Moving from a bad to a good pricing regime: The South African private health care market[*]

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Abstract

The South African private health care market combines a highly concentrated demand side with expensive medical services. This combination suggests that medical insurance schemes are not using their full market power. To explain this puzzle, we construct a delegated bargaining model in which agency costs give rise to two different pricing regimes. In the 'good' pricing regime, the scheme incentivizes its administrator towards aggressive bargaining behavior with health care providers. The 'bad' pricing regime results when the scheme decides against such incentivation. Policy measures that push the number of providers above some critical threshold can force a change from the 'bad' to the 'good' pricing regime.

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1 Introduction

Private health care in South Africa is very expensive. It is neither affordable for the large majority of South African nor does it look like a good deal–compared to international standards–for the minority of South Africans who can afford it. To quote from a recent OECD health working paper about the South African private hospital sector:

> "The health system in South Africa is unique in many ways. South Africa spends 41.8% of total health expenditures on private voluntary health insurance – more than any OECD country – but only 17% of the population – mostly high income citizens - can afford to purchase private insurance. [...] general prices for goods and services in South Africa are half (53%) of that observed in OECD countries. Private hospital price levels are the least affordable in South Africa in comparison with OECD countries, as they have exceeded general price levels by an extent that is not observed in other countries for which data is available. [...] In summary, private hospital prices are expensive relative to what could reasonably be predicted given the country's income and are likely to be expensive even for individuals with higher levels of income." (Lorenzoni and Roubal 2016, p. 4)

These high prices for health care services are puzzling because the private health care expenditures are channelled through a private insurance system that is highly concentrated. The Discovery Health Medical Scheme holds with 2.73 Mil. members a 55% market share of open insurance schemes whereas GEMS, the insurance scheme for government and public employees, holds with 1.83 Mil. members a 47% market share of closed schemes. Across open and closed schemes, the five largest schemes hold together a market share of 86%.[1] In line with South African regulation, health care schemes are non-profit organizations that are managed by private administrators who are profit-maximizing organizations. In addition to handling the whole array of

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[1]Whereas open schemes have to accept everyone who is willing to pay the scheme's premium, closed schemes only cater for specific professional groups. The numbers are taken from the HMI (2018, Tables 5.1, 5.2).

actuarial activity on behalf of the scheme, the administrator is mandated to bargain with hospitals and practitioners about service price levels. According to the Council for Medical Schemes, this administrator industry is also strongly concentrated as only three major corporations administer 75% of open and 90% of closed schemes (cf. CMS 2018). In their 2018 Health Market Inquiry, the Competition Commission South Africa observes that "Schemes and administrators are not sufficiently effective in using buying power to negotiate contracts that would decisively benefit consumers by improving quality of care and achieve savings in premia and reduced out of pocket expenditure" (HMI 2018, p. 9). The question is why South African medical insurance schemes and their administrators fall short in negotiating down health care prices in spite of their apparent market power.

As a possible explanation for this puzzle we propose an agency problem that arises between the insurance scheme and the administrator who bargains on behalf of the scheme with the health care providers. Our formal model consists of two building blocks. The first building block is a standard moral hazard model in which the scheme has to decide whether it wants to incentivize its administrator towards a high effort level or not. Depending on her chosen effort level the administrator will be with a high probability either 'aggressive' or 'passive' in her negotiations with the health care providers.

The second building block formalizes the bargaining process in which either an aggressive or a passive administrator negotiates on behalf of the insurance scheme with the health care providers. Our bargaining model combines bargaining on a spatial market with traveling costs (Bester 1988, 1989) with ordered bargaining (Raskovich 2007 and references therein). If there is only one provider in the health care market, our model reduces to the classical bilateral bargaining model with alternating offers by Rubinstein (1982). In case there is a next provider left to bargain with, however, the administrator has the outside option of quitting the current negotiations to move on to this provider. We formally describe an aggressive versus a passive administrator type through a fast versus a slow market speed of this administrator. Because the outside option of moving on will be valuable for the aggressive but not for the passive administrator, the aggressive administrator will be able to negotiate a better equilibrium price than her passive counterpart. To be more precise, the passive ad-

ministrator will always end up with the high expected price that corresponds to the subgame-perfect Nash equilibrium (SPE) of Rubinstein's (1982) bilateral bargaining game. In contrast, the aggressive administrator will achieve in the SPE a strictly lower expected price because she benefits from the valuable outside option of having–with positive probability–a first mover advantage when bargaining with the next provider.

We bring both building blocks together through the insurance scheme's decision to either incentivize its administrator or not. Depending on the scheme's decision, our model gives rise to two different pricing regimes. On the one hand, there is the 'good' pricing regime in which the incentivized administrator negotiates, with high probability, a low equilibrium price. On the other hand, there is the 'bad' pricing regime in which the non-incentivized administrator achieves this low equilibrium price only with a small probability.

As a specific feature of our bargaining game, the aggressive administrator's price advantage over her passive counterpart strictly increases in the number of providers that operate on the market. For suitable parameter values, the scheme will therefore incentivize its administrator towards greater market-aggressiveness if and only if the number of health care providers is above a critical threshold. Increasing the number of health care providers thus comes with the following pattern of prevailing prices on the health care market:

- Assume that the number of health care providers is increasing but remains below the critical threshold. Although the expected prices marginally decrease, we remain stuck in the 'bad' pricing regime in which high prices prevail with a high probability.

- Now assume that the increasing number of health care providers clears the critical threshold. Suddenly, a change towards the 'good' pricing regime happens to the effect that low prices prevail with a high probability.

Our model thus offers an explanation for the prevailing high prices on the South African private health care market. Irrespective of the highly concentrated demand side the market is stuck in a 'bad' pricing regime because there are simply not enough health care providers operating on this market. Based on this threshold effect our model's advice to health market regulators is straightforward: Try to increase the

4

number of health care providers; and if this only brings down prices marginally, don't be discouraged but try to increase this number even further.

Instead of pushing policy measures that would improve the competition between health care providers, however, South Africa's policy makers are currently focused on the implementation of a National Health Insurance (NHI) that would be mandatory for all South Africans. The proposed economic rationale for the NHI bill is to concentrate the demand side of the market even further to the effect that the NHI would become a de facto monopoly in its negotiations with the health care providers. We are not convinced that more concentration on the demand side of the South African health care market will translate into any significant price decrease. In our model changes in equilibrium prices only result from an increase in the number of providers irrespective of the number of medical schemes and their administrators. That is, our stylized model shows the theoretical possibility that a de facto monopolization of the demand side in the form of the NHI might not have any positive effect on prices whatsoever. In the light of our model we would thus welcome a shift of the South African policy makers' current focus from the further concentration of the demand side towards the question of how to increase the competition on the supply side of the health care market.

How plausible is this paper's central premise according to which a non-incentivized administrator is, at least partially, responsible for the high prices in the South African private health care market? In line with this premise, the Competition Commission South Africa largely blames the administrators for not being sufficiently market-aggressive in their negotiations with the health care providers:

> "Schemes demand almost no accountability from administrators to ensure that administrators manage supply-induced demand and procure services based on value from the supply-side of the market. We expect medical schemes to be aware of supply-induced demand and moral hazard and to ensure that their administrators actively manage these to protect scheme members' health and financial interests. An ability to effectively manage these (and clearly demonstrate it) should be a competitive advantage for any administrator. Regulatory constraints notwithstanding, a widespread inability to manage moral hazard and supply-induced demand

5

would suggest a lack of effective competition in the market for administration." (HMI 2018, p. 9)

In contrast to our modeling approach, however, the Competition Commission exclusively blames this lack of market-aggressiveness on the absence of good governance by the insurance scheme: "[....] trustees and Principal Officers experience no pressure to hold administrators and managed care organisations to account" (HMI 2018, p. 9). There might well exist some degree of collusion between the trustees of the scheme and its administrator on the expense of the scheme members so that the trustees assist the administrator to shirk away from high effort levels. What our approach adds to this discussion is the possibility that the highly concentrated supply side of the market keeps the trustees from incentivizing their administrator even if these trustees act in good faith with the objective to keep insurance premiums as low as possible.

The remainder of our analysis is structured as follows. Section 2 models the principal-agent relationship between the insurance scheme and its administrator. The bargaining game between the administrator and the health care providers is constructed and solved in Section 3. Section 4 links the principal-agent model with the bargaining game to characterize the 'bad' versus the 'good' pricing regimes as equilibrium outcomes. Section 5 discusses policy recommendations for the South African health care market that arise from our model. Section 6 concludes. For the interested reader we briefly discuss in the Appendix the relationship between our approach and existing "Nash-in-Nash" bargaining models applied to health care markets.

2   The medical insurance scheme and its administrator

The medical insurance scheme, or just the 'scheme', pools the identically distributed health risks of its members which correspond to the points in the unit interval. We assume that the law of large number works to the effect that the proportion $\mu \in (0, 1)$ of scheme members falls sick with certainty. Let q denote the price that the scheme pays to the health provider for the treatment of any sick member and let t denote the

amount that the scheme transfers to its administrator. The scheme covers its total costs by collecting ex post the per-capita premium

$$p = q\mu + t$$

whereby q and t will be random in our model.

The scheme employs an administrator who bargains on its behalf with the health care providers about the price q for the treatment of any sick member. The administrator's (Bernoulli) utility U depends on the transfer $t \geq 0$ that she receives from the scheme as well on her chosen effort level $e \geq 0$ such that

$$U(t, e) = u(t) - e$$

Here $u : \mathbb{R}_+ \to \mathbb{R}_+$ denotes some strictly increasing function for which we assume (without any loss of generality) that $u(0) = 0$. We follow here the "standard model" (cf. Chapter 5.2 in Salanié 2005) in that we consider a risk-neutral principal and a Bernoulli utility function U for the agent that is separable in effort and transfer. But note that the utility u from the transfer does not have to be concave (or even differentiable), that is, our agent can have arbitrary risk preferences.

To keep the model as simple as possible, we only consider two different effort levels $e \in \{e_0, e_1\}$ such that $0 = e_0 < e_1$. The chosen effort level will determine the probability with which the administrator is either of the aggressive or the passive type when negotiating with health care providers. Whereas the aggressive administrator will achieve in the subsequent bargaining game a low (i.e., 'good') equilibrium price, denoted q_L, the passive administrator only achieves a high (i.e., 'bad') equilibrium price, denoted q_H.[2]

For the remainder of this Section we impose the following assumption, which we are going to justify later through our formal bargaining model.

Assumption 1. *Fix two expected price values q_L and q_H such that $q_L < q_H$. If the administrator chooses the zero effort level e_0, the probability of the low price q_L*

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[2]To be precise, q_L and q_H will correspond to 'expected' equilibrium prices in our bargaining model because the realized price values depend on whether the administrator or the provider makes the first move in the bargaining game (whereby the corresponding probabilities of this first-mover advantage are parameters of our model).

is π_0 (versus probability $1 - \pi_0$ for q_H). If she chooses instead the high effort level e_1, the probability of the low price q_L is π_1 (versus probability $1 - \pi_1$ for q_H). These 'low-price' probabilities satisfy

$$0 \leq \pi_0 < \pi_1 \leq 1$$

For the special parameter case $\pi_1 = 1$ and $\pi_0 = 0$ the scheme can deduce from the observed prices with certainty the chosen effort level of the administrator. That is, the scheme observes q_H if and only if the administrator has chosen the low effort level whereas it observes q_L if and only if the administrator has chosen the high effort level. Because the effort level is no longer private information to the administrator for this special case, we refer to $\pi_1 = 1$ and $\pi_0 = 0$ as the 'symmetric information benchmark case'. In contrast, whenever $\pi_1 < 1$ or $\pi_0 > 0$, there exists some informational asymmetry between the scheme and the administrator with regards to the administrator's choice of effort level.

Suppose now that the scheme wants the administrator to choose the high effort level e_1 over the zero effort e_0 in an asymmetric information situation where the scheme cannot observe the administrator's effort level. To ensure this, the scheme has to offer incentive compatible transfers t_L, t_H such that the high transfer $t_H > 0$ is paid when the administrator negotiates the low price q_L whereas the low transfer t_L is paid when the high price q_H prevails. The corresponding incentive compatibility condition (ICC) for the expected utility maximizing administrator is

$$\pi_1 u\left(t_H\right) + \left(1 - \pi_1\right) u\left(t_L\right) - e_1 \geq \pi_0 u\left(t_H\right) + \left(1 - \pi_0\right) u\left(t_L\right) \tag{1}$$

In the optimal (i.e., cost-minimizing) contract between the scheme and its administrator, both the ICC (1) and the boundary constraint $t_L \geq 0$ must be binding, which gives us the following result.

Observation 1. *Suppose that the scheme wants to elicit the high effort level from its administrator. Then the cost-minimizing transfers are given as*

$$
\begin{aligned}
t_L &= 0 \\
t_H &= u^{-1}\left(\frac{e_1}{\pi_1 - \pi_0}\right)
\end{aligned}
$$

If the scheme elicits the high effort level through the optimal contract of Observation 1, the expected insurance premium for its members becomes

$$E_{\pi_1}(p) = \left(q_L \mu + u^{-1} \left(\frac{e_1}{\pi_1 - \pi_0} \right) \right) \pi_1 + q_H \mu (1 - \pi_1)$$

In contrast, if the scheme does not want to elicit the high effort level, it would only pay a zero transfer regardless of the realization of the price q. In that case, the expected premium becomes

$$E_{\pi_0}(p) = q_L \mu \pi_0 + q_H \mu (1 - \pi_0)$$

Under the assumption that the objective of the (risk-neutral) scheme is to minimize the expected insurance premium for its members it strictly prefers to the high effort level e_1 rather than the zero effort level e_0 if and only if

$$E_{\pi_1}(p) \quad < \quad E_{\pi_0}(p)$$

$$\Leftrightarrow$$

$$\left(q_L \mu + u^{-1} \left(\frac{e_1}{\pi_1 - \pi_0} \right) \right) \pi_1 + q_H \mu (1 - \pi_1) \quad < \quad q_L \mu \pi_0 + q_H \mu (1 - \pi_0)$$

Straightforward transformations give us the following condition.

Observation 2. *The scheme will incentivize its administrator to choose the high effort level if and only if*

$$u^{-1} \left(\frac{e_1}{\pi_1 - \pi_0} \right) \frac{\pi_1}{\pi_1 - \pi_0} < \mu (q_H - q_L) \tag{2}$$

Note that LHS of inequality (2) decreases with $\pi_1 - \pi_0$ to the effect that the advantage of inducing the administrator to choose e_1 increases with $\pi_1 - \pi_0$. In particular, if the non-incentivized success probability π_0 is almost as high as the incentivized success probability π_1, the LHS (2) becomes large. In that case it might be too costly for the scheme to incentivize its administrator towards the high effort level. Next we are going to derive a closed-form expression for the price difference $q_H - q_L > 0$ from our bargaining model of the health care market. Afterwards, we close off our model by linking the probability of each price to the administrator's chosen effort level.

3 Bargaining on the health care market

3.1 The bargaining process

The administrator bargains, on the behalf of the scheme, about the price of medical services on a health care market with a fixed number $n \geq 1$ of providers. Our formal bargaining game is inspired by Bester's (1988, 1989) model of sequential bargaining who adds to Rubinstein's (1982) bilateral bargaining game with alternating offers the time-costly outside option that the buyer may quit bargaining and move on to another seller. In contrast to Bester's model–where the buyer can approach an arbitrary seller who does not know the buyer's bargaining history–we assume that the administrator can approach each provider only once in a fixed order, which is common knowledge to all players (for ordered bargaining–albeit with take-it-or-leave-it instead of alternating offers–see Raskovich (2007) and references therein on ordered bargaining).

Denote by $\overline{q}$ the reservation price of the administrator and by $\underline{q}$ the (common) reservation price of any given provider. The providers' reservation price $\underline{q}$ is typically interpreted as either the marginal or the average costs of health care services: at any price below these costs a provider would never agree to sell. The administrator's reservation price $\overline{q}$ would naturally correspond to the operational profits that the scheme could maximally generate through the provider's health care service: at any price above these profits the administrator would never agree to buy.

Technically speaking, our ordered bargaining game consists of a finite sequence of 'split-the-pie' subgames such that the administrator has the outside option to reject any offer and move on to the next provider (given that there is a next provider left to approach). The 'size of the pie' is thereby given as the total surplus value $\overline{q} - \underline{q} > 0$, i.e., the difference in the respective reservation prices of the administrator and any given provider. If the administrator and a provider agree to split-the-pie in accordance with their respective shares $\alpha \in [0,1]$ and $1 - \alpha$, the resulting price for health care services becomes

$$q = \alpha \underline{q} + (1 - \alpha) \overline{q}$$

The administrator's objective in the bargaining game is to minimize the expected price for health care services, i.e., to maximize the expectation of her share α.

To fix thoughts, we assume that the n providers are arranged on an one-way street of length n at equal distance of one at the ordered positions $m \in \{1, 2, ..., n\}$. Adding another provider to the market therefore amounts to adding one kilometer to this one-way street.[3] Starting at position $m = 1$ the administrator can approach each provider only in the fixed order $1, 2, ..., n$. Once the administrator has approached the provider at position m both players engage in a standard bilateral bargaining game of alternating offers with infinite time-horizon a la Rubinstein (1982) whereby each bargaining sequence with a given provider lasts one unit of time. Time is discounted by the administrator and the provider by the shared discount factor $\delta \in (0, 1)$. Bargaining over t periods is thus costly to both the administrator and the provider because the size of the pie shrinks by time-discount factor δ^t. At any given stage, the administrator makes the first offer with fixed probability $\lambda \in (0, 1)$. If there exists a next provider at position $m + 1$, the administrator has the outside option to reject any offer from provider m and move on to provider $m+1$. Using the outside option is costly to the administrator because it will take her the traveling time $\tau > 0$ to reach the next provider. Consequently, the administrator discounts the value of her outside option by the factor δ^τ.

3.2 The subgame-perfect Nash equilibrium

As there is a fixed order of n providers, we can solve for the subgame-perfect Nash equilibrium (SPE) of this game through backward induction by starting at the bargaining subgames at the ultimate stage $m = n$ and work our way back up. Denote by α_m^A the share that the administrator will offer in the SPE to provider m. Similarly, denote by α_m^P the SPE share offered by provider m. If there exists only one provider, i.e., $n = 1$, our bargaining game reduces to Rubinstein's (1982) bilateral bargaining game. The next observation recalls the SPE for this classical game (cf. Rubinstein (1982) and, for a simpler proof, Shaked and Sutton (1984)).

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[3]Note that we fix the distance between any two providers at one independently of the number n of providers. In contrast, the spatial competition model in Bester (1989) fixes the length of the street at one to the effect that the (equilibrium) distance between any two providers becomes $\frac{1}{n}$ and thereby strictly decreasing in the number of providers.

Observation 3. *In the SPE of the Rubinstein bargaining game we have:*

(i) *The administrator offers*

$$\alpha^* \equiv \frac{1 - \delta}{1 - \delta^2} \tag{3}$$

and the provider accepts.

(ii) *The provider offers*

$$\alpha_* \equiv \delta \alpha^*$$

and the administrator accepts.

Let $n \geq 2$. Having established for the final stage $m = n$ that the respective 'Rubinstein shares' are offered (and accepted) in the SPE, i.e.,

$$
\begin{aligned}
\alpha_n^A &= \alpha^* \\
\alpha_n^P &= \alpha_*
\end{aligned}
$$

we can move up to the penultimate stage $m = n - 1$. Now the administrator has the outside option to quit the bargaining process and move on to the next, and final, provider. By Observation 3, the expected value of this outside option is

$$v(n) = \lambda \alpha^* + (1 - \lambda) \alpha_*$$

This value is discounted by δ^τ from the administrator's perspective at $n - 1$. If the administrator happens to make the first move, she will always offer–and get accepted– the share (3), which is strictly greater than the traveling time discounted value of the outside option. If instead the provider starts the bargaining process, the administrator has the choice to (i) either wait one time-period until it is her turn to offer the share (3) or (ii) to go for the outside option. The outside option is thus valuable to her if and only if

$$
\begin{aligned}
\delta^\tau v(n) &> \delta \alpha^* \\
&\Leftrightarrow \\
\lambda + (1 - \lambda)\delta &> \delta^{1-\tau}
\end{aligned} \tag{4}
$$

Applying the "outside option principle" (cf. Section 7.4.3. in Osborne and Rubinstein 1994)–according to which the seller will offer in the SPE the traveling time discounted value of the outside option–we thus obtain the following characterization of the SPE shares at the penultimate stage.

Observation 4. *In the SPE we have for the penultimate stage $n-1$:*

(i) *The administrator offers the Rubinstein share*

$$\alpha_{n-1}^{A} = \alpha^{*}$$

and the provider accepts.

(ii) *If the outside-option is valuable to the administrator, i.e., if the inequality (4) holds, then the provider offers*

$$\alpha_{n-1}^{P} = \delta^{\tau} v\left(n\right)$$

Else, he offers the Rubinstein share

$$\alpha_{n-1}^{P} = \alpha_{*}$$

The administrator accepts in either case.

If we move up to stage $n-1$, the value of the outside option becomes

$$v\left(n-1\right) = \lambda \alpha^{*} + \left(1-\lambda\right) \max\left\{\delta^{\tau} v\left(n\right), \alpha_{*}\right\}$$

From this, we can immediately deduce that, at any given stage, the outside option is valuable to the administrator if and only if the inequality (4) holds. Suppose now that (4) holds. We then obtain the following recursive relationship between the values of the outside options for all stages $m \geq 2$

$$v\left(m-1\right) = \lambda \alpha^{*} + \left(1-\lambda\right) \delta^{\tau} v\left(m\right)$$

Moreover, by the "outside option principle", the provider at stage $m = 1$ would then offer in the SPE $\delta^\tau v(2)$ to the administrator. Repeated substitution gives us the following closed-form characterization of this value of the outside option

$$
\begin{aligned}
v(2) &= \sum_{k=0}^{n-3} \left((1-\lambda)\,\delta^\tau \right)^k \lambda \alpha^* + \left((1-\lambda)\,\delta^\tau \right)^{n-2} v(n) \\
&= \frac{1 - \left((1-\lambda)\,\delta^\tau \right)^{n-1}}{1 - \left((1-\lambda)\,\delta^\tau \right)} \lambda \alpha^* + \left((1-\lambda)\,\delta^\tau \right)^{n-2} (1-\lambda)\,\alpha_*
\end{aligned}
$$

Collecting the above arguments gives us the a characterization of the SPE shares.

Proposition 1. *In the SPE, an agreement is reached by accepting the first offer made at the first stage. The respective SPE offers are as follows.*

(i) *Suppose that the outside-option is valuable to the administrator, i.e., inequality (4) holds. Then the administrator offers the Rubinstein share, i.e.,*

$$
\alpha_1^A = \alpha^*
$$

whereas the provider offers

$$
\alpha_1^P = \delta^\tau \left[\frac{1 - \left((1-\lambda)\,\delta^\tau \right)^{n-1}}{1 - \left((1-\lambda)\,\delta^\tau \right)} \lambda \alpha^* + \left((1-\lambda)\,\delta^\tau \right)^{n-2} (1-\lambda)\,\alpha_* \right]
$$

(ii) *Suppose now that inequality (4) is violated. Then both, the administrator and the provider, offer their respective Rubinstein shares, i.e.,*

$$
\begin{aligned}
\alpha_1^A &= \alpha^* \\
\alpha_1^P &= \alpha_*
\end{aligned}
$$

Depending on whether the outside-option is valuable or not to the administrator, there will be two different expected equilibrium prices, which we describe in the following subsection.

3.3 The low versus the high expected equilibrium price

Denote by

$$\alpha^L(\tau, n) \equiv \lambda\alpha^* + (1-\lambda)\delta^\tau \left[\frac{1 - ((1-\lambda)\delta^\tau)^{n-1}}{1 - ((1-\lambda)\delta^\tau)} \lambda\alpha^* + ((1-\lambda)\delta^\tau)^{n-2}(1-\lambda)\alpha_* \right] \tag{5}$$

the expected SPE share of the administrator as a function in τ and n whenever inequality (4) holds. Further denote by

$$\alpha^H \equiv \lambda\alpha^* + (1-\lambda)\delta\alpha^* \tag{6}$$

the expected SPE share of the administrator whenever inequality (4) is violated. Having a valuable outside option is, of course, advantageous for the administrator in the sense that we always have for the difference in these expected shares

$$\alpha^L(\tau, n) - \alpha^H > 0$$

This advantage strictly increases if the traveling time τ decrease and the number n of providers increases. In particular, we have the limit result

$$\lim_{\tau \to 0} \lim_{n \to \infty} \alpha^L(\tau, n) = \lim_{n \to \infty} \lim_{\tau \to 0} \alpha^L(\tau, n) = \alpha^*$$

In words: If the administrator becomes infinitely fast while the number of providers becomes large, her expected share-of-the-pie in the ordered bargaining game becomes identical to the Rubinstein share α^* that she would receive when she makes the first offer in the bilateral bargaining game. This share α^* is thus an upper bound for whatever the administrator might achieve from her outside option compared to the expected share $\alpha^H = \lambda\alpha^* + (1-\lambda)\delta\alpha^*$ that she would obtain without any outside option.

Based on the low and high expected SPE shares (5) and (6), we are now in the position to characterize the positive difference $q_H - q_L$ between the expected high and the low equilibrium prices that we had so far only introduced by Assumption 1.

Corollary 1. *Define the low and the high expected equilibrium prices as*

$$q_L \equiv \alpha^L(\tau, n)\underline{q} + \left(1 - \alpha^L(\tau, n)\right)\overline{q} \tag{7}$$

$$q_H \equiv \alpha^H\underline{q} + \left(1 - \alpha^H\right)\overline{q}$$

15

The corresponding difference between these expected prices is given as

$$q_H - q_L = \left(\alpha^L\left(\tau, n\right) - \alpha^H\right)\left(\overline{q} - \underline{q}\right)$$

which is always strictly positive in our model.

The low expected price q_L will prevail on the market whenever inequality (4) holds whereas we end up with the high expected price q_H if this inequality is violated. The next section links the probability of which expected price will prevail with the question of whether the scheme chooses to incentivize its administrator or not.

4 The "bad" versus the "good" pricing regime

The literature on delegated bargaining typically investigates whether an enforceable contract between principal (i.e., scheme) and agent (i.e., administrator)–which would commit the agent to a specific bargaining behavior–might be beneficial to the principal even if renegotiations are possible (cf., e.g., Haller and Holden 1997; Bester and Sákovics 2001; Cai and Cont 2004). In contrast, our insurance scheme delegates, by assumption, bargaining to the administrator without being able to write an enforceable contract about the administrator's bargaining behavior. The scheme therefore only decides whether to incentivize its administrator or not. To link this binary decision with the probability of low versus high equilibrium prices, this section introduces two administrator types which differ in their market-speed as a proxy for 'aggressive' versus 'passive' bargaining behavior.

Note that the critical condition (4), which determines whether we end up with the low or the high expected equilibrium prices of Corollary 1, can be equivalently transformed into the inequality $\tau < T$ such that the threshold value is given as

$$T \equiv 1 - \frac{\ln\left(\lambda + (1-\lambda)\,\delta\right)}{\ln\delta} \tag{8}$$

Observe that $T \in (0,1)$ for all values $\lambda, \delta \in (0,1)$ so that there always exists a sufficiently fast traveling time τ^* such that $0 < \tau^* < T$ as well as sufficiently slow traveling time τ_* such that $T < \tau_*$ (e.g., just set $\tau_* = 1$). For fixed values of λ and δ

pick any two values τ^* and τ_* satisfying

$$\tau^* < T < \tau_*$$

We use these two different traveling times to formally distinguish between two different levels of market-aggressiveness of the administrator in her negotiations with the health care providers.

Definitions: "Administrator types"

(i) *The "aggressive" administrator type is characterized by the fast traveling time τ^*.*

(ii) *Conversely, the "passive" administrator type is characterized by the slow traveling time τ_*.*

The next assumption links the likelihood of becoming an aggressive versus a passive type to the administrator's chosen effort level.

Assumption 2. *Conditional on whether the administrator chooses the zero-effort level e_0 or the high effort level e_1, we have*

$$\pi_0 \equiv P\left(\tau = \tau^* \mid e = e_0\right) \text{ with } (1 - \pi_0) = P\left(\tau = \tau_* \mid e = e_0\right)$$

and

$$\pi_1 \equiv P\left(\tau = \tau^* \mid e = e_1\right) \text{ with } (1 - \pi_1) = P\left(\tau = \tau_* \mid e = e_1\right)$$

whereby the conditional probabilities of becoming an aggressive administrator satisfy

$$0 \le \pi_0 < \pi_1 \le 1$$

The aggressive administrator will achieve the low expected SPE price q_L in the bargaining game whereas the passive administrator will only achieve the high expected SPE price q_H. This gives us the following relationship between the probabilities of the respective expected equilibrium prices with the administrator's chosen effort level.

Observation 5. *The low expected equilibrium price q_L of Corollary 1 happens with high probability π_1 if the administrator chooses the high effort level e_1. Conversely, q_L happens only with low probability π_0 if the administrator chooses the zero-effort level e_0.*

Definitions: "Pricing regimes"

(i) *We speak of the "good" pricing regime whenever the low expected equilibrium price q_L happens with high probability π_1.*

(ii) *Conversely, we speak of the "bad" pricing regime whenever the low expected equilibrium price q_L only happens with low probability π_0.*

The central question of this paper is under which parameter conditions do we end up in the "good" rather than the "bad pricing" regime. By Assumption 2, this question is equivalent to the question under which parameter conditions does the insurance scheme incentivize its administrator towards a high effort level. For the fixed traveling-time τ^* of the aggressive administrator type, the scheme incentivizes its administrator, by Observation 2 combined with Corollary 1, if and only if

$$u^{-1}\left(\frac{e_1}{\pi_1 - \pi_0}\right)\frac{\pi_1}{\pi_1 - \pi_0} < \mu\left(\alpha^L\left(\tau^*, n\right) - \alpha^H\right)(\bar{q} - \underline{q})$$

Because $\alpha^L\left(\tau^*, n\right)$ is strictly increasing in n, the RHS of this inequality strictly increases in the number of providers whereby it reaches its upper limit with

$$\lim_{n\to\infty} \alpha^L\left(\tau^*, n\right) = \left(\frac{1}{1 - \left((1 - \lambda)\,\delta^{\tau^*}\right)}\right)\lambda\alpha^*$$

By continuity of the RHS in n, we can thus always find a sufficiently large number n of firms if and only if

$$u^{-1}\left(\frac{e_1}{\pi_1 - \pi_0}\right)\frac{\pi_1}{\pi_1 - \pi_0} < \mu\left(\lim_{n\to\infty} \alpha^L\left(\tau^*, n\right) - \alpha^H\right)(\bar{q} - \underline{q})$$

According substitutions for $\lim_{n\to\infty} \alpha^L\left(\tau^*, n\right)$ and α^H gives us this paper's main result.

Proposition 2. *Suppose that the parameters of our model satisfy the inequality*

$$u^{-1}\left(\frac{e_1}{\pi_1 - \pi_0}\right)\frac{\pi_1}{\pi_1 - \pi_0} \tag{9}$$

$$< \quad \mu\left(\left(\frac{1}{1 - \left((1-\lambda)\,\delta^{\tau^*}\right)}\right)\lambda\alpha^* - \left(\lambda\alpha^* + (1-\lambda)\,\delta\alpha^*\right)\right)\left(\bar{q} - \underline{q}\right)$$

Then there exists a critical number $n^* \geq 1$ such that we are in the "good" pricing regime if the number n of providers is strictly greater than n^* whereas we are in the "bad" pricing regime if n is smaller than n^*.

By Proposition 2, an increase in the number of health care providers could only force a change from the "bad" to the "good" pricing regime if the model's parameters satisfy inequality (9). Else, the price advantage of the "aggressive" over the "passive" administrator will never be large enough for the scheme to incentivize its administrator. The following two observations identify parameter conditions that facilitate inequality (9) to hold.

Observation 6. *The LHS of inequality (9) is small if:*

(i) *The incentivized probability of becoming aggressive administrator π_1 is close to one whereas the corresponding non-incentivized probability π_0 is close to zero.*

(ii) *The required high effort level $e_1 > 0$ is close to zero.*

Next turn to the RHS of this inequality.

Observation 7. *The RHS of inequality (9) is large if:*

(i) *The size-of-the-pie $\bar{q} - \underline{q}$ is large.*

(ii) *The fraction of sick insurance scheme members μ is close to one.*

(iii) *The fast traveling time τ^* is close to zero.*

Under the conditions of Observation 6, it becomes less costly for the scheme to incentivize its administrator. Similarly, under the conditions of Observation 7, it becomes more beneficial for the scheme to incentivize its administrator. Either set of conditions would it thus make more plausible that a pricing regime change happens when sufficiently many new providers are added to the market.

5 The South African health care market: Policy recommendations

Interpreted by our model the South African health care market is stuck in a "bad" pricing regime because the lack of sufficiently many health care providers keeps insurance schemes from incentivizing their administrators towards more aggressive bargaining behavior. The supply side of the South African health care market is indeed highly concentrated. For example, only three large private corporations dominate the supply of hospital beds:

> "Three hospital groups; Netcare, Life and Mediclinic, account for 88.4% of acute inpatient beds nationally. Netcare accounts for 33.3% of all acute in-patient beds, Life Healthcare for 28.8% and Mediclinic for 26.3% on a national basis in 2015[...]." (HMI 2018, p. 62)

Moreover, the OECD study by Lorenzoni and Roubal (2016) suggests that the 'size-of-the-pie', which measure the difference between the maximal-willingness-to-pay $\overline{q}$ of the representative scheme member and the costs $\underline{q}$ for health care services, is not smaller for South Africa than for OECD countries with lower prices for health care. According to our model a sufficiently strong increase in the number of providers would therefore give the necessary incentives to medical schemes to incentivize their administrators. This would, in turn, lead to the desired change from a "bad" to a "good" pricing regime on the South African health care market. Our formal analysis thus comes with a straightforward policy recommendation: Increase the number of medical health providers; and if this does not seem to help much, increase their number even more.

South African policy makers are well aware about the huge problems facing the South African health system in general as well as about the high prices on the private health care market in particular. To remedy these problems, the South African parliament is currently discussing a bill which concerns the implementation of a National Health Insurance (NHI) scheme. The NHI would be mandatory to all South Africans thereby largely replacing the currently existing private medical insurance schemes. It is an open question in how far private schemes might viably coexist in the future as top-up options to the NHI. Such top-up option would come with substantially higher health care costs for private scheme members who will have to subsidize the poor population through the NHI beyond the current tax-financing scheme for the public health care sector.

The major economic purpose of the NHI is to strengthen the bargaining position of the demand side on the health care market by turning the demand side into a de facto monopoly. To quote from the motivation for the NHI bill:

> "AND IN ORDER TO [...]
>
> - ensure financial protection from the costs of health care and provide access to quality health care services by pooling public revenue in order to actively and strategically purchase health care services based on the principles of universality and social solidarity;
>
> - create a single framework throughout the Republic for the public funding and public purchasing of health care services, medicines, health goods and health related products, and to eliminate the fragmentation of health care funding in the Republic;
>
> - promote sustainable, equitable, appropriate, efficient and effective public funding for the purchasing of health care services and the procurement of medicines, health goods and health related products from service providers within the context of the national health system [...]"[4]

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[4] As introduced in the National Assembly (proposed section 76); explanatory summary of Bill and prior notice of its introduction published in Government Gazette No. 42598 of 26 July 2019. One can alternatively find the NHI bill under the following link (accessed September 15, 2019): https://www.businesslive.co.za/bd/national/health/2019-08-08-read-the-nhi-bill-here/

In our model health care prices cannot be brought down through a further concentration of the demand side. Note that the medical scheme and its administrator have already a de facto monopoly position as their market power in the ordered bargaining game is not affected by the total number of schemes on the demand side. As a consequence, the NHI's purpose to centralize the demand side through a de facto NHI monopoly has no impact whatsoever on the equilibrium prices in our model. Admittedly, our highly stylized model is bound to omit relevant aspects of reality. However, given the fact that the demand side of the South African private health care market is already highly concentrated, we do not believe that a further concentration–at presumably high administration costs for the NHI–would come with a significant improvement in health care prices.

In our opinion, improving the competition on the supply side of the health care sector, public and private, should be the way forward. Policy measures that can achieve this aim include (i) anti-cartel legislation regarding the highly concentrated South African hospital market, (ii) an expansion of the education and training of medical practitioners and (iii) a deregulation of the high entry barriers to the South African health care market as currently enforced by the policy of the Health Professional Council South Africa (HPCSA). In line with such measures the Competition Commission South Africa makes detailed policy recommendations regarding, e.g., the review of the licensing process for health care facilities (HMI 2018, pp. 364-365) as well as the review of the HPCSA's "ethical rules with a view to their impact on competition" (HMI 2018, p. 359). As economists we would welcome it if the focus of policy interventions into the South African health care market was to shift from a further concentration of the demand side towards such measures that would help to improve the competition between health care suppliers.

6   Concluding remarks

We have presented a model of a private health care market that can explain the co-occurrence of expensive medical services with a highly concentrated demand side. Our approach links a standard moral hazard model–which describes the relationship between the medical insurance scheme and its administrator–with a bargaining

game between the administrator and the health care providers. This bargaining game combines ordered bargaining (Raskovich 2007) with Bester's (1988, 1989) spatial bargaining model in which the value of the buyer's outside option depends on her market-speed. Our model gives rise to two possible pricing regimes. Whereas in the 'good' pricing regime low prices prevail with a high probability, high prices realize with a high probability in the 'bad' pricing regime. These probabilities correspond to the respective probabilities of the administrator being either 'aggressive' or 'passive'. Formally, we model the aggressive type through a market-speed that is sufficiently fast to make her outside option of quitting negotiations and moving on viable. In contrast, the passive type's outside option is not viable because she is too slow.

The prices for medical services are stuck in the 'bad' pricing regime when the medical insurance scheme decides against incentivizing its administrator towards aggressive bargaining behavior. In contrast, the 'good' pricing regime obtains as equilibrium outcome whenever it is optimal for the scheme to incentivize its administrator. The question whether the scheme will incentivize its administrator or not depends–among other parameters–on the number of health care providers. In line with standard industrial organization models, expected equilibrium prices decrease in the number of providers. In addition, however, our model comes with a threshold effect according to which a change from the 'bad' to the 'good' pricing regime happens whenever the number of providers clears a critical threshold. The reason for this threshold effect is that a greater number of providers means a greater value of the outside option for the aggressive administrator type. From the scheme's perspective the resulting advantage from lower prices then offsets the fixed costs for incentivizing its administrator.

Applied to the South African health care market our analysis strongly recommends policy measures that would increase the competition on the supply side. In contrast, policy measures that aim at a further concentration on the demand side–as the implementation of a National Health Insurance currently discussed by South African policy makers–do not have any positive price effect in our model. We would therefore welcome a shift in focus to supply side policies, including, e.g., the implementation of policy measure that have already been outlined in the 2018 Health Market Inquiry by the Competition Commission South Africa.

Finally, let us remark that our combination of a principal-agent model regarding

unobserved 'managerial efforts' with a bargaining model where these 'managerial efforts' matter, might be interesting in more general industrial-organization settings than just the South African private health care market. We are grateful to the following comment by an anonymous referee who remarks on the wider potential of our modeling approach:

> "Standard economic analysis suggests the merits of competition in enhancing efficiency, at least in static terms. Your argument suggests another channel through which competition might be beneficial. It enhances the ability for the principal to provide incentives."

We plan to take up this more general perspective in future research within an industrial-organization set-up that is not restricted by the particularities of the South African private health care market.

Appendix: Related literature about bargaining on health care markets

In empirically motivated research Grennan (2013) and Grennan and Swanson (2016) emphasize the important role of bargaining (e.g., between hospitals and medical device manufacturers) for the formation of prices on the US health care market. These authors use theoretical models which fall under the class of "Nash-in-Nash" bargaining models firstly introduced by Horn and Wolinsky (1988). "Nash-in-Nash" bargaining models combine (i) the axiomatic Nash bargaining solution with (ii) a standard model of simultaneous Betrand price competition that is solved for its strategic Nash equilibrium. In the words of Grennan (2013, p. 159):

> "Prices are set in a model of bargaining in the presence of competition where each hospital negotiates with each manufacturer separately and simultaneously, with the outcome of each negotiation satisfying the bilateral Nash bargaining solution. The outcomes of these bilateral negotiations must be consistent with one another, forming a Nash equilibrium in the sense that no party wants to renegotiate."

More precisely, in a "Nash-in-Nash" bargaining model the equilibrium price q_P^* of each provider P given the equilibrium price vector $\mathbf{q}_{-P}^*$ of the other providers maximizes the following Nash product of the provider's profit and the insurance scheme's surplus

$$\left(D_{AP}\left(q_P, \mathbf{q}_{-P}^*\right)\left(q_P - \underline{q}\right)\right)^{b_P} \left(\overline{q} - q_P\right)^{b_A}$$

where $D_{AP}\left(\cdot\right)$ denotes administrator A's demand function for medical services from provider P and the parameters $b_P, b_A \in [0, 1]$ with $b_P + b_A = 1$ stand for the bargaining power of the provider and administrator, respectively. "Nash-in-Nash" bargaining models are popular in the empirical industrial organization literature[5] because they can–depending on the specification of the demand function–generate a wide range of prices between $\underline{q}$ and $\overline{q}$ as equilibrium prices through according calibrations of the bargaining power parameters. In particular, this class of bargaining models nests

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[5]For references to this applied literature that goes beyond Grennan (2013) and Grennan and Swanson (2016) see, e.g., Collard-Wexler et al. (2019).

Bertrand price competition–with possibly differentiated products[6]–for $b_P = 1$ as well as take-it-or-leave-it pricing through the administrator for $b_A = 1$ as special cases.

Although the "Nash-in-Nash" bargaining model could thus also generate the equilibrium prices of our bargaining model, this would come through an ad hoc calibration. There would be no further explanation concerning the factors that determine the players's respective bargaining powers. In contrast, our combination of ordered bargaining (Raskovich 2007) with time-delay costs that depend on a market-speed parameter (Bester 1988, 1989) tries to be more specific about these factors. For instance, the expected share (5) of the administrator becomes in our bargaining game a function in her market-speed and in the number of providers on the health care market. That is, our approach goes beyond a mere numerical parameter b_A that determines the administrators' bargaining power by offering a specific explanation of how the administrator's market-speed and the number of providers determine the administrator's market power. The fact that the expected low equilibrium price (7) depends on the number of health care providers has been driving our own analysis and our policy recommendations in particular.

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[6]Demand functions for differentiated products include, e.g., demand functions for spatial models with transportation costs such as, e.g., the linear (Hotelling 1929) or the circular (Salop 1979) city models. In contrast to classical Betrand price competition, models with transport costs allow for equilibrium prices that are above marginal costs.

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