Health Insurance and Imperfect Competition in the Health Care Market

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Abstract

Despite the moral-hazard problem in health insurance, unregulated insurance markets are generally thought to maximize consumer welfare. We show that when health care markets are imperfectly competitive, this is no longer true, since a high level of insurance coverage creates a high-priced health care industry. Consumers and insurers rationally anticipate this effect but are nevertheless made collectively worse-off. (This is analogous to the welfare-reducing inflationary bias in a strategic model of monetary policy.) Even though the Government has no more information than the market, it can improve upon the market outcome by restricting insurance coverage. Optimal regulation ought to prohibit insurance for low-cost services and regulate the coinsurance rate for high-cost services. An alternative to regulating insurance markets is for Government to be a monopoly health insurer. We also argue that the existence of price effects may explain the emergence of Preferred Provider Organizations (PPO's).

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1 Introduction

Despite the many market failures inherent in health insurance and health care markets, the role of Government in health insurance is controversial. Optimal insurance must balance the gains from risk-reduction against the moral hazard costs of over-consumption. If the Government has no additional instruments available, then it is generally accepted that unregulated insurance markets will maximise consumer welfare and provide second-best insurance contracts.

The purpose of this paper is to incorporate another component into this balancing act: the effect of health insurance on health care pricing. We show that when health care providers have market power and respond to increased insurance coverage by raising prices, Government regulation can always improve upon the competitive insurance market outcome.

Our results have wide applicability. Imperfect competition is an ubiquitous and necessary feature of the health care industry. Pharmaceutical companies with patents and hospital networks with declining average costs are both instances of the absence of perfect competition in the health care sector. It is therefore important for policy-makers to understand the extent to which this market power can have negative "spill-over" effects on the functioning of the health insurance market.

In our model, the Government has no more instruments or information at its disposal than the market. Neither is it a case that Government wields its regulatory power to lower health care prices to marginal cost. Government improves on the competitive insurance market by ensuring that the inflationary effects of insurance coverage on health care prices are efficiently managed. We show that the optimal regulation completely prohibits insurance for low cost services and caps the coinsurance rate for high-cost services.

Health insurance markets are based on health shocks that raise the marginal utility of wealth. *Ex ante,* a risk-averse consumer wishes to re-distribute wealth from healthy states, where the marginal utility of wealth is low, to ill states. First-best insurance would pay lump-sum benefits that are contingent on health,

but insurers are generally unable to observe health state. Since medical expenditure is both observable and positively correlated with illness, subsidizing such expenditure through coinsurance implements the desired redistribution of wealth across states.

These expenditure subsidies distort health care demand (the well-known *moral hazard* problem), and therefore increase health care prices when health care markets are imperfectly competitive. The latter effect – whose consequences are not well appreciated – alters the optimal coinsurance rate determined in the health insurance market, and is the focus of the present paper. The fact that insurance and health care are complementary services, and their prices jointly determined, has important implications for the welfare generated by the insurance market.[1]

Our analysis is based on standard Zeckhauser-Pauly insurance contracts,[2] which comprise a *premium* paid in all states, and a linear *coinsurance* rate. The insurance market is perfectly competitive. The health care market is a Cournot oligopoly with $n \geq 1$ identical providers, each with constant marginal costs. In Section 5, we also consider the case of a perfectly price discriminating monopolist which charges each consumer a health care price that depends on her individual coinsurance rate.

The equilibrium contract determined in the insurance market will affect the downstream price of health care through its impact on the elasticity of health care demand. Conversely, the price that consumers expect to pay for health care affects their demand for insurance. Our solution takes account of this market interdependence by requiring that purchasers of insurance hold "rational expectations" with respect to health care price. In the Cournot case, purchasers of insurance correctly anticipate the market price of health care. With a perfectly price discriminating monopolist (Section 5), each consumer anticipates the impact of her individual insurance choice on the price of health care she will

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[1] Feldstein (1976), Chiu (1997), and Gaynor and Haas-Wilson (2000).
[2] See Zeckhauser (1970) and Pauly (1968).

face.[3]

We show that if the marginal cost of health care is sufficiently low, then the existence of a health insurance market makes consumers worse off, and the Government ought to prohibit insurance. Feldstein (1976) was the first to speculate that the effect of price increases in health care could potentially destroy the value of insurance. It was left to Chiu (1997) to demonstrate formally how this possibility might occur. Chiu assumes that the supply of health care is (almost) completely inelastic. Under this assumption, health care consumption is (almost) fixed, so health care price inflation completely undermines the effects of the coinsurance subsidy. However, there is little empirical support for the extreme inelasticity of health-care supply required for the Feldstein-Chiu result. Our analysis generates the same conclusion, but under the more plausible assumption of Cournot pricing with low marginal costs.

We also show that when the marginal cost of care is sufficiently high, regulation (rather than prohibition) can improve the market outcome. This result is an extension of Gaynor, Haas-Wilson and Vogt (2000). They assume a competitive insurance sector and show that downstream market power may ameliorate insurance-induced 'over-consumption' of health care by raising prices, but that this is not welfare enhancing. Imperfectly competitive health care markets leave consumers worse off than if health care markets are competitive. However, Gaynor *et al* do not ask whether the competitive *insurance contract* maximizes consumer welfare – we show that it does not.

The intuition for our result is that health-insurance imposes a negative pecuniary externality on consumers through health-care price inflation. As in the usual case of externalities, regulation can be welfare improving.

Regulation of the insurance industry confronts practical obstacles. Such regulation must restrict insurance coverage, even though the market could supply additional coverage at an actuarially fair price. Private gains from trade must go unrealised in order to prevent a reduction in collective welfare. Direct regula-

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[3]In the former case, consumers form a "point" prediction about health care price; while in the latter, they predict the entire "reaction function" of the downstream monopolist.

tion of coinsurance rates could be difficult to implement because of monitoring problems when consumers can hold multiple insurance contracts. An alternative policy is for Government to be the sole provider of insurance. The challenge for such a scheme is to sustain a higher coinsurance rate than that favoured by consumers (i.e., voters), who regard themselves as "under-insured" at the current price of health care services. If a private insurance industry were allowed to co-exist, consumers would opt-out of the public scheme or purchase private supplementary insurance, and this would undermine collective welfare[4].

The outline of the paper is as follows. Section 2 specifies the optimal coinsurance rate as a function of the health care price. In Section 3 we determine the equilibrium health care price as a function of the coinsurance rate. In Section 4, we combine these two functions to demonstrate that there is a unique "rational expectations" equilibrium of the health insurance and health care markets. We also derive the dependence of equilibrium on the number n of downstream firms, and show how market power is more lucrative when consumers can insure against expenditure fluctuations.

In Section 5, we reformulate the model by assuming that the health care provider is a monopolist who perfectly price discriminates, offering discounts to uninsured consumers. We show that Government regulation which prohibits price discrimination is at once more profitable for the monopolist and better for consumers and providers. We speculate that this may provide an additional explanation for the emergence of institutional arrangements (such as Preferred Provider Organisations) which require providers to commit to price schedules prior to insurance contracts being traded. Securing a fixed price for health care lowers equilibrium coinsurance rates and increases health-care demand.

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[4]A third alternative, which I do not pursue, is for Government to regulate health care prices rather than insurance markets (I thank Joshua Gans for pointing out this option).

2   The Competitive Insurance Market

All consumers are *ex ante* identical and face two possible states – *healthy* and *ill* – with a probability π of falling ill. Utility is state-dependent. Healthy consumers have direct utility $\overline{U}(C)$ derived entirely from the consumption, C, of a composite good that serves as numéraire. When ill, the consumer has utility function $\underline{U}(C, h)$, with h denoting health-care consumption. The corresponding indirect utility functions are $\overline{V}(y)$ and $\underline{V}(\rho, y)$, with y income and ρ the consumer's price of health care. We assume

$$\lim_{\rho \to 0} \underline{V}(\rho, y) = \overline{V}(y) \tag{1}$$

for any y. This assumption says that whatever the health shock is, perfect health can be recovered by consuming a sufficient level of health care.

The consumer's initial wealth, W, is the same in each state. When healthy, all income is spent on the composite commodity, giving indirect utility $\overline{V}(W)$. In the ill state, the consumer maximizes $\underline{U}(C, h)$ subject to

$$W \leq C + \rho h.$$

The objective of this paper is to consider the impact of coinsurance rates on demand for health care. To avoid algebraic complications that add no insight into the problem, we therefore make the following assumption:

Assumption 1 *There are no income effects on the demand for health care.*[5]

In view of Assumption 1, we let $h(\rho)$ denote the health care demand function of an ill consumer.

An insurance contract is a pair (P, k), with P the premium (paid in both states), and $k \in [0, 1]$ a coinsurance rate (the fraction of medical bills paid by the consumer). If p is the unsubsidized price of health care, then the consumer's expected utility, given contract (P, k), is given by:

$$\Psi(P, k) = (1 - \pi)\overline{V}(W - P) + \pi\underline{V}(kp, W - P) \tag{2}$$

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[5]See Gaynor, Haas-Wilson and Vogt (2000) for a class of utility functions for which this assumption holds.

The insurance market is assumed to be perfectly competitive, so insurance contracts are actuarially fair. Therefore, letting $q(k, p) = ph(kp)$ denote the total payment by the insured consumer to health care providers, we may express P as the following function of k:

$$P(k) = \pi (1 - k) q(k, p) \tag{3}$$

The optimal coinsurance rate maximizes (2) subject to (3):[6]

$$k(p) = \arg \max_{k} \Psi(P(k), k) \tag{4}$$

The first-order condition for (4) is

$$\pi p \underline{V}_1 (kp, W) - [(1 - \pi) \overline{\alpha} + \pi \underline{\alpha}] P'(k) = 0 \tag{5}$$

where $\underline{\alpha}$ (respectively, $\overline{\alpha}$) is the marginal utility of wealth in the ill (respectively, well) state, and subscripts denote partial derivatives. Of course, both $\underline{\alpha}$ and $\overline{\alpha}$ depend on k and y. We assume:

Assumption 2 $\frac{\partial \underline{\alpha}}{\partial k} > 0$

Assumption 3 $\underline{\alpha} > \overline{\alpha}$ *for all* $k \in (0, 1]$.

Assumption 4 $\lim_{k \to 0} \underline{\alpha} = \overline{\alpha}$.

If Assumption 2 did not hold, Zeckhauser-Pauly contracts would not be able to reduce risk, in the sense of reducing the variance of marginal utilities. This assumption is therefore necessary to justify the use of coinsurance type contracts (Jack and Sheiner, 1997). Assumption 3 implies that when $k > 0$, there is less than full insurance – marginal utilities of income are not equalized across states (see equation (6) below). Assumption 4 strengthens condition (1) to require equality of marginal utilities of income across states when health care is free.

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[6]We express k as a function of p because later we will want to make p endogenous. However, except in Section 5, the individual seller and buyer of insurance take p as given (independent of any particular contract they may choose to sign).

Using Roy's identity and (3), we may rewrite (5) as

$$-\pi\underline{\alpha}q \; - \; [(1-\pi)\,\overline{\alpha} + \pi\underline{\alpha}]\left[\pi\,(1-k)\,\frac{dq}{dk} - \pi q\right] \; = \; 0$$

$$\Rightarrow \quad \alpha^* q \; = \; (1-k)\,\frac{dq}{dk} \tag{6}$$

where

$$\alpha^* \; = \; \frac{(1-\pi)\,(\overline{\alpha} - \underline{\alpha})}{[(1-\pi)\,\overline{\alpha} + \pi\underline{\alpha}]} \; \leq \; 0.$$

A direct application of Lemma 3 in Gaynor, Haas-Wilson and Vogt (2000) gives:

Lemma 1 *Under the maintained assumptions*

$$\frac{dk\,(p)\,p}{dp} \geq 0$$

In other words, when the price of health care rises, $k\,(p)$ falls, but not enough to *raise* health care consumption.

3 The Health Care Market

We now turn to the health care market, which is characterized by imperfect competition and Cournot quantity-setting behavior. There are $n \geq 1$ identical firms with constant marginal costs c. Each firm i takes k and the other firms' output as given, and chooses its own output h^i to maximize profit. Total quantity supplied in the health care market equilibrium is denoted $h^e\,(k)$. Since firms are identical, $h^i = h^e/n$ for each i.

Using the standard Cournot-Nash equilibrium condition, and given that all consumers are identical, $h^e\,(k)$ satisfies

$$\rho\,(h^e\,(k)\,,k) \; + \; \frac{h^e\,(k)}{n}\frac{\partial\rho\,(h^e\,(k)\,,k)}{\partial h} \; = \; c \tag{7}$$

where $\rho(h, k)$ is the inverse demand function of a consumer who faces a coinsurance rate of k. Given Assumption 1 (no income effects) coinsurance scales inverse demand[7]:

$$\rho(h, k) = \frac{\rho(h, 1)}{k} \tag{8}$$

Therefore, letting $\hat{\rho}(h) = \rho(h, 1)$, we may rewrite (7) as follows:

$$\hat{\rho}(h^e(k)) + \frac{h^e(k)}{n} \hat{\rho}'(h^e(k)) = kc \tag{9}$$

Equation (9) shows that the effect of k on h^e is the same as that of a change in marginal cost. Total differentiation of (9) gives:

$$\frac{dh^e}{dk} = \frac{nc}{(n+1)\hat{\rho}'(h^e(k)) + h^e(k)\hat{\rho}''(h^e(k))} \tag{10}$$

The second-order conditions for the firm's profit maximization problem ensures that the denominator is negative, so

$$\frac{dh^e}{dk} < 0 \tag{11}$$

unless $c = 0$.

Letting $p(k) = \rho(h^e(k), k)$ denote the Cournot-Nash equilibrium price of health care, (11) implies

$$\frac{d}{dk} kp(k) > 0.$$

Recall that $kp(k)$ is the out-of-pocket price faced by the insured consumer. However, the model as it stands does not determine the sign of $p'(k)$. It seems realistic to assume that the price of health care rises when consumers face lower coinsurance rates, so we shall impose the following assumption.

Assumption 5 $p'(k) < 0$.

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[7]Note that if there is an income effect, the scaling is accompanied by a shift of the demand curve reflecting the change to the premium.

4 Equilibrium

Having constructed the *partial* equilibrium functions $k(p)$ and $p(k)$, we may now determine the values (k^*, p^*) that equilibrate both markets simultaneously. These values satisfy

$$p(k^*) = p^*$$

and

$$k(p^*) = k^*.$$

We first exclude the possibility of multiple equilibria:

Proposition 1 *There exists at most one equilibrium when $c > 0$.*

Proof. At any point (p^*, k^*) on the $k = k(p)$ curve, Lemma 1 implies that this curve is *no steeper* than the hyperbola

$$k = \frac{k^* p^*}{p}$$

through the same point. On the other hand, if (k^*, p^*) is a point on the $p = p(k)$ curve, then (11) implies that this curve is *strictly flatter* than the hyperbola

$$p = \frac{k^* p^*}{k}$$

through the same point. Therefore, if we plot both curves on the same axes, they satisfy a *single crossing property*: the difference in their slopes has the same sign at any intersection point. This implies the result. $\square$

Figure 1 illustrates the general equilibrium problem. We use p^1 to denote the price of health care when consumers are uninsured ($k = 1$). The dotted line is the hyperbola

$$kp = k^* p^* \tag{12}$$

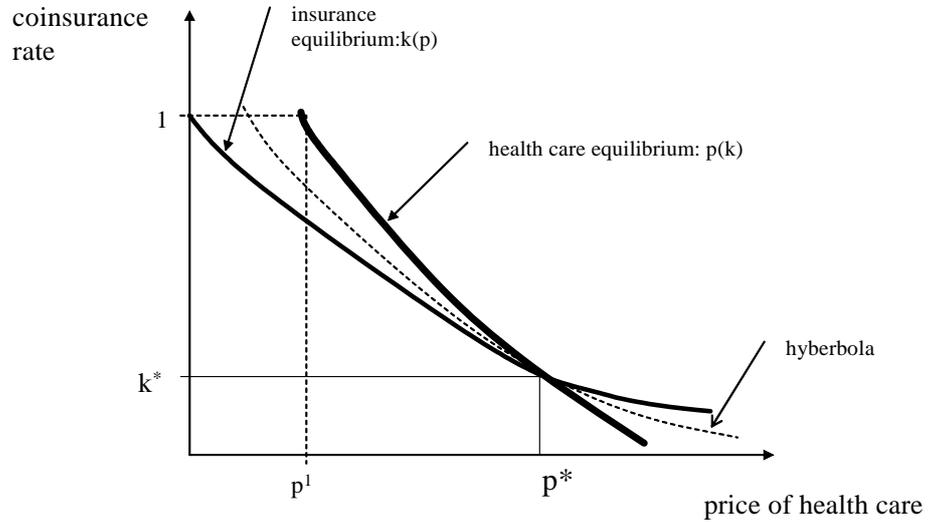and represents the locus along which individual demand for health care is constant at $h(k^* p^*)$.

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Figure 1:

From the diagram we easily deduce a sufficient condition for the existence of equilibrium. According to the first-order condition (6), $k\left(p^1\right) < 1$. Therefore, at $p = p^1$, the $k\left(p\right)$ curve lies *below* the $p\left(k\right)$ curve, as in Figure 1. Condition (6) also implies $k\left(p\right) > 0$ for any $p > 0$. Provided the monopoly price of health care when $c = 0$ is finite – call it p^m – it follows that $p\left(0\right) \le p^m$. In other words, the $k\left(p\right)$ curve is *above* the $p\left(k\right)$ curve when $p = p^m$. From this it follows that the curves intersect at least once in $\left[p^1, p^m\right]$, so an equilibrium exists provided p^m is finite.

Since we have established that an equilibrium exists and is unique, we are ready to discuss the comparative static properties of the model. First consider the effects of health care market competition on equilibrium.

Proposition 2 *Increased market power in health care raises health care prices and lowers both coinsurance rates and health care consumption.*

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Proof. Consider equation (9). For given k, a reduction in n will reduce h^e. This will cause $p(k)$ to shift to the right in Figure 1, so k^* will fall and p^* will rise. Since the new equilibrium is *above* the original hyperbola, $k^* p^*$ has increased so health care consumption has fallen. $\qquad\square$

Increased market power therefore leads to higher health care prices as one would expect, but it also lowers coinsurance rates, giving an extra boost to profitability. When there is an increase in concentration in the health care market, the feed-back effect on coinsurance rates raises demand for health care. This suggests that the value of patents (or other barriers to entry) is higher for goods for which consumers may obtain insurance against their consumption fluctuations.

Next, one may demonstrate the Chiu-Feldstein result in the context of an imperfectly competitive health care market, provided marginal cost is sufficiently low. The pecuniary externality generated by downstream market's response to coinsurance completely destroys the value of the insurance contract.

Proposition 3 *There exists some $\overline{c} > 0$, such that for $c \in (0, \overline{c}]$ the equilibrium leaves consumers worse off than in the absence of an insurance market.*

Proof. From equation (??), if $c = 0$ and $n < \infty$, the schedule $p(k)$ is a hyperbola:

$$p(k) \;\; = \;\; \frac{p^1}{k}.$$

This means that, at any k, the consumer's health care consumption and out-of pocket expenditure are identical to the case of no insurance. However, since $k(p^1) < 1$, the equilibrium value of k is less than 1, which requires an equilibrium premium strictly greater than zero. If $S(c)$ denotes individual consumer surplus from the existence of an insurance industry, then the foregoing argument reveals that $S(0) < 0$. It is straightforward to observe that $S(c)$ is continuous, so $S(c) < 0$ for c sufficiently close to 0. $\qquad\square$

It is important to contrast what is going on here with Chiu (1997). In the latter paper, health care is competitively and perfectly inelastically supplied. This forces the market to completely offset coinsurance through price hikes. In the present paper, the market is imperfectly competitive, so it is not meaningful to talk of a supply curve. The key to the result is the scaling effect on demand from coinsurance – equation (**??**). This effect is largest at the "top" end of the demand curve, and negligible when price is close to zero. The output of a low-cost Cournot market is therefore largely unaffected by coinsurance changes.

At a policy level, Proposition 3 suggests that consumers would be better-off if insurance was prohibited for very low-cost health care services. We expand on the policy implications in the concluding section.

What if c is "large"? In this case, while consumers benefit from the availability of insurance, regulation that lowers k below its market equilibrium level k^* may be welfare-improving.

Consider a benevolent Government that sets a regulated coinsurance rate k^{REG} to maximize representative consumer welfare

$$\widehat{\Psi}\left(P,\ k\right)\ =\ \left(1-\pi\right)\overline{V}\left(W-P\right)\ +\ \pi\underline{V}\left(kp\left(k\right),\ W-P\right)$$

subject to

$$\widehat{P}\ =\ \pi\left(1-k\right)p\left(k\right)h\left(kp\left(k\right)\right) \tag{13}$$

The function $\widehat{\Psi}$, unlike Ψ, does not treat the price of health care as if it were independent of k. While an individual consumer's insurance choice does not impact on health care prices, a regulated coinsurance rate applied to all insurance market transactions will. The regulated coinsurance rate k^{REG} therefore has to balance the benefits from risk-reduction against the costs of both moral hazard *and* the pecuniary externality through health care price. The latter cost factor – which is ignored by the unregulated market – results in k^{REG} above k^*.

To see why, let $\hat{P}\left(k,\ p\left(k\right)\right)$ denote the premium (13) and let $\hat{\Gamma}\left(k,\ p\left(k\right)\right)$ denote $\widehat{\Psi}$ after substitution of $\hat{P}\left(k,\ p\left(k\right)\right)$ for P. We have kept $p\left(k\right)$ as a separate argument so that we may decompose the marginal impact of k into a

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"direct" effect and an "indirect" effect, the latter operating via health care price $p(k)$:

$$\frac{d}{dk}\hat{\Gamma} = \frac{\partial}{\partial k}\hat{\Gamma} + p'(k)\frac{\partial}{\partial p}\hat{\Gamma}.$$

Suppose $k = k^*$. Then the direct effect is zero:

$$\frac{\partial}{\partial k}\hat{\Gamma}\bigg|_{k=k^*} = \frac{d}{dk}\Psi(P(k),k)\bigg|_{k=k^*} = 0.$$

To evaluate the indirect effect, write $\tau = kp$ for the consumer's out-of-pocket price and observe that the premium is $P = \pi(p-\tau)h(\tau)$. The latter expression shows that reducing τ through p (the indirect channel) is cheaper than reductions achieved directly through k, since the net increase in premium is less in the indirect case. Formally (and with a slight abuse of notation):

$$\frac{\partial}{\partial p}\hat{\Gamma} = k\frac{\partial}{\partial \tau}\hat{\Gamma} - [(1-\pi)\overline{\alpha} + \pi\underline{\alpha}]\pi h(\tau)$$

Since

$$\frac{\partial}{\partial \tau}\hat{\Gamma} = \frac{1}{p}\frac{\partial}{\partial k}\hat{\Gamma},$$

which is zero when $k = k^*$, we have

$$\frac{\partial}{\partial p}\hat{\Gamma}\bigg|_{k=k^*} = -[(1-\pi)\overline{\alpha} + \pi\underline{\alpha}]\pi h(kp(k))|_{k=k^*} < 0.$$

Finally, using the fact that $p'(k) < 0$ (Assumption 5), we deduce that

$$\frac{d}{dk}\hat{\Gamma}\bigg|_{k=k^*} > 0,$$

so the optimal regulated coinsurance rate, k^{REG}, is *higher* than k^*.

The problem for the regulator is that, since $p(k^{REG}) < p(k^*)$ and hence $k(p(k^{REG})) < k^{REG}$ (see Figure 2), consumers facing price $p(k^{REG})$ will want supplementary insurance. Therefore, for regulation to be effective, the Government must prevent consumers purchasing more than one insurance contract (or monitor total cover across all contracts held). Similarly, if public provision of insurance was used to solve the problem, the Government would need to prohibit opting-out or supplemental private insurance.
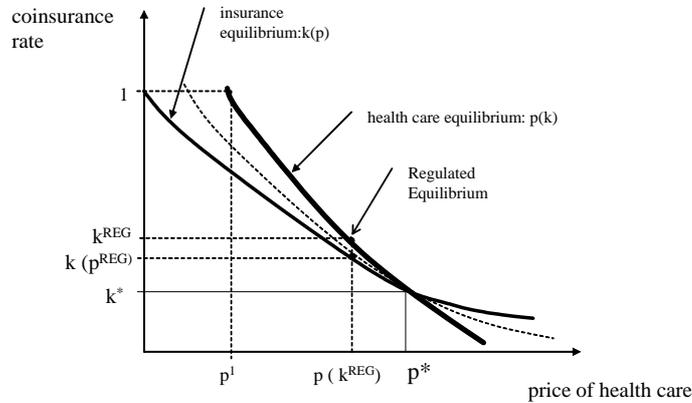
Figure 2:

Would a monopolistic insurer rather than a public insurer also solve the externality problem? In a Zeckhauser-Pauly model, the monopolist chooses k to maximize total surplus (within the insurance market) and then appropriates all the consumer surplus through the premium. In such models, no change in k arises from monopoly insurance because Zeckhauser-Pauly insurance contracts are two-part tariffs.[8]

A monopolist insurer in our model would internalise the effect of k on price – but only to the extent that it effected profit. Consumers' continue to take p as constant. The monopolist would therefore set k to maximise the consumer's perceived surplus (knowing that this is calculated using the wrong p) and set P to extract all this surplus. Therefore, the insurance market equilibrium would yield an identical k to the competitive market.

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[8]In general, when a monopolist can charge a two-part tariff, the competitive quantity is traded.

5 Price Discriminating Monopolist

In this section, we suppose that the individual contracts between a consumer and insurer impact on the health care price. This would be so, for example, if the provided is a perfectly price discriminating monopolist, who offers a price schedule based on the consumer's level of insurance cover. Consumers and insurers therefore anticipate that *individual* insurance decisions will impact on p.

Discounts to uninsured consumers have long been observed in health-care markets. Kessel (1958) was one of the earliest to discuss this practice amongst doctors in the US, arguing that it was motivated, not by generosity, but by a desire to maximize profits. Feldstein (1970) documents evidence that uninsured patients pay around 67% of the price charged to insured patients when visiting the same doctor. More recently, in response to the large number of uninsured people in the US, hospitals and pharmaceutical companies have begun to publish discount schedules for the uninsured. Pfizer recently announced a 27 percent discount for low-income uninsured families.[9]

In this section, we assume perfect price discrimination, so p depends on k. Both consumers and insurers anticipate this and choose $\widetilde{k}$ to maximise

$$\widetilde{\Psi} = (1 - \pi)\,\overline{V}\,(W - P\,(k))\ +\ \pi\underline{V}\,(kp^m\,(k),\ W - P\,(k))$$

where the price of health care $(p^m\,(k))$ is given by the monopolist's reaction function (i.e. $p^m\,(k)$ satisfies (9) with $n = 1$), and

$$P\,(k) = \pi\,(1 - k)\,q$$

Recall that when c is sufficiently low, insurance leaves consumers worse off due to health care inflation. With price discrimination, consumers and insurers no longer take price as given, and will therefore eschew insurance altogether when c is low.

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[9] "Pfizer to Expand Discount Program Uninsured Will Have Access to Lower Drug Prices" *Washington Post*, 8 July 2004, page E03.

Let us define $\rho(k) = p^m(k)k$ as the effective price faced by the consumer. The first-order conditions are therefore

$$\frac{d\widetilde{\Psi}}{dk} = -((1-\pi)\overline{\alpha} + \pi\underline{\alpha})\widetilde{P}'(k) + \frac{d\pi\underline{V}(\rho(k),W)}{dk} \tag{14}$$

we use Roy's identity $\frac{d\pi\underline{V}(pk,W)}{dk} = -\pi h\rho'(k)\underline{\alpha}$ and

$$\widetilde{P}'(k) = \pi\left(-q + (1-k)\frac{dq}{dk}\right)$$

to rewrite 5 as

$$\frac{d\widetilde{\Psi}}{dk} = -((1-\pi)\overline{\alpha} + \pi\underline{\alpha})\pi\left(-q + (1-k)\frac{dq}{dk}\right) - \pi\underline{\alpha}h\rho'(k) \tag{15}$$

Proposition 4 *With a price-discriminating monopolist, there exists a $\overline{c} > 0$ such that the equilibrium coinsurance is $\widetilde{k} = 1$ for all $c \in [0, \overline{c}]$.*

Proof. When $c = 0$, $p^m = \frac{p^1}{k}$ and therefore $\rho'(k) = 0$. Using (15)

$$\frac{d\widetilde{\Psi}}{dk}|_{c=0} = -((1-\pi)\overline{\alpha} + \pi\underline{\alpha})\pi\left(-q + (1-k)\frac{dq}{dk}\right)$$

Using the fact that $\frac{dq}{dk}|_{c=0} = -h^1\frac{p^1}{k^2}$, we have

$$\frac{d\widetilde{\Psi}}{dk}|_{c=0} = ((1-\pi)\overline{\alpha} + \pi\underline{\alpha})\pi\left(h^1\frac{p^1}{k} + (1-k)h^1\frac{p^1}{k^2}\right)$$

$\frac{d\Psi}{dk}|_{c=0} > 0$ when $0 < k \leq 1$, which implies a corner solution of $k = 1$. Moreover, since p^m is continuous in c, and Ψ is continuous in c, the Theorem of the Maximum (Berge, 1963) implies that k is also continuous in c. Since $\frac{d\Psi}{dk}$ is strictly greater than 0 when $c = 0$, the result follows. $\square$

We now turn to the question of whether a price discriminating monopolist could actually benefit from a commitment *not* to price-discriminate. While in standard markets, perfect price-discrimination is both profitable and improves consumer welfare, this does not hold true for the current analysis since price-discrimination has a spill-over effect on the insurance market. If the provider can

commit not to price discriminate, this may make both consumers and providers better off.

Proposition 5 *Provider pre-commitment to a fixed price makes both consumers and providers better off.*

Proof. There are two cases to consider. First, suppose that c is low enough that price discrimination induces consumers to remain uninsured. Then, a pre-commitment to p^1 is better for both the consumer and the provider. The consumer gains, since he obtains an insurance contract which has $k < 1$. Recall from (6), the consumer will always prefer to be insured when he takes the price of health care as given. The monopolist also gains since $p^1 > c$, therefore the higher demand that results from having an insured population increases the profit of monopolist, and insured consumers purchase more health care. Next, consider the case when c is such that despite the price-discrimination, insurance with coinsurance of $\widetilde{k} < 1$ is sold. The monopolist's profits are

$$\left(p^m \left(\widetilde{k} \right) - c \right) h \left(p^m \left(\widetilde{k} \right) \widetilde{k} \right)$$

However, by committing to $p^m \left(\widetilde{k} \right)$ prior to selling the insurance contracting, the health care provider increases provided $k \left(p^m \left(\widetilde{k} \right) \right) < \widetilde{k}$. From (??), we may rearrange the first order conditions as

$$0 = - \left((1 - \pi) \overline{\alpha} + \pi \underline{\alpha} \right) \left(-q + (1 - k) \frac{dq}{dk} \right) - \underline{\alpha} h \rho' (k)$$

$$0 = - \left((1 - \pi) \overline{\alpha} + \pi \underline{\alpha} \right) \pi \left(-q + (1 - k) \frac{dq}{dk} \right) - \pi \underline{\alpha} h \left(p^m + \frac{dp^m}{dk} k \right)$$

$$\left((1 - \pi) \overline{\alpha} + \pi \underline{\alpha} \right) (1 - k) \frac{dq}{dk} = \left((1 - \pi) \overline{\alpha} + \pi \underline{\alpha} \right) q - \underline{\alpha} q - \underline{\alpha} h \frac{dp^m}{dk} k$$

$$\Rightarrow (1 - k) \frac{dq}{dk} = q \alpha^* - \frac{\alpha}{\left((1 - \pi) \overline{\alpha} + \pi \underline{\alpha} \right)} h \frac{dp^m}{dk} k \tag{16}$$

However, when p is fixed $\frac{d\Psi(\widetilde{k})}{dk}$ is $\pi \left(q \alpha^* - \left(1 - \widetilde{k} \right) \frac{dq}{dk} \right)$ and 16 implies that at $\widetilde{k}$ this term is negative since

$$q \alpha^* - \left(1 - \widetilde{k} \right) \frac{dq}{dk} = \frac{\alpha}{\left((1 - \pi) \overline{\alpha} + \pi \underline{\alpha} \right)} h \frac{dp^m}{dk} \widetilde{k} < 0 \tag{17}$$

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and the optimal k in the face of price commitment will be less than $\widetilde{k}$. $\qquad\square$

The emergence of Preferred Provider Organisations may be motivated in part as a response to the presence of price-discrimination in the health care provision market. In many cases, the only difference between PPO and traditional insurance schemes are pre-negotiated prices charged to consumers and insurers by "preferred providers".

6 Conclusion

This paper shows that pecuniary externalities from health insurance are always present when health-care markets are imperfectly competitive, and imply that competitive insurance markets do not maximise consumer welfare. This market failure only disappears in the competitive limit. We argue that this provides a justification for regulating insurance markets.

Since most health-care markets tend to be imperfectly competitive, this result has wide applicability to many health care systems. For example, it has implications for the recent moves by the US Medicare system to include pharmaceuticals in its insurance scheme and for the Australian policy of expanding private health insurance. According to our model, these policies will lead to price inflation and more generous insurance coverage, but may well leave consumers worse off. Therefore, the coinsurance rates ought to be restricted. We also find that for low cost services, the effect of insurance is purely inflationary. Therefore, for these services, Government ought to prohibit insurance.

A testable implication of our analysis is that health care systems that prohibit private supplementary insurance for a particular medical service would face lower prices than systems with a similar sized public insurer who permits supplementary insurance. Indeed, this could be one of the central drivers of the higher pharmaceutical prices faced by the US.

A study by Pavenik (2002) provides empirical support for our prediction that a fall in coinsurance rates leads to increase in health care prices. She uses a unique German policy experiment from 1989 in which the German government

increased the out-of-pocket portion paid by patients for prescription drugs if the drug company charged above a reference price. Previously (i.e. prior to 1989) patients paid a fixed out-of-pocket price regardless of the price. The effect of the reform was to introduce a "kink" in the demand curve for drugs at the reference price – with demand being perfectly inelastic below and elastic above. The introduction of the regime for some drugs (such as antibiotics) was staged over 5 years – and the heterogeneity in timing is exploited to undertake a difference-in-difference estimation procedure. Overall, the effect of the regime change was to reduce price per daily dose between 10 and 26 percent. Suppliers who faced more competition from generics in the same active ingredient class, responded to reference pricing with a larger drop in price. Moreover, the percentage reduction was larger for brand-drugs than for generics.

The claim made by our paper is that while the net effect on the German consumer was a higher out-of-pocket and therefore higher risk, it may nonetheless be a welfare increasing policy. The political problem for the public insurer is that, consumers will want to purchase supplementary insurance (or opt-out) since, taking the price of health care as given, they are under-insured.

We show that the gain in profitability and the increase in price from market-concentration is magnified by feed-back effects from the insurance market. This suggests that the incentives for innovation provided by patents for insurable goods such as drugs is more lucrative than those for non-insurable goods.

We also consider a health-insurance market in the presence of a perfectly-price discriminating monopoly provider. While such perfect price-discrimination is rare, it is now common to observe US hospitals posting discounts for low-income uninsured patients. A particularly striking example of such practices comes from New Zealand, where a doctor is reported to have given an uninsured patients a discount off the insurance company's recommended price for a vasectomy of NZD770. This discount was such that an uninsured patient's out-of-pocket expenditure would be the same as that of an insured patient, completely undermining the value of the insurance contract.[10]

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[10] "Doctor's cut leaves insurers wincing". *New Zealand Herald,* January 1999, p.3.

We show that when consumers anticipate the potential discounts to those with higher coinsurance rate, they may choose not to purchase insurance at all. Moreover, if they do buy insurance, the equilibrium contract has a larger coinsurance rate than would be the case if there was no price discrimination. We find that consumers and health-care providers are better off if the latter can commit not to price discriminate. Preferred provider organisations, by negotiating the price of health care, prior to selling insurance, provides the institutional environment necessary for insurers to commit to a non-discriminatory policy.

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