Health Insurance Mandates in a Model with Consumer Bankruptcy*

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Abstract

We study insurance take-up choices by consumers who face medical-expense and income risks, knowing they can default on medical bills by filing bankruptcy. For a given bankruptcy system we explore total and distributional welfare effects of health insurance mandates, compared with pre-mandates market equilibrium. We consider different combinations of premium-subsides and out-of-insurance penalties, confining attention to budgetary neutral policies. We show that when insurance mandates are enforced through penalties only, the efficient take-up level may be incomplete. However, if mandates are supported also with premium subsidies full insurance coverage is efficient and can be also Pareto improving. Such policies are consistent with the incentives structure set in the ACA for insurance take-up.

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1 Introduction

A common argument for universal health insurance in the debate surrounding the ACA (Affordable Care Act), was prevalent consumer bankruptcies due to uninsured medical bills[1]. However, the theoretical grounds for this argument and its concrete policy implications were not rigorously formalized. This work contributes to filling up that caveat in the theoretical literature.

We study the welfare implications of health insurance mandates in a model where consumers can default on uninsured medical bills by filing bankruptcy. We explore total and distributional welfare effects of supporting (enforcing) insurance mandates with different combinations of premium subsidies and out-of insurance penalties. The analysis highlights budgetary neutral implementations that are Pareto improving (compared with the pre-mandates regime).

The ACA aimed to expand insurance coverage over about 50 million uninsured Americans. At the core of the act are regulations on insurers, and individual health insurance mandates for consumers. In essence, the regulations on insurers aim to eliminate discriminatory practices (cream skimming) and the mandates aim to prevent adverse selection (free-riding).

The large American population with no health insurance prior to the ACA was widely considered as "the problem of the uninsured". Gruber (2008) explains why the high rate of uninsured may be a public concern: (1) if the uninsured are risk averse, lack of insurance implies possible market failures (2) the uninsured impose cost externalities on the health care system due to the provision uncompensated medical care, and (3) paternalism motive: people consider health care as a necessity and a basic right that would be provided more effectively through health insurance.

Gruber (2008) also surveys possible explanations for the high rate of uninsured, covering possible insurance-market failures and there corresponding remedies. The latter were implemented in the ACA through the aforementioned regulations. Another possible explanation considered by Gruber (2008) is the implicit insurance provided through uncompensated care: hospitals reimbursed by Medicare are obligated by federal law to provide acute medical care, regardless of the patient's ability to pay. Other health care providers may do so as well for charity motives.

However, once medically treated patients can choose to default on their medical bills through personal bankruptcy, or to use this option as a threat point in order to negotiate over their debt. Either way, the bankruptcy system enables at least partial discharge of medical bills, thereby providing partial insurance that serves as an imperfect substitute for standard health insurance.

Recently, Mahoney (2015) provided a first compelling empirical support for the role of bankruptcy as an implicit (and imperfect) substitute for standard health insurance. He showed that household's sizable assets (i.e. that are not protected under bankruptcy) are positively correlated with insurance coverage, and with out of pocket medical payments. Both findings are consistent with the substitution hypothesis: the closer household assets are to the exemption level the more it can benefit from defaulting on medical bills. Hence the lower the incentive to get insurance and the larger its bargaining position in negotiating over uninsured medical bills.

[1] See for example Miller et al. (2004), Himmlestien et al. (2005), and Dranove et al. (2006).

Gross and Notowidigoo (2011) use the expansions of Medicaid to identify the effect of health insurance status on consumer bankruptcy prevalence. They find that uninsured medical bills are pivotal to about 25% of low-income household bankruptcies. Their estimate falls between the 17% reported by Dranove and Millenson (2006) and the 29% of reported by Himmlestien et al. (2009). Mazumder and Miller (2014) find that the insurance mandates imposed by the Massachusetts Health Reform reduced the probability for consumer bankruptcy in the state by 18%.

Hence, effective implementation of the insurance mandates defined in the ACA is expected to significantly decrease medical bankruptcies[2]. However, the fact that the potential bankrupted have chosen to rely on bankruptcy as implicit health insurance suggests that they may be worse off under mandated insurance. Who would benefit from insurance mandates then? And what is their total welfare effect? These are the questions we address in this work, by exploring the total and distributional welfare implications of health insurance mandates. Such welfare analysis is essential to the completeness of any policy evaluation, for both theoretical and practical reasons.

The ACA defines a combination of positive and negative incentives to support and enforce insurance take-up. The positive incentives are progressive subsidies for purchasing insurance. The negative incentives are monetary penalties for not buying insurance (see Gruber 2011 for details). Our analysis highlights incentive combinations that support full insurance take-up, which are budgetary neutral and Pareto improving.

To this end we elaborate Mahoney's (2015) consumer-choice model into a stylized market equilibrium framework. We model perfectly competitive providers that load unpaid medical bills (due to bankruptcy) on their menu prices. These menu prices are translated into actuarially fair insurance premiums. Hence, the bankruptcy system implicitly provides a progressive subsidy on medical care to the uninsured. This subsidy is funded through a cost externality on the menu prices paid by insured[3].

Mahoney (2015) emphasizes this cost externality as a normative argument for insurance mandates that are enforced by Pigovion penalties (for remaining uninsured)[4]. Such Pigovion penalties are set equal to the expected discharged medical bills under the bankruptcy option, which is the expected cost externality induced by the uninsured. Unlike Mahoney (2015) our normative analysis follows a utilitarian approach: we compare individual utilities and aggregate utility achieved in under equilibrium in the health care market, with and without insurance mandates. This comparison is surely meaningful for practical reasons, but we argue that it has also normative grounds.

[2] On January 2015 the New-York Times reported on results from a survey run by the Commonwealth Fund, concluding a significant decrease uninsured rate and financial distress due to medical bills in 2014. http://www.nytimes.com/2015/01/15/upshot/financial-distress-connected-to-medical-bills-shows-a-decline-the-first-in-years.html?abt=0002&abg=1 However, medical bankruptcies are not expected to be entirely eliminated because even if everyone has insurance, not all expensive medical treatments are insured.

[3] Hadley et al (2008) estimate that uncompensated (or undercompensated) care provided by hospitals counts for about 5% of their revenues, and the most of it is covered by public reimbursement, and only a smaller fraction is shifted to other payers. Nonetheless, either way the discharged bills are effectively subsidies. In section 3 we will show that our model and result are not sensitive to the exact form of subsidy.

[4] Summers (1989) considered physicians willingness to provide medical care on credit (or inability to avoid such), as a justification for health insurance mandates.

The uninsured are able to externalize the cost of their medical care due to the legal requirement, and the deliberate will of hospitals to provide medical care on credit. To the extent that the legal requirement reflects social preferences, both reasons to provide uncompensated medical care are consistent with the perception of acute medical care as a merit good[5]. That is under consumption of medical care by some imposes disutility on others (who consume more).

We stress that this consumption externality can be mitigated Pigovion subsidies - such as are effectively provided through bankruptcy. This is in line with Coase's (1960) view on the reciprocal nature of externality, implying that the cost of the externality should/could be borne by both parties. However, we do not explicitly model consumption externalities in medical care. Instead, we take the bankruptcy system as given, accounting for any welfare gains it generates due to progressive subsidies in the form of discharged medical bills.

First we show that the efficient take-up level is always higher than the market equilibrium. Then we show that the socially-optimal insurance coverage depends on which implementation is used. If insurance mandates are enforced through penalties only, the optimal take-up level may be incomplete. However, if insurance take-up can be supported also by premium subsidies the socially optimal outcome is complete insurance coverage. Moreover, supporting complete insurance take-up only with subsidies can be Pareto improving with all welfare gains allocated to the initially uninsured.

Our results imply that if health insurance markets are well functioning relying on bankruptcy option as partial insurance is Pareto inefficient. We show that it is always Pareto improving to translate the expected (ex-post) subsidies on medical care through bankruptcy to (ex-ante) premium subsidies. This normative argument for subsidies is missing in Gruber's (2011) reasoning for subsidizing premiums in the ACA. Instead Gruber (2011) suggests that it makes sense to impose individual mandates only if insurance is "affordable". In the discussion we consider basic characteristics of the ACA that are consistent with Pareto improving policy.

The final contribution of this paper is showing that, when bankruptcy option is available, income volatility decreases insurance take-up by prudent consumers[6], but does not alter the main results of our welfare analysis.

The remainder of the paper develops as follows: Section 2 presents the detailed setup. Section 3 studies market equilibrium and insurance take-up, and market efficiency. Section 4 explores the welfare implications of insurance mandates, and discusses the results. Section 5 introduces income risk to the analysis, and section 6 concludes this study.

[5] As pointed out by Gruber (2008) and Summers (1989).
[6] That is $u'''(c_i) > 0$ (see Kimball 1990).

2 The Model

Consider perfectly competitive insurance and health care markets, and a perfect bankruptcy system[7]. The bankruptcy system is defined by the exemption level X , below which wealth is protected under bankruptcy. The perfectly competitive insurers offer full insurance for actuarially fair premiums over the per-unit price of medical care[8].

A unit mass of consumers, indexed i , differ only in income - denoted w. In our static model income coincides with wealth - which is the relevant measure for exemption eligibility under bankruptcy. Income distribution is defined over the finite range $w_i \in (w_L, w_H)$, by the cumulative distribution function $F(w)$. Hence, $p_i \equiv p(w_i) = F'(w_i)$ is the frequency of wealth level w_i. We assume $p(w_i)$ positive and differentiable for all income levels. Income range is denoted $L \equiv w_H - w_L$.

Consumers derive utility from consumption, denoted c. The utility function $u(c_i)$ is strictly concave: $u'(c_i) > 0$, $u''(c_i) < 0$ and $u'''(c_i) > 0$, so consumers are risk averse and prudent (in the sense of Kimball 1990)[9]. The assumed Prudence will serve us in characterizing the equilibrium conditions and the effect of income risk on insurance take-up choices. It plays no role however in the analysis of insurance mandate policies.

The price of non-medical consumption is normalized to one, so consumer with no medical spending derives utility $u_i = u(w_i)$. A uniform health shock hits consumers independently with probability π, imposing a medical bill M. Thus, after utilizing medical care consumers utility is $u(w - M)$. The price M is uniformly charged from all consumers. Hence the actuarially fair premium, denoted m, is given by $m \equiv \pi M$.

Insured consumer who get ill are provided with medical care at no additional cost (zero co-pay), and their insurance fully reimburses medical care providers - M per patient. The uninsured who get sick are being treated regardless their ability to pay. Once treated, the uninsured pays: $\min\{M, w_L - X\}$. Thus, with low enough income the uninsured can escape paying at least part of their medical bills through bankruptcy.

To make bankruptcy effective due to uninsured medical bills we assume: $w_H - M > X > w_L - M$, and to focus on non-trivial insurance choice assume $w_L \geq X$[10]. Finally, the marginal cost of providing medical care is MC. To assure that bankruptcy is effective option even under marginal-cost pricing we assume $MC > w_L - X$.

[7] In particular, we deliberately abstract from all distortions associated with informational imperfection on both insurance markets and the bankruptcy systems.

[8] As the analysis is confined to full insurance on the intensive margin (zero co-pays), whenever we consider "insurance coverage" from here and on we refer to the extensive margins (that is the rate of insured consumers).

[9] This means that marginal utility is convex in consumption level. Prudence is required for decreasing absolute risk aversion. Leland (1968) showed that prudence implies that optimal saving increases with income uncertainty, thereby formalizing the precautionary motive for saving. For more implications of Prudence see Eeckhoudt and Schlesinger (2006).

[10] For consumers with income $w < X$ bankruptcy in this model provides full insurance for free (fully discharged bills). Hence they cannot benefit from standard insurance and will never pay for it.

2.1 Consumer Choice

The utility of the insured consumer is certain

$$E\left[u^I\left(w_i\right)\right] = u\left(w_i - m\right)$$

Facing actuarially fair premiums risk-averse consumers who cannot gain from bankruptcy (for whom $w_i - M > X$) buy insurance. On the other end, for consumers with income equal or below the exemption level it is clearly better not to buy insurance as bankruptcy option eliminates financial risk. For income levels $X < w_i < X + M$ bankruptcy provides partial insurance against medical bills for free. For this income range, expected utility without insurance is given by

$$E\left[u^U\left(w_i\right)\right] = (1-\pi)\,u\left(w_i\right) + \pi u\left(X\right)$$

Hence the expected utility gain (or loss) from getting insurance, denoted Δ is

$$\Delta\left(w_i\right) \equiv E\left[u^I\left(w_i\right)\right] - E\left[u^U\left(w_i\right)\right] = u\left(w_i - m\right) - (1-\pi)\,u\left(w_i\right) - \pi u\left(X\right) \tag{1}$$

Corollary 1 *There exists $\widetilde{w} \in (X, X+M)$ below (above) which no one (everyone) buys insurance.*

Proof. $\frac{\partial \Delta}{\partial w_i} = u'\left(w_i - m\right) - (1-\pi)\,u'\left(w_i\right) > 0$. That is the gain from insurance is increasing monotonically with income. For $w_L = X$:$\Delta < 0$, and for $w > X + M : \Delta < 0$. Thus, due to the continuity of (1) $\exists \widetilde{w} \in (X, X+M)$ s.t $\forall w < \widetilde{w} : \Delta < 0$ and $\forall w > \widetilde{w} : \Delta > 0$. ■

Given $\widetilde{w}$ the uninsured rate is defines by the income cumulative distribution function $F\left(\widetilde{w}\right)$

2.2 Prices

To close the model we assume providers load unpaid medical bills (due to bankruptcy) on their menu prices. Thereby the cost of uncompensated care is loaded on insurance premium[11]. Providers take the uninsured rate as given, knowing they receive full payment for treating insured patients but only the sizeable income from uninsured patients. The zero profit condition for providers implies

$$MC = F\left(\widetilde{w}\right)\overline{M} + \left(1 - F\left(\widetilde{w}\right)\right) M$$

where $\overline{M} < MC$ is the average price paid by the uninsured, given by

$$\overline{M} = \frac{1}{F(\widetilde{w})} \int_{w_L}^{\widetilde{w}} \left(w_i - X\right) p_i di$$

[11] Hadley et al. (2008) report that 75% of the uncompensated care provided by hospitals is funded through federal transfers. Nonetheless, the price loading in our model is equivalent to a lump-sum tax levied by the policy maker as to reimburse consumers defaults on medical bills.

Plugging the above expression for $\overline{M}$ in the zero profit condition we obtain

$$M(\widetilde{w}) = \frac{MC - F(\widetilde{w})\,\overline{M}(\widetilde{w})}{1 - F(\widetilde{w})} = \frac{MC}{1 - F(\widetilde{w})} - \int\limits_{w_L}^{\widetilde{w}} (w_i - X)\,p_i di \tag{2}$$

and the implied actuarially-fair insurance premium is

$$m(\widetilde{w}) = \pi \left[\frac{MC}{1 - F(\widetilde{w})} - \int\limits_{w_L}^{\widetilde{w}} (w_i - X)\,p_i di \right] \tag{2a}$$

3 Equilibrium

3.1 Market insurance take-up

Imposing $\Delta = 0$ in (1) we define the implicit function $\varphi(\widetilde{w}, m)$, which assigns insurance take-up level determined by $\widetilde{w}$ to each given insurance premium level m

$$\varphi(\widetilde{w}, m) \equiv \Delta(\widetilde{w}, m) = 0 \Longrightarrow u(\widetilde{w} - m) - (1 - \pi)\,u(\widetilde{w}) - \pi u(X) = 0 \tag{3}$$

The equilibrium take-up level, denoted w^e, must satisfy (3) and at the same time $m(w^e)$ should satisfying the zero profit condition (2a). Graphically, the equilibrium is defined by an intersection of the curves defined by (2a) and (3), on the (m, w) plane. Applying the implicit function theorem to (3) we derive the change in the income of the marginal insured as a function of insurance premium

$$\frac{d\widetilde{w}}{dm} = \frac{u'(\widetilde{w} - m)}{u'(\widetilde{w} - m) - (1 - \pi)\,u'(\widetilde{w})} > 1 \tag{4}$$

The appendix shows that the assumed prudence $u'''(c) > 0$ is sufficient to assure that (4) is convex in m. Differentiating (2a) for $\widetilde{w}$ we obtain the change premiums due to the effect of the marginal uninsured on breaking-even medical prices

$$\frac{dm}{d\widetilde{w}} = \frac{\pi p_{\widetilde{w}}\,(X + M(\widetilde{w}) - \widetilde{w})}{1 - F(\widetilde{w})} \tag{5}$$

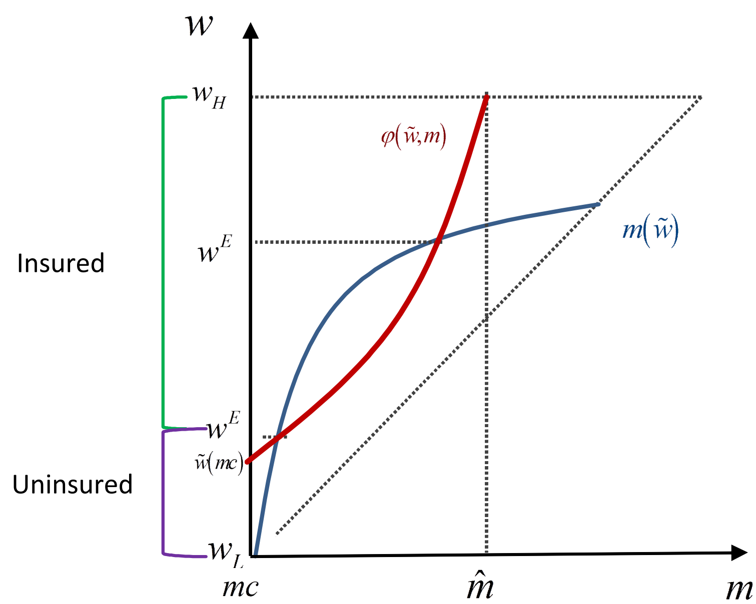
The complete characterization of (5) depends on the exact properties of the income distribution. However, for any income distribution (5) is positive, equals to $\pi p_{w_L}(X + MC - w_L)$ under full insurance take-up, and approaches infinity as the insurance rate goes down to zero. Any intersection between (4) and (5) defines equilibrium rate of uninsured $\widetilde{w}^e$and corresponding insurance premiums $m^e = \pi M^e$, that are consistent with consumers optimal choices and the zero-profit for providers and insurers.

Proposition 1 *For sufficiently thin lower tail of $F(\widetilde{w})$ there exist at least two equilibria take-up levels -$\widetilde{w}^e_L$ and $\widetilde{w}^e_H$. For sufficiently thick lower tail no one buys insurance.*

Proof. Sufficiently thin lower tail of $F(\widetilde{w})$ implies that $\frac{dm}{d\widetilde{w}}$ is flat enough for low values of $\widetilde{w}$ to guarantee intersection between (4) , i.e. equilibrium $\widetilde{w}_L^e$. However, as $\widetilde{w}$ increases $\frac{dm}{d\widetilde{w}} \longrightarrow \infty$, guaranteeing a second intersection with (4) $\widetilde{w}_H^e$, where $\widetilde{w}_L^e < \widetilde{w}_H^e$, and $m_L^e < m_H^e$. Sufficiently thick tail of $F(\widetilde{w})$ implies that $\frac{dm}{d\widetilde{w}}$ is too steep to intersect with (4) and thus no equilibrium exists. ■

Diagram 1 illustrates proposition 1 for the case with low and high equilibria w_L^e and w_H^e .

Diagram 1: Equilibrium Take-up



The origin of axis is scaled to present the lowest possible premium (under full insurance coverage) $mc \equiv \pi MC$ on the horizontal axis, and the lowest income on the vertical axis. The convex curve is derived from (3) and (4). It marks the marginal consumer to buy insurance as a function of insurance premium level.

For each premium level the line $\varphi(\widetilde{w}, m)$ splits the income range to consumers who buy insurance (above the curve) and consumers who choose to rely on the bankruptcy option. Its intercept denoted $\widetilde{w}(mc)$ defines the income level below which consumers prefer not to buy insurance even if the price of medical care equals to marginal cost $P = MC$. For premium levels $m \geq \widehat{m}$ no one buys insurance.

The second curve derived from (5). It marks market insurance-premiums as a function of insurance take-up levels $m(\widetilde{w})$, based on the zero profit condition (2a). For sufficiently thin lower tail of $F(\widetilde{w})$ the $m(\widetilde{w})$ curve is steep enough to intercept with $\varphi(\widetilde{w}, m)$. However, if one interception exists there must be at least one more, at a higher premiums and uninsured rate. This is because the slope of $m(\widetilde{w})$ approaches infinity as uninsured increase toward one, as shown in (5).

The two interception points define low and high equilibria. The lower equilibrium is locally stable - to the left (right) of the equilibrium point w_L^e insurance take-up rate is too low to support zero profit for health care providers. Hence insurance premiums are increasing along with $\widetilde{w}$. To the right of this point health care providers are making positive profit. Hence competition among providers will bring premiums down and insurance take will increase.

The high equilibrium w_H^e is locally unstable: to the right of the equilibrium premiums are increasing to infinity and insurance rate goes to one. To the left of this equilibrium point the market converges to the lower equilibrium. Hence we will focus on the lower equilibrium as the expected market outcome. For sufficiently thick lower tail of $F(\widetilde{w})$ the $m(\widetilde{w})$ curve is entirely below the $\widetilde{w}(mc)$ curve. Thus, there is no equilibrium in the market: insurance take-up level is always too low to support non-negative profit for health care providers[12].

3.2 Efficient insurance take-up

Next we characterize the efficient insurance coverage in the market, defined by the marginal insured consumer with income w^*. The income level w^* maximizes the following utilitarian objective function given the exemption level X and subject to the zero profit condition (2a)

$$\underset{w^*}{MAX} : W = \int_{w^*}^{w_H} u\left(w_i - m\left(w^*, X\right)\right) p_i di + \int_{w_L}^{w^*} \left[\left(1-\pi\right) u\left(w_i\right) + \pi u\left(X\right)\right] p_i di \tag{6}$$

Applying Leibnitz Rule [13] we derive the first order condition for insurance coverage rate that maximizes (6)

$$\frac{\frac{dm}{d\widetilde{w}^*}\left(1 - F\left(w^*\right)\right) E\left[u_I'\left(w - m\left(w^*, X\right)\right)\right]}{p_{\widetilde{w}^*}} = \left(1-\pi\right) u\left(w^*\right) + \pi u\left(X\right) - u\left(w^* - m\left(w^*, X\right)\right) \tag{7}$$

Note that the right side of (7) equals $\triangle\left(w^*\right)$. Substituting (5) into (7) we rewrite the latter

$$\pi\left(X + M\left(w^*\right) - w^*\right) E\left[u_I'\left(w - m\left(w^*, X\right)\right)\right] = \triangle\left(w^*\right) \tag{7a}$$

Conditions (7)-(7a) equalize gains to the marginal consumer who opts out of insurance (on the right side), with utility losses to the remaining insured due to resulting increase in premiums (on the left side). Note that the market equilibrium condition (3) equalizes the right side of (7) to zero. Hence the socially optimal insurance coverage and corresponding premium must be below the line defined by $\varphi\left(\widetilde{w}, m\right)$, and yet on the zero-profit line $m\left(\widetilde{w}\right)$[14].

[12] There is also the limit case of unique equilibrium, where (2a) is tangent to (3).

[13] $\frac{d}{dy} \int_{g_1(y)}^{g_2(y)} f\left(x,y\right) dx = \int_{g_1(y)}^{g_2(y)} \frac{df}{dy} f\left(x,y\right) dx + g_2'\left(y\right) f\left(g_2\left(y\right), y\right) - g_1'\left(y\right) f\left(g_1\left(y\right), y\right)$

That is integrating with variable boundaries.

[14] See diagram 1.

By the definition of $\varphi(\widetilde{w}, m)$, the marginal social utility (MSU) on the right side of (7a) is negative for $w_L^E < w^* < w_H^E$ and positive otherwise. This is because for $w_L^E < w^* < w_H^E$ the zero profit line is above above the insurance take up curve, meaning that for this premiums range more consumer would like to have insurance than what is needed to support zero profit. Hence it cannot be the optimal policy to impose a higher uninsured level. The marginal social cost (MSC) on the left size of (7a) is positive. Condition (7a) holds with equality, implying $0 < w^* < w_L$, iff $MSU(w_L) > MSC(w_L)$[15], that is

$$\pi (X + MC - w_L) E[u_I'(w - mc)] > \triangle(w_L)$$

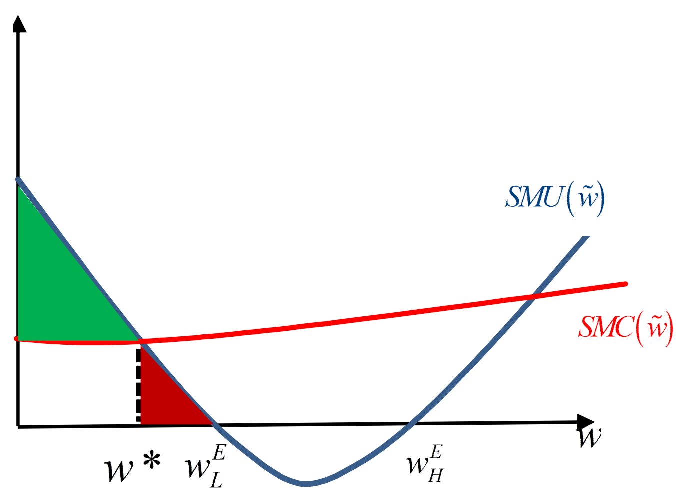
This condition holds for a sufficiently thin lower-tail of $F(\widetilde{w})$, ensuring that the gains from opting out of insurance to lowest income consumers are higher than the losses for the all others remaining insured - due to increase in medical prices. Proposition 2 concludes the latter analysis.

Proposition 2 $w^* < w_L^E$ *, the efficient insurance coverage is higher than market-equilibrium one. For a sufficiently thin lower-tail of $F(\widetilde{w})$ it is positive: $w_L < w^* < w_L^E$, and it is zero $w^* = w_L$ otherwise.*

Proof. The right side of (7a) is negative for $w_L^e < w^* < w_H^e$, and positive otherwise. The left side of (7a) is positive. Hence if (7a) holds with equality $w^* < w_L^E$. Otherwise $w^* = w_L$. ■

Bankruptcy provides a progressive subsidy on medical-care to uninsured consumers. It is welfare improving if $w^* > w_L$. Diagram 2 illustrates efficiently incomplete insurance coverage.

Diagram 2: Efficient Insurance Take-up



The U shape curve is the utility gain for the marginal uninsured which by the definition of (3) is negative between the two market equilibrium points. The other curve is the marginal social

[15] Otherwise $\forall w : MSC > MSU \; \forall w$, implying corner solution $w^* = 0$.

cost, which equals the utility loss to the remaining insured consumers, generated by the increase in medical prices and thereby insurance premiums. The exact shape of this curve depends on income distribution but it is definitely positive.

The (green) area between SMU and SMC left of w^* marks social gains from subsidizing medical care through bankruptcy up to the efficient level w^*. The (red) area below SMU for $w \in \left(w^*, w_l^E\right)$ marks the dead weight loss from the excessive reliance on the bankruptcy system under market equilibrium. For the case where full insurance coverage is efficient, i.e. $w^* = w_L$, the SMU curve is entirely above the SMU curve.

4 Insurance Mandates

4.1 Welfare analysis

Let us define implementation policy $\psi(t,s)$ that is set to support (enforce) health insurance mandates. Each implementation $\psi(t,s)$ assigns an income dependent penalty $t_i = t(w_i)$ for not buying health insurance, and a premium subsidy $s_i = s(w_i)$ if purchasing insurance. Hence, the total incentive to buy insurance provided by policy $\psi(t,s)$ is $t+s$. We assume penalties are not exempted under bankruptcy[16], and confine attention to fully effective implementations that satisfy

$$\psi(t,s) \ni \forall t_i + s_i > 0 : \begin{array}{c} u\left(w_i - (m - s_i)\right) > (1-\pi)\, u(w_i) + \pi u(X) - t_i \\ and\ u(w_i - m) < (1-\pi)\, u(w_i) + \pi u(X) \end{array}$$

That is under fully effective implementation the initially uninsured face zero incentive, and all the initially uninsured are facing a positive incentive $t_i + s_i > 0$ that makes insurance purchase their preferred choice. Subsidies are funded with tax revenue T levied through a lump sum tax τ imposed on the selected income range (w_τ, w_H), where w_τ is the lowest income level to pay the tax

$$T \equiv \tau(w_H - w_\tau) = \int_{w_L}^{\widetilde{w}} s_i di$$

Next, we define a Pigovion policy that equalizes the expected subsidy on medical-care through bankruptcy to an up-front (ex-ante) total incentive to buy insurance.

Definition 1 $\psi^{pigov}(t,s)$ *is a Pigovion Policy* $\ni \forall i:\ t_i + s_i = Max\left\{\pi\left(M + X - w_i\right), 0\right\}$.

On one extreme the Pigovion policy composes only *Pigovion Penalties*

$$\psi^{pigov}(t,0) \ni \forall i:\ s_i = 0, t_i = Max\left\{\pi\left(M + X - w_i\right), 0\right\}$$

On the other extreme it composes only *Pigovion Subsidies*

$$\psi^{pigov}(0,s) \ni \forall i:\ s_i = Max\left\{\pi\left(M + X - w_i\right), 0\right\}, t_i = 0$$

[16] The ACA exempts annual penalties if Bankruptcy was filed during the first six months of the year.

Lemma 1 $\forall \psi^{pigov}(t,s) : u(w_i - m - s_i) > \pi u(w_i - t_i) + (1-\pi) u(X - t_i)$. *All Pigovion policies are effective.*

Proof. $\forall \psi^{pigov}(t,s) : (1-\pi)(w_i) + \pi X - t_i = w_i - (m - s_i) \Rightarrow t_i + s_i = \pi(M + X - w_i)$. All Pigovion incentives equalize expected consumption with and without insurance. Hence, in face of Pigovion incentive risk averse consumer strictly prefer buying insurance. ■

Proposition 3 $\forall \psi^{pigov}(t,s) : w^e_{\psi^{pigov}} = w_L$. *Any Pigovion policy supports full insurance take-up*

Proof. $\forall \psi^{pigov}(t,s)$: all consumers with $w^e < w_L$ are buying insurance (by Lemma 1), and if everyone is insured $P = MC$ by (2a). The subsidies cost under Pigovion policy does not exceed the cost of subsidizing medical care through bankruptcy: $\forall \psi^{pigov}(t,s) : \int_{w_L}^{w^e} s_i di \in [0, (m^* - mc)(\widetilde{w} - w_L)]$. Hence any Pigovion Policy can indeed be funded through a tax $\tau \in (0, m - mc)$ on the initially insured, without making them drop their insurance. ■

Note that Pigovion subsidies do not affect the expected consumption of the initially uninsured, whereas for all other Pigovion policies the expected consumption of the initially uninsured is lower under insurance mandates. This implies the following propositions.

Proposition 4 *Under Pigovion Subsidies the initially uninsured are better off and the initially insured are indifferent.*

Proof. Under Pigovion Subsidies all medical-care subsidies provided initially through bankruptcy are translated into premium subsidies. All the initially uninsured are better off getting full insurance (by Corollary 2). The initially insured are indifferent because the direct tax they are paying equals the implicit premium tax under bankruptcy: $\tau = m - mc$.

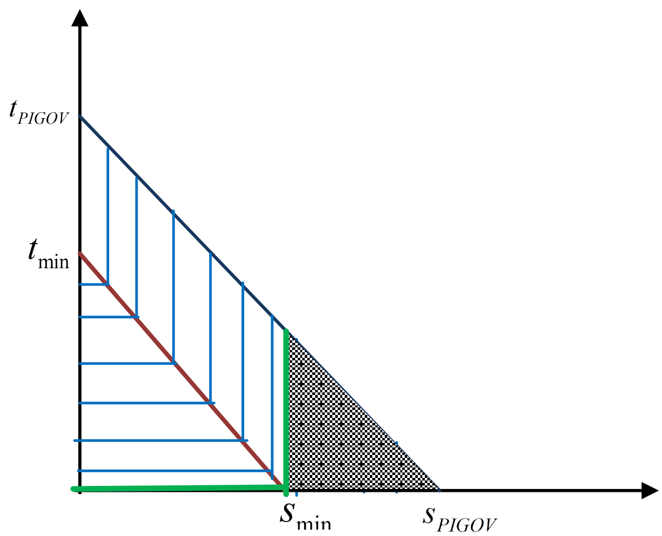
■

Proposition 5 *Under Pigovion Penalties the initially uninsured with $w_i \in (w_L, \widetilde{w}(mc))$ are worse off and all others are better off.*

Proof. As premiums go down to mc all consumers $w_i \in (w_L, \widetilde{w}(mc))$ still prefer not to buy insurance but do it in light of the penalty. All others gain from lower medical price. ■

As all Pigovion incentives are strictly effective there must exist policies that provide smaller incentives, which are weakly effective denoted $\psi^{\min}(t,s)$. Diagram 3 illustrates the impact of different implementations policies on the representative uninsured.

Diagram 3: Incentives impact



The flipped L-shape (blue) lines are indifference curves. The reservation utility of the typical uninsured is defined by the bald (green) indifference curve. The (red) line that connects $t_{\min}$ with $s_{\min}$ marks the incentives that are weakly effective in supporting insurance take-up (out if indifference)[17]. The linear highest (grey) curve marks all Pigovion incentives.

All incentives below the $t_{\min}$-$s_{\min}$ line are not effective in supporting insurance take-up, implying that the uninsured pays the penalty and does not utilize the subsidy. Therefore utility is decreasing with penalty level. All incentives above that line are effective. Hence, utility is increasing with subsidy level. The doted triangle marks policies that make the (initially) uninsured better off, for which $s \in (s_{\min}, s_{PIGOV})$. Note that the intercepts of Pigovion penalties and minimal effective penalties negatively depend on the income of the uninsured.

4.2 Discussion

Propositions 3-5 highlights the principle inefficiency of the partial insurance provided by the bankruptcy system. Any given external cost imposed on the initially-insured due to uncompensated care can better serve the uninsured by subsidizing their insurance premiums. Mahoney's (2015) simulations suggests that under Pigovion penalties insurance take up would be almost complete. Proposition 3 provides theoretical support to this estimation.

In fact, Pigvion penalties are equivalent to excluding medical bills from exemption under bankruptcy. However, if $w^* > w_L$ Pigovion penalties are not socially optimal. Moreover, in this case even supporting w^* with effective penalties on the excessively uninsured $w_i \in (w^*, w^e)$ is Pareto inefficient. Pareto improvement can be still achieved by subsidizing premiums for $w_i \in (w_L, w^*)$.

[17] This line illustrative and should not be linear. Its actual slope is given by $\frac{\partial t_{\min}}{\partial s_{\min}} = -\frac{u'(w-m+s)}{(1-\pi)u'(w-t)+\pi u'(X-t)}$.

To summarize, propositions 3-5 provide two conclusions: (a) In face of well-functioning insurance markets the option to default on medical bills bankruptcy is socially inefficient. Hence full insurance coverage is necessary for efficient policy. (b) Even if insurance markets are efficient premium subsidies can be Pareto improving compared with the initial status quo.

The ACA is designed to implement the individual insurance mandates with penalties that are increasing with income, and subsidies that are decreasing with income (see Gruber 2011 for details). Our analysis implies that such implementation can be Pareto Improving and budgetary neutral. While a full simulation of the ACA welfare impact is beyond the scope of this study, considering key aggregate figures may still be illuminative as a first order evaluation.

Hadley et al. (2008) estimate that the uninsured receive \$56 billion in uncompensated care (2008 dollars), of which 75% are publicly funded. The annual cost of the subsidies provided in the ACA is estimated around \$88 billion for the year 2019 [18]. Deflated to 2008 prices assuming 2% annual inflation rate and adjusting for 1% annual population growth rate this number goes down to \$65 billion. That is the estimated cost of uncompensated care and premium subsidies are roughly of similar scale. By comparison, the 170 million Americans who got their health insurance through workplace in 2010, received about a \$250 billion annual tax-breaks subsidy (Gruber 2011).

Mahoney's (2015) points out that the penalties set by the ACA to be negatively correlated with Pigovion ones. That is they are lower than Pigovion for low income and higher than Pigovion for high income. His simulation result predicts that the ACA penalties will push only 40% of the uninsured under insurance coverage. However, our analysis shows that it is the sum of subsidies and penalties that determines the entire incentive provided by the policy.

The income dependent penalties and subsidies defined in the ACA are nationally uniform. Such uniform implementation is may have differential impact on insurance take-up across states that run diverse bankruptcy systems (see Mahoney 2015). For states with more limited (generous) bankruptcy option the incentives to buy insurance set by the ACA are stronger (weaker). Nonetheless, a nationally uniform policy can support full insurance take-up if penalties are set high enough. Then the uniform subsided will effectively eliminate the cross-states differences in gains from bankruptcy as implicit health insurance. However, the welfare implication across state will not be uniform.

5 Income risk and Insurance take-up

Here turn now to validate our previous results for consumers who face also income risk, which is highly relevant to the context of bankruptcy. We still assume $u'''(c_i) > 0$ (that is consumers are "prudent" as marginal utility is convex in consumption level). We consider an independent and symmetric income shocks that hits consumers with probability ρ. With probability $\frac{\rho}{2}$ it either increases or decreases income by the fraction ϕ.

Note that the Pigovion incentives defined in section 5 still support full insurance take-up, as they still equalize expected consumption with and without insurance. To see that consider for example

[18] Source: CBO estimations athttp://www.cbo.gov/sites/default/files/amendreconprop.pdf

the marginal consumer to take insurance under the certain income $\widetilde{w}$, and assume she faces small income shocks such that $(1+\phi)\,\widetilde{w} - M < X$. Then expected consumption with insurance is

$$(1-\rho)\,(\widetilde{w}-m) + \frac{\rho}{2}\,[(1-\phi)\,\widetilde{w}-m] + \frac{\rho}{2}\,[(1+\phi)\,\widetilde{w}-m] = \widetilde{w}-m \tag{8}$$

The expected consumption with no insurance is still

$$E\,(\widetilde{w}) = (1-\pi)\left[(1-\rho)\,\widetilde{w} + \frac{\rho}{2}\,(1-\phi)\,\widetilde{w} + \frac{\rho}{2}\,(1+\phi)\,\widetilde{w}\right] + \pi X = (1-\pi)\,\widetilde{w} + \pi X \tag{8a}$$

and the implied expected subsidy on medical care under bankruptcy is

$$E\,(\widetilde{w}) = \pi \left[\begin{array}{c} (1-\rho)\,(M-\widetilde{w}+X) + \\ +\frac{\rho}{2}\,(1-\phi)\,(M-\widetilde{w}+X) + \frac{\rho}{2}\,(1+\phi)\,(M-\widetilde{w}+X) \end{array}\right] = \pi\,(M-\widetilde{w}+X) \tag{8b}$$

Corollary 2 *Propositions 3-5 hold under income risk.*

Proof. The sum of the right sides in (8a) and (8) equals (8a). ∎

Consumer's expected utility with and without insurance are given, respectively, by

$$E\left(u^I\right) = (1-\rho)\,u\,(\widetilde{w}-m) + \frac{\rho}{2}\,[u\,((1-\phi)\,\widetilde{w}-m) + u\,((1+\phi)\,\widetilde{w}-m)] \tag{9}$$

$$E\,(u^u) = (1-\pi)\left\{(1-\rho)\,u\,(\widetilde{w}) + \frac{\rho}{2}\,[u\,((1-\phi)\,\widetilde{w}) + u\,((1+\phi)\,\widetilde{w})]\right\} + \pi u\,(X) \tag{9a}$$

Hence, the utility gain from insurance, denoted $\triangle \equiv E\left(u^I\right) - E\,(u^u)$as before, becomes

$$\begin{aligned} \triangle \;=\; & (1-\rho)\,u\,(\widetilde{w}-m) + \frac{\rho}{2}\,[u\,((1-\phi)\,\widetilde{w}-m) + u\,((1+\phi)\,\widetilde{w}-m)] - \\ & -(1-\pi)\left\{(1-\rho)\,u\,(\widetilde{w}) + \frac{\rho}{2}\,[u\,((1-\phi)\,\widetilde{w}) + u\,((1+\phi)\,\widetilde{w})]\right\} - \pi u\,(X) \end{aligned} \tag{10}$$

By the definition of the indifference consumer $\widetilde{w}$ we have

$$(1-\rho)\,u\,(\widetilde{w}-m) = (1-\pi)\,(1-\rho)\,u\,(\widetilde{w}) + \pi u\,(X)$$

Hence, we can rewrite (10) as

$$\triangle = \frac{\rho}{2}\left\{\begin{array}{c} [u\,((1-\phi)\,\widetilde{w}-m) + u\,((1+\phi)\,\widetilde{w}-m)] - \\ -(1-\pi)\,[u\,((1-\phi)\,\widetilde{w}) + u\,((1+\phi)\,\widetilde{w})] - 2\pi u\,(X) \end{array}\right\} \tag{10a}$$

The definition of $\widetilde{w}$ implies that $\phi = 0 \Longrightarrow \triangle = 0$. Differentiating (10a) for ϕ yields

$$\frac{d\triangle}{d\phi} = \frac{\rho}{2}\left[\begin{array}{c} -u'\,((1-\phi)\,\widetilde{w}-m) + u'\,((1+\phi)\,\widetilde{w}-m) + \\ +(1-\pi)\,u'\,((1-\phi)\,\widetilde{w}) - (1-\pi)\,u'\,((1+\phi)\,\widetilde{w}) \end{array}\right] \tag{11}$$

Proposition 6 *Income risk decreases insurance take-up by prudent consumers.*

Proof. For $m = 0 : \frac{d\triangle}{d\phi} = 0$. Differentiating (9a) for m one gets $\frac{d\triangle}{d\phi dm} = u''\left((1-\phi)\widetilde{w} - m\right) - u''\left((1+\phi)\widetilde{w} - m\right)$, which is negative by the definition of prudence, hence $\frac{d\triangle}{d\phi} < 0 \; \forall m > 0 \Rightarrow \triangle < 0$ $\forall m, \phi > 0$. ■

In case that income shocks are large enough so that $(1+\phi)\widetilde{w} - M > X$ equation (10a) becomes

$$\triangle = \frac{\rho}{2}\left\{\begin{array}{c} \left[u\left((1-\phi)\widetilde{w} - m\right) + u\left((1+\phi)\widetilde{w} - m\right)\right] - \\ -(1-\pi)\left[u\left((1-\phi)\widetilde{w}\right) + u\left((1+\phi)\widetilde{w}\right)\right] - \pi u(X) - \pi u\left((1+\phi)\widetilde{w} - M\right) \end{array}\right\}$$

The above expression is smaller than (10a) hence for $(1+\phi)\widetilde{w} - M > X$ income risk also decreases insurance take-up.

6 Conclusions

This study performs equilibrium welfare-analysis of health insurance mandates in a model with consumer bankruptcy. We explored both total and distributional welfare effects of implementing mandates with different combinations of penalties and subsidies, characterizing a set of budgetary neutral and Pareto improving policies.

We find that in face of well-functioning insurance markets, it is Pareto improving to eliminate "medical-bankruptcy" by supporting full insurance take up with premium subsidies, and possibly out of insurance penalties. Rough evaluating suggest that in first order approximation the set of penalties and subsidies set by the ACA are consistent with Pareto efficient policy.

In this paper we deliberately abstracted the possible moral hazards induced by both health insurance and the bankruptcy system (as a form of social insurance). Moral hazard with respect to medical consumption would make a case for limiting insurance provision whereas inefficiency on the bankruptcy system would increase the net benefits from increased insurance coverage.

Future research could apply the theoretical framework developed in this paper to simulate and quantify the full welfare implications of different mandates policy. Future research is also called to elaborate the present framework into a dynamic setup that incorporates borrowing (saving) choices along with insurance take-up decisions.

Appendix: proof for the convexity of $\frac{d\widetilde{w}}{dm}$

Equation (4) $\frac{d\widetilde{w}}{dm} = \frac{u'(\widetilde{w}-m)}{u'(\widetilde{w}-m)-(1-\pi)u'(\widetilde{w})} > 1$ can be written as

$$\frac{d\widetilde{w}}{dm} = \frac{1}{1 - \frac{(1-\pi)u'(\widetilde{w})}{u'(\widetilde{w}-m)}} \tag{A.1}$$

The above expression is increasing with m, that is $\frac{d\widetilde{w}}{dm^2} > 0$ iff $\frac{d\frac{(1-\pi)u'(\widetilde{w})}{u'(\widetilde{w}-m)}}{dm} > 0$. Deriving $\frac{d\widetilde{w}}{dm^2}$ explicitly we obtain

$$\frac{d\frac{(1-\pi)u'(\widetilde{w})}{u'(\widetilde{w}-m)}}{dm} = (1-\pi)\frac{\frac{d\widetilde{w}}{dm}u^{''}\left(\widetilde{w}\right)u'\left(\widetilde{w}-m\right) - u'\left(\widetilde{w}\right)u^{''}\left(\widetilde{w}-m\right)\left(\frac{d\widetilde{w}}{dm}-1\right)}{u'\left(\widetilde{w}-m\right)^2} \tag{A.2}$$

Applying $\frac{d\widetilde{w}}{dm} = \frac{1}{1-\frac{(1-\pi)u'(\widetilde{w})}{u'(\widetilde{w}-m)}}$ to A.2 elaborates it to

$$\frac{(1-\pi)}{u'\left(\widetilde{w}-m\right)^2}\frac{\left[u^{''}\left(\widetilde{w}\right)u'\left(\widetilde{w}-m\right)^2 - u'\left(\widetilde{w}\right)^2\left(1-\pi\right)u^{''}\left(\widetilde{w}-m\right)\right]}{u'\left(\widetilde{w}-m\right) - \left(1-\pi\right)u'\left(\widetilde{w}\right)} \tag{A.3}$$

The sign of A.3 is determined by the expression in the brackets. It is negative if

$$\left|u^{''}\left(\widetilde{w}\right)\right|u'\left(\widetilde{w}-m\right)^2 > u'\left(\widetilde{w}\right)^2\left(1-\pi\right)\left|u^{''}\left(\widetilde{w}-m\right)\right| \tag{A.4}$$

For A.4 to be negative,- implying $\frac{d\widetilde{w}}{dm^2} > 0$ - it is sufficient to have $u^{''}\left(\widetilde{w}\right) > u^{''}\left(\widetilde{w}-m\right)$ that is $u^{'''}\left(\cdot\right) > 0$. Q.E.D.

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