Liquidity Constraints, Insurance Coverage, and Market Outcomes

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Abstract

The implications of health insurance provision to market outcomes are studied in a model with liquidity-constrained consumers and multiple differentiated medical providers. Within this framework, insurance provision induces two contradicting effects on medical prices: lower demand elasticity under insurance sales works to increase prices, and a market size effect works to decrease prices by bringing new providers into the market. If liquidity constraints under spot sales are sufficiently binding relative to market-entry cost per consumer, insurance provision brings medical prices down, below their spot market level, and improves welfare. The analysis applies also to the impact of premium subsidies and universal coverage on medical prices.

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1 Introduction

Health insurance provision can make medical care affordable to consumers who cannot pay the spot medical prices due to liquidity constraints.[1] Although the affordability of medical care and health insurance are a major public concern in developed economies, the implications of insuring liquidity-constrained consumers were only scarcely studied in the theoretical literature. The present study provides a first analysis of the topic in a market with multiple differentiated medical providers (e.g., hospitals, physicians, pharmaceutical companies),

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[1] In a 2019 Gallup poll, 25% of Americans reported delaying treatment for serious medical conditions due to cost concern.
https://news.gallup.com/poll/269138/americans-delaying-medical-treatment-due-cost.aspx

who sell their products to liquidity-constrained consumers, either directly (i.e., in the spot market) or under insurance coverage (i.e., through option contracts). It is shown that, within this framework, the implications of health insurance provision to market outcomes, and particularly medical prices, are determined by two contradicting effects. First is the lower demand elasticity ("LDE") effect: a lower demand elasticity in the insurance market, compared with spot market demand, works to increase equilibrium medical prices. Second is the market-size ("MS") effect: as insurance provision makes medical care affordable to more consumers it increases effective demand at any price level. That, in turn, works to lower equilibrium medical prices by bringing new providers into the market, thereby intensifying competition.[2] The MS effect drives the novel results in this paper: it is shown that if the liquidity constraints are sufficiently binding in the spot market the MS effect dominates the LDE effect and the provision of medical care under insurance coverage brings medical prices down, below their spot market level, and improves market welfare. This happens in medical-care markets with sufficiently high marginal cost of provision relative to consumers' liquidity constraints and to market-entry cost per-consumer. Moreover, it is shown that this result applies also to the implications of insurance-premium subsidies and universal coverage on medical prices.

Nyman (1999) was the first to highlight that health insurance can make medical care more affordable by easing consumers' liquidity constraints.[3] However, in Nyman's analysis the price of medical care is exogenously given. The work by Besanko, Dranove and Garthwait (2020), hereafter "BDG", is first to analyze the effect of insurance provision to liquidity constrained consumers on medical prices and welfare. They analyze a market with monopolistic medical care provider to highlight the LDE effect: they show that as demand for insurance premiums is less elastic than spot market demand, if the medical product is provided under insurance coverage the monopolist set the price higher than in their spot sales price. Consequently, in BDG's analysis health insurance provision benefits only the consumers who gain access to medical care through the improved affordability, while hurting consumers who could afford to pay the (lower) spot market prices.

Whereas the scenario of a monopolistic provider studied by BDG suits well markets for patented pharmaceuticals, for example, other segments of the health care sector present various degrees of competition among medical providers, e.g., hospitals, outpatient care clinics, and off-patent pharmaceuticals. The present study addresses the latter in a model market with multiple providers of differentiated medical products. In this framework, as

[2]This effect would not be present if consumers were not restricted from participating in the spot market by liquidity constraints.

[3]Nyman refers to consumers' affordability gains from insurance as the "access motive".

insurance coverage makes medical care affordable to more consumers it increases effective demand, which in turn works to decrease medical prices by bringing new providers into the market. This MS effect is the key novel element in the present analysis and the source of its proposed contribution to the literature: the MS effect that presents in the market with multiple providers contradicts and may outweighs the LDE effect highlighted by BDG in the monopolistic market, thereby reversing both their positive and normative results.[4]

The present analysis is conducted in Salop's (1979) spatial competition model that is extended to include consumer-specific liquidity constraints.[5] A related study by Nell Richter and Schiller (2009), hereafter "NRS", also explored the implications of insurance provision to market outcomes in Salop's (1979) circular market, with no liquidity constraints.[6] Like BDG (2020), NRS also highlight lower demand-price elasticity in insurance markets, compared to spot market demand, though along a different margin: in their analysis all market products are covered under a comprehensive insurance policy, and medical providers included under the insurance policy compete over sick consumers who face out of pocket expenses defined by the policy coinsurance rate. With a lower coinsurance rate consumers become less sensitive to differences in medical prices when choosing between providers, and consequently medical prices increase beyond their spot market level. In NRS' analysis, however, consumers have no liquidity constraints and, therefore, it abstracts from the MS effect that is highlighted in the present study. It will be shown below that the MS effect can also dominate the LDE effect studied by NRS, and reverse their welfare analysis results that point at certain welfare impairment under insurance sales.

The present study is related also to a recent literature on the implications of premium subsidies to health insurance market outcomes. One thread of this literature documented the positive effect premium subsidies, which are set to make health insurance more affordable, on insurance take up; see for example Finkelstein et al. (2019) and Tebaldi et al. (2023). Another line of research focuses on quantifying the benefits to consumers from premium subsidies, that is the pass-through rate, as a function of insurers' market power; see for example Jaffe and Shepard (2020), Decarolis et al. (2020), Polyakova and Ryan (2021, 2023), Tabelini (2024), and Einav at al. (2024). These studies abstract from the potential

[4] In the present setup consumers benefit from firms' entry both through the resulting decrease in medical prices and the increased product variety. Therefore, a price decrease is sufficient but not necessary for an increased consumers surplus.

[5] Numerous other studies employed Salop's original framework to analyses various aspects of health care market performance. See for example See for example Gal-Or (1999a,b), Brekke et al. (2011), Grossman (2013), Brekke et al. (2017a,b) Sorek and Beard (2018).

[6] NRS note that their analysis, as much as the present one, applies not only to health insurance and medical care markets, but also to other "repair" markets, such as car repair services that are commonly provided under car insurance coverage.

effect of the subsidies on medical care markets and the MS effect that is highlighted in the presents study, which abstracts from insurers profit considerations.[7][8] In that regard, the present study complements this literature on the implications of insurance subsidies (including universal coverage policy) on health insurance market outcomes, while leaving the analysis of a unified framework that comprises both market layers (i.e., insurers and medical providers) for future work.

The existing literature documented increased market-entry by medical providers following the expansion of health insurance coverage: Finkelstein (2007) documented market-entry in the American hospitals industry following the introduction of Medicare. Similarly, Blume-Kohout and Sood (2013) and Dubois et al. (2015) document increase in pharmaceutical R&D following the introduction of Medicare Part D. However, these works do not untangle the MS effect from the LDE effect on market-entry highlighted in the present study, and do not assess their combined effect on medical prices.[9] Therefore, the theoretical results derived below call for empirical validation that falls beyond the scope of the present study.[10]

The remainder of the paper is organized as follows: Section 2 presents the spatial competition model with consumer-specific liquidity constraints. Section 3 presents the equilibrium in the spot market for medical care. Section 4 studies the implications of health insurance sales to market outcomes. Section 5 studies the welfare properties of the model market, and Section 6 concludes this study.

2 Model

The analysis builds on Salop's (1979) circular model of spatial competition, which is extended to include consumer-specific liquidity constraints. The market is populated with a consumers' mass of measure L, indexed "i". Each consumer faces an independent probability $\pi \in (0,1)$ of becoming sick. Therefore, the fraction π of all consumers becomes sick, defining the potential market demand for medical care, $d \equiv \pi L$. Sick consumers are uniformly

[7] The market size effect could in principle work to intensify competition also in health insurance markets. However, given the natural higher degree of concentration in the insurance industry relative to various segments of the health care sector it seems more relevant to the latter.

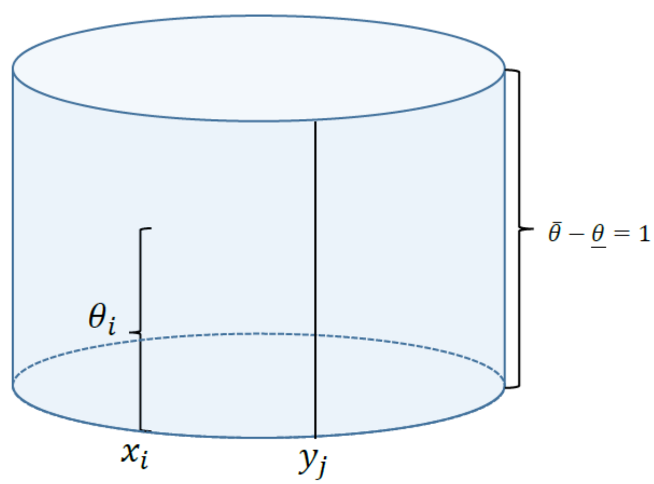
[8] The present analysis includes perfectly competitive insurers and a powerful public insurer, such as Medicare.

[9] The LDE effect works to increase market entry by raising markups and the MS effect works to increase market entry by raising demand.

[10] Finkelstein (2007) documented market entry in the American hospitals industry following the introduction of Medicare. Similarly, Blume-Kohout and Sood (2013) and Dubois et al. (2015) document increase in pharmaceutical R&D following the introduction of Medicare Part D. However, these works do not untangle the MS effect from the LDE effect on market entry (through higher medcial prices) and do not assess their combined effect on medical prices.

distributed on the circumference of the medical-care market, and their location is denoted x. The market circumference can resemble the geographical dimension, or the medical needs (and products) dimension. There are N medical care providers in the market, indexed "j". The providers are symmetrically located on the market circumference and their location is denoted by y. The consumer's liquidity constraint, denoted θ, is drawn from a uniform distribution, independently of their location on the market circle, $\forall x : \theta \sim U\left[\underline{\theta}, \overline{\theta}\right]$. The lowest liquidity constraint is assumed to be positive, $\underline{\theta} > 0$, and to enhance tractability the liquidity constraint range is normalized to one, $\overline{\theta} - \underline{\theta} = 1$. Therefore, geometrically, the population of sick consumers is uniformly distributed over a cylinder surface, of a unit circumference and a unit height. The circumference of the cylinder defines the spatial market dimension along which providers and consumers are horizontally differentiated. The cylinder's height defines the liquidity constraint dimension, which is vertical. Each consumer i is defined by location and liquidity constraint coordinates, $i = (x_i, \theta_i)$ on the out area of the cylinder, that is the consumers' type space.

Figure 1 : Consumers' and providers' type space



The baseline utility of a healthy consumer is v and a medical need (i.e., sickness) reduces the consumer's utility to zero if not satisfied (cured). Each sick consumer seeks to utilize at most one unit of medical care that restores their baseline utility, v, which represents the consumer's maximal willingness to pay. The utilization of medical care from provider j incurs the monetary cost p_j and a non-monetary spatial (transportation or mismatch) cost $t|x_i - y_j|$, where t is the marginal spatial cost parameter, and $|x_i - y_j|$ is the length of the shorter arc that connects x_i and y_i.[11] Therefore, the net utility for the sick consumer i from

[11] Assuming a monetary spatial cost would impair tractability without altering our qualitative results.

utilizing medical care from provider j is[12]

$$u_i = v - p_j - t|x_i - y_j| \tag{1}$$

If $v > \theta_i$, consumer i is subject to a liquidity constraint, and if $v > p > \theta_i$ the liquidity constraint is binding. Without loss of generality, we assume that all consumer face liquidity constraints, $v > \overline{\theta}$, and if a medical product is financially affordable the spatial cost is always worth baring, that is $v - t > \overline{\theta}$. Lastly, each medical provider incurs a fix cost f, and a constant marginal production cost, $c > 0$.

3 Spot sales

Before turning to analyzing the spot market outcomes under spatial competition, consider first the benchmark case of a single monopolistic provider, as studied by BDG. The demand faced by the monopoly is $\overline{\theta}-p$, and the implied surplus, $PS = d\left(\overline{\theta} - p\right)(p - c)$, is maximized with the price $p_s^m = \frac{\overline{\theta}+c}{2}$,for which the surplus is $PS_s^m = d\left(\frac{\overline{\theta}-c}{2}\right)^2$.[13][14] For the monopolistic market to exist, this surplus must exceed the fix cost: $\frac{d}{4}\left(\overline{\theta} - c\right)^2 > f$. It is guaranteed that with multiple medical providers the equilibrium prices and spatial costs will be lower than in the monopolistic market. With multiple providers operating in the market, each provider j competes with their neighboring providers, denoted $j \pm 1$, over the marginal consumer $\tilde{x}$ that is located at the following point along the arc that connects them:

$$\tilde{x}_{s,j} \leq \frac{1}{2}\left(\frac{p_{j\neq 1} - p_j}{t} + \frac{1}{N}\right) \tag{2}$$

If the liquidity constraints were not binding the demand faced by producer j would compose all consumers within the distance $\tilde{x}$ from their location, generating the surplus $PS_j = d2\tilde{x}\left(\overline{\theta} - \underline{\theta}\right)(p_j - c)$ that is maximized with the (symmetric) price $p_s^* = \frac{t}{N} + c$.[15] Plugging this price into the surplus expression and equalizing it to the entry cost, that is imposing zero-profit, pins down the number of operating providers and corresponding equilibrium price: $N_s^e = \sqrt{\frac{dt}{f}}$, $p_s^e = \sqrt{\frac{ft}{d}} + c$.[16] However, for $p_s^e = \sqrt{\frac{ft}{d}} + c > \underline{\theta}$, the liquidity constraints are binding under spot sales, and this is the case that will be considered hereafter by assuming $c \geqslant \underline{\theta}$. Under binding liquidity constraints, if provider j charges a price equal

[12] The linearity of the utility function implies risk neutrality, which enables focusing on the affordability effect of insurance provision, with loss of generality for the main results derived below.

[13] The subscript s stands for spot market, and the superscript m denotes "monopoly".

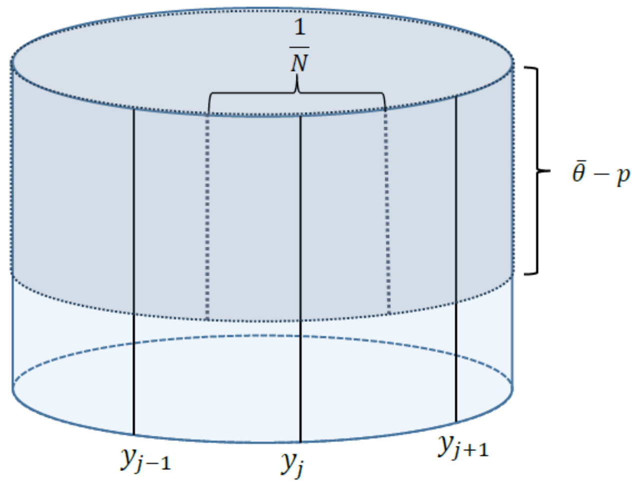
[14] For $c > \overline{\theta} - 2$ the liquidity constraints are binding for some consumers, $p_s^m > \underline{\theta}$.

[15] Assuming $v > p_s^*$.

[16] The asterisk superscript denotes maximizing values, and superscript e denote equilibrium values.

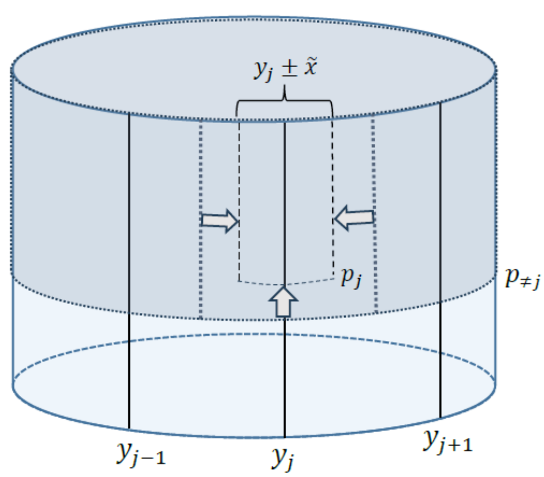
to their rivals', $p_j = p_{\neq j} = p$, all providers share the market equally and each provider sells to $\frac{d(\overline{\theta}-p)}{N}$ consumers, as illustrated in Figure 2.

Figure 2: Demand for product j under symmetric prices



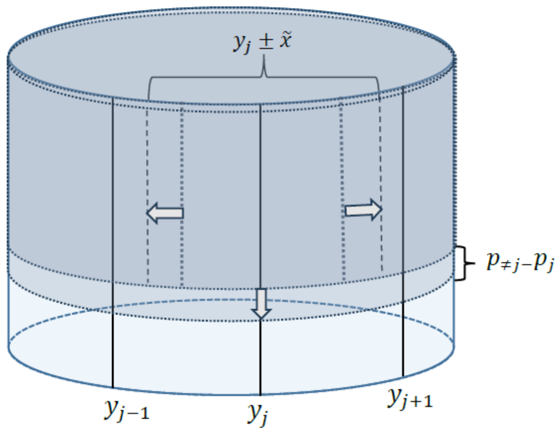
The upper darker part of the cylinder represents market demand, which comprises $d\left(\overline{\theta} - p_j\right)$ consumers, and its N^{th} share is served by provider j. If provider j raises their price above their rivals' the demand they face shrinks both horizontally and vertically, reading $d2\tilde{x}\left(\overline{\theta} - p_j\right)$, as illustrated in Figure 3.

Figure 3: Demand for product j for $p_j > p$



If provider j lowers their price, below their rivals', the horizontal extent of their sales will increase at the expense of their neighboring providers, and it will expand vertically to all consumer within the liquidity constraints range $p_{\neq j} - p_j$,[17] as illustrated in Figure 4.

Figure 4: Demand for product j under for $p_j < p$



As a marginal price-cut deviation from a uniform market price is always more profitable than a marginal price increase, the symmetric equilibrium price needs to be proof to price cut deviation, that generates the following surplus:

$$PS_{s,j} = d\left[2\tilde{x}\left(\overline{\theta} - p_{j+1}\right) \ + (p_{j+1} - p_j)\right](p_j - c) \tag{3}$$

Maximizing (3) with respect to p_j yields the following implicit expression for symmetric providers' optimal prices

$$p_s^* = \frac{t}{N}\frac{1}{1 + \frac{t}{\overline{\theta} - p_s^*}} + c \tag{4}$$

For any number of operating providers, the optimal price in (4) is lower than the one derived above for the fully served market, for any number of operating providers, N. This is because the liquidity constraints add the vertical margin along which demand decreases with price, thereby making demand more elastic. The zero-profit condition determines the number of operating providers, each serving $\frac{1}{N}$ of market demand under the price from equation (4):

[17] By the assumption $v - t > \overline{\theta}$.

$$\frac{d\left(\overline{\theta}-p_s^*\right)\left(p_s^*-c\right)}{N_s^e}=f \tag{5}$$

Substituting (5) back into (4) yields the implicit equilibrium price equation for spot-market sales

$$\left(p_s^e-c\right)^2=\frac{ft}{d}\frac{1}{\left(\overline{\theta}-p_s^e\right)+t} \tag{6}$$

Proposition 1 *For $\left(\overline{\theta}-c\right)>\frac{f}{d}$ there exists a unique equilibrium price in the spot market, p_s^e, that decreases with market size and increases with entry cost and the marginal production cost, spatial cost parameter, and consumers upper liquidity constraint.*

Proof. Within the relevant range, $p_s^*\in\left(c,\overline{\theta}\right)$, the right side of (6) increases with p_s^* - from $\frac{ft}{d}\frac{1}{\left(\overline{\theta}-c\right)+t}$ to $\frac{f}{d}$, and the left side increases from zero to $\left(\overline{\theta}-c\right)$. Therefore, if $\left(\overline{\theta}-c\right)>\frac{f}{d}$, a unique long run equilibrium exists, defined by the intersection between the two curves. Equation 6a implies that the equilibrium price increases with f,t and c, and decreases with d and $\overline{\theta}$. ■

4 Insurance sales

Turning to analyzing the market outcomes under health insurance coverage, consider first a monopolistic provider that sells their product under insurance policy with the fair risk premium, π, for which the implied demand and surplus are $\overline{\theta}-\pi p_I$ and $PS=d\left(\overline{\theta}-\pi p_I\right)\left(p_I-c\right)$, respectively.[18] The monopolistic profit-maximizing price and corresponding surplus are $p_I^m=\frac{\frac{\overline{\theta}}{\pi}+c}{2}$ and $PS_I^m=d\left(\frac{\overline{\theta}-\pi c}{2}\right)^2$, respectively, which are higher than their counterpart values under spot sales, due to the LDE effect highlighted by BDG.[19][20] Assuming $p_I^m=\frac{\frac{\overline{\theta}}{\pi}+c}{2}<v$, for $\frac{d}{4}\left(\overline{\theta}-c\right)^2<f<\frac{d}{4}\left(\frac{\overline{\theta}}{\pi}-c\right)^2$, the provision of medical care under insurance coverage supports the existence of the market that is missing under spot sales due to liquidity constraints.[21] However, even if the spot market exists, insurance coverage increases medical care utilization by making it more affordable: the insurance premium paid by consumers, $\pi p_I^m=\frac{\overline{\theta}+\pi c}{2}$, is lower than the monopolistic spot price, $p_s^m=\frac{\overline{\theta}+c}{2}$. The analysis of spatial

[18] The subscript I denotes market outcomes under insurance coverage.

[19] Demand elasticity (in absolute value) is $\frac{1}{\frac{\overline{\theta}}{\pi p}-1}$, and it increases with π.

[20] For $\pi=1$, these price and surplus expressions coincide with the spot market values, as all the market outcomes under insurance sales presented below.

[21] That is includes the case where $\overline{\theta}<c<\frac{\overline{\theta}}{\pi}$ and $f<\frac{d}{4}\left(\frac{\overline{\theta}}{\pi}-c\right)^2$.

competition below starts with the unrealistic case of perfectly competitive insurance markets, where each medical product is sold under separated insurance policy. This abstraction from comprehensive insurance policies that cover multiple medical products (providers) serves methodological purpose, which is neutralizing the bundling effect of such policies on prices, to allow isolating and highlighting the LDE and MS effects under study.[22] Nonetheless, the main results derived for single product insurance policies will be then reproduced with comprehensive coverage under the market structure studies in NRS, and for the case where medical prices are set through bargaining between medical providers and a public insurer.

4.1 Competitive prices

Consider a perfectly competitive insurance market, where each medical product j is being sold under a separated insurance policy for the fair risk premium $\pi \cdot p_j$. It assumed that consumers know their location on the market before getting sick.[23] Therefore, they will buy only one single product policy, which maximizes their expected utility. Under such insurance sales medical providers compete with their immediate neighboring providers over consumers' demand for insurance policies, and the marginal-consumer equation (2) modifies to

$$\tilde{x}_{I,j} \leq \frac{1}{2} \left[\frac{\pi \left(p_{j+1} - p_j \right)}{t} + \frac{1}{N} \right] \tag{7}$$

Equation (7) presents the LDE effect highlighted by BDG, though on a different demand margin: with a lower π consumers and thereby demand is less sensitive to the price differential between providers, thus horizontal competition between providers in relaxed, like in NRS analysis. If the liquidity constraints are binding also in the insurance market, that is some consumers cannot afford the equilibrium premiums, the surplus equation (3) modifies to

$$PS_{I,j} = d \left[2\tilde{x}_{I,j} \left(\overline{\theta} - \pi p_{j+1} \right) + \pi \left(p_{j+1} - p_j \right) \right] \left(p_j - c \right) \tag{8}$$

The second addend in the brackets of (8) represents the same LDE effect presented in BDG, on the vertical - liquidity constraints - margin of demand: with lower π this demand margin also becomes less elastic.[24] After (8) is substituted into (7), the symmetric surplus-maximizing price and corresponding insurance premium are obtained

[22] The bundling effect will be included and readdressed in Subsection 4.2 below.

[23] As in Lyon (1999) and Katz (2011) for example. This assumption is natural to the interpretation of spatial location as geographical address, but less intuitive for the interpretation of spatial location as specific medical need. Under the comprehensive insurance policies that will be considered below, it can be alternatively assumed that the consumer's actual medical need is drawn from a uniform distribution over the market circumference, as in Gal-Or (1999), Sorek (2016), and Sorek and Beard (2018).

[24] Particularly in comparison with spot market demand for which $\pi = 1$.

$$p_I^* = \frac{t}{\pi N} \frac{1}{1 + \frac{t}{\overline{\theta} - \pi p_I^*}} + c \tag{9}$$

$$\pi p_I^* = \frac{t}{N} \frac{1}{1 + \frac{t}{\overline{\theta} - \pi p_I^*}} + \pi c \tag{9a}$$

Equation (9) presents the dual LDE effect that was identified separately above: the π in the denominator of the first factor on the right side of (9) represents the LDE effect on the vertical - liquidity constraints - margin of demand, which was highlighted by BDG. The π in the denominator of the second factor on the right side of (9) represents the LDE effect on the horizontal margin along which providers compete over consumers, as in NRS. Due to this combined LDE effect the price in (9) is higher than the corresponding spot price presented in equation (4). Comparing (9a) with (4) reveals that short run insurance policies are cheaper than the spot market prices, that is insurance sales make medical care more affordable, thereby inducing the MS effect. The magnitude of both the LDE and MS effect increases with a lower probability, π. Both the LDE and MS effects work to increase profitability and thereby bring firm's market-entry beyond spot sales level, as to satisfy the zero-profit condition

$$\frac{d(p_I^e - c)\left(\overline{\theta} - \pi p_I^e\right)}{N_I^e} = f \tag{10}$$

Substituting (10) back into (9), and rearranging, yields the equilibrium prices under insurance sales

$$(p_I^e - c)^2 = \frac{ft}{\pi d} \frac{1}{\left(\overline{\theta} - \pi p_I^e\right) + t} \tag{11}$$

For $\left(\frac{\overline{\theta}}{\pi} - c\right)^2 > \frac{f\pi}{d}$ there exists an equilibrium price that solves (11), with an implied insurance premium that is affordable to some consumers, $\pi p_I^e < \overline{\theta}$. However, this condition is already contained in the one that guarantees the existence of an equilibrium spot price, presented in Proposition 1, implying that selling medical care under insurance coverage can support the existence of a missing spot market.[25] Equation (11) still shows the horizontal LDE effect, represented by the first π in the denominator. The π in the parenthesis in the denominator represents the MS effect that works to decrease equilibrium prices, and also cancels out the vertical LDE effect presented in (9).[26] The total effect of selling medical care

[25] For $(\overline{\theta} - c)^2 < \frac{ft}{\pi d} \frac{1}{\overline{\theta}(1-\pi)+t}$, medical prices under insurance sales exceed the highest liquidity constraint, $p_I^e > \overline{\theta}$.

[26] The LDE effect presented in (11a) is the horizontal LDE effect from the prices in equation (9). The

under insurance coverage on medical prices depends on whether the LDE effect or the MS effect is dominant.

Proposition 2 *For* $\frac{t}{\pi} < \overline{\theta} < \frac{\pi}{1-\pi}$ *there exists a parameters space* (c, f, t, d) *for which the liquidity constraints are binding under insurance sales and medical prices are lower than spot market prices.*

Proof. Comparing (11) with (6) reveals that equilibrium prices under insurance coverage are lower if

$$\frac{t+\overline{\theta}}{1+\pi} < p_s^e < \overline{\theta} \tag{P2}$$

For condition (P2) to hold it is necessary that $\frac{t}{\pi} < \overline{\theta}$. Under the latter condition, equation (6) implies that the equilibrium spot price satisfies the left inequality in (P2) if $(\frac{t+\overline{\theta}}{1+\pi} - c)^2 < \frac{ft}{d}\frac{1+\pi}{\pi(\overline{\theta}+t)}$, which is guaranteed to hold for sufficiently high marginal cost. For this price to result in a liquidity-binding insurance premiums it is also necessary that $\overline{\theta} < \frac{\pi}{1-\pi}$. Therefore, if $\frac{t}{\pi} < \overline{\theta} < \frac{\pi}{1-\pi}$, which requires also $t < \frac{\pi^2}{1-\pi}$, there exists a parameters space (c, f, t, d) to support condition (P2) above. ■

The contradictory LDE and MS effects apply also to the impact of insurance premium subsidies on medical prices in our model market. Under a premiums subsidy of rate τ for consumers equation (11) modifies to

$$(p_I^e - c)^2 = \frac{ft}{(1-\tau)\,\pi d}\frac{1}{\left[\overline{\theta} - (1-\tau)\,\pi p_I^e\right] + t} \tag{12}$$

Equation (12) shows that the premium subsidy intensifies both the LDE and MS effects. Replacing π with $(1-\tau)\,\pi$ in Proposition 2 yields the conditions under which insurance coverage with subsidized premiums brings medical prices below their spot sales level. The subsidy tightens the parameters space.

Proposition 3 *Insurance premium subsidies can bring down medical prices.*

Proof. Comparing (12) with (11) reveals that the premium subsidy brings down equilibrium prices down if $p_I^e > \frac{t+\overline{\theta}}{\pi(2-\tau)}$, where p_I^e is the equilibrium price under insurance coverage with no subsidy and τ is the considered subsidy rate. Equation (11) implies that this condition holds if

$$\left[\left(t+\overline{\theta}\right) - \pi(2-\tau)c\right]^2 < \frac{ft}{d}\frac{\pi(2-\tau)^3}{(1-\tau)\left(t+\overline{\theta}\right)} \tag{P3}$$

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vertical LDE effect presented in equation (9) does not show in (11a), as it is cancels out by the market size effect.

As mentioned above, for the insurance market to exist with no subsidies, it is required that $\pi p_I^e < \overline{\theta}$. For both conditions to be satisfied it is necessary that $\overline{\theta} > \frac{t}{1-\tau}$. Imposing this requirement on condition (P3) reveals that having $\left(\overline{\theta} - \pi c\right)^2 < \frac{\pi f}{d} < \left(\frac{\overline{\theta}}{\pi} - c\right)^2$ is sufficient for the insurance market to exist with no premium subsidies, and that the premium subsidy brings down medical prices, if $\overline{\theta} > \frac{t}{1-\tau}$. ■

Next, consider a policy intervention that makes insurance premiums affordable to all consumers through financial transfers, which is a Universal Coverage policy, "UC". In this case both the MS and the LDE effects are maximized: all consumers are served, and the restraining effect of the liquidity constraints on equilibrium prices is muted as pricing considerations are restricted to the horizontal competition over market shares. With all consumers being insured, the producer-surplus equation (8) modifies to

$$PS_{UC,j} = d2\tilde{x}_{UC,j}(p_j - c) \tag{13}$$

Plugging the marginal consumer from equation (7) into (13) and maximizing for the price yields

$$p_{UC}^* = \frac{t}{\pi N} + c \tag{14}$$

The zero-profit condition under UC is

$$f = \frac{d\left(p_{UC}^e - c\right)}{N_{UC}^e} \tag{15}$$

and substituting (15) back into (14) yields the equilibrium price and market-entry level:

$$p_{UC}^e = \sqrt{\frac{tf}{\pi d}} + c,\ N_{UC}^e = \sqrt{\frac{td}{\pi f}} \tag{16}$$

For $\pi = 1$, the expressions in (16) coincide with the spot market outcomes with no liquidity constraints. The equilibrium price is higher under insurance coverage, i.e., for $\pi < 1$, due to horizontal LDE effect, and the higher prices imply higher market-entry under the zero-profit requirement. For the UC policy to be effective, the equilibrium insurance premiums implied by (16) should not be affordable to all consumers without transfers, $\pi p_I > \underline{\theta}$, that is $\sqrt{\frac{\pi t f}{d}} + \pi c > \overline{\theta} - 1$.[27]

Proposition 4 *Universal coverage policy can bring down medical prices below their baseline level under insurance sales.*

[27] If the reversed inequality holds, the equilibrium prices under insurance coverage imply that the insurance premiums are affordable to consumers. In this case equation (11a) is not relevant.

Proof. Plugging the price from (16) back into (11) reveals that an effective UC policy brings down medical prices under insurance coverage if the following condition holds

$$\overline{\theta} - \sqrt{\frac{\pi t f}{d}} - \pi c < 1 - t \tag{17}$$

For effective UC policy to be viable, the left side in (P4) that reads $\overline{\theta} - \pi p_{UC}$, must be positive. Therefore, having $t < 1$ is necessary for satisfying (P4). Condition (P4) contains the requirement for the UC policy to be effective. Finally, having $\pi\sqrt{\frac{f\pi}{d}} < \overline{\theta} - \pi c < \sqrt{\frac{\pi t f}{d}} + 1 - t$, guarantees also the existence of a baseline equilibrium price from equation (11). Under these conditions, effective universal coverage brings down medical prices under insurance coverage. ■

Proposition 5 *Medical prices under universal coverage policy can be lower than their spot market level.*

Proof. Plugging the price from (16) back into (6) reveals that an effective UC policy brings medical prices below their spot market level if

$$\overline{\theta} - \left(\sqrt{\frac{tf}{\pi d}} + c\right) < \pi - t \tag{P5}$$

For the price under UC policy to be lower than the spot price it must satisfy $p_{UC} < \overline{\theta}$. Therefore, the left side in (P5), which reads $\overline{\theta} - p_{UC}$, must be positive, requiring $\pi > t$. Moreover, combining the requirement $p_{UC} < \overline{\theta}$ with the UC policy being effective, that is $\pi p_{UC} < \overline{\theta} - 1$, implies the following additional necessary condition: $\overline{\theta} < \frac{1}{1-\pi}$. ■

Proposition 5 applies also to the analysis of NRS that is extended to include liquidity constraints. In their analysis, all medical products are bundled under a single comprehensive insurance policy and sick consumers are paying the coinsurance rate, $\sigma \in (0, 1)$, when utilizing medical care. Sick consumers choose their preferred provider by minimizing the sum of the implied co-payment charge σp and associated spatial cost. The lower the co-payment rate, the less sensitive consumers are to differences in prices set by neighboring medical providers and, consequently, equilibrium prices rise. This is the horizontal LDE effect highlighted by NRS. This effect can be represented in equations (16) above by replacing π with the co-payment rate σ:

$$p_I^e = \sqrt{\frac{tf}{\sigma d}} + c, \; N_I^e = \sqrt{\frac{dt}{\sigma f}} \tag{18}$$

The identical presentation of σ and π in equations (16) and (17), respectively, implies that the results summarized in Proposition 5 regarding the effect of UC policy on medical prices with single-product insurance policies and no co-payments, apply also to the case studied by NRS with comprehensive insurance policies and positive co-payments. That is the inclusion of medical care under insurance coverage, and particularly UC policy, can bring medical prices down, contrary to the results NRS derived for a market with no consumers liquidity constraints.

4.2 Bargained prices

This subsection validates the main results obtained thus far in a more realistic insurance-market framework, in which medical prices are set through bargaining between medical providers and an insurer that bundles all contracted medical products under a single comprehensive policy. For simplicity, assume a single public insurer that aims to maximize consumers' welfare with a fair risk premium. Sick insured consumers bear only the spatial cost associated with utilizing their preferred medical product under coverage. Therefore, all the providers included the insurance policy share the market equally - each one sells to $\frac{1}{N}$ of the insured consumers. The expected cost per insured consumer for the insurer is $\pi\overline{p} = \pi \sum_{j=1}^{N} \frac{p_j}{N}$, which is also the insurance premium. For this premium, consumers demand for insurance is $d\left(\overline{\theta} - \pi\overline{p}\right)$ and the expected surplus for provider j that contracts with the insurer is[28]

$$PS_{IB,j} = \frac{d}{N}\left(\overline{\theta} - \pi\overline{p}\right)(p_j - c) \tag{19}$$

I employ the "Nash-in-Nash" bargaining procedure, in which the insurer bargains simultaneously with all providers.[29] Given that all other providers are included in the policy, contracting also with provider j will yield consumers the expected additional surplus

$$\triangle CS_{IB,j} = d\left(\overline{\theta} - \pi\overline{p}\right)\left(\frac{t}{2N^2} + \frac{p_{\neq j} - p_j}{N}\right) \tag{20}$$

The surplus expressions (18) and (19) imply the following Nash Product, NP, which is maximized by the price bargained between the insurer and provider j

[28] The subscript IB denotes values under insurance coverage with bargained prices.

[29] Arie et al. (2024) show that this simultaneous bargaining can result in overpricing that eliminates consumers surplus and offer a sequential bargaining procedure to overcome this overpricing effect.

$$NP = \left[\frac{d\left(\overline{\theta} - \pi\overline{p}\right)}{N} \left(\frac{t}{2N} + (p_{\neq j} - p_j) \right) \right]^{\alpha} \times \left[\frac{d\left(p_j - c\right)\left(\overline{\theta} - \pi\overline{p}\right)}{N} \right]^{1-\alpha} \tag{21}$$

where $\alpha \in (0,1)$ defines the insurer's relative bargaining power. Maximizing (20) with respect to p_j (counting for its effect on the average price $\overline{p}$) yields the following symmetric bargaining-outcome price

$$p^*_{IB} = \frac{(1-\alpha)}{\frac{2\alpha N}{t} + \frac{\pi}{N\left(\overline{\theta} - \pi p^*_B\right)}} + c \tag{22}$$

Equation (21) shows that the number of contracted providers, N, induces contradicting effects on the bargained price: the first addend in the denominator on the right side of (21) implies that with more contracting providers the bargained price goes down. This is the "market power effect" which weakens the bargaining position of each provider as the number of providers increases. This effect is amplified with the relative bargaining power of the insurer, α, and it weakens with consumers relative preference for product variety, t.[30] The second addend shows the positive impact of the number of negotiating providers on the bargained price. This is the "bundling effect" induced by selling all medical products under a single policy that is sold for the average products price. As the number of providers increases, the effect of a unilateral price increase by a single provider on the average price diminishes, making such a price increase more beneficial. This effect, represented by $\frac{\pi}{N\left(\overline{\theta} - \pi p^*_B\right)}$, is the rate of change in demand for insurance due to a marginal increase of price by a single provider. For $N^2 > \frac{t\pi}{2\alpha\left(\overline{\theta} - \pi p^*_{IB}\right)}$, the market power effect dominates the bundling effect that is the bargained prices decrease with the number of contracted providers. Imposing the zero-profit condition on (21) yields the equilibrium bargained price:

$$\left(p^e_{IB} - c\right)^2 = \frac{(1-\alpha)\, ft}{2\alpha d} \frac{1}{\left(\overline{\theta} - \pi p^e_{IB}\right) + \frac{\pi t f^2}{2\alpha d^2 \left(\overline{\theta} - \pi p^e_{IB}\right)^2 \left(p^e_{IB} - c\right)^2}} \tag{23}$$

Under universal coverage policy the bundling effect is muted as demand becomes independent of the price, and the factor $\left(\overline{\theta} - \pi\overline{p}\right)$ in the Nash Product (20), is replaced with 1. Consequently, the resulting equilibrium bargained prices and corresponding market-entry level modify to

[30] Ho and Lee (2019) and Leibman (2022) consider the potential gain to the insurer from excluding providers, as exclusion is used to threaten the contracted providers with replacement.

Galor Or (1999) also highlights gains to competing insurers from exclusive contracts with selected providers, as a means to differentiate insurance policies from each other.

$$p_{UCB}^e = \sqrt{\frac{(1-\alpha) ft}{2\alpha d}} + c,\ N_{UCB}^e = \sqrt{\frac{(1-\alpha) dt}{2\alpha f}} \tag{24}$$

Having $\pi p_{UCB}^e \in \left(\underline{\theta}, \overline{\theta}\right)$, or $\overline{\theta} - \pi p_{UCB}^e \in (0,1)$, is necessary for the UC policy to be viable and effective.

Proposition 6 *Universal coverage policy can bring down bargained medical prices.*

Proof. Plugging (23) back into (22) reveals that UC prices are lower if

$$\left(\overline{\theta} - \pi p_{UCB}^e\right)^2 - \left(\overline{\theta} - \pi p_{UCB}^e\right)^3 > \frac{\pi f}{d(1-\alpha)} \tag{25}$$

The expression in the parentheses on the left side of (P6) is effective demand under the UC policy. Within the relevant range, $\overline{\theta} - \pi p_{UCB}^e \in (0,1)$, the left side of (P6) follows an inverted U shape, varying from zero to zero as effective demand, $\overline{\theta} - \pi p_{UCB}^e$, increases. It is maximized with $\overline{\theta} - \pi p_{UCB}^e = \frac{2}{3}$, for which condition (P6) reads $\frac{4}{27} > \frac{\pi f}{d(1-\alpha)}$. With this condition satisfied there exists a parameters space around the maximizing value ($\overline{\theta} - \pi p_{UCB}^e = \frac{2}{3}$) for which (P6) holds and effective universal coverage policy brings down bargained prices. ■

Notice that if prices are lower under UC policy the second denominator in the right side of (22) satisfies is smaller than one: $\left(\overline{\theta} - \pi p_{IB}^e\right) + \frac{\pi t f^2}{2\alpha d^2 \left(\overline{\theta} - \pi p_{IB}^e\right)^2 \left(p_{IB}^e - c\right)^2} < 1$. Recall also that for the market power effect to dominate the bundling effect in (21), it is required that $N^2 > \frac{t\pi}{2\alpha\left(\overline{\theta} - \pi p_{IB}^*\right)}$. Under the zero-profit condition the latter inequality reads $\left(\overline{\theta} - \pi \overline{p}\right) > \frac{t\pi f^2}{2\alpha d^2 \left(\overline{\theta} - \pi p_{IB}^*\right)^2 (p_j - c)^2}$. Therefore, within the parameters space that supports Proposition 6, for $\overline{\theta} - \pi p_{UCB}^e > \frac{1}{2}$, it is also guaranteed that the market size effect dominates the bundling effect and the market size effect on the bargained prices under the UC policy is at work.

5 Welfare

From the ex-ante welfare perspective, the optimal market outcomes maximize the sum of the expected consumers' surplus, which is their expected net utility, and producers' profits. If insurance sales result in lower prices and higher market-entry as highlighted in the propositions above, all consumers are better off. However, higher prices and higher market-entry can still make all consumers better off if the deduction in the spatial cost associated with higher market-entry makes up for the price increases. For a given market price and market-entry level, market welfare under insurance sales, denoted W, is given by

$$W(p,N) = L\left(\overline{\theta} - \pi p\right)\pi\left[(v - \pi c) - \pi 2Nt\int_0^{\frac{1}{2N}} x dx\right] + L(1-\pi)\left(\pi p - \underline{\theta}\right)v - Nf = \tag{26}$$

The first addend is the sum of expected surpluses for consumers and providers that engage in the medical care market. The second addend is the expected utility of the consumers who forego buying insurance coverage and medical care due to liquidity constraints, and the last addend is the fix costs made by the operating providers. Simplifying (24) yields

$$W(p,N) = d\left(\overline{\theta} - \pi p\right)\left[(v - c) - \frac{t}{4N}\right] - Nf + v(L - d) \tag{24a}$$

Equation (24a) implies that for any given market-entry level, N, lowering medical prices to relax liquidity constraints improves welfare. Maximizing (24a) for N reveals that the efficient market entry level decreases with medical price, as the number served consumers decreases:[31]

$$N^{**} = \sqrt{\left(\overline{\theta} - \pi p\right)\frac{dt}{4f}} \tag{27}$$

For $\pi = 1$, equation (24a) and equation (25) apply to the spot market welfare maximizing outcomes. Therefore, the first-best welfare policy incorporates the price that makes medical care affordable to all consumers, $p^{**} = \underline{\theta}$, and the corresponding market-entry level from (25) for the fully served market.[32] To assess the welfare implications of insurance sales in our model, consider the second-best market outcomes subject to zero-profit. The results of this analysis are also useful as a guide to price-regulation as a single instrument policy. Imposing the zero-profit condition (10) on (24a) yields the following welfare maximizing prices under spot sales and insurance sales, for $\pi = 1$ and $\pi < 1$, respectively[33]

$$(p^{**} - c)^2 = \frac{tf}{4d\left[v + \overline{\theta} - (1+\pi)p^{**}\right]} \tag{28}$$

The welfare maximizing price in (26) balances between higher medical care utilization that increases total welfare and firm's market-entry, which is excessive for a given price (as in Salop's original model). The welfare maximizing price decreases with the value of medical care, v, and increases with π. The latter result implies that the welfare maximizing

[31] The welfare maximizing outcomes are denoted with double asterisk.

[32] These market outcomes can be supported by UC with the regulated the $p = \frac{t}{4} + c$, which is the equilibrium bargained price for $\alpha = \frac{2}{3}$.

[33] Having $\left(v + 1 - \frac{\overline{\theta}-1}{\pi}\right)\left(\frac{\overline{\theta}-1}{\pi} - c\right)^2 < \frac{tf}{4d} < \left(v - \overline{\theta}\right)\ \left(\overline{\theta} - c\right)^2$ guarantees an interior solution for (26).

price under insurance sales is lower than under spot sales. This is due to the market size effect induced under insurance sales, which implies a higher market-entry at any price level. Comparing (26) with (11) reveals that under the initial assumption, $v - p - t > 0$, the welfare maximizing prices are lower than the equilibrium prices, for any π value. The latter results imply the following Proposition.

Proposition 7 *If the provision of medical care under insurance coverage results in lower (higher) medical price, insurance sales are welfare improving (impairing). Yet, equilibrium prices in the model market are always above the welfare maximizing ones and providers' market-entry level is excessive.*

6 Conclusion

This study presented the first analysis of the implications of health insurance provision to liquidity- constrained consumers in a market with multiple differentiated medical providers. The analysis adds to the literature by highlighting the Market Size effect induced under insurance sales as liquidity constraints are relaxed and more consumers can afford to utilize medical care. The market size effect works to decrease medical prices by bringing more medical providers into the market, thereby intensifying competition. It was shown that the MS can dominate market outcomes, bringing medical prices under insurance sales below their spot market level, resulting in a Pareto improvement for all consumers and an increase in total market welfare. Moreover, it was also demonstrated that insurance premium subsidies and universal insurance coverage policies can bring down medical policies through the MS effect they induce. These results yet call for empirical validation and re-examination in a framework the includes powerful for-profit insurers, which are both left for future studies.

References

[1] Arie G., Grieco P., Rachmilevitz S., 2024. Bargaining on Price on Behalf of Price-Insensitive Downstream Consumers. Forthcoming in International Journal of Industrial Organization.

[2] Besanko D., Dranove D. and Gartwaite C., 2020. Insurance Access and Demand Response: Price and welfare implications. Journal of Health Economics 73, 1-27.

[3] Blume-Kohout M.E, Sood N., 2013. Market Size and Innovation: Effects of Medicare Part D on Pharmaceuticals Research and Development. Journal of Public Economics 97, 327-336

[4] Brekke, K. R., Siciliani, L., and Straume, O. R. (2011), Hospital Competition and Quality with Regulated Prices, Scandinavian Journal of Economics 113, 444–469.

[5] Brekke K.R, Siciliani L., Straume O.R, 2017. Hospital Mergers with Regulated Prices. Scandinavian Journal of Economics 119 , 597–627.

[6] Brekke K.R, Siciliani L., Straume O.R., 2017. Horizontal Mergers and Product Quality. Canadian Journal of Economics 50, 1063–1103.

[7] Decarolis F., Polyakova M., Ryan S.P., 2020. Subsidy Design in Privately Provided Social Insurance: Lessons From Medicare Part D. Journal of Political Economy 128, 1712–1752.

[8] Dubois P., de Mouzon O., Scott-Morton F., Seabright P., 2015. Market Size and Pharmaceutical innovation. The RAND Journal of Economics 46, 844–871.

[9] Einav L., Finkelstein A., and Tebaldi P., 2024. Market Design in Regulated Health Insurance Markets:Risk Adjustment vs. Subsidies. NBER Working Paper 32586.

[10] Finkelstein A., 2007. The aggregate Effects of Health Insurance: Evidence from the Introduction of Medicare. Quarterly Journal of Economics 122,1-37.

[11] Finkelstein A., Hendren N., and Shepard M., 2019. Subsidizing Health Insurance for Low-Income Adults: Evidence from Massachusetts. American Economic Review 109, 1530–67.

[12] Gal–Or, E. 1999. Mergers and Exclusionary Practices in Health Care Markets. Journal of Economics & Management Strategy 8, 315–350.

[13] Gal-Or, E., 1999. The Profitability of Vertical Mergers between Hospitals and Physician practices. Journal of Health Economics 18, 621–652.

[14] Jaffe S.,Shepard M., 2020. Price - Linked Subsidies and Imperfect Competition in Health Insurance. American Economic Journal: Economic Policy 12, 279–311.

[15] Katz, M. L. 2011. Insurance, Consumer Choice, and the Equilibrium Price and Quality of Hospital. The B.E. Journal of Economic Analysis & Policy (Advances) 11, Article 5.

[16] Liebman E., 2022. Bargaining in Markets with Exclusion: An Analysis of Health Insurance Networks. Working paper. https://drive.google.com/file/d/1k0ZreyxXJk71OlPaZAVj2X7wGmqObE3H/view

[17] Lyon, T. P. 1999. Quality Competition, Insurance, and Consumer Choice in Health Care Markets. Journal of Economics & Management Strategy 8:545–80.

[18] Nell, M., A. Richter, and J. Schiller. 2009. When Prices Hardly Matter: Incomplete Insurance Contracts and Markets for Repair Goods. European Economic Review 53:343–354.

[19] Nyman, J.A., 1999. Health Insurance: the Access Motive. Journal of Health Economics 18, 141-52.

[20] Polyakova M., Ryan S.P., 2021. Subsidy Targeting with Market Power, NBER Working Paper 26367.

[21] Polyakova M., Ryan S.P., 2023. Market Power and Redistribution: Evidence from the Affordable Care Act. Working paper. https://bpb-us-w2.wpmucdn.com/sites.wustl.edu/dist/7/3643/files/2023/05/ACA_SubsidyTargeting-aug-26-2022.pdf

[22] Salop S.C., 1979. Monopolistic Competition with Outside Goods. The Bell Journal of Economics 10, 141-156.

[23] Competition and Product Choice in Option-Demand Markets. The B.E. Journal of Economic Analysis & Policy (contributions) 2016, 16, 785-805.

[24] Sorek G., Beard R.T., 2018. Public Health Insurance with Monopolistically Competitive Providers and Optional Spot Sales. The B.E. Journal of Economic Analysis & Policy.

[25] Tebaldi P., Torgovitsky A. and Yang H., 2023. Nonparametric Estimates of Demand in the California Health Insurance Exchange. Econometrica 91, 107-146.

[26] Tebaldi P., 2024. Estimating Equilibrium in Health Insurance Exchanges: Price Competition and Subsidy Design under the ACA. Forthcoming in The Review of Economic Studies, .