individual Level)	170,846		
Plan Tier Variation in Family	170,425	421	0.25%
Premium, CSR, or FPL Varies in Family	169,355	1,070	0.63%
Collapse to Family Level	*99,098*		
Washington	N	Dropped	% Dropped
Initial Data (Individual Level)	214,328		
Missing Plan ID	209,517	4,811	2.24%
Premium, CSR, or FPL Varies in Family	201,111	8,406	4.01%
Collapse to Family Level	*141,590*		

Distribution of Insurers

Table A2 shows the distribution of insurers by state among both all plans and chosen plans.

Table A2: Distribution of Insurers by State

	California		Colorado		Washington	
	All Plans	Chosen	All Plans	Chosen	All Plans	Chosen
Observations:	29,422,519	1,053,132	5,972,419	96,246	11,031,550	129,736
Ambetter	0	0	0	0	0.09	0.22
Blue Shield CA	0.19	0.28	0	0	0	0
Cigna	0	0	0.14	0.1	0	0
Community Health Plan	0	0	0	0	0.004	0.0003
Group Health Co-op	0	0	0	0	0.05	0.18
Humana	0	0	0.08	0.07	0	0
LA Care	0.04	0.01	0	0	0	0
Oscar	0.04	0.001	0	0	0	0
Regence	0	0	0	0	0.1	0.003
Anthem Blue Cross	0.26	0.23	0.21	0.13	0	0
BridgeSpan	0	0	0	0	0.13	0.02
Chinese Community	0.01	0.01	0	0	0	0
Colorado Choice/Friday Health	0	0	0.07	0.06	0	0
Elevate/Denver Health Medical	0	0	0.04	0.002	0	0
Health Net	0.13	0.13	0	0	0	0
Kaiser	0.18	0.26	0.22	0.51	0.01	0.04
LifeWise	0	0	0	0	0.07	0.07
Molina	0.07	0.07	0	0	0.03	0.17
Premera Blue Cross	0	0	0	0	0.14	0.27

Additional Results Tables

Table A3: Chosen Plans and Enrollee Characteristics

	Under 250% FPL				250-400% FPL				Over 400% FPL			
	Individual		Family		Individual		Family		Individual		Family	
Plan Characteristics	N=618,441		N=254,908		N=149,544		N=100,829		N=114,522		N=42,155	
Financial Attributes	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Actual Premium	$1,402	1179	$2,225	2022	$3,333	1725	$5,662	3365	$4,559	2329	$10,579	4804
Premium without Tax Credit	$4,922	2361	$10,754	4306	$5,590	2629	$12,027	4732	$4,624	2360	$10,919	4816
Individual Age 27 Standard Premium	$2,963	632	$2,949	590	$2,987	736	$3,047	713	$3,055	857	$3,113	819
Bronze	24%	0.43	17%	0.38	44%	0.50	40%	0.49	40%	0.49	41%	0.49
Silver	70%	0.46	79%	0.41	40%	0.49	46%	0.50	32%	0.47	36%	0.48
Gold	3%	0.16	3%	0.16	8%	0.27	9%	0.29	12%	0.33	14%	0.35
Platinum	2%	0.15	2%	0.13	5%	0.21	4%	0.20	9%	0.29	8%	0.27
Catastrophic	1%	0.08	0%	0.02	3%	0.18	0%	0.05	7%	0.25	1%	0.11
Cheapest Bronze Plan in Set	0.057	0.23	0.038	0.19	0.093	0.29	0.078	0.27	0.074	0.26	0.072	0.26
Cheapest Silver Plan in Set	0.19	0.39	0.237	0.43	0.089	0.28	0.107	0.31	0.043	0.20	0.05	0.22
Cheapest Gold Plan in Set	0.006	0.08	0.007	0.08	0.017	0.13	0.02	0.14	0.016	0.13	0.018	0.13
Cheapest Platinum Plan in Set	0.006	0.08	0.006	0.08	0.013	0.11	0.012	0.11	0.015	0.12	0.014	0.12
Deductible (Individuals)	$2,016	2425	$1,589	2142	$3,820	2215	$3,549	2149	$3,579	2397	$3,386	2286
Deductible (Families)	$4,032	4851	$3,179	4283	$7,642	4429	$7,099	4297	$7,159	4793	$6,773	4572
Max OOP (Individuals)	$3,532	1962	$3,168	1758	$6,243	694	$6,234	642	$6,152	862	$6,164	835
Max OOP (Families)	$71	39.2	$63	35.2	$125	13.9	$125	12.8	$123	17.2	$123	16.7
Copayment: Primary Care Physician	$46	13.3	$46	11.4	$48	17.5	$48	16.0	$44	17.9	$43	17.2
Copayment: Outpatient Physician	$48	7.5	$49	7.4	$48	7.4	$50	7.2	$47	7.5	$48	7.5
Copayment: Inpatient Facility	$408	195	$424	196	$427	203	$448	198	$406	195	$414	198
Coinsurance: Primary Care Physician	32%	0.10	31%	0.11	35%	0.09	35%	0.09	32%	0.09	31%	0.09
Coinsurance: Outpatient Physician	35%	0.29	30%	0.26	44%	0.35	42%	0.34	39%	0.32	37%	0.30
Coinsurance: Inpatient Facility	35%	0.30	31%	0.26	46%	0.35	44%	0.35	41%	0.32	39%	0.31

(Continued on the next page)

Table A3 (Continued): Chosen Plans and Enrollee Characteristics

	Under 250% FPL				250-400% FPL				Over 400% FPL			
	Individual		Family		Individual		Family		Individual		Family	
Plan Characteristics	N=618,441		N=254,908		N=149,544		N=100,829		N=114,522		N=42,155	
Plan Network Attributes	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Network Size (% of Physicians)	19%	0.12	19%	0.12	21%	0.12	21%	0.12	20%	0.11	22%	0.12
PPO	42%	0.49	44%	0.50	44%	0.50	50%	0.50	44%	0.50	47%	0.50
HMO	60%	0.50	56%	0.50	56%	0.50	50%	0.50	56%	0.50	53%	0.50
Financial Attributes												
High Quality Rating (4-5 stars)	29%	0.46	24%	0.43	37%	0.48	33%	0.47	38%	0.49	34%	0.48
Lower Quality Ratings (1-3 stars)	56%	0.50	57%	0.50	54%	0.50	58%	0.49	54%	0.50	58%	0.49
No Quality Rating	24%	0.43	26%	0.44	23%	0.42	18%	0.39	16%	0.37	16%	0.37
Non-Profit	31%	0.46	34%	0.47	32%	0.47	35%	0.48	31%	0.46	34%	0.48
Regional	7%	0.26	7%	0.25	10%	0.30	9%	0.28	8%	0.27	8%	0.27
Demographics												
Self-Enrolled	38%	0.486	28%	0.448	44%	0.496	34%	0.474	62%	0.486	53%	0.499
Assisted Enrollment	62%	0.492	72%	0.5	57%	0.483	66%	0.499	38%	0.44	47%	0.465
Age (of Head of Household)	43	14.105	45	13.228	46	14.396	42	17.657	40	14.212	38	18.445
Qualify for Catastrophic Plan	28%	0.45	5%	0.22	22%	0.42	5%	0.22	29%	0.45	8%	0.28
Family Size	1	0	2.22	0.532	1	0	2.65	0.959	1	0	2.78	1.003
California	84%	0.37	87%	0.33	57%	0.50	70%	0.46	71%	0.45	66%	0.48
Washington	10%	0.30	8%	0.28	11%	0.31	8%	0.28	9%	0.28	10%	0.29
Colorado	6%	0.24	4%	0.21	33%	0.47	22%	0.42	21%	0.40	25%	0.43

Plan quality rating variables only for CA and CO

Catastrophic Plans only shown when available to household

Table A4: Plan Choice Model with Plan Quality (CA, CO)

	Under 250% FPL		250-400% FPL		Over 400% FPL	
	Individual	Family	Individual	Family	Individual	Family
Premium ($100)	0.889***	0.923***	0.948***	0.967***	0.945***	0.976***
Elasticity	*1.38*	*2.87*	*2.19*	*2.40*	*2.42*	*2.76*
	(0.0004)	(0.0004)	(0.0005)	(0.0003)	(0.0007)	(0.0004)
Network Size (10%)	1.15***	1.18***	1.20***	1.25***	1.14***	1.20***
	(0.0026)	(0.0044)	(0.0055)	(0.0066)	(0.0051)	(0.0084)
High Quality (4-5 stars)	2.65***	3.69***	3.97***	4.04***	4.74***	4.29***
	(0.025)	(0.059)	(0.059)	(0.080)	(0.074)	(0.113)
Medium Quality (3 stars)	1.32***	3.08***	1.99***	2.73***	1.33***	1.79***
	(0.016)	(0.067)	(0.045)	(0.074)	(0.028)	(0.063)
No Quality	1.03***	1.60***	0.82***	0.81***	1.004	1.0499*
	(0.007)	(0.017)	(0.011)	(0.014)	(0.016)	(0.029)
Silver	40.1***	26.5***	1.98***	2.47***	3.31***	1.76***
	(4.8987)	(0.2536)	(0.0804)	(0.1009)	(0.1234)	(0.0876)
Gold	12.4***	3.66***	0.71***	0.62***	5.02***	1.70***
	(0.9631)	(0.5415)	(0.0461)	(0.0506)	(0.3097)	(0.1413)
Platinum	15.4***	1.76***	0.51***	0.45***	10.0***	1.85***
	(1.6131)	(0.3577)	(0.0440)	(0.0490)	(0.8850)	(0.2192)
Cheapest Bronze Plan	0.50***	0.31***	2.34***	1.54***	2.04***	2.12***
	(0.0246)	(0.0535)	(0.0387)	(0.0486)	(0.0334)	(0.0569)
Cheapest Silver Plan	1.18***	1.15***	1.46***	1.33***	1.09***	1.08***
	(0.0080)	(0.0111)	(0.0187)	(0.0203)	(0.0185)	(0.0284)
Cheapest Gold Plan	0.69***	0.66***	1.07***	0.98***	0.63***	0.64***
	(0.0189)	(0.0272)	(0.0294)	(0.0302)	(0.0179)	(0.0277)
Cheapest Platinum Plan	0.75***	0.89***	1.09***	1.067*	0.92***	1.02
	(0.0195)	(0.0354)	(0.0320)	(0.0405)	(0.0264)	(0.0471)
HMO	0.321***	0.239***	0.386***	0.291***	0.279***	0.261***
	(0.0023)	(0.0029)	(0.0051)	(0.0045)	(0.0043)	(0.0067)
Deductible	1.043***	1.013***	0.995***	0.993***	1.021***	1.000
	(0.0012)	(0.0011)	(0.0009)	(0.0006)	(0.0009)	(0.0006)
Max OOP	0.9912***	0.9671***	0.9817***	0.9865***	0.9956***	0.9935***
	(0.0016)	(0.0016)	(0.0010)	(0.0007)	(0.0009)	(0.0006)
Non-Profit Insurer	0.59***	0.64***	0.94***	1.02***	1.18***	1.49***
	(0.0056)	(0.0123)	(0.0091)	(0.0115)	(0.0131)	(0.0269)
Regional Insurer	0.65***	0.69***	0.45***	0.45***	0.48***	0.47***
	(0.0062)	(0.0101)	(0.0077)	(0.0087)	(0.0089)	(0.0136)
Inpatient Physician						
High Coinsurance	3.40***	3.05***	2.25***	3.90***	1.18***	1.57***
	(0.0910)	(0.1742)	(0.1085)	(0.2170)	(0.0385)	(0.0717)
Low Copay	1.48***	1.26***	1.21***	1.53***	0.60***	0.961
	(0.0103)	(0.0159)	(0.0300)	(0.0449)	(0.0129)	(0.0324)
High Copay	0.88***	1.20***	0.62***	0.78***	0.47***	0.62***
	(0.0174)	(0.0386)	(0.0147)	(0.0195)	(0.0092)	(0.0173)

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Table A4 (Continued): Plan Choice Model with Plan Quality

	Under 250% FPL		250-400% FPL		Over 400% FPL	
	Individual	Family	Individual	Family	Individual	Family
Outpatient Facility						
High Coinsurance	0.30***	0.30***	0.47***	0.31***	0.54***	0.45***
	(0.0076)	(0.0161)	(0.0223)	(0.0168)	(0.0173)	(0.0196)
Low Copay	0.44***	0.34***	1.21***	0.942	1.10***	0.8791**
	(0.0099)	(0.0131)	(0.0392)	(0.0396)	(0.0362)	(0.0500)
High Copay	0.87***	0.59***	2.24***	1.67***	1.87***	1.31***
	(0.0218)	(0.0228)	(0.0713)	(0.0600)	(0.0621)	(0.0703)
Primary Care						
High Coinsurance	0.932**	0.346***	0.331***	0.464***	1.510***	1.05
	(0.0270)	(0.0191)	(0.0107)	(0.0212)	(0.0416)	(0.0439)
Low Copay	2.44***	2.37***	1.17***	1.57***	1.38***	1.30***
	(0.0318)	(0.0621)	(0.0408)	(0.0654)	(0.0312)	(0.0427)
High Copay	1.88***	1.83***	1.26***	2.59***	1.73***	1.70***
	(0.0248)	(0.0517)	(0.0234)	(0.0843)	(0.0231)	(0.0400)
Observations	17,204,835	6,739,632	3,670,039	2,565,249	3,865,758	1,412,825

Reference categories: Bronze Plans, PPO Plans, Low coinsurance (for each service type)
*** p<0.01, ** p<0.05, * p<0.1

Table A5: Plan Quality Willingness-to-Pay

	Under 250% FPL		250-400% FPL		Over 400% FPL	
Model	Individual	Family	Individual	Family	Individual	Family
Main Model						
High Quality	$1,236***	$2,118***	$2,839***	$5,030***	$2,841***	$6,107***
Medium Quality	$211***	$1,355***	$1,013***	$2,594***	$346***	$2,440***
Low Quality	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*
No Quality	$209***	$834***	-$447***	-$423***	-$61	$188*
Enrollment Type$^{\nabla}$						
Self-Enrolled						
High Quality	$1,556***	$2,644***	$3,197***	$6,042***	$3,868***	$10,273***
Medium Quality	$797***	$2,542***	$1,662***	$5,363***	$7	$968
No Quality	$246***	$826***	-$262***	-$680***	$237***	$836***
Assisted Enrollment						
High Quality	$1,139***	$2,023***	$2,205***	$4,088***	$2,651***	$6,103***
Medium Quality	$678***	$1,814***	$1,438***	$3,681***	$239	$2,492***
No Quality	$244***	$809***	-$496***	-$491***	-$76	$46
New vs. Returning						
New Enrollee						
High Quality	$1,485***	$2,461***	$3,138***	$5,425***	$3,525***	$7,557***
Medium Quality	$474***	$1,945***	$1,539***	$3,821***	-$184***	$966***
No Quality	$549***	$1,257***	-$223***	$3	$319***	$545***
Returning Enrollee						
High Quality	$909***	$1,573***	$2,167***	$4,273***	$2,080***	$4,437***
Medium Quality	$64***	$795***	$448***	$1,417***	$636***	$3,010***
No Quality	-$179***	$60***	-$615***	-$1,048***	-$353***	-$362***
By Choice Set Size$^{\Delta}$						
Small Choice Sets						
High Quality	$1,154***	$2,015***	$2,822***	$4,709***	$3,433***	$7,070***
Medium Quality	$686***	$1,830***	$1,396***	$3,834***	-$300**	-$1,007*
No Quality	$66***	$618***	-$1,271***	-$1,614***	-$887***	-$1,969***
Large Choice Sets						
High Quality	$1,197***	$1,772***	$2,523***	$5,255***	$2,121***	$4,290***
Medium Quality	$175***	$582***	$1,327***	$2,927***	$369***	$1,891***
No Quality	$409***	$936***	$570***	$2,014***	$302***	$1,469***

*** p<0.01, ** p<0.05, * p<0.1. Models control for covariates from Appendix Table A4

$^{\nabla}$ Results for the California data (where the information was available)

$^{\Delta}$ Small vs large choice sets defined as being below vs above the median number of plans (31)

Table A6: Plan Choice Model: State Stratifications

	Under 250% FPL		250-400% FPL		Over 400% FPL	
California	Individual	Family	Individual	Family	Individual	Family
Premium ($100)	0.884***	0.917***	0.944***	0.965***	0.943***	0.977***
Elasticity	*0.97*	*2.21*	*2.15*	*2.25*	*2.74*	*2.59*
	(0.0005)	(0.0004)	(0.0006)	(0.0004)	(0.0008)	(0.0006)
Network Size (10%)	1.22***	1.31***	1.23***	1.32***	1.17***	1.24***
	(0.0034)	(0.0057)	(0.0066)	(0.0082)	(0.0083)	(0.0147)
Observations	13,166,292	5,420,262	2,933,613	1,993,443	2,119,930	675,584
	Under 250% FPL		250-400% FPL		Over 400% FPL	
Colorado	Individual	Family	Individual	Family	Individual	Family
Premium ($100)	0.920***	0.952***	0.943***	0.970***	0.946***	0.971***
Elasticity	*1.33*	*2.10*	*2.71*	*2.33*	*2.71*	*3.32*
	(0.0012)	(0.0012)	(0.0021)	(0.0012)	(0.0016)	(0.0010)
Network Size (10%)	1.26***	1.21***	1.17***	1.13***	1.26***	1.20***
	(0.0087)	(0.0164)	(0.0175)	(0.0171)	(0.0111)	(0.0136)
Observations	2,480,618	682,843	386,872	336,828	1,494,115	654,893
	Under 250% FPL		250-400% FPL		Over 400% FPL	
Washington	Individual	Family	Individual	Family	Individual	Family
Premium ($100)	0.909***	0.937***	0.914***	0.953***	0.904***	0.954***
Elasticity	*2.23*	*3.12*	*4.41*	*4.17*	*5.23*	*5.06*
	(0.0012)	(0.0012)	(0.0016)	(0.0012)	(0.0027)	(0.0021)
Network Size (10%)	1.23***	1.27***	1.12***	1.18***	1.20***	1.28***
	(0.0055)	(0.0099)	(0.0071)	(0.0114)	(0.0109)	(0.0189)
Observations	5,335,444	1,770,586	1,862,096	814,497	844,155	339,463

*** p<0.01, ** p<0.05, * p<0.1

Table A7: Plan Choice Model with Plan Quality: State Stratifications

	Under 250% FPL		250-400% FPL		Over 400% FPL	
California	Individual	Family	Individual	Family	Individual	Family
Premium ($100)	0.883***	0.916***	0.946***	0.967***	0.945***	0.978***
Elasticity	*1.16*	*2.52*	*2.19*	*2.41*	*2.61*	*2.51*
	(0.0005)	(0.0004)	(0.0006)	(0.0004)	(0.0008)	(0.0006)
Network Size (10%)	0.88***	0.93***	0.92***	0.95***	0.92***	0.96***
	(0.0030)	(0.0045)	(0.0064)	(0.0078)	(0.0083)	(0.0146)
High Quality	3.10***	4.42***	4.60***	4.29***	7.94***	7.92***
	(0.0342)	(0.0751)	(0.0718)	(0.0943)	(0.1551)	(0.2791)
Missing Quality	1.23***	1.90***	0.97*	0.88***	1.45***	1.33***
	(0.0096)	(0.0209)	(0.0131)	(0.0164)	(0.0240)	(0.0408)
Observations	13,166,292	5,420,262	2,933,613	1,993,443	2,119,930	675,584
	Under 250% FPL		250-400% FPL		Over 400% FPL	
Colorado	Individual	Family	Individual	Family	Individual	Family
Premium ($100)	0.889***	0.937***	0.921***	0.956***	0.923***	0.961***
Elasticity	*2.37*	*2.75*	*3.85*	*3.41*	*4.18*	*4.64*
	(0.0012)	(0.0012)	(0.0021)	(0.0013)	(0.0016)	(0.0010)
Network Size (10%)	1.08***	1.18***	1.11***	1.12***	1.13***	1.12***
	(0.0058)	(0.0140)	(0.0149)	(0.0155)	(0.0076)	(0.0111)
High Quality	1.74***	1.71***	1.15**	1.31***	2.57***	1.53***
	(0.0349)	(0.0607)	(0.0507)	(0.0527)	(0.0588)	(0.0453)
Missing Quality	2.08***	4.73***	3.29***	7.21***	5.11***	28.67
	(0.1767)	(1.0355)	(0.8947)	(3.4238)	(0.7766)	(15.0761)
Observations	2,480,618	682,843	386,872	336,828	1,494,115	654,893

*** p<0.01, ** p<0.05, * p<0.1

Table A8: Plan Choice Model: Instrumenting for Premium

	Under 250% FPL		250-400% FPL		Over 400% FPL	
	Individual	Family	Individual	Family	Individual	Family
Premium ($100)	0.945***	0.973***	0.967***	0.982***	0.960***	0.984***
Elasticity	*1.00*	*0.90*	*1.38*	*1.29*	*1.75*	*1.64*
	(0.0003)	(0.0002)	(0.0005)	(0.0003)	(0.0006)	(0.0004)
Network Size (10%)	1.28***	1.32***	1.20***	1.30***	1.17***	1.21***
	(0.003)	(0.005)	(0.006)	(0.007)	(0.006)	(0.009)
Observations	22,540,279	8,510,218	5,532,135	3,379,746	4,709,913	1,752,288

*** p<0.01, ** p<0.05, * p<0.1

Table A9: Plan Choice Mixed Logit Model

	Under 250% FPL		250-400% FPL		Over 400% FPL	
	Individual	Family	Individual	Family	Individual	Family
Premium ($100)	0.836***	0.887***	0.907***	0.952***	0.895***	0.967***
	(0.0012)	(0.0011)	(0.0023)	(0.0012)	(0.0024)	(0.0014)
Network Size (10%)	1.25***	1.37***	1.18***	1.32***	1.21***	1.22***
	(0.0062)	(0.0112)	(0.0118)	(0.0150)	(0.0122)	(0.0184)
Premium Coefficient Distribution (Odds Ratios)						
10th Percentile	0.720	0.818	0.875	0.926	0.849	0.951
25th Percentile	0.757	0.835	0.887	0.932	0.862	0.954
Median	0.803	0.857	0.902	0.938	0.884	0.958
75th Percentile	0.865	0.878	0.919	0.943	0.910	0.961
90th Percentile	0.931	0.914	0.943	0.951	0.938	0.966
Network Size Coefficient Distribution (Odds Ratios)						
10th Percentile	0.948	0.966	0.931	1.068	1.237	1.239
25th Percentile	1.072	1.095	1.009	1.120	1.242	1.240
Median	1.243	1.309	1.152	1.235	1.246	1.241
75th Percentile	1.514	1.636	1.351	1.366	1.252	1.241
90th Percentile	1.809	1.991	1.560	1.479	1.257	1.242
Observations	22,540,279	8,510,218	5,532,135	3,379,746	4,709,913	1,752,288

*** p<0.01, ** p<0.05, * p<0.1

Table A10: Plan Choice Model: Alternative Provider Network Measures

Not Scaled by	Under 250% FPL		250-400% FPL		Over 400% FPL	
Group Providers	Individual	Family	Individual	Family	Individual	Family
Premium ($100)	0.895***	0.926***	0.951***	0.969***	0.947***	0.977***
Elasticity	*2.43*	*3.13*	*2.20*	*2.41*	*2.60*	*2.57*
	(0.0004)	(0.0004)	(0.0005)	(0.0003)	(0.0007)	(0.0005)
Network Size (10%)	1.05***	1.17***	1.03***	1.14***	1.01	1.04***
	(0.003)	(0.005)	(0.005)	(0.007)	(0.007)	(0.011)
Rating Region	Under 250% FPL		250-400% FPL		Over 400% FPL	
Provider Networks	Individual	Family	Individual	Family	Individual	Family
Premium ($100)	0.894***	0.925***	0.950***	0.968***	0.946***	0.977***
Elasticity	*2.42*	*3.15*	*2.21*	*2.42*	*2.61*	*2.60*
	(0.0004)	(0.0004)	(0.0005)	(0.0004)	(0.0007)	(0.0005)
Network Size (10%)	1.18***	1.27***	1.13***	1.23***	1.059***	1.10***
	(0.003)	(0.005)	(0.005)	(0.007)	(0.006)	(0.009)
Observations	22,540,279	8,510,218	5,532,135	3,379,746	4,709,913	1,752,288

*** p<0.01, ** p<0.05, * p<0.1

Table A11: Plan Choice Model: Alternative Plan Quality Categories

	Under 250% FPL		250-400% FPL		Over 400% FPL	
	Individual	Family	Individual	Family	Individual	Family
Premium ($100)	0.884***	0.919***	0.947***	0.966***	0.944***	0.975***
Elasticity	*3.14*	*2.16*	*2.47*	*2.44*	*2.78*	*2.30*
	(0.0004)	(0.0004)	(0.0006)	(0.0004)	(0.0007)	(0.0005)
Network Size (10%)	1.11***	1.14***	1.17***	1.20***	1.11***	1.12***
	(0.003)	(0.004)	(0.005)	(0.006)	(0.005)	(0.008)
High Quality	2.57***	3.34***	3.73***	3.50***	4.57***	3.72***
	(0.0145)	(0.0320)	(0.0422)	(0.0476)	(0.0577)	(0.0759)
No Quality	1.03***	1.56***	0.79***	0.74***	0.94***	0.91***
	(0.0058)	(0.0131)	(0.0108)	(0.0118)	(0.0151)	(0.0241)
Observations	17,204,835	6,739,632	3,670,039	2,565,249	3,865,758	1,412,825

*** p<0.01, ** p<0.05, * p<0.1

Chapter 3: Plan Switching Decisions in California's Health Insurance Marketplace

Abstract

Plan switching rates among returning Marketplace enrollees have remained consistently high. However, not much is known about the underlying reasons for the plan switching decisions of this population. Using 2016-2017 data from California's Marketplace, I examine how changes in the attributes of chosen plans over time may affect enrollee decisions to switch plans or disenroll from the Marketplace. I find that plan switching decisions on Marketplace are significantly affected by changes in the premium, changes in provider network size, and changes in plan quality of chosen plans. A plan's 10 percentage-point (p.p.) decrease in network size is associated with a 5-13 p.p. increase in the probability an enrollee switches plans on the Marketplace in the following year, and an increase in plan quality is associated with a 10-15 p.p. decrease in the probability of switching, relative to a decrease in plan quality. Additionally, enrollees who are newly enrolled, older, or had assistance in enrollment exhibited a lower likelihood of subsequently disenrolling from the Marketplace.

1 Introduction

In recent years, an increasing share of US households without access to affordable employer-sponsored health insurance have enrolled in Affordable Care Act (ACA) Marketplace/Exchange plans (Ericson et al., 2017). The Marketplaces were established to deliver quality insurance to individuals at affordable prices by relying on consumer choice, product transparency, and market competition to incentivize insurers to provide such plans. Since the initial enrollment period, consumers have maintained high plan switching rates. Around 30% of returning enrollees on the Federally Facilitated Marketplace (FFM) switched plans in 2015, compared to 2.8% among enrollees in employer-sponsored health plans and 7% among those in the Massachusetts Health Connector (Sanger-Katz, 2018; DeLeire and Marks, 2015).

However, not much is known about the plan switching and disenrollment decisions of ACA enrollees, who constitute 4% of the US population (Barnett and Vornovitsky, 2016). Though there are various potential explanations, not much is known about the specific factors contributing to the switching rates and the plan-level factors that affect consumer switching decisions. Additionally, several prominent insurers have scaled back or exited from the Marketplaces in recent years. A better understanding of consumer plan switching decisions could inform policymakers in their assessment of programs addressing the continuity of coverage and care among enrollees. It could also help inform insurers' plan offering decisions over time in order to retain a higher share of enrollees.

This paper examines how changes in the attributes of chosen plans over time may affect enrollee decisions to switch plans or disenroll from the Marketplace. Specifically, I focus on how consumers may respond to changes in the premium, provider network size, and plan quality of their chosen plans in the subsequent enrollment period in the California Marketplace.

California Marketplace enrollees' plan switching decisions are significantly af-

fected by changes in the premium, network size, and plan quality of their chosen plan. A 10% increase in total premium and a 10 p.p. decrease in provider network size are respectively associated with a 10 p.p. and 5-13 p.p. increases in the probability of switching plans among enrollees who stay on the Marketplace. Likewise, having an increase in one's plan quality rating (relative to a decrease) is associated with a 10-15 p.p. reduction in the likelihood of switching plans. Furthermore, disenrollment decisions seem to be correlated with person-level characteristics, as age (head of household) and having assisted enrollment are positive associated with decisions to re-enroll on the Marketplace.

The rest of the paper proceeds as follows. Section 2 discusses the related literature, and Section 3 provides details on the methods and data. Section 4 presents the results. Section 5 concludes.

2 Related Literature

There is a paucity of research studies exploring plan switching in the context of the ACA Marketplaces. Ericson et al. (2017) uses a randomized study design to find that providing personalized potential cost savings information to enrollees made them more likely to shop around, but not switch plans in the Colorado Marketplace. In general, most research to date has been disseminated through reports issued by the Office of the Assistant Secretary for Planning and Evaluation (ASPE). DeLeire and Marks (2015) find that enrollees in the Federally-Facilitated Marketplaces (FFM) are sensitive to plan premium changes (with a premium elasticity of around 3) after controlling for mean premium changes of other plans in their given choice set. Two other policy research briefs from ASPE (2016, 2017) find that a large share (43%) of returning consumers switched plans in 2016, and that consumers were more responsive to net premium changes rather than total premium changes.

Outside of the ACA context, there is quite an extensive literature on plan switching, notably in Medicare Part D (prescription drug plans). Earlier studies such as Kling et al. (2008) and Bundorf and Szrek (2010) have used randomized experiments to find that: 1) enrollees presented with personalized information on potential cost savings in changing plans are more likely to switch plans and incur lower expected costs without reductions in plan quality and that 2) the size of a choice set faced by an enrollee is not associated with the probability of plan enrollment or switching.

With the increased accessibility of individual level administrative data, the existing body of literature on plan switching in Part D and other employer-sponsored insurance settings with insurance choice has largely been focused on whether consumers make "good" choices and whether they have "improved" over time. This has been done by estimating models of plan switching to assess how consumers may be overspending over time (Heiss et al., 2016; Ketcham et al., 2012, 2015; Abaluck and Gruber, 2016). However, these studies have found somewhat mixed results with respect to the effects of plan switching decisions (or lack thereof) on consumer welfare. Other studies such as Polyakova (2016) and Handel and Kolstad (2015) have found considerable switching costs and plan inertia among enrollees in plan choice settings.

The few related studies in the ACA context (and most studies in other insurance settings) have focused on consumer choice and switching decisions with respect to changes in premiums and cost-sharing. Consequently, this paper is the first to examine plan switching decisions in the ACA Marketplace as a function a broader set of changes in plan attributes and choice set characteristics, including notable non-financial attributes such as network size and plan quality. Moreover, this paper also adds to the nascent ACA plan switching literature by exploring disenrollment decisions as related to household characteristics and changes in plan attributes over time. In assessing enrollee plan switching decisions, this paper also uses data from more re-

cent enrollment periods (2016-2017) relative to other studies, which can shed light on consumer dynamics among enrollees who are more experienced with the Marketplace.

3 Methods

Models to Assess Plan Switching Decisions

I use logistic (logit) regressions to analyze enrollee decisions to disenroll from the Marketplace. The specification for the decision to disenroll from the Marketplace is:

$$Logit(Disenroll_i) = \Delta P_i'\alpha + \Delta S_i'\beta + P_i'\gamma + S_i'\delta + C_i'\phi + \varepsilon_{ij} \tag{1}$$

where P, S are the respective vectors of plan attributes and means of enrollee i's choice set in 2016 (Year 1)[1], $\Delta P, \Delta S$ are the respective vectors for changes in plan attributes (of the plan chosen in Year 1) and changes in choice set means for each enrollee, and C is a set of household characteristics. The outcome is modeled as the log odds (or logit) of disenrollment. The specific variables will be discussed in the Data section to follow. The regression is at the household-year level.

I also model plan switching decisions using similar logit regressions. I estimate this model on consumers who enrolled on the California Marketplace in both 2016 and 2017. I exclude households who were forced to switch plans to remain on the Marketplace (those who chose a plan in 2016 which subsequently got canceled as well as those who moved to a different rating region between 2016 and 2017). The main specification to examine enrollee plan switching decisions is as follows:

$$Logit(Switch_i) = \Delta P_i'\alpha + \Delta S_i'\beta + P_i'\gamma + S_i'\delta + C_i'\phi + \varepsilon_{ij} \tag{2}$$

Note that the right-hand side of this specification is exactly the same as in Equation 1

[1]Thus $\Delta P_i = P_{i,2017} - P_{i,2016}$ and likewise for ΔS_i.

for disenrollment decisions. For both the disenrollment and plan switching models, the coefficients of interest are α. These shed light on how changes to an enrollees' chosen plans are associated with decisions to switch plans or disenroll from the Marketplace. I also conduct analyses using binary outcome variables for specific types of plan switching, separately for switching by plan type, insurer, and metal tier. I also include insurer brand fixed effects for chosen plans in Year 1. This would eliminate the time-invariant unobserved factors affecting the switching probability for each chosen plan (in Year 1). All coefficients are exponentiated to be presented as odds ratios (OR). I convert the coefficients of interest from odds ratios into marginal effects to identify the percent point changes in the probability of disenrolling or switching plans associated with the changes in the attributes of one's chosen plan.

Identification and Robustness Checks

As stated above, the main model addresses the identification issues to some extent by including brand fixed effects for chosen plans as well as some demographic characteristics. A key issue is that plan premiums may be endogenous due to unobserved demand factors. I address this issue by running robustness checks that instrument for each plan's premium (and change in premium) with the average premium of that plan offered in other rating regions in each given state.[2] I also run a specification with premium and network size changes as categorical variables to explore the potential non-linearity in the relationship between plan switching decisions and premium and network size.

A key limitation is the fact that I do not have data on health (neither for health status nor health care utilization), which would undoubtedly be an important confounder to causal estimates for plan switching. The results from the logit models

[2]This approach has been previous used to identify plan attribute coefficients by variations across plans offered by the same brands in a region. However, the exclusion restriction may not necessarily be satisfied for the instrument, as noted by Abaluck and Gruber (2011). Thus, the main models will not use the instrumented premium, though the results are quite comparable.

for plan switching and disenrollment decisions should be interpreted as associations, rather than causal estimates.

4 Data

I use individual-level enrollment data for 2016 and 2017 from the California Marketplace along with additional data from the Robert Wood Johnson Foundation Health Insurance Exchange (HIX) Compare on plan characteristics and from Vericred on provider networks. The state enrollment data includes information on plans selected by each enrollee along with demographic information including age, family income as a percent of the federal poverty limit (FPL), Advanced Premium Tax Credit (APTC) amounts, gender, subsidy eligibility, and smoking status. These individual-level data are then collapsed to the household level to examine household level plan choice and plan switching decisions.

The final analytic file for this paper is constructed by merging these data sets at the region-county level for each state along with additional plan quality information from the California Health Benefits Exchange.[3] This includes a total of 856,587 households in California in 2016 who were enrolled in Marketplace plans. Table 1 presents the specific breakdown for the disenrollment and plan switching samples.

Model Variables

I run all models separately for six subsamples based on individual versus family enrollment and by income group (under 250% FPL, 250-400% FPL, and over 400% FPL). The income groups are created to match the cut-offs for CSR eligibility (up to

[3]The reason why the merge is done for each county-region as opposed to the rating region level is because not all plans offered in a region are offered in each county within that region, if a region spans multiple counties in a state. While virtually all counties are contained completely within a rating region, an exception is California's Los Angeles County, which is composed of two rating regions that together span the county.

250% FPL) and tax credit eligibility (up to 400% FPL) which affect the net premiums faced by enrollees.[4,5] Plan switching is delineated by whether an enrollee's chosen Marketplace plans differs from their previously chosen plan by either insurer brand, metal tier, or plan type.

The variables for plan attributes, choice set mean characteristics, and the changes in these two sets of variables are described in the following sections. The coefficients of interest for the plan switching logit models are the changes in the plan attributes of chosen plans between Years 1 and 2 (2016-2017). The plan attributes of interest are premium, provider network size, and plan quality.

Provider Network Size, Plan Quality, and Premium

Plan provider network size is measured as the share of physicians that are in-network in the state rating region in which the plan is sold.[6] The Vericred data lists all of the providers covered by each plan. To calculate the provider network size for each plan, I calculate the number of physicians in the rating region within the provider network and divide it by the total number of physicians in the respective rating region as the denominator.[7] Since the data provides information on both individual and group providers by specialty, I adjust and account for the group size of group providers by physician specialty when constructing the provider network size measures.

[4]Both of these cutoffs are strict cutoffs. CSRs and tax credit subsidies abruptly stop for individuals over 250% and 400% FPL, respectively. Tax credits adjustments are made to account for the difference in the actual annual income versus the income declared when an enrollee signs up for a Marketplace plan, but no similar adjustments are made for CSRs.

[5]Household income levels in the California data are presented as has six categories of percent FPL (under 138, 138-150, 150-200, 200-250, 250-400, and over 400% FPL).

[6]Technically, the denominator is defined as the total number of physicians in the counties in a state rating region in which a plan is sold. This distinction is made because a small share of plans are only sold in a strict subset of counties in the respective state rating region. A plan not entering into a particular set of counties in the state rating region would thus have no need to network with the providers in those counties.

[7]The unit of observation in the raw provider network data is either an individual physician or a group physician practice (with the specialty denoted in both cases). The majority of physicians in the data are listed as an individual physician. The physician groups are categorized by physician specialty but are not given an exact group size. To address this issue, I multiply each group practice by the average number of physicians in a group practice of that specialty.

I create a quality measure based on four categories: low quality (1-2 stars), medium quality (3 stars), and high quality (4-5 stars), and "no quality."[8,9] A continuous plan quality measure from 1-5 stars cannot be constructed because 14% of plans have "no quality" as their plan quality rating. These "no quality" measures are not missing data, but rather show up to enrollees as having no quality rating available when viewed on the Exchange website. These cutoffs in the plan quality variable are selected to roughly delineate the plan choices in three similarly sized categories among plans with available quality ratings. While quality ratings are generally given at the insurer level, some insurers have different quality ratings pertaining to different plan types.[10]

I utilize total annual household premiums for the plan switching models. Total premiums are used instead of net premiums (net of tax credits) in order to reduce the direct influence of changes in income from the associations between changes in premium costs and enrollee decisions to switch plans or disenroll. Other financial attributes included in the models are: metal tier, deductible, maximum out-of-pocket (OOP) amount, and plan type (HMO or PPO).

Changes in Plan Attributes

The coefficients on the changes in the plans attributes of each enrollee's chosen plan from Year 1 to Year 2 are the coefficients of interest for the plan switching logit models. The variables of interest are: percent change in total premium, change in

[8]Lin and McCarthy (2018) use this high quality plan cutoff definition.

[9]Consumers are provided an overall quality rating based on 3 major aspects of plan performance: getting the right care, care experience, and plan services for members. These quality measures are constructed using: a) health records of a sample of members from each plan (checked to compare their medical care with standards for care and treatments that are proven to help patients and whether they got unnecessary care), b) multiple aspects of health care quality checked by medical charts and billing (for issues like proper controls for high blood pressure, lowering cholesterol, getting proper medications), and c) a survey of members' experiences with their providers and care along with their experiences in obtaining information from the plan's service staff.

[10]Some insurers may only have quality ratings for one type of plan but not another (e.g. for their HMOs but not their PPOs).

network size, and changes in plan quality.[11]

Choice Set Means and Changes in Choice Set Means

The logit models for plan switching and disenrollment include choice set mean characteristics (for Year 1) and changes in choice set mean characteristics between Years 1 and 2. These choice set control variables help isolate the measures of consumer responsiveness to changes in plan attributes independent of the changes in the choice sets that consumers face. Consumer responsiveness to plan switching (when faced with a 10% increase in their plan's premium, for example) may be different when the average plan in their choice set has a 4% increase in premium versus a 25% increase in premium. Choice set mean characteristics include: the number of plans available in one's choice set, average total premium, average network size, and the share of plans in each quality rating category (high, medium, low, or none). The changes in these choice set level measures between 2016 and 2017 are included as well.

Household/Personal Characteristics

The logit models for plan switching and disenrollment decisions also include the following household covariates: age (head of household), whether a household self-enrolled (versus using a plan Navigator or some other form of assisted enrollment), and whether a household was newly enrolled on the California Marketplace in 2016 (Year 1).

[11] In addition, I also include changes in a plan's deductible and maximum OOP amounts between the two years.

5 Results

Summary Statistics

Table 1 shows the plan switching and disenrollment decisions made by enrollees. 67% of 2016 enrollees re-enrolled onto ACA Marketplace plans in 2017, suggesting a significant turnover rate in the ACA Marketplaces as noted in DeLeire and Marks (2015). Among enrollees in the plan switching sample (who both re-enrolled and were not forced to switch plans to stay on the Marketplace), 15% of enrollees switched plans between 2016 and 2017. Among plan switchers (henceforth "switchers"), 64%, 43%, and 48% switched insurers, metals, and plan types (with a considerable share of people switching across more than one category).

Table 2 shows the summary statistics for the main plan switching logit models, separately for switchers and non-switchers. As expected, plan switchers faced larger increases in annual premium (both in absolute and percent changes) relative non-switchers. At the same time, non-switchers (switchers) were comparatively more likely to have an increase (decrease) in their plan's quality rating. The network size change is quite similar across the two groups, with both decrease around 6 percentage points, which is reflective of the overall trend towards narrow networks among ACA Marketplace plans in recent years (Polsky et al. 2017).

The changes in choice set mean characteristics from 2016-2017, choice set mean characteristics in Year 1 (2016), and person level characteristics are fairly similar for switchers versus non-switchers. It is worth noting that there is quite a substantial increase in the share of low quality (1-2 star) plans in California between 2016 and 2017, with that share rising over 30 percentage points as a fraction of all available plans. The attributes of chosen plans in Year 1 (2016) are also fairly similar between the two groups. One notable difference is that a much higher proportion of non-switchers (36%) chose high quality plans in Year 1, relative to non-switchers (20%).

Moreover, a greater share of switchers experienced decreases in plan quality (49%) relative to non-switchers (35%). These differences are suggestive of plan switching decisions that may be driven in part by dissatisfaction with plan quality over time.

Table 4 shows the changes in the attributes of actual chosen plans in 2016 and 2017 for the full sample, separately for switchers and non-switchers. Switchers tend to have a smaller increase in premium and larger reductions in plan network size (compare their 2016 and 2017 chosen plans), relative to non-switchers.

Disenrollment Decisions

Table 5 shows the logit model results for 2016 enrollees' decisions to disenroll from the Marketplace in 2017. There do not seem to be any specific associative trends between changes in plan attributes and disenrollment decisions. However, there are several enrollee characteristics associated with disenrollment decisions. Being a new enrollee (first-time enrollees in 2016) is associated with having around 1.2 times higher odds of re-enrolling on the Marketplace, relative to returning enrollees. Age (among heads of household) and re-enrollment on the Marketplace are also positive correlated.

In addition, enrollees under 400% FPL who self-enrolled in 2016 are significantly less likely to re-enroll into Marketplace plans relative to those who used a Plan Navigator or other form of assisted enrollment in 2016 (with about 0.9 times the odds of re-enrollment). To be sure, disenrollment from the Marketplace is not necessary a negative outcome itself. For example, Gordon et al. (2018) found that a considerable share of ACA beneficiaries who disenrolled from the Marketplace enrolled into Medicaid. Nevertheless, given that households using assisted enrollment are associated with being significantly more likely to re-enroll onto the ACA Marketplace (and thus less likely to have an interruption in their coverage), it may be worthwhile to further examine the impact of Plan Navigators and enrollment assistance as interventions to help ACA enrollees with re-enrollment and to help provide continuity of coverage.

Plan Switching Decisions

The results for the main plan switching logit models are shown in Table 6. As expected, increases in plan premium and decreases in network size of chosen plans are associated with enrollees being more likely to switch plans. A 10% increase in total premium and a 10 p.p. decrease in network size are respectively associated with a 9-13 p.p. and 5-13 p.p. greater probability of switching plans, with higher income enrollees relatively more sensitive to changes in network size. Furthermore, having an increase in the plan quality of one's chosen plan is associated with a 10-15 p.p. reduction in the likelihood of switching plans, relative to having a decrease in plan quality. These results are consistently robust across income levels and for individuals versus families. Enrollees appear to be quite responsive to changes in key non-financial plan attributes (network size and plan quality) in their decisions to switch plans.

Additionally, having a plan with a larger network size in the first year is associated with significantly lower odds (0.6-0.8) of subsequently switching plans. Moreover, being a new enrollee (in 2016) is associated with having lower odds of switching plans, conditional on re-enrollment.

Types of Plan Switching

Table 7 presents the marginal probabilities for specific types of plan switching as a function of the changes in plan attributes of one's chosen plan from the previous year. For conciseness, all subsequent results tables will only show the marginal probabilities on plan switching associated with changes in plan attributes. The three outcomes modeled denote plan switching along: 1) insurer, 2) metal tier, and 3) plan type.[12] As expected, premium increases are associated with a higher probability of switching

[12]These categories are not mutually exclusive. Refer to Table 1 for the specific breakdown of the types of plan switching.

along all three axes. Enrollees who want to shop around for comparatively cheaper plans can ostensibly do so by switching along any of the three axes.

However, enrollees who face a decrease in network size (10 p.p.) have a higher probability of switching plans by plan type (2-4 p.p.) and insurers (2 p.p.), but not metal tier.[13] This makes sense as switching along metal tier alone would not affect one's plan network size. The consistent response to switching along plan types also makes sense in light of the fact that PPOs tend to have much larger network sizes than HMOs. As HMOs have more limited out-of-network coverage, enrollees in these plans could therefore be more adversely affected by reductions in network size over time.

Likewise, enrollees appear responsive to increases in the quality rating of their chosen plan by exhibiting lower probabilities of switching along insurers (5-9 p.p. reduction) and plan type (8-21 p.p. reduction), but not metal tier. As with network size, plan quality varies across insurers and sometimes by plan types within insurers, but not by metal tier.

Robustness Checks for Plan Switching Decision Results

The robustness checks for the plan switching results with instrumented premiums (for both total premiums and changes in total premiums) are presented in Table 8. Overall, the results with instrumented plan premiums are highly similar to those found in the main model. The associations between reductions in plan network size and plan switching are smaller in magnitude, but are still largely significant.

Table 9 displays the results for an alternative specification with indicator variables for changes in total premium and plan network size to explore potentially non-linear associations between these factors and plan switching decisions. The respective reference categories are for chosen plans with a less than 10% increase in total pre-

[13]The effect for switching along insurers is not significant for enrollees with incomes between 250-400% FPL.

mium and for plans that exhibit an increase in network size between 2016 and 2017. As expected, larger premium increase categories are associated with higher probabilities of switching plans. However, the relationship between changes to network size and plan switching decision does not seem to be as proportional, as there is not much of a difference when comparing a network size reduction of 0-10 p.p. to a reduction of more than 10 p.p.

6 Conclusion

Enrollee plan switching decisions on the ACA Marketplace are significantly affected by changes in the key non-financial attributes of their chosen plans over time. The probability that an enrollee switches plans on the Marketplace in a subsequent enrollment period is strongly associated with reductions in provider network size and increases in the premium of their plan. Likewise, increases in plan quality are associated with significant decreases in the likelihood of switching plans in the subsequent year, relative to decreases in plan quality. On the other hand, disenrollment decisions seem to be less correlated with changes in plan attributes relative to household characteristics. However, enrollees who are older (age of head of household), new to the Marketplace (in the previous year), or had assistance in enrollment are relatively more likely to re-enroll onto the Marketplace.

A key limitation is that the Marketplace enrollment data does not have corresponding data on health care utilization or spending. As such, I am not able to take into account changes in health status or health utilization, which would be a critical confounder impacting plan switching decisions in regards to how enrollees respond to changes in their health plans. In addition, coverage decisions may also be affected by changes in employer-sponsored coverage or changes in income that would make enrollees Medicaid-eligible. These changes would confound a causal interpretation of

disenrollment decision estimates. The results of this paper therefore serve as descriptive associations and ballpark figures rather than more particular estimates of causal effects.

A limitation to generalizability is that the study only uses data from California. The average Marketplace enrollee in California has more plans and insurers to choose from than the average enrollee in the US. However, given the relatively good "health" of the California Marketplace in providing ample choice of health plans for enrollees, the results are useful in describing the results under a setting that is more representative of an environment as intended by the ACA's implementers.

Despite these limitations, the results show that enrollee plan switching decisions on the Marketplace are consistently associated with changes in premium and the key non-financial attributes (network size and plan quality) in the expected directions. This seems to strongly suggest that ACA enrollees have a significant responsiveness to changes in provider network size and quality (along with premium) in their plan switching decisions. Consumer responsiveness to changes in plan quality and network size could inform insurers' decisions to continue to invest in these attributes in order to attract and retain enrollees in their plans, especially when they may have a more limited ability to compete on premiums due to plan standardization in the ACA Marketplaces.

Furthermore, given that the use of assisted enrollment (through Plan Navigators) is associated with a lower probability that an enrollee subsequently disenrolls from the ACA Marketplace (and thus reduces the likelihood of having an interruption in coverage), it may be worthwhile for policymakers and researchers to further examine the impact of Plan Navigators and assisted enrollment channels towards the objective of maintaining continuity of care and coverage for ACA enrollees. Future research could utilize data from available state all-payer claims databases to take into account health status and health care utilization in examining plan switching

and disenrollment decisions. Researchers using these data can also more explicitly explore coverage and plan switching patterns among those who disenroll from the Marketplace.

References

Abaluck, J. and Gruber, J. (2011). Choice Inconsistencies among the Elderly: Evidence from Plan Choice in the Medicare Part D Program. *American Economic Review*, 101(4):1180–1210.

Abaluck, J. and Gruber, J. (2016). Evolving Choice Inconsistencies in Choice of Prescription Drug Insurance. *American Economic Review*, 106(8):2145–2184.

ASPE (2016). Marketplace Premiums after Shopping, Switching, and Premium Tax Credits, 2015-2016. Technical report, Office of the Assistant Secretary for Planning and Evaluation, Washington, D.C.

ASPE (2017). Did Consumers Respond to Changes in Gross Premiums or to Changes in Premiums Net of Tax Credits When Making Health Plan Choices in the 2016 ACA Marketplaces. Technical report, Office of the Assistant Secretary for Planning and Evaluation, Washington, D.C.

Barnett, J. and Vornovitsky, M. (2016). Health Insurance Coverage in the United States: 2015. Technical report, United States Census Bureau.

Bundorf, M. K. and Szrek, H. (2010). Choice Set Size and Decision-Making: The Case of Medicare Part D Prescription Drug Plans. *Medical Decision Making*, 30(5):582–593.

DeLeire, T. and Marks, C. (2015). Consumer Decisions Regarding Health Plan Choices, in the 2014 and 2015 Marketplaces. Technical report.

Ericson, K. M. M., Kingsdale, J., Layton, T., and Sacarny, A. (2017). Nudging Leads Consumers In Colorado To Shop But Not Switch ACA Marketplace Plans. *Health Affairs*, 36(2):311–319.

Gordon, S., Sommers, B., Wilson, I., and Trivedi, A. (2018). Risk Factors for Early Disenrollment from Colorado's Affordable Care Act Marketplace.

Handel, B. R. and Kolstad, J. T. (2015). Health Insurance for Humans: Information Frictions, Plan Choice, and Consumer Welfare. *American Economic Review*, 105(8):2449–2500.

Heiss, F., McFadden, D., Winter, J., Wuppermann, A., and Zhou, B. (2016). Inattention and Switching Costs as Sources of Inertia in Medicare Part D. Working Paper 22765, National Bureau of Economic Research.

Ketcham, J. D., Lucarelli, C., Miravete, E. J., and Roebuck, M. C. (2012). Sinking, Swimming, or Learning to Swim in Medicare Part D. *American Economic Review*, 102(6):2639–2673.

Ketcham, J. D., Lucarelli, C., and Powers, C. A. (2015). Paying Attention or Paying Too Much in Medicare Part D. *American Economic Review*, 105(1):204–233.

Kling, J., Mullainathan, S., Shafir, E., Vermeulen, L., and Wrobel, M. (2008). Misperception in choosing Medicare drug plans.

Lin, H. and McCarthy, I. M. (2018). Multimarket Contact in Health Insurance: Evidence from Medicare Advantage. Working Paper 24486, National Bureau of Economic Research.

Polyakova, M. (2016). Regulation of Insurance with Adverse Selection and Switching Costs: Evidence from Medicare Part D. *American Economic Journal: Applied Economics*, 8(3):165–195.

Sanger-Katz, M. (2018). High Rate of Shopping and Switching in Obamacare Plans Is a Good Sign. *The New York Times*.

Tables

Table 1: Plan Switching and Enrollment

	Observations	Percent
2016 California Enrolled Households	856,587	
Re-Enrolled on CA Marketplace	571,068	67%
Plan Switching Sample *	506,463	59%
Among Plan Switching Sample		
Plan Switchers	77,677	15%
Among Plan Switchers		
Switched Insurer Only	14,048	18%
Switched Metal Tier Only	3,439	4%
Switched Plan Type Only	24,376	31%
Switched Insurer and Metal Tier	22,696	29%
Switched Insurer and Plan Type	5,570	7%
Switched Metal Tier and Plan Type	522	1%
Switched All Three Aspects	7,026	9%

* This consists of households that re-enrolled in 2017 who were not forced to switch plans due to plan cancellations or moving to a different state rating region.

Table 2: Summary Statistics

	Switchers		Non-Switchers	
	Mean	SD	Mean	SD
Changes, Attributes of Chosen Plan, 2016-17				
Percent Change, Total Premium	15%	0.07	12%	0.07
Change, Total Premium	$1,176	987	$852	801
Change, Network Size (p.p.)	-6.2	7.6	-6.1	7.4
Increase in Plan Quality	21%	0.41	40%	0.49
Decrease in Plan Quality	49%	0.50	35%	0.48
No Change in Plan Quality*	30%	0.46	25%	0.43
Changes, Choice Set Mean Characteristics, 2016-17				
Change, Number of Plans in Choice Set	3.6	2.4	3.4	2.7
Percent Change, Premium	1.9%	0.02	1.8%	0.01
Change, Average Provider Network Size (p.p.)	-5.6	2.7	-5.9	3.1
Change, Share of High Quality Plans (4-5 stars)	-0.01	0.06	-0.01	0.06
Change, Share of Medium Quality Plans (3 stars)	-0.17	0.07	-0.18	0.07
Change, Share of Low Quality Plans (1-2 stars)	0.32	0.09	0.34	0.10
Change, Share of Plans with No Quality	-0.14	0.08	-0.15	0.09
Attributes of Chosen Plan, 2016				
Total Premium (Individual)	$5,171	$2,450	$5,119	$2,392
Total Premium (Family)	$11,327	$4,563	$11,388	$4,496
Net Premium (Individual)	$2,517	$2,014	$2,129	$1,772
Net Premium (Family)	$4,166	$3,997	$3,895	$3,669
Network Size (% of Physicians)	20%	0.11	18%	0.11
Deductible (Individual)	$2,720	$1,908	$2,985	$1,724
Deductible (Family)	$5,441	$3,815	$5,970	$3,449
Max OOP (Individual)	$6,101	660	$6,206	470
Max OOP (Family)	$12,200	1,319	$12,410	941
Bronze Plan**	16%	0.36	20%	0.39
Silver Plan	65%	0.48	72%	0.45
Gold Plan	9%	0.29	5%	0.21
Platinum Plan	9%	0.28	4%	0.20
HMO Plan	46%	0.50	61%	0.49
PPO Plan	54%	0.50	39%	0.49
High Quality (4-5 stars)	20%	0.40	36%	0.48
Medium Quality (3 stars)	49%	0.50	35%	0.48
Low Quality (1-2 stars)	10%	0.30	13%	0.34
No Quality	21%	0.41	16%	0.36
Choice Set Mean Characteristics, 2016				
Number of Plans in Choice Set	29	6.0	28	6.5
Average Total Premium (Individual)	$5,594	2,363	$5,786	2,499
Average Total Premium (Family)	$12,379	4,375	$12,836	4,603
Average Network Size (% of Physicians)	16%	0.04	16%	0.04
Share of High Quality Plans	22%	0.09	23%	0.10
Share of Medium Quality Plans	19%	0.07	21%	0.07
Share of Low Quality Plans	32%	0.09	31%	0.08
Share of Plans with No Quality	26%	0.09	25%	0.09
Observations	77,677		428,786	

* Includes a few plans changing from "No Quality" to obtaining a star rating.
** Includes a small share of Catastrophic plans

Table 3: Enrollee Characteristics

	Switchers		Non-Switchers	
Enrollee Characteristics, 2016	Mean	SD	Mean	SD
Under 250% FPL	68%	0.47	70%	0.46
250-400% FPL	21%	0.41	20%	0.40
Over 400% FPL	11%	0.31	10%	0.30
Individual	61%	0.49	67%	0.47
Age (Head of Household)	43	14	44	14
Self-Enrolled	36%	0.48	38%	0.48
New Enrollee	64%	0.48	64%	0.48
Qualify for Catastrophic Plan	18%	0.38	18%	0.39
Household Size	1.6	0.84	1.5	0.81
Observations	77,677		428,786	

Table 4: Changes in Attributes of Chosen Plans, 2016-2017

	Full Sample		Switchers		Non-Switchers	
	Mean	SD	Mean	SD	Mean	SD
Change, Total Premium	$927	1,616	$765	2,102	$991	1,375
Change, Net Premium	$405	1,657	$212	1,979	$481	1,506
Change, Network Size (p.p.)	-7.9	9.8	-12.6	13.1	-6.1	7.4
Increase in Plan Quality	34%	0.47	18%	0.38	40%	0.49
Decrease in Plan Quality	29%	0.46	15%	0.36	35%	0.48
Observations	506,483		77,677		428,786	

Table 5: Re-Enrollment Decision

	Under 250% FPL		250-400% FPL		Over 400% FPL	
Odds Ratios (unless noted)	Individual	Family	Individual	Family	Individual	Family
Changes, Attributes of Chosen Plan, 2016-17						
Change, Premium (10%)	1.005	1.0003	1.010	1.036	0.963	1.003
Marginal Probability	*0.001*	*0.0001*	*0.002*	*0.007*	*-0.009*	*0.001*
	(0.013)	(0.021)	(0.024)	(0.033)	(0.028)	(0.053)
Network Size Decrease (10 p.p.)	0.89***	1.19***	0.97	1.21***	0.78***	0.80**
Marginal Probability	*-0.03*	*0.03*	*-0.01*	*0.04*	*-0.06*	*-0.05*
	(0.019)	(0.041)	(0.044)	(0.067)	(0.046)	(0.083)
Increase in Plan Quality	0.86**	1.19	0.84	1.23	1.11	0.88
Marginal Probability	*-0.03*	*0.03*	*-0.04*	*0.04*	*0.03*	*-0.03*
	(0.052)	(0.16)	(0.090)	(0.17)	(0.12)	(0.18)
No Change in Plan Quality	0.71***	1.04	0.81**	1.11	0.99	0.77
Marginal Probability	*-0.08*	*0.01*	*-0.05*	*0.02*	*-0.002*	*-0.06*
	(0.042)	(0.14)	(0.079)	(0.14)	(0.090)	(0.13)
Change, Deductible ($100)	0.998	0.996	0.999	1.009	1.027	1.032*
	(0.007)	(0.006)	(0.012)	(0.007)	(0.021)	(0.017)
Change, Maximum OOP ($100)	1.073***	1.030**	1.049***	1.009	1.015	0.998
	(0.007)	(0.012)	(0.009)	(0.008)	(0.011)	(0.010)
Changes, Choice Set Mean Characteristics, 2016-17						
Change, Choice Set Size	0.94***	1.00	0.95***	1.01	0.90***	0.93***
(Number of Plans)	(0.002)	(0.004)	(0.005)	(0.007)	(0.007)	(0.012)
Percent Change, Premium	1.14***	1.16***	1.10***	1.11***	1.25***	1.09
	(0.019)	(0.032)	(0.034)	(0.043)	(0.049)	(0.066)
Change, Average Network Size	1.12***	1.52***	0.97	1.57***	1.14	1.27
(10 p.p.)	(0.034)	(0.075)	(0.062)	(0.12)	(0.10)	(0.19)
Change, High Quality Share	0.17***	38.0***	0.094***	3.35***	0.082***	0.13**
	(0.029)	(10.9)	(0.033)	(1.45)	(0.040)	(0.11)
Change, Medium Quality Share	0.49***	110***	0.22***	6.86***	0.49	0.82
	(0.084)	(30.7)	(0.076)	(2.92)	(0.22)	(0.62)
Change, No Quality Share	1.40***	2.43***	1.30	0.83	3.45***	2.31*
	(0.16)	(0.47)	(0.28)	(0.23)	(1.00)	(1.11)
Attributes of Chosen Plan, 2016						
Premium ($100)	0.988***	1.003***	0.990***	1.005***	0.996***	1.004***
	(0.0005)	(0.0002)	(0.0008)	(0.0003)	(0.0009)	(0.0004)
Network Size	1.13***	0.87***	1.07**	0.88***	1.23***	1.15*
(% of Physicians)	(0.018)	(0.023)	(0.036)	(0.037)	(0.050)	(0.082)
Bronze Plan	1.38***	2.01***	1.07*	1.47***	1.05	1.44***
	(0.059)	(0.49)	(0.040)	(0.19)	(0.039)	(0.18)
Silver Plan	1.10***	1.45***	0.93**	1.13**	0.97	1.15*
	(0.025)	(0.12)	(0.030)	(0.058)	(0.043)	(0.089)
HMO Plan	0.84***	0.93	0.83	0.87	1.34***	0.87
	(0.053)	(0.13)	(0.094)	(0.13)	(0.14)	(0.17)
Deductible ($100)	0.99***	1.00**	1.00***	1.00***	1.00***	1.00***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Maximum OOP ($100)	0.98***	0.99**	0.98***	1.00	0.99**	1.00
	(0.002)	(0.003)	(0.002)	(0.002)	(0.003)	(0.003)

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Table 5 (Continued): Re-Enrollment Decision

	Under 250% FPL		250-400% FPL		Over 400% FPL	
Odds Ratios (unless noted)	Individual	Family	Individual	Family	Individual	Family
Choice Set Mean Characteristics, 2016						
Choice Set Size	1.01***	0.97***	1.01*	0.98***	0.99*	0.99
(Number of Plans)	(0.0015)	(0.0024)	(0.0033)	(0.0040)	(0.0037)	(0.0067)
Average Premium ($100)	1.02***	1.01**	1.00	0.99***	0.97***	0.96***
	(0.002)	(0.003)	(0.003)	(0.004)	(0.005)	(0.007)
Average Network Size	0.88***	1.70***	0.79***	1.66***	0.75***	1.03
(% of Physicians)	(0.025)	(0.080)	(0.045)	(0.12)	(0.058)	(0.13)
High Quality Share	0.30***	0.24***	0.68**	0.70*	0.96	1.07
	(0.024)	(0.030)	(0.11)	(0.13)	(0.20)	(0.35)
Medium Quality Share	0.74**	0.49***	1.54*	0.81	2.91***	3.18**
	(0.10)	(0.13)	(0.39)	(0.27)	(0.98)	(1.76)
No Quality Share	0.53***	0.19***	1.44	0.51**	2.44***	1.72
	(0.055)	(0.032)	(0.32)	(0.14)	(0.69)	(0.80)
Person Level Characteristics						
Age (Head of Household)	1.029***	1.007***	1.029***	1.004***	1.014***	1.002**
	(0.0008)	(0.0005)	(0.0015)	(0.0005)	(0.0015)	(0.0008)
Self-Enrollment	0.89***	0.82***	0.96***	0.88***	0.99	0.96
	(0.006)	(0.010)	(0.014)	(0.016)	(0.017)	(0.027)
New Enrollee (in 2016)	1.16***	1.26***	1.16***	1.29***	1.17***	1.17***
	(0.0082)	(0.015)	(0.017)	(0.024)	(0.020)	(0.034)
Constant	3.14***	12.5***	1.91**	2.36**	2.67***	3.39**
	(0.51)	(4.81)	(0.56)	(0.92)	(0.85)	(1.89)
Observations	423,439	185,661	95,053	66,837	63,742	21,855

Reference categories: gold/platinum plans, PPO plans, low quality plans, decrease in plan quality
Insurer brand fixed effects are included and robust standard errors are in parentheses.
*** $p < 0.01$, ** $p < 0.05$ * $p < 0.1$

Table 6: Plan Switching Decision

	Under 250% FPL		250-400% FPL		Over 400% FPL	
Odds Ratios (unless noted)	Individual	Family	Individual	Family	Individual	Family
Changes, Attributes of Chosen Plan, 2016-17						
Change, Premium (10%)	2.31***	2.45***	2.39***	2.21***	2.92***	2.18***
Marginal Probability	*0.09*	*0.12*	*0.10*	*0.10*	*0.13*	*0.10*
	(0.055)	(0.081)	(0.099)	(0.10)	(0.16)	(0.20)
Network Size Decrease (10 p.p.)	1.62***	1.33***	1.78***	1.55***	2.61***	2.76***
Marginal Probability	*0.05*	*0.04*	*0.07*	*0.06*	*0.12*	*0.13*
	(0.071)	(0.076)	(0.14)	(0.13)	(0.27)	(0.46)
Increase in Plan Quality	0.26***	0.46***	0.38***	0.31***	0.46***	0.34***
Marginal Probability	*-0.15*	*-0.10*	*-0.11*	*-0.15*	*-0.09*	*-0.13*
	(0.024)	(0.074)	(0.064)	(0.058)	(0.094)	(0.12)
No Change in Plan Quality	0.55***	1.02	0.64***	0.50***	0.68**	0.52***
Marginal Probability	*-0.07*	*0.003*	*-0.05*	*-0.09*	*-0.05*	*-0.08*
	(0.047)	(0.15)	(0.089)	(0.077)	(0.10)	(0.13)
Change in Deductible	0.93***	1.02	0.95**	0.97**	0.91**	0.92**
($100)	(0.020)	(0.015)	(0.024)	(0.013)	(0.037)	(0.030)
Change in Maximum OOP	0.99	1.00	1.03	1.02	1.01	1.07***
($100)	(0.015)	(0.022)	(0.018)	(0.014)	(0.025)	(0.024)
Changes, Choice Set Mean Characteristics, 2016-17						
Change, Choice Set Size	1.05***	1.04***	1.04***	1.02*	1.00	0.99
	(0.0063)	(0.0093)	(0.012)	(0.014)	(0.012)	(0.024)
Percent Change, Premium	1.09***	0.96***	1.09***	0.90***	1.09***	0.96**
	(0.0048)	(0.0055)	(0.012)	(0.0086)	(0.013)	(0.021)
Change, Average Network Size	1.01	1.03	0.73***	0.89	0.88	1.29
(10 p.p.)	(0.066)	(0.092)	(0.082)	(0.11)	(0.14)	(0.31)
Change, High Quality Share	13.5***	14.7***	1.52	4.17**	0.045***	0.13
	(5.18)	(7.85)	(1.00)	(2.99)	(0.038)	(0.18)
Change, Medium Quality Share	10.1***	46.5***	0.13***	1.28	0.019***	0.12
	(3.68)	(24.2)	(0.087)	(0.92)	(0.016)	(0.16)
Change, No Quality Share	0.39***	0.49**	0.68	1.40	0.40*	1.15
	(0.089)	(0.15)	(0.27)	(0.63)	(0.22)	(0.97)
Attributes of Chosen Plan, 2016						
Total Premium ($100)	0.998*	1.000	0.998	0.999***	1.004*	1.002*
	(0.00085)	(0.00027)	(0.0013)	(0.00042)	(0.0020)	(0.0012)
Network Size	0.64***	0.73***	0.72***	0.76***	0.55***	0.56***
(% of Physicians)	(0.021)	(0.033)	(0.042)	(0.050)	(0.040)	(0.065)
Bronze Plan	0.30***	0.31***	0.32***	0.29***	0.32***	0.45***
	(0.021)	(0.13)	(0.019)	(0.056)	(0.022)	(0.10)
Silver Plan	0.29***	0.24***	0.40***	0.34***	0.47***	0.45***
	(0.015)	(0.034)	(0.024)	(0.029)	(0.041)	(0.068)
HMO Plan	0.45***	1.13	0.63***	0.61**	0.44***	0.40***
	(0.042)	(0.18)	(0.099)	(0.12)	(0.075)	(0.12)
Deductible ($100)	1.017***	1.007***	1.017***	1.010***	1.019***	1.012***
	(0.0013)	(0.0024)	(0.0015)	(0.0013)	(0.0020)	(0.0020)
Maximum OOP ($100)	1.006	1.002	0.999	0.995	1.006	0.983***
	(0.0040)	(0.0055)	(0.0048)	(0.0035)	(0.0065)	(0.0058)

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Table 6 (Continued): Plan Switching Decision

	Under 250% FPL		250-400% FPL		Over 400% FPL	
Odds Ratios (unless noted)	Individual	Family	Individual	Family	Individual	Family
Choice Set Mean Characteristics, 2016						
Choice Set Size	1.001	0.996	1.014**	1.007	1.036***	1.017
	(0.0030)	(0.0043)	(0.0058)	(0.0066)	(0.0073)	(0.012)
Average Premium ($100)	1.008***	1.001	1.001	0.999	0.986***	0.998*
	(0.00077)	(0.00064)	(0.0012)	(0.00070)	(0.0022)	(0.0013)
Average Network Size	1.09	0.91	0.73***	0.95	0.88	1.13
	(0.066)	(0.074)	(0.078)	(0.11)	(0.12)	(0.24)
High Quality Share	1.93***	0.76	6.70***	7.65***	5.04***	4.75***
	(0.26)	(0.14)	(1.64)	(2.01)	(1.69)	(2.50)
Medium Quality Share	0.23***	0.17***	0.25***	0.41*	0.74	1.49
	(0.054)	(0.063)	(0.093)	(0.20)	(0.35)	(1.14)
No Quality Share	0.20***	0.12***	2.70**	1.96	0.90	1.66
	(0.042)	(0.031)	(1.06)	(0.82)	(0.48)	(1.38)
Person Level Characteristics						
Age (Head of Household)	1.004**	1.000	1.000	1.002**	1.024***	1.001
	(0.0015)	(0.00070)	(0.0025)	(0.00082)	(0.0031)	(0.0014)
Self-Enrollment	0.97**	0.88***	1.00	0.93**	1.10***	1.04
	(0.013)	(0.017)	(0.025)	(0.027)	(0.035)	(0.051)
New Enrollee (in 2016)	0.87***	0.91***	0.91***	0.97	0.91***	0.84***
	(0.012)	(0.017)	(0.024)	(0.029)	(0.029)	(0.044)
Constant	1.09	1.35	0.18***	1.02	0.033***	1.91
	(0.32)	(0.78)	(0.083)	(0.58)	(0.020)	(1.87)
Observations	235,868	115,752	59,254	44,853	37,463	13,273

Reference categories: gold/platinum plans, PPO plans, low quality plans, decrease in plan quality
Insurer brand fixed effects included and robust standard errors in parentheses.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 7: Types of Plan Switching

	Under 250% FPL		250-400% FPL		Over 400% FPL	
Marginal Probabilities	Individual	Family	Individual	Family	Individual	Family
Outcome: Switch Insurers						
Change in Premium	0.063***	0.100***	0.046***	0.052***	0.053***	0.036***
(10%)	(0.002)	(0.004)	(0.003)	(0.004)	(0.004)	(0.006)
Network Size Decrease	0.023***	0.021***	0.011	0.0095	0.020**	0.030**
(10 p.p.)	(0.004)	(0.007)	(0.007)	(0.008)	(0.008)	(0.013)
Increase in Plan Quality	-0.066***	-0.076***	-0.060***	-0.089***	-0.045***	-0.051**
	(0.009)	(0.021)	(0.013)	(0.016)	(0.014)	(0.023)
Outcome: Switch Metal Tiers						
Change in Premium	0.022***	0.027***	0.023***	0.028***	0.035***	0.046***
(10%)	(0.002)	(0.003)	(0.004)	(0.005)	(0.005)	(0.010)
Network Size Decrease	0.001	0.001	0.004	-0.0003	0.0004	0.023
(10 p.p.)	(0.003)	(0.005)	(0.008)	(0.009)	(0.012)	(0.019)
Increase in Plan Quality	0.021***	-0.005	0.013	-0.025	0.030	0.012
	(0.007)	(0.012)	(0.018)	(0.019)	(0.022)	(0.042)
Outcome: Switch Plan Type						
Change in Premium	0.068***	0.063***	0.063***	0.058***	0.064***	0.048***
(10%)	(0.003)	(0.007)	(0.003)	(0.005)	(0.004)	(0.007)
Network Size Decrease	0.045***	0.018**	0.034***	0.023***	0.038***	0.040***
(10 p.p.)	(0.004)	(0.008)	(0.006)	(0.008)	(0.007)	(0.012)
Increase in Plan Quality	-0.10***	-0.21***	-0.085***	-0.16***	-0.076***	-0.084***
	(0.009)	(0.022)	(0.013)	(0.020)	(0.016)	(0.029)
Observations	235,868	115,752	59,254	44,853	37,463	13,273

Reference category: Decrease in plan quality. *** $p < 0.01$, ** $p < 0.05$ * $p < 0.1$

Table 8: Plan Switching Probabilities: Instrumented Premiums

	Under 250% FPL		250-400% FPL		Over 400% FPL	
Marginal Probabilities	Individual	Family	Individual	Family	Individual	Family
Change in Premium	0.09***	0.13***	0.09***	0.09***	0.10***	0.08***
(10%)	(0.003)	(0.005)	(0.005)	(0.006)	(0.007)	(0.012)
Network Size Decrease	0.02***	0.001	0.02**	0.004	0.05***	0.06***
(10 p.p.)	(0.005)	(0.008)	(0.009)	(0.011)	(0.012)	(0.021)
Increase in Plan Quality	-0.07***	0.01	-0.09***	-0.10***	-0.08***	-0.11**
	(0.010)	(0.022)	(0.020)	(0.023)	(0.025)	(0.044)
No Change in Plan Quality	0.00	0.11***	-0.01	-0.037	-0.01	-0.06*
	(0.009)	(0.020)	(0.017)	(0.020)	(0.019)	(0.031)
Observations	235,868	115,752	59,254	44,853	37,463	13,273

Reference category: Decrease in plan quality. *** $p < 0.01$, ** $p < 0.05$ * $p < 0.1$

Table 9: Plan Switching Probabilities: Non-Linear Premium and Network Size Changes

	Under 250% FPL		250-400% FPL		Over 400% FPL	
Marginal Probabilities	Individual	Family	Individual	Family	Individual	Family
>20% Premium Increase	0.14***	0.21***	0.16***	0.15***	0.16***	0.11***
	(0.005)	(0.008)	(0.009)	(0.011)	(0.013)	(0.023)
10-20% Premium Increase	0.12***	0.16***	0.12***	0.11***	0.12***	0.08***
	(0.004)	(0.006)	(0.008)	(0.009)	(0.012)	(0.021)
<10% Premium Increase	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*
10+ p.p. Network Size	0.06***	0.11***	0.02*	0.04***	0.06***	0.07**
Decrease	(0.007)	(0.012)	(0.013)	(0.015)	(0.019)	(0.031)
0-10 p.p. Network Size	0.05***	0.08***	0.03***	0.03***	0.11***	0.07***
Decrease	(0.006)	(0.010)	(0.010)	(0.012)	(0.015)	(0.027)
Increase in Network Size	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*
Increase in Plan Quality	-0.17***	-0.11***	-0.17***	-0.19***	-0.25***	-0.25***
	(0.011)	(0.022)	(0.020)	(0.023)	(0.026)	(0.047)
No Change in Plan Quality	-0.14***	-0.061***	-0.14***	-0.16***	-0.19***	-0.20***
	(0.009)	(0.020)	(0.017)	(0.019)	(0.019)	(0.031)
Observations	235,868	115,752	59,254	44,853	37,463	13,273

Reference category: Decrease in plan quality. *** $p < 0.01$, ** $p < 0.05$ * $p < 0.1$

Chapter 4: The Welfare Impacts of Provider Network Size and Plan Quality Restrictions on Marketplace Health Insurance Plans

Abstract

Policymakers have considered provider network adequacy and minimum plan quality rating regulations in health insurance settings to promote adequate access to care and plan standards for consumers. However, there is limited information about how such regulations may affect net consumer welfare. Using plan valuations estimated from mixed logit plan choice models, I simulate the expected effects of hypothetical network adequacy and plan quality rating requirements on consumer welfare using data from the California, Colorado, and Washington Marketplaces. I simulate the effects of network adequacy requirements (covering at minimum 10% and 20% of all regional physicians) and a requirement for plans to have a quality rating exceeding two stars (out of five). I find significant reductions in annual expected consumer surplus under minimum network size requirements, with individuals facing reductions of 1-3% and 4-7% of net premiums under 10% and 20% minimum network size thresholds, respectively. However, plan quality requirements have an ambiguous welfare effect, with individuals facing expected welfare changes ranging from a 3% loss to a 12% gain relative to net premiums. Policymakers should carefully consider such regulations in light of their potential effects on consumer welfare.

1 Introduction

The Affordable Care Act (ACA) Marketplaces/Exchanges have enrolled a large and increasing share of American households since the initial enrollment period in 2014. The Marketplaces were established to provide affordable and "high quality" insurance for households shopping on the individual marketplace. They primarily rely on consumer choice, product transparency, and (in some states) active negotiations with insurers to deliver affordable plans. Policymakers have also introduced certain plan requirements that regulate various aspects of Exchange-eligible health plans to promote plan quality.

There are various ways of characterizing and measuring plan "quality." Policymakers have considered provider network size and plan quality ratings (measured as a combination of customer satisfaction and an assessment of care provided) as important measures of plan quality in relatively choice-rich settings (e.g. for Medicare Part D prescription drug plans and Medicaid Managed Care plans). Minimum thresholds have been considered or set for these plan attributes in different contexts as a way to ensure adequate standards of care and access to care for enrollees.

At the outset, the ACA required Marketplace plans to have provider networks that included 20% of "essential community providers," and that services should be accessible to enrollees without "unreasonable" delay (Baicker and Levy, 2015). Similar definitions adopted by state Medicaid managed care programs involve requirements such as having access to a reasonable share of local primary care providers and reasonable travel distance to nearest providers (Ndumele et al., 2018).

Similarly, minimum plan quality requirements have been implemented among Medicare Part D and Medicare managed care plans. In these settings, low-perform plans (with plan quality ratings of two stars or less out of five) are flagged with a "low-performing indicator" to consumers and are removed altogether if they retain such low quality over 2 years (Reid et al., 2013). Insurers affected by these regulations

would be incentivized to react by implementing changes to increase their plan quality or by removing the plans from the respective platforms.

Previous research has established that consumers have significantly positive valuations for network size and plan quality ratings in various health insurance exchange settings (Ericson and Starc, 2015; DeLeire et al., 2017; Du, 2018). Prior research also suggests that welfare losses due to the removal of plans from consumer choice sets may be tempered when combined with the removal of some aspect of plan differentiation among remaining plans (Lucarelli et al., 2012). Furthermore, insurers may promote adverse selection by selecting on enrollees using the targeted construction of provider networks or taking advantage of specific plan quality policies (Decarolis et al., 2017; McGuire et al., 2014). However, it remains unclear how net consumer welfare would change under policy scenarios that specifically regulate provider network size and plan quality ratings (to promote plan quality and access) when balanced with potential cost increases to consumers.

This study simulates the effects of potential network adequacy requirements and plan quality restrictions on expected consumer surplus using data from the California, Colorado, and Washington Marketplaces. First, I simulate the effect of two minimum network size thresholds, consisting of 10% and 20% minimum network size thresholds (which would affect about 33% and 50% of chosen plans, respectively). Then, I simulate a minimum quality restriction requiring plans to have a plan quality star rating that exceeds two stars (out of five). I use mixed logit models of plan choice to derive consumer valuations of plan attributes used to calculate changes in expected welfare under the different policy scenarios.

I find significant reductions in expected consumer surplus when minimum network thresholds are put into place. Individuals across income levels face welfare reductions of \$30-45 (1-3% of net premiums) and \$115-205 (4-7% of net premiums) under 10% and 20% minimum network size thresholds, respectively. In contrast, the

effects of minimum plan quality ratings seem to be more ambiguous. Individuals across income categories face changes in annual expected welfare ranging from -$90 to $509 (from a 3% loss to a 12% gain relative to net premiums) under a minimum quality threshold above two stars, with considerable variation in both gains and losses in expected welfare across income and household size categories. Under both policy simulations, there is significant variation in the impact of the policies on consumer welfare due to the variations in the valuations of plan attributes and plan availability across households.

This paper is one of few to estimate consumer valuations of plan attributes in the ACA setting using individual level enrollment data. Moreover, this is the first study (to my knowledge) which explores how specific adequacy policies affecting provider network and plan quality minimum requirements could impact expected consumer welfare in the choice-rich ACA Marketplace setting. These results are also generalizable to other settings with insurance choice where such policies are in effect or considered, as there are currently only a limited number of studies on these policy welfare questions.

The rest of the paper is structured as follows. Section 2 describes the study data and methods. Section 3 presents the results. Section 4 discusses the results and potential implications. Section 5 concludes.

2 Data and Methods

2.1 Data

The analyses of health plan choice use individual-level enrollment data for 2016 from the from California, Washington, and Colorado Marketplaces along with additional data on plan characteristics from the Robert Wood Johnson Foundation Health Insurance Exchange (HIX) Compare and provider network data from Vericred. The

state enrollment data files include plans selected by each enrollees along with basic demographics, income levels, and other household information necessary to calculate net premiums. These individual-level data are then collapsed to the household level to examine household plan choice. The three states represent a large share of total Marketplace enrollees (16% in 2016).

The final analytic file for this paper is constructed by merging these three data sets (i.e., Exchange, RWJF HIX and Vericred) at the region-county level for each state along with some additional plan and insurer information, notably plan star ratings from California and Colorado.[1] The final sample has information from 1,301,841 households (1,061,153 from California, 99,098 from Colorado, and 141,590 from Washington). The share of enrolling households with income under 250% FPL, 250-400% FPL, and over 400% FPL are 68%, 20%, and 12%, respectively.

Plan Attributes

They key plan attributes are network size and plan quality. The relative valuation of net premium is also important in serving both as an important control and in forming the basis for constructing valuations for network size and plan quality to then calculate changes in expected consumer surplus under alternative choice sets. The net household premium measure is calculated as the household's total annual premium for each plan minus that household's tax credit (based on the second-cheapest silver plan in the region). The models also include controls for additional plan attributes, including: indicators for metal tiers, indicators for the cheapest available plan in each metal tier, plan type (HMO/PPO), deductible, maximum out-of-pocket (OOP), coinsurance/copay (for inpatient physician services, outpatient facilities, and primary care), and insurer brand fixed effects (FE). These controls are presented in Appendix

[1]The reason why the merge is done for each county-region as opposed to the rating region level is because not all SBM plans offered in a region are offered in each county within that region, if a region spans multiple counties in a state.

Table A1 with a full set of regression results.

Provider network size for a given plan is measured as the proportion of physicians in an area covered by that plan.[2] To calculate the provider network size for each plan, I calculate the number of physicians in the rating region within the provider network and divide it by the total number of physicians within the counties of the respective rating region where that plan is actually sold (rather than the entire rating area). I create physician network measures for each plan in the subset (if applicable) of counties in each rating region that the plan is offered in, as not all plans sold in each region are offered in each county within that region.

I create a quality measure based on four categories: low quality (1-2 stars), medium quality (3 stars), and high quality (4-5 stars), and "no quality." A continuous plan quality measure from 1-5 stars cannot be constructed because 23% of plans have "no quality" as their plan quality rating. These cutoffs in the plan quality variable are selected to roughly delineate the plan choices in three similarly sized categories among plans with available quality ratings. While quality ratings are generally given at the insurer level, some insurers have different quality ratings pertaining to different plan types.[3] Refer to Du (2018) for more information how the plan quality ratings are constructed by the state Health Benefits Exchanges.

2.2 Methods and Approach

Mixed Logit Models

I use mixed logit models of plan choice to estimate enrollee valuations of different plan attributes (notably provider network size and plan quality). These are in turn used to estimate the changes in expected consumer surplus due to different policy

[2]This distinction is made because not all plans sold in a state rating region is sold in every county within that rating region.

[3]Some insurers may only have quality ratings for one type of plan but not another (e.g. for their HMOs but not their PPOs).

scenarios. The empirical model is based on the random utility model used to derive conditional, multinomial, and mixed logit models (McFadden, 1973; Train, 2009). This overall structure has been utilized by several other plan choice studies (Sen and DeLeire, 2018; Tebaldi, 2017). The mixed logit also relaxes IIA assumptions and estimates a distribution around the relevant coefficients, allowing one to observe a range of valuations for plan attributes of interest. The mixed logit specification in the context of plan attribute valuations is:

$$Logit(Plan_i) = f(X'_{n,i}(\tilde{b}_{n,i} + \beta_n), X'_{m,i}\beta_m, S, B, \varepsilon_i) \quad (1)$$

where X is a vector of observable plan attributes (e.g. plan quality, premium), S is a set of enrollee fixed effects (included in the mixed logit model by definition), and B is a set of insurer brand fixed effects. i is an enrollee index (and thus a choice set index as well), n indexes the subset of plan attributes X which are modeled with random coefficients (premium, network size, and plan quality) and m indexes the remaining plan attributes which are modeled without random effects. Indices for each plan are omitted for concision. For the variables with random coefficients, $\tilde{b}_{n,i}$ (normally distributed around 0) are values from the vector $\tilde{b}$ representing the enrollee-level deviations from the relevant overall coefficients estimated for the sample. These estimates allow for heterogeneity in the valuation of provider network size and plan quality for the simulated changes in welfare.

Simulations

Next, I explore how expected consumer welfare might change due to: 1) network adequacy requirements and 2) minimum quality restrictions. First, I simulate the effect of two minimum network size thresholds: 10% and 20% minimum provider network size thresholds. Then, I simulate a minimum quality restriction requiring plans to have a quality rating that exceeds two stars.

The simulations use the results from the mixed logit models to calculate changes in expected consumer welfare due to the aforementioned policies using the logsum approach (Small and Rosen, 1981). After estimating the mixed logit models on the actual choice sets observed in the data, I change the choice set faced by the consumer to reflect the new requirements for each simulated policy change (to be explained shortly). The expected consumer surplus (CS) of plan j to consumer i can be written with utility U as:

$$E[CS_i] = \frac{1}{a_i} E[\max_j U_{ij}] \quad \forall j \tag{2}$$

where a_i is the marginal utility of income of individual i. Small and Rosen (1981) shown that:

$$\frac{dE[\max_j U_{ij}]}{dV_{ij}} = P_{ij} = \frac{\exp V_{ij}}{\sum_k \exp V_{ik}} \tag{3}$$

Integrating this equality yields[4]

$$E[\max_j U_{ij}] = \int \frac{\exp V_{ij}}{\sum_k \exp V_{ik}} = \ln \left(\sum_k \exp V_{ik} + C \right) \tag{4}$$

and then

$$E[CS_i] = \frac{1}{a_i} \ln \left(\sum_k \exp V_{ik} \right) + C \tag{5}$$

where C is an unknown constant because an absolute utility level cannot be measured. This equation provides the expected consumer surplus of the choice set. The change in expected consumer welfare due to a change from an old choice set to a new choice set (with respective superscripts A and B) that a consumer faces can be written as:

[4]As stated in Chapter 2, the utility U_{ij} can be additively decomposed into a systematic component V_{ij} (a function of observable plan attributes) and a random component ε_{ij} unobserved by the outside observer.

$$\triangle E[CS_i] = \frac{1}{a_i}\left[\ln\left(\sum_k \exp V_{ik}^B\right) - \ln\left(\sum_k \exp V_{ik}^A\right)\right] \quad (6)$$

where the constant C is differenced out in this expression. Subtracting the expected consumer surplus of B from A generates the change in consumer welfare in dollar terms. This method of simulation is motivated by studies exploring the effects of tax credits and the availability of new insurance plans on plan choice (Pauly and Herring, 2000, 2002).

Note that this method calculates the expected consumer surplus of enrollees at the stage of decision-making, before any realized health care utilization and costs. This quantifies the change in expected consumer surplus due to how well-matched the set of plan choices are to the health insurance preferences of the consumers.[5]

To create the counterfactual choice sets, I first increase the respective attribute of plans affected by the policy requirement to the minimum threshold (e.g. increasing plans with network sizes below 10% to a 10% network size). To calculate the increase in plan premium for affected plans, I run the following model on the unadjusted, standardized annual premium:

$$Prem_{i,j} = \beta_1 \text{Net. Size}_{i,j} + \beta_2(\text{Med. Quality})_{i,j} + \beta_3(\text{Hi Quality})_{i,j} + \mathbf{\Gamma}_{i,j} + \varepsilon_{i,j} \quad (7)$$

where i, j are subscripts for each plan and state-rating region combination and Γ is a vector of other plan attribute controls, including an indicator for having no plan quality, insurer brand fixed effects, other financial and plan type attributes. The coefficients of interest are β_1 for network size and β_2 for plan quality, which are used to make adjustments to the premiums of plans affected by the respective policies.[6]

[5]For instance, enrollees who have a very high aversion to plan premium and a very low valuation of provider network size might be worse off under network adequacy restrictions because the choice set they face, from which they choose their plans, would potentially be less well-aligned to the insurance preferences of the enrollee.

[6]β_2 is the additional premium associated with a medium quality plan (3 stars) relative to a low quality plan (1-2 stars).

For network size, I calculate the semi-elasticity of the network size coefficient (β_1) to find the percentage change in premium for each 10 percentage point change in plan network size and scale the premiums of affected plans proportional to the amount that the plan network size must be increased (in p.p. terms) to meet the minimum network threshold in question. I perform the analogous calculations for quality by bumping up low quality plans ($\leq$ 2 stars) to 3 stars (as medium quality plans). I then scale the premiums of plans affected by the minimum quality threshold using β_2, which is the coefficient representing an additional premium amount for medium quality plans relative to low quality plans.

The increases in the individual standardized premiums are then transformed into the corresponding total premiums faced for each household by adjusting for the relevant information for each enrolling household (age, household size, APTC amount, etc.).[7] Thus, the only difference in the counterfactual choice sets will be the changes in the network size or quality and in the premiums of the affected plans. This parsimonious approach assumes that all changes on the supply side will be reflected in the increase in plan premiums for affected plans.

2.3 Limitations

A key limitation of the simulation approach is that the study does not directly model the insurer response to potential network adequacy or plan quality requirements. I assume that insurers will not remove affected plans from the Marketplace, but will instead raise the network size or quality rating of the affected plans to the required threshold and increase the premiums for the affected plans to reflect the necessary cost of meeting the respective policy requirement. The precision of the estimates

[7] I find that a 10 percentage point increase in provider network size and an increase from low quality ($\leq$ 2 stars) to medium quality (3 stars) are respectively associated with \$70 and \$157 increases in the unadjusted, standardized annual premium for an individual at age 27. From a semi-elasticity perspective, a 10 percentage point change in provider network size is associated with a 2.2% increase in the unadjusted plan premium. These estimates are used to scale up the premiums of affected plans faced by each household.

from these simulations are limited by the fact that they do not directly attempt to model the insurer's supply-side changes and responses to the network size or quality requirements. Thus, these estimates are more general "ballpark" estimates on how such requirements might affect expected consumer surplus.

The results of the paper may be limited in generalizability to the ACA Marketplaces as a whole as the data consists of only three states (CA, CO, WA). Consumers in these three states have more plans and insurers to choose from compared to the nationwide average. However, these states covered about one sixth of all ACA enrollees in 2016. Given the relatively good "health" of the Marketplaces in the three states in having several plans and insurers for enrollees to choose from, the results are useful in elucidating consumer dynamics under settings as intended at the ACA's implementation.

3 Results

3.1 Sample Statistics

Table 1 shows the descriptive statistics for chosen plans and all plans faced by enrollees living in California, Colorado, and Washington who selected an Marketplace plan in 2016. Consumers tend to enroll in higher quality plans relative to the distribution of plan quality across choice sets. Meanwhile, the average network size of chosen plans and all plans are similar. Given that almost 70% of enrollees have income levels under 250% FPL (previously mentioned), it makes sense that average net annual premiums (after APTC) tend to be significantly lower than total (pre-APTC) annual premiums and that consumers are disproportionately more likely to enroll into Silver plans (where cost-sharing reductions are applied), relative to plans in other metal tiers.

3.2 Mixed Logit Plan Attribute Valuations

Table 2 presents the results of the main mixed logit models of plan choice on the full sample of three states.[8] These are the results used to inform consumer valuations for the network adequacy restriction simulations. I focus on the coefficients on premium and network size (as odds ratios) shown in Table 2, while the full regression results for this specification and sample are shown in Appendix Table A1. We can see that enrollees across the different stratifications are quite responsive to premium and network size. Controlling for other factors, individual enrollees across income categories exhibited 0.84-0.90 times the odds of choosing a plan for a $100 increase in annual premium ($p < 0.001$) and 1.2-1.3 times higher odds of choosing a plan for 10 p.p. increase in network size ($p < 0.001$). The distribution of the enrollee-level coefficients for net premium and network size are shown in the bottom half of Table 2. There is considerable variation in the responsiveness to premium and network size, particularly for relatively lower income individuals.

Table 3 presents the results of the mixed logit models with plan quality (for California and Colorado) and are used to inform the consumer valuations for the minimum quality requirement simulations. The results also include (not shown) the control variables shown in Table A1 (with the exception of insurer brand fixed effects). Enrollee valuations of premium and network size are quite significant in the expected directions and fairly similar in magnitude to those shown in Table 2. Across all stratifications, enrollees are significantly more likely to pick high quality plans and medium quality plans relative to low quality plans. All else equal, individual enrollees have 5.2-5.5 and 1.3-2.1 times higher odds of choosing high quality and medium plans, respectively, relative to low quality plans. Like the case with network size and premium seen in Table 2, there is also considerable variation in the responsiveness to

[8]Note that plan quality is not included because Washington did not have plan quality ratings in 2016.

plan quality in this sample, as seen in the bottom half of Table 3.

3.3 Minimum Provider Network Size Simulations

Table 4 shows the results of the simulation of a 10% and 20% network adequacy requirement on the change in expected consumer surplus. Enrollees face significant reductions in expected consumer welfare when minimum network adequacies are put into place. Individuals across income levels face welfare reductions of $30-45 (1-3% of net premiums) and $115-205 (4-7% of net premiums) under 10% and 20% minimum network size thresholds, respectively. There is considerable variable in the magnitude of the expected welfare loss. For example, individual enrollees at 250-400% FPL faced expected welfare changes between the 10^{th} and 90^{th} percentiles ranging from -$66 to $1 for the 10% requirement and -$204 to $9 for the 20% requirement.

3.4 Plan Quality Restriction Simulations

The effects of the minimum quality requirement (that plans must exceed 2 stars) are shown in Table 5. In contrast to the network adequacy results, the effects of minimum plan quality ratings on expected consumer welfare seems to be more ambiguous. Individuals across income groups face changes in expected welfare ranging from -$90 to $509 (from a 3% loss to a 12% gain relative to net premiums). Moreover, there is sizable variation within income and household size categories, with individuals 250-400% FPL facing an expected welfare change ranging from -$383 to $171 between the 10^{th} and 90^{th} percentiles.

4 Discussion

This study examined the expected welfare implications of potential network adequacy requirements and plan quality restrictions for ACA Marketplace plans. Using

mixed logit plan choice models on data from the California, Colorado, and Washington Health Benefits Exchanges, I found that enrollees were quite responsive to plan quality, provider network size, and plan premium, in line with findings from studies in related plan choice settings such as the Massachusetts Connector and Medicare managed care plans (Reid et al., 2013; Ericson and Starc, 2015).

Using the estimated plan attribute valuations, I found that average expected consumer surplus was reduced under network adequacy restrictions for each of the six household/income groups, with a larger reduction in expected consumer surplus corresponding to the more stringent 20% network size requirement. There is considerable variation in the reduction of expected consumer surplus across different enrollees. But overall, given that enrollees tend to prefer both lower premiums and larger network sizes, the results suggest that network adequacy restrictions may lead to a lower expected consumer surplus for most enrollees by reducing the possibility of choosing cheaper, narrow network plans.

In contrast, the effects of minimum plan quality ratings on expected consumer welfare seems to be more ambiguous. When plans are required to exceed 2 stars (low quality threshold), there is considerable variation in both losses and gains in expected consumer welfare across income groups and between individual and family households. The larger variation in expected welfare changes can partly be explained by two differences, relative to network size. First, enrollees exhibited larger variation in their valuations of plan quality relative to network size. Second, the distribution of plan quality across state rating regions was relatively more variable than that of network size. Overall, these results suggest that the implementation of minimum plan quality requirements may have a more ambiguous, heterogeneous effect on consumer surplus compared to the more consistent effects of network adequacy requirements.

The welfare implications of the stylized network adequacy restrictions relate to the fundamental idea that there is a trade-off between access to care and costs. Thus,

policymakers will need to balance the need for both in order to both foster competition between providers and insurers (to reduce premiums) and to ensure proper access to care (Baicker and Levy, 2015).

Broad networks are beneficial to consumers primarily with respect to access to care and in facilitating a greater choice of physicians and hospitals. However, narrow networks could benefit enrollees in a couple of ways, chiefly through insurer-provider negotiations which allow insurers to further compete on premiums. Provider networks give insurers leverage in their negotiations with providers over reimbursement rates, by offering higher patient volume in return for lower reimbursement rates. The insurer bargaining power relative to physician groups (and hospitals) can help keep prices lower for enrollees especially in the competitive, price-transparent ACA Marketplace context (Howard, 2014). This is particularly true as providers have consolidated into larger health systems in recent years. As a result, the creation of more exclusive narrow networks has been one of the most effective ways for insurers to maintain leverage over reimbursement rates (and pass some of the savings on to consumers). Network adequacy restrictions could curtail insurers abilities to negotiate with providers, thereby restricting the ability to compete on premium for enrollees (Baicker and Levy, 2015). Again, while the causal mechanisms are beyond the scope of this study's simulations, the savings to consumers could also be reflected by the fact that insurers could help direct patients to high-value providers, especially as insurers have recently become more involved in the delivery of care, encouragement of providers to adopt best practices, and cost-effectiveness of care to compete on price (Howard, 2014).

At the same time, there are key drawbacks and adverse outcomes that may result from insurers restricting networks. Insurers could tailor the construction of narrow networks to "cream skim" from the risk pool and discourage the enrollment of sicker enrollees. Insurers creating narrow networks may seek to exclude or limit

access to specialized health care providers to deter high-risk enrollees from their plans, driving up overall costs in the Marketplaces by exacerbating adverse selection in the market.

Taken together with the pricing and bargaining mechanisms that affect insurer and plan provider networks, the results of the study suggest that policymakers should at minimum be cautious in their implementation of network adequacy requirements and should consider how to best balance cost and affordability among enrollees and the target population. This may require "better" ways of measuring network adequacy and communicating this information to enrollees in order to inform their decisions.

The welfare implications for plan quality restrictions are harder to contextualize, partly due to the fact that such ratings are much less commonly utilized in other insurance contexts. Even among ACA Marketplaces, only a few state-based marketplace (SBM) states have implemented plan quality ratings for enrollees. The most similar setting would be for Medicare Part D PDPs and Medicare Advantage managed care plans, which utilize a plan quality restriction that the simulation in this paper is based on.

However, the economic implications of plan quality restrictions are also less clear from a theoretical perspective relative to those of network adequacy requirements. The effects of these policies on welfare ultimately depend on how costly it is for firms to raise their plan quality ratings, and thus how much their prices increase for affected consumers. Policymakers interested in establishing plan quality thresholds in the ACA context should account for the wide variation in plan quality valuations and the potential for changes in these valuations over time as consumers "learn" with respect to how reliable quality ratings are as a signal of actual plan quality (more generally speaking).

As previously mentioned, the study has a few notable limitations. Importantly, insurer response to various policies is assumed rather than modeled, specifically in

their decisions not to remove affected plans from the Marketplace. In addition, I use the association between premium and the non-financial attributes to infer the potential costs to insurers of improving plans along those dimensions. This method has been used in other studies such as Dafny et al. (2017), but is limited in terms of explaining the mechanisms which generate the estimates obtained. The precision of the estimates from these simulations is limited by these two key factors, and thus serve more as ballpark estimates on how such requirements might affect expected consumer surplus.

Furthermore, the welfare implications might be limited in their generalizability to enrollees nationwide as the data are from three states (CA, CO, WA) that have fairly competitive Marketplaces. Nonetheless, the results from this sample are useful in exploring consumer dynamics and welfare changes under settings with more "healthy" Marketplaces as intended under the ACA.

Despite the limitations, this paper makes key contributions to the literature. This study is one of few to estimate consumer valuations of plan attributes in the ACA setting using precise enrollee-level enrollment files. Moreover, this is the first study (to my knowledge) which explores how specific regulations affecting provider networks and plan quality could impact expected consumer welfare in the choice-rich ACA Marketplace environment.

5 Conclusion

Provider network adequacy requirements may reduce consumer welfare by effecting increases in plan costs, thereby limiting the set of affordable plans that a sizable share of enrollees may prefer. On the other hand, the effects of minimum quality restrictions are more ambiguous and heterogeneous with respect to consumer welfare among ACA enrollees. In addition, enrollees are quite responsive to both provider network size and

plan quality. Policymakers should be thoughtful in considering the implementation of potential network adequacy or plan quality threshold requirements. Policymakers should evaluate the tradeoffs between plan affordability and access to care/other plan benefits and also take into account potential unintended consequences that may pan out in the interplay between consumers, insurers, and providers.

Ultimately, this study provides an initial overview of the welfare implications of policies affecting provider networks and plan quality in the context of the ACA Marketplaces. Enrollee-level SBM enrollment data and detailed plan-level data have become increasingly available. There remains a significant gap in the literature that can be addressed by estimating structural models of supply and demand in order to provide insight on the causal mechanisms behind shifts in consumer welfare vis-à-vis policies affecting non-financial plan attributes.

References

Baicker, K. and Levy, H. (2015). How Narrow a Network Is Too Narrow? *JAMA Internal Medicine*, 175(3):337–338.

Dafny, L. S., Hendel, I., Marone, V., and Ody, C. (2017). Narrow Networks On The Health Insurance Marketplaces: Prevalence, Pricing, And The Cost Of Network Breadth. *Health Affairs*, 36(9):1606–1614.

Decarolis, F., Guglielmo, A., and Luscombe, C. (2017). Open Enrollment Periods and Plan Choices. Working Paper 24156, National Bureau of Economic Research.

DeLeire, T., Chappel, A., Finegold, K., and Gee, E. (2017). Do Individuals Respond to Cost-Sharing Subsidies in their Selections of Marketplace Health Insurance Plans? *Journal of Health Economics*, 56(Supplement C):71–86.

Du, S. (2018). Health Plan Choice and the Valuation of Plan Attributes in the ACA Marketplaces.

Ericson, K. M. and Starc, A. (2015). Measuring Consumer Valuation of Limited Provider Networks. *American Economic Review*, 105(5):115–119.

Howard, D. H. (2014). Adverse Effects of Prohibiting Narrow Provider Networks. *New England Journal of Medicine*, 371(7):591–593.

Lucarelli, C., Prince, J., and Simon, K. (2012). The Welfare Impact of Reducing Choice in Medicare Part D: A Comparison of Two Regulation Strategies. *International Economic Review*, 53(4):1155–1177.

McFadden, D. L. (1973). Conditional Logit Analysis of Qualitative Choice Behavior. In *Frontiers in Econometrics*. Wiley, New York.

McGuire, T. G., Newhouse, J. P., Normand, S.-L., Shi, J., and Zuvekas, S. (2014). Assessing Incentives for Service-Level Selection In Private Health Insurance Exchanges. *Journal of Health Economics*, 0:47–63.

Ndumele, C. D., Staiger, B., Ross, J. S., and Schlesinger, M. J. (2018). Network Optimization And The Continuity Of Physicians In Medicaid Managed Care. *Health Affairs*, 37(6):929–935.

Pauly, M. V. and Herring, B. J. (2000). An Efficient Employer Strategy for Dealing with Adverse Selection in Multiple-Plan Offerings: An MSA Example. *Journal of Health Economics*, 19(4):513–528.

Pauly, M. V. and Herring, B. J. (2002). Cutting Taxes for Insuring: Options and Effects of Tax Credits for Health Insurance. Technical report, American Enterprise Institute, Washington, D.C.

Reid, R. O., Deb, P., Howell, B. L., and Shrank, W. H. (2013). Association between medicare advantage plan star ratings and enrollment. *JAMA*, 309(3):267–274.

Sen, A. and DeLeire, T. (2018). Consumer Choice and Learning in Private Insurance Markets: Evidence from the ACA Marketplaces.

Small, K. and Rosen, H. (1981). Applied Welfare Economics with Discrete Choice Models. *Econometrica*, 49(1):105–30.

Tebaldi, P. (2017). Estimating Equilibrium in Health Insurance Exchanges: Price Competition and Subsidy Design under the ACA.

Train, K. E. (2009). *Discrete Choice Methods with Simulation*. Cambridge University Press, Cambridge ; New York, 2 edition edition.

Tables

Table 1: Plan Summary Statistics

N = 46,426,138	Chosen Plans		All Plans	
Plan Network Attributes	Mean	SD	Mean	SD
Network Size (% of Physicians)	20%	0.12	21%	0.14
PPO	44%	0.50	35%	0.48
HMO/EPO	56%	0.50	65%	0.48
*Plan Quality Ratings**				
High Quality (≥4 Stars)	30%	0.46	24%	0.43
Middle Quality (3 stars)	28%	0.45	22%	0.41
Low Quality (≤2 Stars)	28%	0.45	31%	0.46
No Quality	14%	0.35	23%	0.42
Financial Attributes				
Total Premium, Individual	$4,994	2,423	$5,531	2,941
Net Premium, Individual	$2,137	1,888	$3,100	2,280
Total Premium, Family	$11,094	4,505	$12,362	5,612
Net Premium, Family	$3,979	3,904	$6,099	4,735
Bronze	28%	0.45	31%	0.46
Silver	62%	0.49	30%	0.46
Gold	5%	0.22	23%	0.42
Platinum	3%	0.18	14%	0.35
Catastrophic**	1%	0.12	3%	0.16

*All plan quality rating variables only for CA, CO (N= 35,562,421)

**Catastrophic Plans only shown when available to family

Table 2: Plan Choice Mixed Logit Results

	Under 250% FPL		250-400% FPL		Over 400% FPL	
	Individual	Family	Individual	Family	Individual	Family
Net Premium	0.836***	0.887***	0.907***	0.952***	0.895***	0.967***
($100)	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)
Network Size	1.25***	1.37***	1.18***	1.32***	1.25***	1.24***
(10 p.p.)	(0.006)	(0.011)	(0.012)	(0.015)	(0.012)	(0.018)
Premium Coefficient Distribution (Percentiles)						
10th	0.776	0.854	0.876	0.938	0.851	0.960
25th	0.800	0.870	0.883	0.941	0.861	0.962
Median	0.825	0.881	0.898	0.949	0.882	0.966
75th	0.854	0.898	0.921	0.958	0.913	0.971
90th	0.891	0.921	0.943	0.968	0.945	0.977
Network Size Coefficient Distribution (Percentiles)						
10th	1.178	1.113	1.089	1.174	1.237	1.239
25th	1.223	1.224	1.136	1.231	1.242	1.240
Median	1.277	1.359	1.198	1.319	1.246	1.241
75th	1.357	1.594	1.283	1.438	1.252	1.241
90th	1.457	1.769	1.380	1.548	1.257	1.242
Observations	22,540,279	8,510,218	5,532,135	3,379,746	4,709,913	1,752,288

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 3: Plan Choice Mixed Logit Results with Plan Quality (CA, CO)

	Under 250% FPL		250-400% FPL		Over 400% FPL	
	Individual	Family	Individual	Family	Individual	Family
Net Premium	0.837***	0.885***	0.911***	0.953***	0.892***	0.962***
($100)	(0.001)	(0.001)	(0.002)	(0.001)	(0.003)	(0.002)
Network Size	1.16***	1.16***	1.24***	1.26***	1.20***	1.15***
(10 p.p.)	(0.005)	(0.010)	(0.012)	(0.014)	(0.013)	(0.018)
High Quality	5.16***	7.72***	5.46***	5.64***	5.23***	3.40***
	(0.058)	(0.198)	(0.136)	(0.182)	(0.213)	(0.232)
Med. Quality	1.34***	2.91***	2.05***	2.57***	1.21***	1.44***
	(0.037)	(0.138)	(0.101)	(0.155)	(0.058)	(0.094)
Low Quality	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*
No Quality	1.38***	2.30***	0.76***	0.84	0.95	1.02
	(0.014)	(0.039)	(0.044)	(0.106)	(0.085)	(0.107)
High Quality Plan Coefficient Distribution (Percentiles)						
10th	5.147	6.819	5.461	5.634	3.163	1.028
25th	5.151	7.185	5.463	5.639	3.862	1.543
Median	5.156	7.500	5.464	5.644	4.368	2.108
75th	5.161	8.055	5.465	5.650	7.523	8.868
90th	5.166	9.324	5.466	5.654	9.439	14.423
Medium Quality Plan Coefficient Distribution (Percentiles)						
10th	1.306	2.450	2.009	2.230	1.196	1.435
25th	1.319	2.593	2.023	2.306	1.200	1.435
Median	1.334	2.766	2.039	2.405	1.205	1.436
75th	1.363	3.414	2.068	3.061	1.210	1.436
90th	1.396	3.779	2.114	3.309	1.214	1.436
Observations	17,204,833	6,739,699	3,670,070	2,565,314	3,865,754	1,412,883

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 4: Changes in Consumer Surplus, Network Adequacy Restrictions

	Under 250% FPL		250-400% FPL		Over 400% FPL	
10% Threshold	Individual	Family	Individual	Family	Individual	Family
Mean	**-$45**	**-$100**	**-$31**	**-$71**	**-$35**	**-$64**
10 Percentile	-$91	-$202	-$66	-$178	-$47	-$146
25 Percentile	-$44	-$98	-$29	-$86	-$23	-$76
Median	-$11	-$21	-$3	-$17	-$8	-$34
75 Percentile	$0	$0	$0	$0	-$1	-$5
90 Percentile	$0	$3	$1	$0	$0	$0
20% Threshold						
Mean	**-$115**	**-$211**	**-$123**	**-$266**	**-$204**	**-$272**
10 Percentile	-$204	-$482	-$204	-$536	-$165	-$447
25 Percentile	-$97	-$181	-$85	-$293	-$88	-$297
Median	-$42	-$69	-$25	-$124	-$48	-$188
75 Percentile	-$10	-$2	$0	-$31	-$15	-$58
90 Percentile	$0	$30	$9	$0	$0	-$9

Table 5: Changes in Consumer Surplus, Minimum Quality Threshold

	Under 250% FPL		250-400% FPL		Over 400% FPL	
	Individual	Family	Individual	Family	Individual	Family
Mean	**$184**	**-$41**	**-$90**	**-$477**	**$509**	**$925**
10 Percentile	$20	-$435	-$383	-$1,177	$90	-$33
25 Percentile	$63	-$269	-$198	-$779	$188	$251
Median	$139	-$93	-$49	-$426	$343	$742
75 Percentile	$243	$195	$49	-$117	$516	$1,238
90 Percentile	$369	$453	$171	$166	$809	$1,920

Appendix

Table A1: Plan Choice Mixed Logit Model Full Results

	Under 250% FPL		250-400% FPL		Over 400% FPL	
	Individual	Family	Individual	Family	Individual	Family
Net Premium	0.836***	0.887***	0.907***	0.952***	0.895***	0.967***
($100)	(0.0011)	(0.0009)	(0.0021)	(0.0010)	(0.0021)	(0.0013)
Network Size	1.26***	1.37***	1.18***	1.32***	1.24***	1.24***
(10 p.p.)	(0.0053)	(0.0096)	(0.0101)	(0.0126)	(0.0108)	(0.0162)
Silver	2.611***	2.754***	2.512***	2.656***	1.89***	2.396***
	(0.0392)	(0.0780)	(0.0701)	(0.0913)	(0.0602)	(0.1262)
Gold	1.488***	1.35***	1.603***	1.567***	0.986	1.147***
	(0.0126)	(0.0168)	(0.0328)	(0.0360)	(0.0305)	(0.0536)
Platinum	1.135***	1.187***	1.412***	1.217***	0.763***	0.880*
	(0.0365)	(0.0578)	(0.0552)	(0.0555)	(0.0354)	(0.0603)
Cheapest Bronze Plan	5.819***	5.67***	0.842***	0.988	1.904***	0.989
	(0.3089)	(0.5100)	(0.0409)	(0.0602)	(0.1062)	(0.0821)
Cheapest Silver Plan	1.56***	2.784***	0.200***	0.229***	1.697***	0.578***
	(0.0820)	(0.2606)	(0.0152)	(0.0219)	(0.1541)	(0.0787)
Cheapest Gold Plan	1.234***	2.123***	0.091***	0.143***	2.493***	0.638***
	(0.0667)	(0.2024)	(0.0100)	(0.0192)	(0.3234)	(0.1254)
HMO	0.393***	0.386***	0.465***	0.400***	0.454***	0.390***
	(0.0055)	(0.0091)	(0.0125)	(0.0121)	(0.01317)	(0.0184)
Deductible	0.996***	0.994***	0.973***	0.983***	0.995***	0.991***
	(0.0008)	(0.0007)	(0.0009)	(0.0006)	(0.00124)	(0.0009)
Maximum OOP	0.989***	0.989***	0.989***	0.994***	0.996***	0.999
	(0.0012)	(0.0011)	(0.0017)	(0.0010)	(0.0016)	(0.0012)
Inpatient Physician						
Low Copay	1.166***	1.279**	0.944	1.343***	0.568***	0.57***
	(0.0625)	(0.1457)	(0.0862)	(0.1504)	(0.0346)	(0.0489)
High Copay	1.379***	1.153***	1.266***	1.423***	0.696***	0.955
	(0.0168)	(0.0245)	(0.0597)	(0.0789)	(0.0271)	(0.0591)
High Coinsurance	0.787***	0.876**	0.624***	0.79***	0.624***	0.761***
	(0.0248)	(0.0460)	(0.0234)	(0.0328)	(0.0213)	(0.0380)
Outpatient Facility						
Low Copay	0.591***	0.456***	0.72***	0.517***	1.059	1.033
	(0.0305)	(0.0498)	(0.0648)	(0.0571)	(0.0629)	(0.0858)
High Copay	0.644***	0.557***	1.265***	1.129*	1.183***	1.218***
	(0.0259)	(0.0397)	(0.0721)	(0.0810)	(0.0667)	(0.1178)
High Coinsurance	0.921***	0.831***	2.032***	1.637***	1.538***	1.356***
	(0.0386)	(0.0535)	(0.1045)	(0.0968)	(0.0857)	(0.1224)
Primary Care						
High Copay	0.469***	0.370***	0.308***	0.348***	0.753***	0.607***
	(0.0111)	(0.0172)	(0.0117)	(0.0180)	(0.0299)	(0.0404)
Low Coinsurance	2.445***	3.006***	2.496***	2.56***	1.639***	1.583***
	(0.0360)	(0.0853)	(0.0819)	(0.1144)	(0.0551)	(0.0793)
High Coinsurance	2.213***	2.848***	1.921***	2.942***	1.70***	1.686***
	(0.0358)	(0.0920)	(0.0524)	(0.1233)	(0.0354)	(0.0647)
Insurer Brand FE	Y	Y	Y	Y	Y	Y
Observations	22,540,279	8,510,218	5,532,135	3,379,746	4,709,913	1,752,288

Reference categories: Bronze Plans, PPO Plans. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Chapter 5: Conclusion

This dissertation explored three research questions related to consumer decision-making in the Health Insurance Marketplace established by the ACA. The first and second papers examined plan choice and plan switching decisions in the Marketplaces, respectively. The third paper simulated the welfare impacts of hypothetical policies affecting provider networks and plan quality ratings among Marketplace plans.

The first paper (Chapter 2) examined how enrollees value plan attributes (notably provider network size and plan quality) on the ACA Marketplaces. I found that consumers are quite responsive to network size and plan quality. Individual enrollees exhibited an annual WTP of $200-300 for a 10 percentage-point (p.p.) (25 percentile) increase in provider network size and a WTP of $1,200-2,800 for a high quality plan (4-5 stars) relative to a low quality plan (1-2 stars). Additionally, consumers who faced smaller choice sets or were newly enrolled tended to be even more responsive to these non-financial plan attributes in their choice of plans.

The second paper (Chapter 3) examined how changes in the attributes of chosen plans over time were associated with enrollee plan switching decisions in the California Marketplace. I found that changes in the premium, provider network size, and plan quality of chosen plans were significantly associated with the probability that enrollees switched plans in the subsequent enrollment period. A plan's 10 p.p. decrease in network size was associated with a 5-13 p.p. increase in the probability a returning enrollee switched plans on the Exchange, and an increase in plan quality was associated with a 10-15 p.p. decrease in switching. Furthermore, enrollees who were newly enrolled, older, or had assistance in enrollment displayed a lower likelihood

of disenrolling from the Marketplace in the subsequent year.

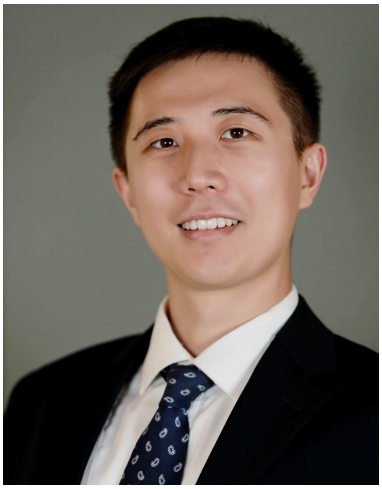
The third paper (Chapter 4) simulated the expected effects of hypothetical network adequacy and plan quality requirements on consumer welfare in the Marketplaces using mixed logit models of plan choice. I found that expected consumer surplus would be significantly reduced under minimum network adequacy requirements. I found significant reductions in annual expected consumer surplus under minimum network size requirements, with individuals facing reductions of 1-3% and 4-7% of net premiums under 10% and 20% minimum network size thresholds, respectively. However, plan quality requirements had an ambiguous welfare effect, with individuals facing expected welfare changes ranging from a 3% loss to a 12% gain relative to net premiums.

The results from Papers 1 and 2 also suggest that policymakers should take consumer responsiveness to provider network size and plan quality into account in their efforts to facilitate consumer decision-making on the state Marketplaces. The fact that enrollees strongly value plan quality ratings where provided suggests that the implementation of plan quality ratings on the federally-facilitated marketplace and other individual-market health exchanges could be useful to consumers in other insurance exchange settings. They can provide consumers with useful, summarized measures of plan quality that may otherwise be harder to assess. In addition, given that consumers consistently value the breadth of provider networks, policymakers may have a greater incentive to provide better, more understandable provider network size information for Marketplace plans (such as categorical measures of network size). It would be especially important to verify that the information provided for both network size and plan quality are validated and accurate, given the level of consumer responsiveness to these measures. Furthermore, consumer responsiveness to levels and changes in plan quality and network size could inform insurers' decisions to invest in these attributes as another way of attracting enrollees to their plans and competing

on the Marketplace.

Policymakers should also be thoughtful when considering the potential implementation of minimum requirements related to network adequacy or plan quality ratings. Policymakers should evaluate the tradeoffs between affordability and access to care (along with other plan benefits) to consumers and take into account the potentially unintended consequences of policies and other changes to the Marketplace platform vis-à-vis interactions between consumers, providers, and insurers.

Vita



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His research focuses on consumer decision making in health care, health insurance markets, and the effects of housing and neighborhood poverty on health care utilization. After graduation, Shawn will work in the Health Care Practice at Analysis Group in New York.