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 endogenous number of 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. By easing liquidity constraints, insurance provision induces also a Market Size effect that works to decrease prices by bringing new providers into the market. The relative strength of the MS effect increases with consumers population size and with a higher marginal cost to entry cost ratio. When the MS effect dominates the LDE effect medical prices are lower under insurance sales. These results apply also to insurance premium subsidies and universal insurance coverage. Market welfare and consumer surplus increase under price caps that reduce the number of medical providers.

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1 Introduction

The affordability of medical care and health insurance is a major public concern in developed economies and have been a main argument for public health insurance provision and insurance premium subsidies. Health insurance makes medical care affordable to consumers who cannot pay the spot medical prices due to liquidity constraints.[1] Yet, the implications of insuring liquidity-constrained consumers to market outcomes 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 products) and liquidity-constrained consumers.

The analysis is conducted within Salop's (1979) model of spatial competition that is extended to include consumer-specific liquidity constraints. It is shown that 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 under insurance provision works to increase equilibrium medical prices, thereby bringing new firms into the market. Second is the Market-Size ("MS") effect: as insurance provision makes medical care affordable to more consumers it increases effective demand. This increase in effective demand induces further market entry of medical providers, which works to lower equilibrium medical prices by intensifying competition.

The relative strength of the MS effect increases with a high marginal cost of medical care provision relative to market entry cost per consumer: a higher marginal cost implies a higher spot market prices which makes more consumers forego medical care due to liquidity constraints, that is making the liquidity constraints more binding to spot market demand. A lower entry cost per consumer implies higher market-entry by new firms once the liquidity constraints are eased under insurance sales. Therefore, if consumers' liquidity constraints sufficiently bind spot demand, and firms-entry potential is sufficiently high, the negative MS effect on medical prices

[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

dominates the positive LDE effect.[2]

The current literature on the implications of insurance provision to medical care market outcomes emphasizes the role of the LDE effect, but abstract the MS effect which is highlighted in the present analysis and induces its novel results: (a) when spot demand is confined by consumers' liquidity constraints, the provision of medical care under insurance coverage has ambiguous effect on medical price, which depends on firms cost structure, (b) These results apply also to the implications of subsidizing insurance premiums and universal insurance coverage to market outcomes - these are two popular policies aimed at extending the population of insured consumer, and (c) Market welfare and consumer surplus can be increased by capping medical prices. The welfare (consumer surplus) maximizing prices for insurance sales are lower (higher) than for spot sales.

The remainder of the paper is organized as follows: Section 2 highlights the proposed contribution of this study to current literature. Section 3 presents the spatial competition model with consumer-specific liquidity constraints. Section 4 presents the equilibrium in the spot market for medical care. Section 5 studies the implications of health insurance sales to market outcomes. Section 6 studies the welfare properties of the studied market, and Section 7 concludes this study.

2 Literature

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. A more recent work by Besanko, Dranove and Garthwaite (2020), hereafter "BDG", study the welfare effect of insurance provision in a market with liquidity-constrained consumers. They analyze a market with monopolistic medical care provider to highlight the LDE effect and its

[2]For example, a high entry-to-marginal costs ratio likely characterizes pharmaceuticals market, and low entry-to-marginal costs ratio likely characterizes medical clinics that offer specialist physicians services.

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

welfare implications: as demand for insurance premiums is less elastic than spot market demand, the monopolistic provider sets a higher price when selling medical care under insurance coverage. Consequently, while health insurance provision benefits the consumers who gain access to medical care through the improved affordability, it hurts the consumers who could afford paying the (lower) spot market price.

Nell Richter and Schiller (2009), hereafter "NRS", study a different LDE effect and its welfare implications within Salop's (1979) circular market framework of spatial competition, with no liquidity constraint:[4] in their analysis all market products are covered under the same insurance policy, and medical providers compete over sick consumers who face out-of-pocket expenses defined by a coinsurance rate. With a lower coinsurance rate consumers become less sensitive to differences in medical prices when choosing between providers, and, consequently, equilibrium medical prices under insurance sales increase beyond their spot market level. This increase in equilibrium prices under insurance sales, brings more medical providers into the market, which is welfare impairing. In NRS' analysis, however, consumers have no liquidity constraints.

The present study combines the analyses by BDG and NRS in an integrated framework of spatial competition with endogenous market entry and liquidity-constrained consumers. Within this framework, the provision of medical care under insurance coverage induces the Market Size effect, along with the LDE effects studied by BDG and NRS. The MS effect offsets and possibly even counters the LDE effect on medical price, by bringing more medical providers into the market.[5] Market entry benefits all consumers by working to lower medical prices and reducing spatial costs. Nonetheless, due to the business stealing effect, market entry under both spot and insurance sales remains excessive in the studied model with liquidity constrained consumers, as in NRS and Salop's (1979) original analysis.

[4] Various other studies employed Salop's original framework to analyze various aspects of health care market performance. See for example Gal-Or (1999a,b), Brekke et al. (2011), Grossman (2013), Brekke et al. (2017a,b) Sorek and Beard (2018). NRS note that their analysis, as much as the present one, applies not only to health insurance and medical, but also to other "repair" markets, such as car repairs that are commonly provided under car insurance coverage.

[5] The MS effect is absent from BDR and NRS analyses because the former assume monopolistic provider and the latter abstract from liquidity constraints.

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.[6] Therefore, the theoretical results derived below call for empirical validation that falls beyond the scope of the present study.[7]

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 of premium subsidies - 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 effect of the subsidies on medical care markets, in particular the MS effect that is highlighted here.[8][9] The analysis of a unified framework that comprises both market layers - insurers and medical providers - is left for future work.

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

[7]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.

[8]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.

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

3 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 the same, yet independent, probability $\pi \in (0, 1/2)$ 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 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 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 the liquidity constraint range is denoted $h \equiv \overline{\theta} - \underline{\theta}$. Therefore, each consumer i is defined by location and liquidity constraint coordinates, $i = (x_i, \theta_i)$ on the out area of the cylinder of unit circumference and h units height.

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 met (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.[10] Therefore, the net utility for the sick consumer i from utilizing medical care from provider j is[11]

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

[11]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.

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

If $v > \theta_i$, consumer i is subject to a liquidity constraint, and if $v > p > \theta_i$ the liquidity constraint is binding. To enhance tractability in the analysis below, and without loss of generality, it is further assumed that all consumers face liquidity constraints, $v > \overline{\theta}$, and if they can financially afford a medical product the spatial cost is always worth bearing, that is, $\forall i : v - t > \theta_i$, which is guaranteed to hold if $t < v - \overline{\theta}$ (given the assumed unit circle-circumference). The latter assumption means that the financial constraint is more binding for purchase decisions than spatial costs, and its technical implications to the analysis will be clarified below. Lastly, each medical provider incurs a fix cost f, and a constant marginal production cost, c.

4 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 $PS_s^m = d\left(\frac{\overline{\theta}-c}{2}\right)^2$.[12][13] For the monopolistic market to exist, this surplus must exceed the fix cost: $\frac{d}{4}\left(\overline{\theta} - c\right)^2 > f$.

With multiple providers operating in the market, each provider j competes with their neighboring providers, denoted $j \pm 1$, over the marginal consumer $\tilde{x}$ located along the arc that connects them:

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

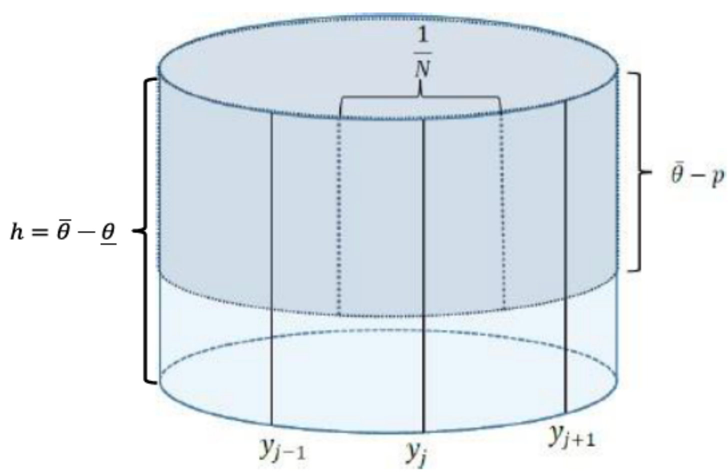
If the liquidity constraints were not binding the demand faced by producer j

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

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

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 $p_s^* = \frac{t}{N} + c$. 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 for the fully-served market: $N_s^e = \sqrt{\frac{dt}{f}}$, $p_s^e = \sqrt{\frac{ft}{d}} + c$.[14] However, for $p_s^e = \sqrt{\frac{ft}{d}} + c > \underline{\theta}$, the liquidity constraints are binding under spot sales, which is the case we confine attention to hereafter, by assuming $c \geqslant \underline{\theta}$. Under binding liquidity constraints, if provider j charges a price equal to their rivals', $p_j = p_{\neq j} = p$, all providers share the market equally and each provider sells to $\frac{d\left(\overline{\theta}-p\right)}{N}$ consumers, as illustrated in Figure 1 below.

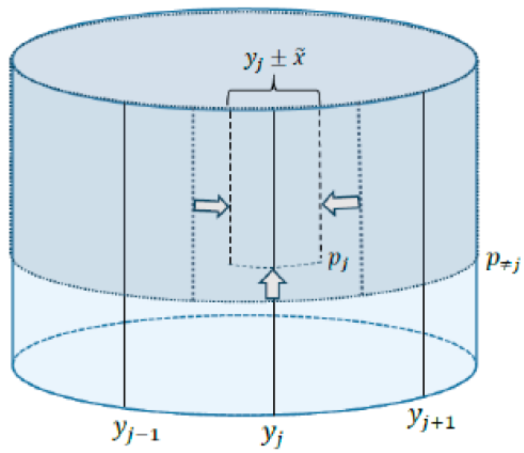
Figure 1: Demand for product j under symmetric prices



The upper darker part of the cylinder represents market demand, which comprises $d\frac{\left(\overline{\theta}-p_j\right)}{h}$ 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 $d\frac{2\tilde{x}\left(\overline{\theta}-p_j\right)}{h}$, as illustrated in Figure 2.

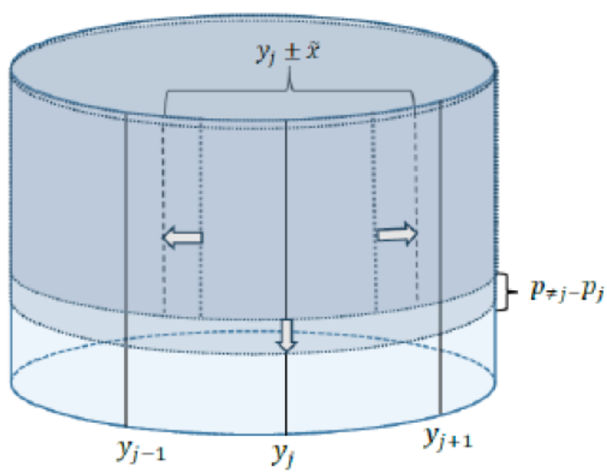
[14]The asterisk superscript denotes maximizing values, and the superscript "e" denotes equilibrium values.

Figure 2: 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. In addition, demand for their product expands vertically to all consumer within the liquidity constraints range $p_{\neq j} - p_j$, as illustrated in Figure 3 below.

Figure 3: Demand for product j under for $p_j < p$



The vertical demand expansion to all consumers who can afford purchasing product j is due to the assumption made above that the spatial cost is always worth bearing, that is $v - t > \overline{\theta}$. [15] The liquidity constraints in the market under study imply that a marginal price-cut deviation from a uniform market price is always more profitable than a marginal price increase. Therefore the symmetric equilibrium price needs to be proof to price cut deviation, which under the assumption $v - t > \overline{\theta}$ generates the following surplus:

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

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

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

The zero-profit condition determines the number of operating providers, each serving $\frac{1}{N}$ of market demand under the price from equation (4):

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

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

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

Proposition 1. *For* $(\overline{\theta} - c)^2 > \frac{fh}{d}$ *there exists a unique equilibrium price in the spot market,* $p_s^e \in \left[c, \overline{\theta}\right]$*, which decreases with market size, d, and increases with the liquidity constraints range, entry cost and the marginal production cost, marginal spatial cost, and consumers upper liquidity constraint (h, f, c, t,* $\overline{\theta}$*).*

[15] Without this assumption the width of the vertical demand expansion varies within the liquidity constraint range $p_{\neq j} - p_j$, which complicate calculations without altering the content of the analysis and its qualitative results.

Proof. Within the relevant range, $p_s^* \in \left(c, \overline{\theta}\right)$, the right side of (6) increases with p_s^* - from $\frac{fht}{d}\frac{1}{\left(\overline{\theta}-c\right)+t}$ to $\frac{f}{d}$, and the left side increases from zero to $\left(\overline{\theta}-c\right)$. Therefore, if $\left(\overline{\theta}-c\right)^2 > \frac{hf}{d}$, a unique equilibrium exists, defined by the intersection between the two curves. Equation (6) implies that the equilibrium price increases with h, f,t and c, and decreases with d and $\overline{\theta}$. ■

5 Insurance sales

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 $\frac{\overline{\theta}-\pi p_I}{h}$ and $PS = \frac{d}{h}\left(\overline{\theta}-\pi p_I\right)(p_I - c)$, respectively.[16] The monopolistic profit-maximizing price and corresponding surplus are $p_I^m = \frac{\frac{\overline{\theta}}{\pi}+c}{2}$ and $PS_I^m = \frac{d}{h}\left(\frac{\overline{\theta}-\pi c}{2}\right)^2$, respectively, which are higher than their counterpart values under spot sales, due to the LDE effect.[17] For $\pi = 1$, these price and surplus expressions coincide with their corresponding spot market values, as do all market outcomes under insurance sales presented below.

Assuming $p_I^m = \frac{\frac{\overline{\theta}}{\pi}+c}{2} < v$, for $\left(\overline{\theta}-c\right)^2 < \frac{4hf}{d} < \left(\frac{\overline{\theta}}{\pi}-c\right)^2$, providing medical care under insurance coverage supports the existence of the market that is missing under spot sales due to liquidity constraints. However, even if the spot market exists, insurance sales increase 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 with multiple providers below starts with the unrealistic case of perfectly competitive insurance markets, under two alternative modeling approaches: Subsection 5.1 established the main results of this study following the modeling approach of the insurance market employed by BDG's. Subsection 5.2 shows that the same results hold also under the modeling approach employed by NRS. Subsection 5.3 reproduces the same qualitative results for the more realistic scenario where medical prices are set through bargaining between insurers and providers.

[16]The subscript I denotes market outcomes under insurance sales.

[17]Demand elasticity (in absolute value), given by $\frac{1}{\frac{\overline{\theta}}{\pi p}-1}$, decreases with lower π.

5.1 Competitive prices

Consider a perfectly competitive insurance market, where each medical product j is being sold under a separate insurance policy for the fair risk premium $\pi \cdot p_j$. It is assumed that consumers know their location on the market before getting sick.[18] Therefore, they will buy only one single-product policy, which maximizes their expected utility. Under such insurance sales each medical provider competes with their neighboring providers, as in the spot market, but 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 on a demand's horizontal margin: with a lower π consumers are less sensitive to the price differential between providers, thus horizontal competition between providers is relaxed. If the liquidity constraints are binding also in the insurance market, some consumers cannot afford the equilibrium premiums, and the surplus equation (3) modifies to[19]

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

The π in the first 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.[20] After (8) is substituted into (7), the symmetric surplus-maximizing price and corresponding insurance premium are obtained

[18] 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 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).

[19] It will be shown below that this is the case if $\sqrt{\frac{\pi t f}{d}} + \pi c < \overline{\theta} - h$.

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

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

Equation (9) presents the dual LDE effect that was identified separately above: the π in the denominator of the first (second) factor on the right side of (9) represents the LDE effect on demand's horizontal (vertical) margin. Due to this combined LDE effect the price in (9) is higher than the corresponding spot price presented in equation (4). Comparing the insurance premium in (9) with the spot prices in (4) reveals that the insurance premiums are more affordable, thereby inducing the MS effect. The magnitude of both the LDE and MS effect increases with a lower probability, π, and they both work to increase profitability, thereby inducing firms market entry beyond spot sales level as to satisfy the zero-profit condition

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

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

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

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.[21] The total effect of selling medical care under insurance coverage on medical prices depends on whether the LDE effect or the MS effect is dominant.

For $(\overline{\theta} - \pi c)^2 > \frac{\pi h f}{d}$ there exists an equilibrium price that solves (11), with 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. Therefore, the existence of spot market equilibrium guarantees the existence of market equilibrium under insurance sales.

[21] The vertical LDE effect presented in equation (9) does not show in (11) because it is canceled out by the MS effect.

Comparing (11) with (6) reveals that for $\frac{t+\overline{\theta}}{1+\pi} < p_s^e$ equilibrium prices under insurance sales are lower than spot sales, and satisfying the affordability requirement, $p_s^e < \overline{\theta}$, requires $t < \pi\overline{\theta}$. By equation (6), the former condition is satisfied if $\frac{\pi}{1+\pi}\left(\frac{\overline{\theta}}{t}+1\right)\left(\frac{t+\overline{\theta}}{1+\pi}-c\right)^2 < \frac{hf}{d}$. Lastly, by Proposition 1, the existence of a spot medical care market requires also $\frac{hf}{d} < (\overline{\theta}-c)^2$.

Therefore, for medical prices under insurance sales to be lower than their spot prices the value of $\frac{hf}{d}$ must satisfy $\frac{\pi}{1+\pi}\left(\frac{\overline{\theta}}{t}+1\right)\left(\frac{t+\overline{\theta}}{1+\pi}-c\right)^2 < \frac{hf}{d} < (\overline{\theta}-c)^2$. For $t = \pi\overline{\theta}$ the two sides of the latter condition coincide, and thus it cannot be satisfied. However, evaluating the derivative of the left side of the condition with respect to t, for $t = \pi\overline{\theta}$, reveals that it is positive if $\frac{\overline{\theta}-c}{\overline{\theta}} < 2\pi$. That is, for a sufficiently binding liquidity constraints that satisfies $\frac{\overline{\theta}-c}{\overline{\theta}} < 2\pi$, there exists a range of values for $\frac{hf}{d}$ which satisfies the above compound inequality. The latter results are highlighted in the following proposition.

Proposition 2. *For* $\frac{\pi}{1+\pi}\left(\frac{\overline{\theta}}{t}+1\right)\left(\frac{t+\overline{\theta}}{1+\pi}-c\right)^2 < \frac{hf}{d} < (\overline{\theta}-c)^2$*, medical prices under insurance sales are lower than spot medical prices.*

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

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

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 range of t values for which the MS effect dominates the LDE effect.

Corollary 1. *Under the conditions specified in proposition 2, insurance premium subsidies have negative marginal effect on medical prices.*

Next, consider a Universal Coverage ("UC") policy that makes insurance premiums affordable to all consumers through financial transfers. 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

$$\frac{d\left(p^e_{UC} - c\right)}{N^e_{UC}} = f \tag{15}$$

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

$$p^e_{UC} = \sqrt{\frac{tf}{\pi d}} + c,\ N^e_{UC} = \sqrt{\frac{td}{\pi f}} \tag{16}$$

Plugging the price from (16) back into (11) reveals that UC brings down medical prices under insurance coverage if $\pi p^e_{UC} > \overline{\theta} - h + t$. having also $\pi p^e_{UC} < \overline{\theta}$ guarantees the existence of equilibrium insurance prices in (11) and affordability of insurance premiums under UC to some consumers. Combining the two latter conditions yields $\overline{\theta} - h + t < \pi p^e_{UC} < \overline{\theta}$. Because p^e_{UC} is independent of $\overline{\theta}$, for $t < h$ there exist a range of values $p^e_{UC} = \sqrt{\frac{\pi tf}{d}} + \pi c$ for which the compounded inequality is satisfied, and the universal coverage brings down medical prices under insurance sales.

Proposition 3. *For $t < h$ and $\overline{\theta} - h + t < \sqrt{\frac{\pi tf}{d}} + \pi c < \overline{\theta}$ universal coverage brings down medical prices under insurance sales.*

5.2 Alternative interpretation

All the results derived thus far apply also to the following alternative modeling approach and parameters interpretation. Consider a market with a public insurance plan that pays premiums for all consumers, so they are all covered by default, as is the case in most developed economies and with the elderly under Medicare coverage in the USA. Assume further that all medical providers are included under one comprehensive insurance policy as in the previous analysis with bargained prices.

Here, liquidity constraints may limit medical care utilization in the presence of copayments, which are commonly included in real insurance policies. Consider specifically copayments that are set as a fraction $\sigma \in (0,1)$ of the full medical price, that is a co-insurance rate. In such a market, for $\sigma p_I^e > \overline{\theta} - h$ the liquidity constraints are binding for some consumers.

In this market, sick consumers choose their preferred provider by minimizing the sum of the implied co-payment charge σp and the 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 (2009). In addition, lower copayment rates induce also the MS effect by easing liquidity constraints.

All the results presented above, in Subsection 5.1, apply to the market structure described here after replacing π with the co-payment rate σ, in equations (7)-(16), Corollary 2, and the Propositions 2-3. That is if the MS effect dominates the LDE effect, the provision of medical care under the public insurance coverage brings medical prices below their spot market level, and medical prices can go down with a decrease in the co-insurance rate. These results contrast NRS' definite conclusion that medical medical prices increase under insurance coverage and are negatively related to the co-insurance rate, derived for the same market structure with no liquidity constraints.

5.3 Bargained prices

Consider now the more realistic case in which medical prices are set through bargaining between medical providers, and insurers that bundle 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 contracted providers share the market equally - each one of them sells to $\frac{1}{N}$ of the insured consumers. The fair insurance premium is equal to the expected cost per insured for the insurer is $\pi\overline{p} = \pi \sum_{j=1}^{N} \frac{p_j}{N}$. For this premium, consumers demand for insurance is $\frac{d}{h}\left(\overline{\theta} - \pi\overline{p}\right)$ and the expected surplus for provider j that contracts with the insurer is[22]

$$PS_{IB,j} = \frac{d}{hN}\left(\overline{\theta} - \pi\overline{p}\right)(p_j - c) \tag{17}$$

I employ the "Nash-in-Nash" bargaining procedure, in which the insurer bargains simultaneously with all providers.[23] Given that all other providers are included in the policy, contracting also with provider j will yield consumers the expected additional surplus

$$\triangle CS_{IB,j} = \frac{d}{h}\left(\overline{\theta} - \pi\overline{p}\right)\left(\frac{t}{2N^2} + \frac{p_{\neq j} - p_j}{N}\right) \tag{18}$$

The surplus expressions (17) and (18) imply the following Nash Product, NP, which is maximized by the price bargained between the insurer and provider j, given the insurer's relative bargaining power, $\alpha \in (0, 1)$:

$$NP = \left[\frac{d\left(\overline{\theta} - \pi\overline{p}\right)}{hN}\left(\frac{t}{2N} + (p_{\neq j} - p_j)\right)\right]^{\alpha} \times \left[\frac{d\,(p_j - c)\left(\overline{\theta} - \pi\overline{p}\right)}{hN}\right]^{1-\alpha} \tag{19}$$

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

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

Maximizing (19) with respect to p_j (counting for its effect on the average price $\overline{p}$) yields the following symmetric bargained price

$$p_B^* = \frac{(1-\alpha)}{\frac{2\alpha N}{t} + \frac{\pi}{N\left(\overline{\theta}-\pi p_B^*\right)}} + c \tag{20}$$

Equation (20) 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 (20) captures 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.[24]

The second addend captures 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.[25] Imposing the zero-profit condition on (20) yields the equilibrium bargained price:

$$\left(p_B^e - c\right)^2 = \frac{(1-\alpha)\, hft}{2\alpha d} \frac{1}{\left(\overline{\theta}-\pi p_B^e\right) + \frac{\pi t h^2 f^2}{2\alpha d^2 \left(\overline{\theta}-\pi p_B^e\right)^2 \left(p_B^e - c\right)^2}} \tag{21}$$

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 (19), is replaced with 1. Consequently, the resulting equilibrium price and corresponding firms-entry level modify to

[24] 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.

[25] The expression that captures the bundling effect, $\frac{\pi}{N\left(\overline{\theta}-\pi p_B^*\right)}$, is the rate of change in demand for insurance due to a marginal increase of price by a single provider

$$p_{UC}^{e}=\sqrt{\frac{(1-\alpha)\,ft}{2\alpha d}}+c,\; N_{UC}^{e}=\sqrt{\frac{(1-\alpha)\,dt}{2\alpha f}} \tag{22}$$

Having $\pi p_{UCB}^{e}\in\left(\underline{\theta},\overline{\theta}\right)$, or $\overline{\theta}-\pi p_{UCB}^{e}\in(0,h)$, is necessary for the UC policy to be viable and effective. Plugging (22) back into (21) reveals that UC prices are lower if $\left(\overline{\theta}-\pi p_{UC}^{e}\right)^{2}-\frac{1}{h}\left(\overline{\theta}-\pi p_{UC}^{e}\right)^{3}>\frac{\pi hf}{d(1-\alpha)}$. Within the relevant range for effective UC policy , $\overline{\theta}-\pi p_{UCB}^{e}\in(0,h)$, the left side of the latter condition follows an inverted U shape and is maximized with $\overline{\theta}-\pi p_{UCB}^{e}=\frac{2}{3}h$, for which it reads $\frac{4}{27}>\frac{\pi hf}{d(1-\alpha)}$. If this inequality holds there exists a range of $\overline{\theta}$ values for which universal coverage lowers bargained prices, as p_{UC}^{e} is independent of $\overline{\theta}$. This inference is highlighted in the following proposition.

Proposition 4. *For $\frac{4}{27}>\frac{\pi hf}{d(1-\alpha)}$ there exists a range of $\overline{\theta}$ for which universal coverage works to bring down bargained medical prices.*

6 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. For a given market price and firms-entry level, market welfare under insurance sales, denoted W, is given by

$$W\left(p,N\right)=\frac{d}{h}\left(\overline{\theta}-\pi p\right)\left[\left(v-\pi c\right)-\pi 2Nt\int_{0}^{\frac{1}{2N}}xdx\right]-Nf \tag{23}$$

The first addend is the sum of expected surpluses for consumers and providers that engage in the medical care market. The second (negative) addend is the fix costs made by the operating providers. Simplifying (23) yields

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

Equation (24) implies that for any given market-entry level, N, lowering medical prices to relax liquidity constraints improves welfare. Maximizing (24) for N reveals that the efficient market entry level decreases with medical price, as the number of served consumers decreases:[26]

$$N^{**} = \sqrt{\left(\overline{\theta} - \pi p\right) \frac{dt}{4hf}} \tag{25}$$

For $\pi = 1$, equation (24) and equation (25) apply to the spot market welfare maximizing outcomes. 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.

To assess the welfare implications of insurance sales in our model, consider the second-best market outcomes subject to the zero-profit requirement (i.e., free entry). 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 welfare function $W = \frac{d}{h}\left(v - p_I^e\right)\left(\overline{\theta} - \pi p\right) - \frac{tf}{4(p_I^e - c)}$, that is maximized by the price[27]

$$(p^{**} - c)^2 = \frac{thf}{4d\left[v + \overline{\theta} - (1+\pi)p^{**}\right]} \tag{26}$$

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 utilization level (as in Salop's original model). Therefore, the welfare maximizing price decreases with the value of medical care for consumers, v, which increases the relative importance of affordability, and it increases with π, due to the MS effect induced under insurance sales which increases affordability.

Comparing (26) with (11) reveals that under the initial assumption, $v - p - t > 0$, the welfare maximizing price is lower than the equilibrium price, for any π value. The latter results imply the following proposition.

Proposition 5. *The welfare maximizing medical prices are lower than the market equilibrium prices for both spot sales and under insurance sales. The welfare maximizing price under insurance sales are lower than under spot sales.*

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

[27]Having $\overline{\theta} > 3h$ is sufficient to guarantee an interior solution for (26) under insurance sales.

As equation (26) defines the welfare maximizing prices under free entry, Proposition 5 implies that under both spot and insurance sales market-entry levels are excessive: capping medical price below their equilibrium levels to satisfy (26) pushes firms out of the market.

Lastly, let us confine attention to consumers' surplus alone, under free entry, given by

$$CS(p) = \frac{d}{h}\left(\overline{\theta} - \pi p\right)\left[v - \frac{tf}{4\frac{d}{h}(p-c)\left(\overline{\theta} - \pi p\right)}\right] \tag{27}$$

If equilibrium prices do not increase under insurance sales, the reduced spatial cost due to market entry which guarantees that all consumers are better off. However, with higher prices and higher market-entry the overall impact on consumers who could afford spot prices is ambiguous. The price that maximizes (27) is

$$p_{CS}^{**} = \sqrt{\frac{tf}{\pi d}\frac{h}{4v}} + c \tag{28}$$

Notice that unlike the welfare maximizing price, the price that maximizes consumer surplus is higher under insurance sales. Plugging the price from (28) in (11) reveals that the market equilibrium prices, under both spot and insurance sales, are higher than the ones that maximizes consumers surplus. This result is highlighted in our last proposition.

Proposition 6. *The consumer surplus maximizing prices are lower than the market equilibrium prices for both spot sales and under insurance sales. The consumer surplus maximizing prices under insurance sales are higher than higher spot sales.*

7 Conclusion

This study analyzed the implications of health insurance provision to liquidity-constrained consumers in a market with multiple differentiated medical providers, and free entry. The analysis adds to the literature by highlighting the Market-Size effect induced under insurance sales that ease consumers' liquidity constraints: the

MS effect works to decrease medical prices by bringing more medical providers into the market, thereby intensifying competition.

Therefore, the MS effect counters the Lower Demand Elasticity effect that is highlighted in the current literature, which works to increase medical prices under insurance sales. It was shown that the relative strength of the two contradicting effects depends on the cost structure of the firms and the tightness of consumers liquidity constraints in the medical care market. These results apply as well to insurance premium subsidies and universal insurance coverage policies, which also induce the contradicting LDE and MS effects. It was further shown that in medical markets with liquidity-constrained consumers both welfare and consumers surplus can be enhanced with price caps.

The results derived here call for empirical validation and re-examination in a framework the includes powerful for-profit insurers, which are both left for future studies.

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