2017-02-13

Forthcoming in *Journal of Political Economy*

Social Norms in Social Insurance*

by

Assar Lindbeck♣ and Mats Persson#

Abstract

We analyze how insurance arrangements, labor supply, moral hazard and outright cheating are affected by social norms. One question is under what conditions norms may improve social welfare. Another is under what conditions people should be allowed to opt out of social insurance. We introduce an informal production sector to analyze the consequences of alternative assumptions about the information available to norm enforcers. This highlights one important aspect of norms, namely that they may compensate for the insurer's limited information.

Key words: Income insurance, endogenous norms, sick pay, sickness absence, stigmatization

JEL codes: D82, H55, H75, I13, J22

---

* We are indebted to Pär Holmberg, Sebastian Koehne, Harald Lang and Thomas Önskog for valuable comments and suggestions on a draft of the paper. Constructive comments from the editor (James Heckman) and three anonymous referees are also acknowledged.
♣ Institute of international Economic Studies, Stockholm University, S-106 91 Stockholm, Sweden, and Research Institute of Industrial Economics, Stockholm, Sweden. E-mail: assar@iies.su.se
Institute of international Economic Studies, Stockholm University, S-106 91 Stockholm, Sweden. E-mail: mp@iies.su.se

I. Introduction

Moral hazard in the form of "overusing" or outright cheating on social-insurance benefits does not seem to have been a serious problem during the early decades of the modern welfare state. One explanation is that social norms in favor of regular work and/or against benefit-dependence constrained such behavior. It is likely, however, that such norms weakened in response to gradually more generous welfare-state benefits and an increase in the number of beneficiaries. It is also likely that the incentives among parents to instill work norms in their children subsided with the emergence of the modern welfare state, whereby an individual could survive also without working.[1] This development created a case for informal social control by fellow citizens since the administrators of the income-insurance system have only limited capacity to monitor the behavior of insured individuals.

There is a rapidly expanding literature in the social sciences on the role of social norms. [2] In the present paper, we ask three fundamental questions on this issue in the context of social insurance: What are the effects of social norms on individual and aggregate behavior? What are the effects on the design of optimal insurance contracts and on welfare? What is the role of information among norm enforcers for the functioning of social norms? While the first question has been discussed extensively in the literature, the second and third questions have been analyzed to a lesser extent. In this paper, we deal with all three of these questions. We analyze the interaction between economic incentives and social norms when norm enforcers have limited information – thereby combining sociological and economic mechanisms.

Our analysis is formally confined to income insurance associated with sick leave (temporary disability) – an important type of income insurance particularly in European countries. However, the general principles of the analysis are also relevant for other forms of income insurance, such as early retirement for health reasons (permanent disability), and unemployment insurance. [3]

[1] For empirical evidence, see Lindbeck and Nyberg (2006).

[2] See e.g. Parsons (1952), Ullmann-Margalit (1977), Opp (1979), Axelrod (1986), Coleman (1990), Hechter and Opp (2001) and Bicchieri (2006).

[3] Examples of theoretical studies of norms in the context of income transfers are Besley and Coate (1992), Lindbeck (1995) and Lindbeck, Nyberg and Weibull (1999). Examples of empirical studies of norms in social policy are Bertrand, Luttmer and Mullainathan (2000), Heinemann (2008), Halla and Schneider (2014), and Lindbeck, Palme and Persson (2016).

The paper is organized as follows. We begin by discussing some general problems of modeling social norms (section II). We then introduce norms into an insurance model with only one production sector (section III). Although that model is simplistic, it serves as a useful benchmark for more elaborate models. In Section IV we add an informal production sector. This not only increases the realism of the analysis; it also allows for more elaborate assumptions about the information held by fellow citizens (the norm enforcers). Section V concludes.

II. Social Norms and Social Preferences

A social norm prescribes desirable behavior. Individuals who do not behave accordingly are punished. The norm is a public good, and this feature raises a fundamental question: why would an individual incur the cost and trouble of enforcing the norm? One answer is that there exists a meta-norm, according to which citizens should punish those who fail to punish norm-breakers (cf. Axelrod, 1986). A problem with this explanation is that it easily runs into an infinite regress of higher-order meta-norms.

Of course, if there are no private costs of enforcing norms, this public-goods problem disappears. Gary Becker's (1974) notion of "social preferences" provides an example. With such preferences, an individual's reputation – others' opinion of him – is an argument in his utility function. [4] This means that the individual's reputation might be harmed if he violates norms. According to Becker's approach, norm enforcement takes place automatically through everyday social interaction, where the norm enforcers reveal their opinion about the norm violator in many subtle, and often costless, ways. In fact, it is hard to *avoid* having an opinion about others – and to avoid revealing it. [5] With this approach, there are no costs associated with enforcing social norms. Of course, it is easy to conceive of situations where enforcement costs are quite significant – but there is also experimental evidence that many individuals actually enjoy punishing norm breakers (see Fehr and Gächter, 2000). For these reasons we refrain from explicitly modeling enforcement costs – as in fact other authors also do.

[4] Becker (1974) enters what he calls the individual's "distinction in his occupation" as an argument in the utility function. Along the same lines, we refer to the individual's "reputation in society".

[5] Another example of costless norm enforcement is a game-theoretic approach where norms are treated as equilibria of strategic interaction; see Ullmann-Margalit (1977).

Another question concerns the discomfort of becoming stigmatized. We follow the tradition in the literature of assuming that the discomfort of violating a social norm is smaller if many others also violate the norm; in this sense, the norm is assumed to be endogenous. This holds regardless of whether the disutility is due to loss of status or to active harassment by fellow citizens.

The model in Lindbeck and Persson (2013) – where an individual's health is treated as a continuous, stochastic variable – provides a suitable framework for the analysis of social norms in the context of income insurance. The reason is that both the individual's health status and the the norm – namely that people should not overuse or cheat on benefits – are continuous phenomena in the real world. [6]

III. Norms in a One-Sector Model

A. The Basic Model

With only one production sector, an individual has two ways of supporting himself; either he works in that sector or he lives on benefits. Representing consumption utility by an increasing, concave function $u(\cdot)$, the total utility of an insured individual can then be written

$$u(1-p)+\theta \qquad \text{when working,} \tag{1}$$

$$u(b)-\varphi \qquad \text{when living on benefits.} \tag{2}$$

Here, p is the premium paid to the insurer, b is the benefit received when not working, θ is the (dis)utility of working, and φ is the subjectively felt stigma of living on benefits. We normalize the wage rate to unity. In this section we deal only with mandatory insurance.

The variables θ and φ deserve some comments. For simplicity, we call θ the individual's "health", but it in fact denotes the comfort or discomfort of working – a much wider concept than health. θ is a continuous stochastic variable drawn from a cumulative probability distribution $F(\theta)$, and throughout the paper we assume that it is observable only by the individual himself.

[6] By contrast, the influential paper by Diamond and Mirrlees (1978), and papers following that tradition (such as Golosov and Tsyvinski, 2006), treat health as a dichotomous variable; people are either able or unable to work.

According to (1) and (2), the variable θ affects the individual only while working; for given consumption, it expresses the *utility difference* between working and staying home. [7]

The term $\varphi \geq 0$ in (2) represents the utility loss of violating the social norm. This representation is consistent with the assumption that an individual is concerned about his reputation, which is damaged when he violates the norm (cf. Becker, 1974). It also conforms to the observation that individuals in the real world actually seem to feel that living on benefits is shameful, and that the shame is connected to receiving benefits *per se*, rather than to the size of benefits; see Moffitt (1983). Indeed, in the literature, norms have usually been represented as in equation (2).[8] Since we study social norms rather than internalized norms, equation (2) builds on the implicit assumption that fellow citizens, who enforce the norm, are actually able to observe whether an individual lives on benefits.

It may be asked why staying home and living on benefits should be stigmatized in our one-sector model. After all, there is no outright cheating in that model, but only the classical moral-hazard problem: since θ is unobservable to the insurer, the individual may be tempted to stay home more often than he would do if the insurer had full information about him. As is well known in the literature, the insurer deals with this moral-hazard problem by offering less than full insurance ($b < 1 - p$). The question then is whether a norm can contribute to improving the unavoidable trade-off between moral hazard and income smoothing.

Our assumption that φ is decreasing in the number of beneficiaries means that the norm is *endogenous*. However, we also discuss the special case where the norm is *exogenous*, i.e., where φ is a constant – a case that is relevant when norms change only slowly over time.

By assuming that each individual can have different outcomes in the health variable θ, the model allows for heterogeneity *ex post*. However, in the real world, individuals also differ *ex ante* in many respects, such as income, the shape of the utility function, and the shape of the probability

---

[7] In the labor economics literature, work is usually assumed to generate disutility for the individual, which in our context would mean that θ could only take negative values. But there is no *a priori* reason to assume that individuals always dislike work. It may often be pleasant rather than onerous, partly due to social interaction with coworkers. In our model, we therefore allow θ to take both negative and positive values. For an analysis, and a survey of empirical studies, according to which work *per se* is often pleasant, see Rätzel (2012).

[8] See, for instance, Besley and Coate (1992) and Lindbeck, Palme and Persson (2016).

distribution $F(\theta)$. Since this paper emphasizes the role of social norms, we limit the heterogeneity *ex ante* to differences in the norm term φ.

Let us henceforth write φ as a function $\varphi(\pi, \alpha, i)$, assuming that each individual i has his own φ function. Here, π is the aggregate absence rate in society (to be formally defined later on). If the norm is endogenous, the partial derivative $\varphi_1(\pi, \alpha, i)$ is strictly negative, while it is zero if the norm is exogenous. The second argument in the norms function, α, is simply a shift parameter affecting the strength of the norm for a given π. We assume that the partial derivative $\varphi_2(\pi, \alpha, i) > 0$, but we make no assumptions about the second derivative φ_{22} or the cross derivative φ_{12}; we return to the shift parameter later on (section III.D). In the following, we refer to the level of $\varphi(\pi, \alpha, i)$ as the "strength" of the norm for individual i. A higher value of $\varphi(\pi, \alpha, i)$ for individual i, due to lower π or higher α, will be referred to as a "stronger" norm.

Individual i chooses to stay home from work and live on benefits if $u(1-p) + \theta \leq u(b) - \varphi(\pi, \alpha, i)$, which defines the cutoff

$$\theta_i^* = u(b) - u(1-p) - \varphi(\pi, \alpha, i). \tag{3}$$

Thus individual i stays home if the realization of θ is less than θ_i^*, and goes to work otherwise. The fraction of time during which individual i chooses to stay home then is

$$\pi_i \equiv F(\theta_i^*). \tag{4}$$

It follows from (3) and (4) that individuals with a particularly strong norm – i.e., a high value of $\varphi(\pi, \alpha, i)$ for given values of π and α – stay home less often than other individuals.

B. Social Multipliers and Multiple Equilibria

It is well known that models with social interaction may give rise to social multipliers in the sense of Glaeser, Sacerdote and Scheinkman (2003). Such models may also generate multiple equilibria (see, e.g., Brock and Durlauf, 2001). Do these phenomena occur also in our model?

Let us start with the issue of social multipliers. We formalize the definition of π:

$$\pi \equiv \int \pi_i \, dG(i) \equiv \int F(\theta_i^*) dG(i), \tag{5}$$

where $G(i)$ is the distribution of individuals across the population. Differentiatiating (5) yields

$$\frac{\partial \pi}{\partial p} = m \cdot u'(1-p) \int f(\theta_i^*) dG(i)\,, \qquad \frac{\partial \pi}{\partial b} = m \cdot u'(b) \int f(\theta_i^*) dG(i), \tag{6a}$$

where $f(\cdot) \equiv F'(\cdot)$ and where

$$m \equiv \frac{1}{1 + \int f(\theta_i^*) \cdot \varphi_1(\pi, \alpha, i) dG(i)} \tag{6b}$$

is the social multiplier. Stability requires the multiplier to be positive (Appendix 1). In fact, $m > 1$ in the case of an endogenous norm (i.e., when $\varphi_1(\pi, \alpha, i) < 0$) – as befits a proper multiplier. Further, $m = 1$ when the norm is exogenous. Since m is positive, $\partial \pi / \partial p > 0$ and $\partial \pi / \partial b > 0$; aggregate work absence increases if either p or b increases, as we would expect.

Suppose that the government raises the benefit rate b without realizing that the norm is in fact endogenous. Then the ensuing increase in sickness absence is underestimated. We suggest that such policy surprises to the government often occur in the real world.

Note that the derivatives in (6) abstract from the requirement of budget balance for the insurer.[9] To derive the social multiplier under a balanced budget, we impose the budget constraint

$$(1 - \pi)p = \pi b. \tag{7}$$

Substituting p from (7) into (3)-(5), and differentiating with respect to b, shows that

$$\left.\frac{d\pi}{db}\right|_{\substack{balanced \\ budget}} > \frac{\partial \pi}{\partial b}.$$

[9] This is the reason why we have used the notation $\partial \pi / \partial p$ and $\partial \pi / \partial b$ instead of $d\pi / dp$ and $d\pi / db$.

The intuition behind this result is that starting from a balanced budget, raising b leads to an increase in work absence and thus to a budget deficit. To restore budget balance, p has to be raised, which leads to a further increase in absence.

Let us now turn to the possibility of multiple equilibria. Equations (3)-(5) imply

$$\pi = \int F[u(b) - u(1-p) - \varphi(\pi, \alpha, i)]dG(i). \tag{8}$$

If the norm is exogenous (i.,e., if $\varphi_1(\pi, \alpha, i) = 0$), the right-hand side of (8) is independent of π and thus (8) has a unique solution π. In the case of endogenous norms ($\varphi_1(\pi, \alpha, i) < 0$) the right-hand side of (8) is instead strictly increasing in π and may be non-linear; thus, for a given pair (p, b), the equation may have multiple solutions for π.

Does this mean that our model as a whole may have multiple equilibria? The answer is no. To clarify this issue, we write the budget constraint (7) as $(1-\pi)/\pi = b/p$. The left-hand side of this equation is monotonically decreasing in π, while the right-hand side is constant. Hence, for any given pair (p, b) there is only one unique π that satisfies the budget constraint (7). It is true that (8), regarded in isolation, may have multiple solutions π – but at most one of these solutions satisfies the budget constraint.

Thus, while social interaction generates multiple equilibria in many models, this is not the case in our insurance model. The budget-balance requirement imposes a sufficiently strong discipline on the model to guarantee a unique equilibrium.

C. The Insurance Contract in Social Optimum

To characterize the socially optimal insurance contract (p, b), we maximize the Lagrangean

$$\begin{aligned} L \equiv \int \{(1-\pi_i) \cdot [u(1-p) + E(\theta|\theta > \theta_i^*)] + \pi_i \cdot [u(b) - \varphi(\pi, \alpha, i)]\}dG(i) \\ + \lambda\left\{p \int (1-\pi_i)dG(i) - b \int \pi_i dG(i)\right\}. \end{aligned} \tag{9}$$

The first-order conditions with respect to p and b are (see Appendix 2)

$$[\lambda - u'(1-p)](1-\pi) = \left[\lambda \cdot (p+b) + \int \pi_i \cdot \varphi_1(\pi, \alpha, i) dG(i)\right] \frac{\partial \pi}{\partial p}, \tag{10a}$$

$$[u'(b) - \lambda]\pi = \left[\lambda \cdot (p+b) + \int \pi_i \cdot \varphi_1(\pi, \alpha, i) dG(i)\right] \frac{\partial \pi}{\partial b}. \tag{10b}$$

It is well known from the insurance literature that, because of the moral-hazard problem, full insurance is not optimal. However, one might think that a sufficiently strong norm against living on benefits would make full insurance desirable. Is this true?

To address this question, we first note that the right-hand side of (10a) is positive if the norm is exogenous, i.e., if $\varphi_1(\pi, \alpha, i) = 0, \forall i$. Therefore, the left-hand side is also positive, implying that $\lambda > u'(1-p)$. Applying the same reasoning to the right-hand side of (10b), we have $u'(b) > \lambda$. Thus, $u'(b) > \lambda > u'(1-p)$ which implies that $b < 1-p$ for a concave function $u(\cdot)$. The conclusion is that less-than-full insurance is always optimal in the case of exogenous norms.

This conclusion may seem surprising. Not even a very strong exogenous norm against living on benefits can curb moral hazard sufficiently to make full insurance optimal. The intuition is that there is always a moral-hazard problem as long as θ is unobservable. Thus, the moral-hazard problem remains regardless of how much the cutoff θ_i^* has been driven down by a very strong norm. The insurer mitigates this remaining moral-hazard problem by offering less-than-full insurance ($b < 1-p$).

The situation is more complex when the norm is endogenous. Since $\varphi_1(\pi, \alpha, i) < 0$, the sign of the term within square brackets on the right-hand sides of (10) is ambiguous. This means that less-than-full, full, or even more-than-full insurance may be optimal in this case. But why do endogenous norms, in contrast to exogenous norms, have this implication for the optimal contract? We return to this question at the end of section III.D.

D. Are Norms Good for Welfare?

What, then, are the welfare consequences of a social norm against living on benefits? On the one hand, a norm imposes discomfort on those who are stigmatized, but on the other hand, it may lead to less absence – which improves the insurer's budget and therefore allows more generous insurance. To analyze the net effect, we make use of the shift parameter α in the norm function $\varphi(\pi, \alpha, i)$, recalling that α represents exogenous factors that affect the strength of the norm for given i and π. First, we differentiate π, using (8):

$$\frac{\partial \pi}{\partial \alpha} = m \cdot \int -f(\theta_i^*)\varphi_2(\pi, \alpha, i) dG(i) < 0, \tag{11}$$

where m is given by (6b). Indeed, as one would expect, a stronger norm against paid sickness absence leads to less absence, *ceteris paribus*. Note that deriving the expression for $\partial\pi/\partial\alpha$ does not imply that we regard α as a policy instrument for the government; rather, α could vary, for instance, across countries due to differences in culture, history, etc. [10]

To study how welfare is affected by the shift parameter, including indirect effects, we differentiate (9) with respect to α, making use of (10) and (11); see Appendix 3. We obtain[11]

$$\frac{\partial L}{\partial \alpha} = \pi \left[1 - \frac{\lambda}{u'(b)}\right] \int \varphi_2 \cdot \frac{f^i}{\bar{f}} dG(i) - \int \varphi_2 \cdot \pi_i \, dG(i), \tag{12}$$

where we use the shorthand notation $f^i \equiv f(\theta_i^*)$, $\bar{f} \equiv \int f^i dG(i)$, $\varphi_2 \equiv \varphi_2(\pi, \alpha, i)$. Since the sign of the first term on the right-hand side of (12) is ambiguous, we cannot in general sign the derivative $\partial L/\partial\alpha$, except in some special cases. One of these cases occurs when $\varphi(\pi, \alpha, i)$ is additively separable in i and α, i.e., when $\varphi(\pi, \alpha, i) = \xi(\pi, \alpha) + \psi(i)$ or $\varphi(\pi, \alpha, i) = \xi(\alpha) + \psi(\pi, i)$. In both these formulations, the direct effect of a change in α on φ is the same for all individuals:

$$\varphi_2(\pi, \alpha, i) = \varphi_2(\pi, \alpha), \ \ \forall i. \tag{13}$$

Then (12) can be written as $\partial L/\partial\alpha = -\pi\varphi_2\lambda/u'(b)$, which is clearly negative.

---

[10] In principle, the government might be able to affect the norm to some extent, for instance by advertising campaigns. We do not pursue this issue here.

[11] According to the Envelope Theorem, the effect of a change in α on indirect utility $V(\alpha)$ is equal to the partial effect of α on the Lagrangean: $dV/d\alpha = \partial L/\partial\alpha$. Therefore, (12) tells us how changes in α affect welfare V in social optimum, where the welfare consequences of induced (second-order) adjustments of p and b are zero.

By contrast, without additive separability, a stronger norm gives rise to complicated distributional effects and the sign of $\partial L/\partial\alpha$ is then in general undetermined. But there is at least one more case where $\partial L/\partial\alpha$ is negative. This case occurs if the first-order conditions (10a) and (10b) imply full, or more-than-full, insurance. Then $\lambda \geq u'(b)$, and the first term on the right-hand side of (12) is non-positive. This means that $\partial L/\partial\alpha < 0$ also in this case. We conclude that with additive separability, or with full (or more-than-full) insurance, the discomfort of a stronger norm dominates over the advantage of an improved insurance budget. Since the total welfare effect is then negative, the best norm is no norm at all in these two cases.

These welfare considerations help us understand why full, or even more-than-full, insurance may be optimal when norms are endogenous – a conclusion we reached earlier in section III.C. The explanation can be found in the fact that $\partial L/\partial\alpha < 0$ in some cases. A weaker norm would then be desirable. While the government may not be able to weaken the norm directly (unless α were a policy parameter), it may do so indirectly by offering full or even more-than-full insurance, which would increase π and thus reduce the strength of the norm $\varphi(\pi, \alpha, i)$.

E. Opting Out and Adverse Selection

So far, we have assumed that social insurance is mandatory. Although this is a common feature in the real world, we now turn to the possibility that individuals are allowed to opt out from the system. By the term "social insurance", we mean a contract (p, b) – mandatory or not – that is offered by the government.[12] To analyze opting out, we impose more structure on the $\varphi(\pi, \alpha, i)$ functions by assuming that $i \in [0, \infty)$ and that $i > j \quad \rightarrow \quad \varphi(\pi, \alpha, i) > \varphi(\pi, \alpha, j)$.

By this assumption, we can regard i as an indicator of an individual's sensitivity to the opinion of others: individuals with low values of i are relatively insensitive, while individuals with high values of i are more sensitive. From (3) we see that the cutoff θ_i^* is decreasing in i, which by (4) means that for given values of π and α, more sensitive individuals have a lower absence rate than others: $\partial\pi_i/\partial i < 0$.

Who, then, would want to opt out of social insurance? To answer this question, we note that the expected utility of an individual who is insured, with a contract (p, b), is

[12] One reason why the government would offer such a contract could be that a competitive insurance market might not emerge (for instance, due to adverse selection as discussed by Rothschild and Stiglitz, 1976).

$$EU(i|p,b) \equiv (1-\pi_i)\cdot[u(1-p)+E(\theta|\theta>\theta_i^*)]+\pi_i\cdot[u(b)-\varphi(\pi,\alpha,i)]. \quad (14)$$

For simplicity, we set the reservation utility of an individual who considers opting out equal to a constant: $EU(i|0{,}0) \equiv K$, where the contract (0,0) indicates that the individual has opted out. [13] Voluntary participation thus requires that $EU(i|p,b) \geq K$. Differentiating (14) with respect to i yields $\partial EU(i|p,b)/\partial i < 0$. Thus, the more sensitive an individual is to the judgment of others, the less he values insurance.

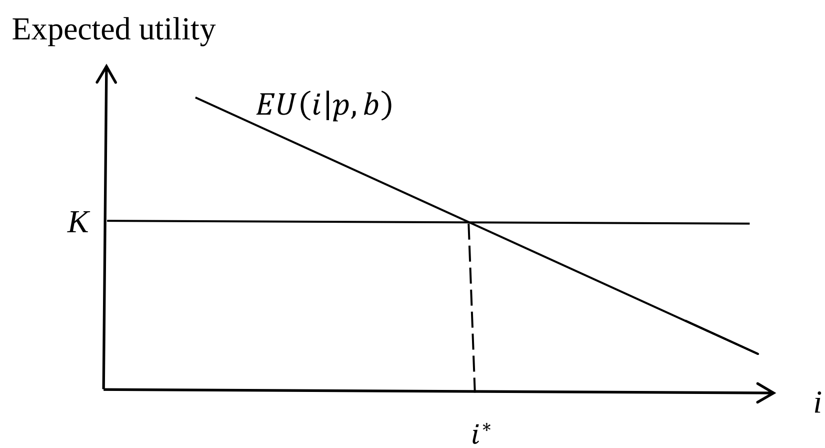

FIG. 1. – Expected utility with and without insurance.

Figure 1 illustrates the decision to participate, by depicting the relation between sensitivity i and expected utility $EU(i|p,b)$. The individual with sensitivity i^* is indifferent between being and not being insured; hence individuals with $i > i^*$ would like to opt out. This would create adverse selection since those who choose to remain in the system have higher absence rates than those who opt out.

When opting out is allowed, the results in sections III.B-III.D are modified. The social multiplier now becomes more complicated than in the expression without opting out (6b), but is still greater than unity in the case of endogenous norms (see Appendix 1). Moreover, $\partial\pi/\partial b > 0$ as in (6a),

---

[13] If a person who has opted out from the social insurance scheme is uninsured, he would in our framework earn a gross (and net) wage equal to unity when working, and zero when not working. K may alternatively be interpreted as the expected utility of other (non-competitive) types of insurance, for instance insurance schemes tied to the workplace or the profession.

but the sign of $\partial\pi/\partial p$ is now ambiguous. This ambiguity reflects two counteracting effects on π of a higher p. One is a positive direct effect on absence from work among those who are actually insured. The other is a negative effect on the number of individuals who choose to be insured (since $\partial i^*/\partial p < 0$; see Appendix 1).

If opting out is allowed, the Lagrangean is

$$L = \int_0^{i^*} EU(i|p,b)dG(i) + \int_{i^*}^{\infty} K \cdot dG(i) + \lambda\left[p\int_0^{i^*}(1-\pi_i)dG(i) - b\int_0^{i^*}\pi_i dG(i)\right], \quad (15)$$

where the position of the marginal individual i^* is determined by the equation $EU(i^*|p,b) = K$. The first-order conditions with respect to p and b tell us that the optimal contract may entail not only less-than-full ($b < 1-p$), but also full ($b = 1-p$) or more-than-full ($b > 1-p$), insurance; all three possibilities may occur in the case of exogenous as well as endogenous norms (see Appendix 2). This is in contrast to the case of a mandatory system (no opting out), as analyzed in section III.C, where full or more-than-full insurance can be optimal only if norms are endogenous. The intuition why also exogenous norms may result in full insurance is that all individuals with $i > i^*$ would like to opt out. However, these individuals are particularly valuable to the system since they have relatively low absence rates and thus are net contributors to the insurer's budget. In order to induce them to remain in the system, they have to be offered better income smoothing than they would receive in a mandatory system – possibly full (or even more-than-full) insurance. [14]

Our model provides a tractable way of discussing the welfare consequences of allowing individuals to opt out. Following Becker (1968), we model prohibition of a particular type of behavior (in this case, opting out) in terms of a penalty on such behavior. The penalty $S \geq 0$ could be enforced either by the government, or by fellow citizens in the form of a social stigma. It is deducted from the reservation utility K. The Lagrangean then becomes similar to (15), but with the term under the second integral being $(K-S)$ instead of K. Moreover, the sensitivity i^* of the marginal individual is now given by $EU(i^*|p,b) = K - S$. Introducing a

[14] As for the welfare effects of a stronger norm, we note that the sign of $dL/d\alpha$ is now ambiguous even in the case of additive separability (13) – cf. Appendix 3.

penalty S is thus equivalent to shifting the horizontal line in figure 1 downwards, thereby generating a new intersection with the downward-sloping curve (14) at a higher value of i^*; thus $\partial i^*/\partial S > 0$. To analyze the welfare effect of a penalty for opting out, we differentiate the Lagrangean with respect to S:

$$\frac{\partial L}{\partial S} = -[1 - G(i^*)] + \lambda[p(1 - \pi_{i^*}) - b\pi_{i^*}]g(i^*)\frac{\partial i^*}{\partial S}. \tag{16}$$

Since the first term in (16) is negative and the second is positive, the sign is ambiguous. There are then three possibilities. One is that L has a corner solution such that welfare is maximized for $S = 0$; this means that allowing opting out would be beneficial to society and should not be penalized at all. Another possible corner solution is that welfare is maximized when S is so large that no one would chose to opt out; in this case, allowing opting out would be harmful to society, and social insurance should be mandatory. Finally, an interior solution may be optimal.

Hence, equation (16) illustrates the trade-off between the disutility of those who suffer from higher penalty against the utility gain achieved by an improved insurance budget. Note that $[1 - G(i^*)]$ is the number of individuals who opt out. The first term (including the minus sign) in (16) thus represents the direct utility loss if the penalty is increased. The second term reflects the marginal individual's contribution $[p(1 - \pi_{i^*}) - b\pi_{i^*}]$ to the insurance budget. This contribution, which is positive, is weighted by the positive number $g(i^*)\partial i^*/\partial S$ and transformed into utility terms by λ. To determine the outcome of such a trade-off requires numerical simulations for alternative parameterizations of the model.

Our analysis of opting out means that individuals self-select into two possible contracts: (p, b) for those who stay in and $(0,0)$ for those who opt out. The discussion can be extended to a richer menu of contracts (p_1, b_1), (p_2, b_2), …, (p_N, b_N) into which individuals may self-select. Numerical simulations of such extensions would provide the social-insurance authority with a richer set of policy designs.[15]

[15] For numerical simulations of a menu of contracts in a different type of insurance model, without norms, see Golosov, Troshkin and Tsyvinski (2016).

So far, we have analyzed a rather stylized model of the economy, with only one production sector. In the next section, we study a more realistic case when there is a second production sector (an "informal economy") alongside the regular economy.

IV. Norms in a Two-Sector Model

A. An Economy with Two Production Sectors

With two sectors, we are able to study a richer set of assumptions about information. While we assume that the insurer is unable to observe whether an individual works in the informal economy, the neighbors may have some information on this point. However, we still assume that the realization of an individual's health variable θ is known only by himself.

Work outside the regular labor market is assumed to yield a reward w. This may be a monetary wage (when working in the shadow economy) or an imputed income in kind (when working at home). Throughout, we assume that $w < 1$, since productivity is likely to be lower for household work and work in the shadow economy than in the regular economy.

While the (dis)utility of work in the regular economy is θ, we set the (dis)utility of work outside of the regular economy to $\gamma\theta$. Whether γ is larger or smaller than unity is not obvious. If the informal sector consists of household work, the individual can choose the type and intensity of work; it is then natural to assume that $\gamma < 1$. If instead the informal sector consists of work in the shadow economy, γ may be smaller or larger than unity.

For brevity, we confine the analysis to the case where $\gamma < 1$ and, as shorthand, we refer to work outside of the regular economy as "household work". This type of work could be interpreted not only as, for instance, repairing one's own house or working in the garden, but also as leisure activities such as sports and entertainment. This interpretation of "leisure" conforms to the view of Becker (1965) that households produce services for themselves by using time and intermediate inputs; w would then represent the production and consumption of such services.

With such a second production activity, the individual has four options: (i) working in the regular economy earning a net wage $1 - p$, (ii) working outside of the regular economy living only on the wage w, (iii) receiving benefits when simultaneously working outside of the regular economy, w, and (iv) living solely on benefits. The utilities for these alternatives are:

$$u(1-p)+\theta \tag{1}$$

$$u(w)+\gamma\theta \tag{17}$$

$$u(w+b)+\gamma\theta \tag{18}$$

$$u(b) \tag{19}$$

The norm φ might ideally be attached to cheaters only, i.e., to those who collect "double income" $(w+b)$. However, due to limited information, neighbors may not be able to observe exactly who cheats and who does not. Depending on the information available to the neighbors, the stigmatization φ is attached to different activities. We start with what we call a "blunt norm" based on rather limited information.

B. A Blunt Norm

We now assume that neighbors can only observe whether or not an individual works in the regular economy.[16] They cannot distinguish between alternatives (17), (18), and (19). Individuals who belong to any of these three groups are observationally equivalent in the eyes of their neighbors who, therefore, have to treat all three groups in the same way. The norm then results in "collateral damage" in the sense that non-cheaters are stigmatized. The alternatives open to the individual are:

$$u(1-p)+\theta \tag{1}$$

$$[u(w)+\gamma\theta-\varphi] \tag{20}$$

$$u(w+b)+\gamma\theta-\varphi \tag{21}$$

$$u(b)-\varphi \tag{2}$$

Note that cheating (21) in this case always dominates over honest work at home (20); this is indicated by the square brackets in (20). Thus, with the information assumed here, there are only three relevant alternatives for the individual: work in the formal sector (1), cheating (21) and honestly living on benefits (2). This means that the norm, in fact, harms everyone who receives benefits – cheaters as well as honest beneficiaries.

The basic properties of this model are schematically illustrated in figure 2, where we depict the three utility levels as functions of θ. If the individual calls in sick, and lives on benefits, the

[16] We deal only with mandatory social insurance; analyzing opting out in the two-sector model is straightforward, but tedious (see Appendix 4).

utility level is (2), represented by the (dashed) horizontal line in the figure. If instead he works in the regular economy, utility is (1), represented by the dashed line with unit slope. Finally, if he works at home while also receiving benefits, utility is given by (21) which also increases in θ, although with slope $\gamma < 1$.[17] For any given realization of θ, the individual chooses the alternative that yields the highest utility, as illustrated by the solid (envelope) curve in the figure.

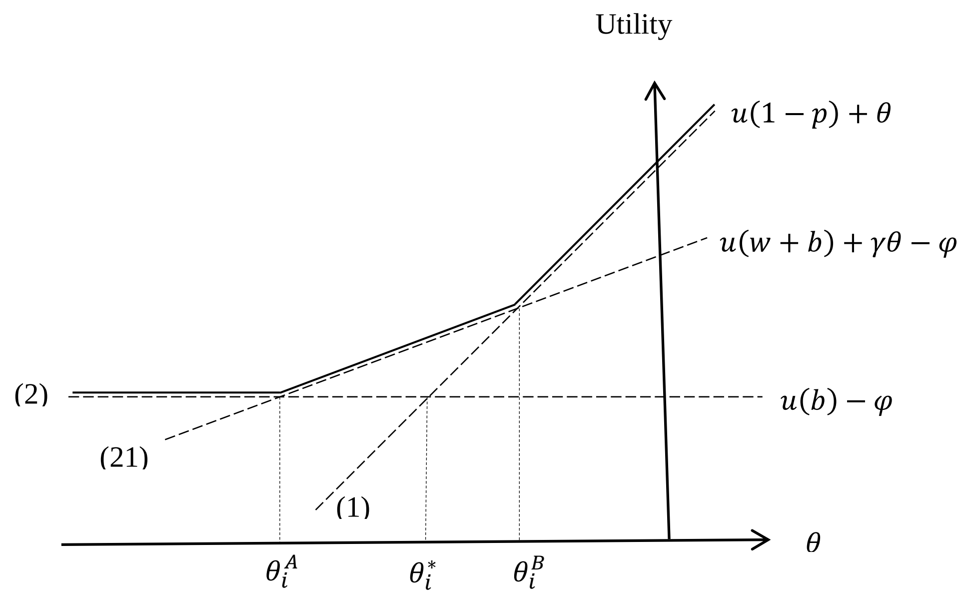

FIG. 2. – Alternative utility levels (1), (2) and (21) for different values of θ.

There are two cutoff points in this model. One is between living on benefits b and living on double income, $w + b$; we denote this cutoff by θ_i^A (see Appendix 4). The other cutoff is between living on double income $w + b$ and living on a regular net wage $1-p$; we denote this cutoff by θ_i^B. There is also a third cutoff θ_i^* in the case where the norm is so strong that (21) is dominated by (1) and (2). In this case, the individual will not cheat at all, and the model becomes identical to the one-sector model in section III, with θ_i^* given by (3).

By deriving the first-order conditions for social optimum (Appendix 4) it is straightforward to show that the conditions for less-than-full, full and more-than-full insurance are similar to those in the one-sector model. There is, however, an important difference between the two models. We

[17] A similar analysis could also be pursued for the case where $\gamma > 1$. This may be realistic for some types of work in the shadow economy.

have seen that the sign of $\partial L/\partial \alpha$ is negative in some cases (namely additive separability and/or full insurance) in the one-sector model. By contrast, in our two-sector model, the sign of $\partial L/\partial \alpha$ is always ambiguous. The reason for the ambiguity is that there is an additional trade-off in the two-sector model, as compared to the one-sector model. On the one hand, the norm has the advantage of reallocating resources away from individuals with a double income $w + b$ and hence with a relatively low marginal utility of consumption – resources that could be put to better use. On the other hand, the norm has the disadvantage of reducing household work – a productive, low-cost activity that yields consumption goods for the individual. Depending on the parameters of the model, the trade-off between these two forces can yield either corner solutions or interior solutions for the norm strength. The optimal norm strength could then be either (i) zero, implying a large number of cheaters; or (ii) so high that all cheaters are driven out, which means that the model is transformed into the one-sector model of section III; or (iii) intermediate, implying a moderate number of cheaters.

C. Variations of the Assumptions about Information in the Two-Sector Model

Table 1 shows alternative assumptions about what neighbors can observe. In *Column 1* we refer to the situation discussed in section IV.B above (a "blunt norm").

Column 2 (a "precise norm") refers to a situation where neighbors have so good information that they are able to identify cheaters. By contrast to the blunt norm, the precise norm causes no collateral damage since no honest beneficiaries are stigmatized. There are two possible outcomes for each individual in this case. For an insensitive individual, with a low $\varphi(\pi, \alpha, i)$, the utility level $u(w + b) + \gamma\theta - \varphi$ dominates over $u(w) + \gamma\theta$ and the individual will prefer cheating to doing honest household work. For a sensitive individual, with a large $\varphi(\pi, \alpha, i)$, the utility level $u(w) + \gamma\theta$ dominates over $u(w + b) + \gamma\theta - \varphi$ and the individual prefers honest household work to cheating. The larger the value of α, the fewer who choose cheating.[18]

[18] In the extreme case, when α is so large that nobody cheats, the model turns into a two-sector model with no norm at all. Such a model might be interesting in its own right, but is outside the scope of the present paper.

TABLE 1

ALTERNATIVE ASSUMPTIONS ABOUT INFORMATION AND STIGMATIZATION IN THE TWO-SECTOR MODEL

1. Blunt norm: stigma on those who do not work in the regular economy	2. Precise norm: stigma on those who cheat the system	3. Stigma on those who live on benefits	4. Stigma on those who work in the irregular economy
$u(1-p)+\theta$	$u(1-p)+\theta$	$u(1-p)+\theta$	$u(1-p)+\theta$
$[u(w)+\gamma\theta-\varphi]$	$u(w)+\gamma\theta$	$u(w)+\gamma\theta$	$[u(w)+\gamma\theta-\varphi]$
$u(w+b)+\gamma\theta-\varphi$	$u(w+b)+\gamma\theta-\varphi$	$u(w+b)+\gamma\theta-\varphi$	$u(w+b)+\gamma\theta-\varphi$
$u(b)-\varphi$	$u(b)$	$u(b)-\varphi$	$u(b)$

Column 3 is an intermediate case, where neighbors can observe who receives benefits but cannot distinguish between cheaters (with income $w+b$) and honest beneficiaries (with income b). Collateral damage will thus occur. There are two possible outcomes for the individual. People with low $\varphi(\pi,\alpha,i)$ will choose cheating, while people with high $\varphi(\pi,\alpha,i)$ will choose honest household work. The relative sizes of these groups depend on the value of α; the larger the value of α, the smaller is the number of cheaters. When α is so large that there are no cheaters, we are in a two-sector model that is similar to the one-sector model in the sense that only those living on sick pay are stigmatized.

Column 4 is another intermediate case, where neighbors can see who works outside the regular economy, but cannot see who receives benefits. In this case, honest household work is always dominated by cheating, as indicated by the square brackets around the term $u(w)+\gamma\theta-\varphi$. For individuals with low values of $\varphi(\pi,\alpha,i)$, the options are the same as in the case of a precise norm. For individuals with large values of $\varphi(\pi,\alpha,i)$, the options are to work in the regular sector or to live on benefits – i.e., the same as in our one-sector model without norms(cf. Lindbeck and person, 2013). As in the case of a precise norm (column 2), collateral damage is avoided.

With an exogenous norm ($\varphi_1 = 0$), all four cases in table 1 are similar in the sense that the optimal contract implies less-than-full insurance: $b < 1 - p$.[19] With an endogenous norm, optimum could imply less-than-full, full or more-than-full insurance depending on parameter values. The intuition for the ambiguity in the case of endogenous norms is the same as in the one-sector model. Moreover, the welfare effects are ambiguous in all four cases: the sign of $\partial L/\partial \alpha$ is undetermined. Thus the three points at the end of section IV.B apply to all four columns of table 1: the optimal norm strength could imply a corner solution with either (i) a maximum number of cheaters or (ii) no cheaters at all, or an interior solution with (iii) a moderate number of cheaters.

As in the one-sector model, the optimal insurance system implies a trade-off between income smoothing, moral hazard, and the discomfort of being stigmatized. Moreover, in the two-sector model, moral hazard can take a specific form, namely cheating. As a result, the trade-off may well imply that there are cheaters around in the social optimum.

This discussion highlights a specific feature of norms, namely to compensate for limited ability of insurers to monitor insured individuals. In columns 2 and 4 of table 1, neighbors are assumed to have information that is not easily available to the insurer. In particular, they can see who works in the informal sector. It is also reasonable to assume that it is easier for neighbors than for the insurer to enforce the norm, a point equally relevant for the one- and the two-sector model.

V. Concluding Remarks

It is a commonplace that insurers can mitigate moral hazard by offering contracts with less-than-full insurance. Such a contract, however, comes at a welfare cost in the form of limited income smoothing, and the optimal contract entails a trade-off between moral hazard and income smoothing. In this paper, we study the possibility that moral hazard can also be mitigated if there is a social norm against "overuse" or outright cheating. However, such a norm imposes an additional welfare cost, i.e., the discomfort of being stigmatized. How does this three-dimensional trade-off operate as compared to the traditional, two-dimensional trade-off between moral hazard and income smoothing?

[19] The proof for the case in column 1 is given in Appendix 4; the proofs for the cases in columns 2-4 can be worked out in a similar fashion.

To address this issue, we first analyzed a stripped-down model with only one production sector. It turned out that if all individuals are equally affected by variations in stigmatization, a social norm will not improve the trade-off between income smoothing and moral hazard. The best norm in that model is no norm at all. If instead individuals are unequally affected, a norm may be beneficial to welfare because of distributional effects among individuals.

We then turned to a more realistic model, with one formal and one informal production sector. It is then possible to analyze outright cheating (by living on a double income $w + b$) in addition to traditional moral hazard. In such a model, a norm can enhance welfare under more general circumstances than in the one-sector model. The two-sector model also highlights the role of information for the functioning of the norm. Clearly, a norm is particularly beneficial if the norm enforcers (neighbors) have such good information that they can identify cheaters and thus avoid collateral damage on honest beneficiaries.

Finally, our study raises an interesting ethical problem. Even in a social optimum, there may be lots of cheaters around. Thus, insurers and insured individuals – as well as a hypothetical "social planner" – may accept insurance contracts that entail some cheating. In this sense, there may be a clash between welfare maximization and the ethical principle "Thou shalt not cheat".

Appendix 1: Social multipliers and stability of the one-sector model

If aggregate absence is expected to be π^e, each agent chooses absence $\pi_i = F[u(b) - u(1-p) - \varphi(\pi^e, \alpha, i)]$). By (3) and (4), total absence is $\pi = \int F[u(b) - u(1-p) - \varphi(\pi^e, \alpha, i)]\, dG(i)$. If $\pi \neq \pi^e$, the economy is out of equilibrium, and individuals adjust their expectation π^e upward (if $\pi > \pi^e$) or downward (if $\pi < \pi^e$). Stability requires that the discrepancy between actual and expected absence then falls, i.e., that $\partial(\pi - \pi^e)/\, \partial\pi^e < 0$. This derivative is

$$\frac{\partial(\pi - \pi^e)}{\partial\pi^e} = -\int f(\theta_i^*)\varphi_1(\pi, \alpha, i) dG(i) - 1 \tag{A1}$$

which must be negative for stability. Note that this expression is identical (but with a minus sign) to the denominator in the multiplier m in (6b). Thus stability requires that $m > 0$.

If opting out is allowed, the upper integration limit in the definition of π is i^*. Differentiating $\pi \equiv \int_0^{i^*} \pi_i dG(i) \equiv \int_0^{i^*} F(\theta_i^*) dG(i)$, we obtain

$$\frac{\partial\pi}{\partial p} = m \cdot \left[u'(1-p)\int_0^{i^*} f(\theta_i^*) dG(i) + \pi_{i^*}\, g(i^*)\frac{\partial i^*}{\partial p}\right], \tag{A2a}$$

$$\frac{\partial\pi}{\partial b} = m \cdot \left[u'(b)\int_0^{i^*} f(\theta_i^*) dG(i) + \pi_{i^*}\, g(i^*)\frac{\partial i^*}{\partial b}\right], \tag{A2b}$$

$$m \equiv \frac{1}{1 + \int_0^{i^*} f(\theta_i^*)\varphi_1(\pi, \alpha, i) dG(i) - \pi_{i^*} g(i^*)\frac{\partial i^*}{\partial\pi}}. \tag{A2c}$$

Since an increase in b makes the $EU(i|p, b)$ curve in figure 1 shift upwards, we have $\partial i^*/\partial b > 0$. This implies that $\partial\pi/\partial b > 0$. However, an increase in p makes the $EU(i|p, b)$ curve shift downwards, i.e., $\partial i^*/\partial p < 0$. Therefore, the sign of $\partial\pi/\partial p$ is undetermined. As for stability, the derivative $\partial(\pi - \pi^e)/\, \partial\pi^e$ is equal to (A1) plus a term $\pi(i^*)g(i^*)\partial i^*/\partial\pi^e$. The inverse of that derivative (with a minus sign) is equal to the multiplier m in (A2c). Further, differentiating (14) with respect to π yields $\partial EU(i|p, b)/\partial\pi = -\pi_i\varphi_1(\pi, \alpha, i) > 0$ which in turn implies $\partial i^*/\partial\pi > 0$. Thus stability requires that $m > 0$ also when opting out is allowed.

Appendix 2: Derivation of the first-order conditions in the one-sector model

Differentiating the Lagrangean (9) with respect to p yields

$$\frac{dL}{dp} = \int \left\{ -f(\theta_i^*)\frac{\partial \theta_i^*}{\partial p}u(1-p) - f(\theta_i^*)\frac{\partial \theta_i^*}{\partial p}\theta_i^* - [1-F(\theta_i^*)]u'(1-p) \right. \\ + f(\theta_i^*)\frac{\partial \theta_i^*}{\partial p}[u(b)-\varphi(\pi,\alpha,i)] - F(\theta_i^*)\varphi(\pi,\alpha,i)\frac{\partial \pi}{\partial p} \\ \left. + [1-F(\theta_i^*)]\lambda - \lambda(p+b)\frac{\partial F(\theta_i^*)}{\partial p} \right\} dG(i). \qquad \text{(A3)}$$

By (3), all terms containing $f(\theta_i^*)\partial\theta_i^*/\partial p$ in (A3) vanish; rearranging, we obtain (10a).

In the case where opting out is allowed, the relevant Lagrangean is instead (15). The derivative dL/dp then is the expression in (A3), plus the terms

$$EU(i^*|p,b)g(i^*)\frac{\partial i^*}{\partial p} - Kg(i^*)\frac{\partial i^*}{\partial p} + \lambda\{p[1-F(\theta_{i^*}^*)] - bF(\theta_{i^*}^*)\}g(i^*)\frac{\partial i^*}{\partial p}.$$

Of these terms, the first two vanish since the marginal individual i^* is indifferent between being and not being insured. Since $\pi \equiv \int_0^{i^*} \pi_i dG(i)$ when opting out is allowed, we have

$$\int_0^{i^*} \frac{\partial F(\theta_i^*)}{\partial p} dG(i) = \frac{\partial \pi}{\partial p} - \pi_{i^*} g(i^*)\frac{\partial i^*}{\partial p}. \qquad \text{(A4)}$$

Substituting this expression into the $\lambda(p+b)$ term in (A3) and rearranging, we obtain

$$[\lambda - u'(1-p)][G(i^*)-\pi] = \left[\lambda\cdot(p+b) + \int_0^{i^*} \pi_i\cdot\varphi_1(\pi,\alpha,i)dG(i)\right]\frac{\partial \pi}{\partial p} - \lambda p g(i^*)\frac{\partial i^*}{\partial p}.$$

A similar procedure for b yields

$$[u'(b)-\lambda]\pi = \left[\lambda\cdot(p+b) + \int_0^{i^*} \pi_i\cdot\varphi_1(\pi,\alpha,i)dG(i)\right]\frac{\partial \pi}{\partial b} - \lambda b g(i^*)\frac{\partial i^*}{\partial b}. \qquad \text{(A5)}$$

The $g(i^*)\partial i^*/\partial p$ and $g(i^*)\partial i^*/\partial b$ terms refer to the effects on the number of individuals who are insured. When opting out is allowed, these terms are non-zero, making it impossible to say whether the right-hand sides of the marginal conditions are positive or not, also in the case of an exogenous norm. Therefore, the possibility full and more-than-full insurance cannot be dismissed.

Appendix 3:Analysis of the welfare consequences of norms

Differentiating the Lagrangean (9) yields

$$\frac{\partial L}{\partial \alpha} = \int \left\{ -f(\theta_i^*) \frac{\partial \theta_i^*}{\partial \alpha} u(1-p) - f(\theta_i^*) \frac{\partial \theta_i^*}{\partial \alpha} \theta_i^* + f(\theta_i^*) \frac{d\theta_i^*}{\partial \alpha} [u(b) - \varphi(\pi, \alpha, i)] \right.$$
$$\left. - F(\theta_i^*) \left[\varphi_1(\pi, \alpha, i) \frac{\partial \pi}{\partial \alpha} + \varphi_2(\pi, \alpha, i) \right] - \lambda(p+b) \frac{\partial F(\theta_i^*)}{\partial \alpha} \right\} dG(i)$$

where $\partial \pi / \partial \alpha < 0$ is given by (11). By the same reasoning as in Appendix 2, all the terms containing $f(\theta_i^*) \partial \theta_i^* / \partial \alpha$ vanish, and we have.

$$\frac{\partial L}{\partial \alpha} = -\frac{\partial \pi}{\partial \alpha} \left[\lambda(p+b) + \int F(\theta_i^*) \varphi_1(\pi, \alpha, i) dG(i) \right] - \int F(\theta_i^*) \varphi_2(\pi, \alpha, i) dG(i).$$

Rewriting the first-order condition with respect to b in (6a) as

$$\left[\lambda \cdot (p+b) + \int \pi_i \varphi_1(\pi, \alpha, i) dG(i) \right] = \frac{[u'(b) - \lambda]\pi}{\partial \pi / \partial b},$$

we substitute this into the expression for $dL/d\alpha$ and rearrange terms, to obtain

$$\frac{\partial L}{\partial \alpha} = \left\{ -\frac{\frac{\partial \pi}{\partial \alpha}}{\frac{\partial \pi}{\partial b}} [u'(b) - \lambda]\pi - \int \pi_i \cdot \varphi_2(\pi, \alpha, i) dG(i) \right\}. \qquad \text{(A6)}$$

The sign of this expression is ambiguous. Using the expressions for $\partial \pi / \partial \alpha$ and $\partial \pi / \partial b$ in the case of mandatory insurance, and rearranging, yields (12).

In the case of opting out, the upper limit of integration in the expression for $\partial L / \partial \alpha$ above should be i^*. Further, the derivative contains, in addition to the expression above, some more terms:

$$EU(i^*|p,b) g(i^*) \frac{\partial i^*}{\partial \alpha} - K g(i^*) \frac{\partial i^*}{\partial \alpha} + \lambda \{ p[1 - F(\theta_{i^*}^*)] - bF(\theta_{i^*}^*) \} g(i^*) \frac{\partial i^*}{\partial \alpha}.$$

Taking into account the fact that the first two of these terms cancel, and that $\int_0^{i^*} \partial F(\theta_i^*) / \partial \alpha \, dG(i) = \partial \pi / \partial \alpha - \pi_{i^*} g(i^*) \partial i^* / \partial \alpha$, and substituting from the first-order condition (A5), we obtain an expression like (A6), but with an extra term, containing expressions for i^* at the end. Using the expressions for $\partial \pi / \partial \alpha$ and $\partial \pi / \partial b$ for the case where opting out is allowed, this results in a rather complicated expression, the sign of which is ambiguous.

Appendix 4: Optimality in the Two-Sector Model

The analysis is carried out for the case when opting out is allowed. For a mandatory system, all expressions below apply if we set $i^* = \infty$, $g(i^*) = 0$ and $\partial i^* / \partial x = 0$, where x is p, b or α.

The three cutoffs are (for a sufficiently strong norm, θ_i^B will coincide with θ_i^A):

$$\theta_i^A = \frac{u(b) - u(w+b)}{\gamma}, \qquad \theta_i^B = \frac{u(w+b) - u(1-p) - \varphi(\pi, \alpha, i)}{1-\gamma},$$

$$\theta_i^* = u(b) - u(1-p) - \varphi(\pi, \alpha, i).$$

The Lagrangean is

$$\begin{aligned} L = \int_0^{i^*} \Big\{ & [1 - F(\theta_i^B)]\big[u(1-p) + E(\theta \big| \theta > \theta_i^B)\big] \\ & + \big[F(\theta_i^B) - F\big(\theta_i^A\big)\big]\big[u(w+b) + \gamma E\big(\theta \big| \theta_i^A < \theta < \theta_i^B\big) - \varphi(\pi, \alpha, i)\big] \\ & + F\big(\theta_i^A\big)[u(b) - \varphi(\pi, \alpha, i)]\Big\} \, dG(i) \\ & + K \int_{i^*}^{\infty} dG(i) + \lambda \left\{ p \int_0^{i^*} [1 - F(\theta_i^B)] dG(i) - b \int_0^{i^*} F(\theta_i^B) dG(i) \right\} \end{aligned}$$

where $\pi = \int_0^{i^*} F(\theta_i^B) dG(i)$. The first-order condition with respect to p is

$$\begin{aligned} & [\lambda - u'(1-p)] \int_0^{i^*} [1 - F(\theta_i^B)] \, dG(i) \\ & \quad = \int_0^{i^*} \left\{ \lambda(p+b) f(\theta_i^B) \frac{d\theta_i^B}{dp} + F(\theta_i^B) \varphi_1(\pi, \alpha, i) \frac{d\pi}{dp} \right\} dG(i) \\ & \quad - \lambda \big\{ p\big[1 - F\big(\theta_{i^*}^B\big)\big] - bF\big(\theta_{i^*}^B\big) \big\} g(i^*) \frac{di^*}{dp}, \end{aligned}$$

or

$$\begin{aligned} & [\lambda - u'(1-p)] \int_0^{i^*} [1 - F(\theta_i^B)] \, dG(i) \\ & \quad = \left[\lambda(p+b) + \int_0^{i^*} F(\theta_i^B) \varphi_1(\pi, \alpha, i) dG(i) \right] \frac{d\pi}{dp} - \lambda p g(i^*) \frac{di^*}{dp} \end{aligned} \tag{A7a}$$

The first-order condition with respect to b is

$$\begin{aligned} & \int_0^{i^*} \big\{ F\big(\theta_i^A\big) u'(b) + \big[F(\theta_i^B) - F\big(\theta_i^A\big)\big] u'(w+b) - F(\theta_i^B)\lambda \big\} dG(i) \\ & \quad = \int_0^{i^*} \left\{ \lambda(p+b) f(\theta_i^B) \frac{d\theta_i^B}{db} + F(\theta_i^B) \varphi_1(\pi, \alpha, i) \frac{d\pi}{db} \right\} dG(i) \\ & \quad - \lambda \big\{ p\big[1 - F\big(\theta_{i^*}^B\big)\big] - bF\big(\theta_{i^*}^B\big) \big\} \, g(i^*) \frac{di^*}{db}, \end{aligned}$$

or

$$\begin{aligned} & \int_0^{i^*} \big\{ F\big(\theta_i^A\big) u'(b) + \big[F(\theta_i^B) - F\big(\theta_i^A\big)\big] u'(w+b) - F(\theta_i^B)\lambda \big\} dG(i) \\ & \quad = \left[\lambda(p+b) + \int_0^{i^*} F(\theta_i^B) \varphi_1(\pi, \alpha, i) dG(i) \right] \frac{d\pi}{db} - \lambda p g(i^*) \frac{di^*}{db} \end{aligned} \tag{A7b}$$

We now assume that (i) the system is mandatory, i.e., there is no opting out; and (ii) the norm is exogenous, i.e., $\varphi_1(\pi, \alpha, i) = 0, \forall i$. With these two assumptions, and the same reasoning as when we considered equation (10a) in the one-sector model, we see that the right-hand side of (A7a) is positive. Thus the left-hand side of (A7a) must be positive, too. This implies $\lambda > u'(1 - p)$.

Similarly, the right-hand side of (A7b) is positive under (i) and (ii). Write the left-hand side as

$$Au'(b) + (B - A)u'(w + b) - B\lambda$$

where $A \equiv \int_0^{i^*} F(\theta_i^A) dG(i)$, $B \equiv \int_0^{i^*} F(\theta_i^B) dG(i)$. If the right-hand side is positive, the left-hand side must also be positive. Divide the left-hand-side by B, which, since $B > (B - A) > 0$, does not affect the sign of the left-hand side:

$$\frac{A}{B}u'(b) + \frac{B - A}{B}u'(w + b) > \lambda$$

This expression says that the weighted average of $u'(b)$ and $u'(w + b)$ is greater than λ; thus the larger of the two components in the average must be greater than λ. We therefore have that $u'(b) > \lambda > u'(1 - p)$ which implies that $b < 1 - p$: under assumptions (i) and (ii), less-than-full insurance is optimal in the two-sector model. Now, successively removing (i) and (ii) gives rise to the same reasoning as in the case of the one-sector model. The qualitative conclusions concerning the optimal contract (p, b) are therefore the same as for the one-sector model.

References

Axelrod, Robert. 1986. “An Evolutionary Approach to Norms”, *Am. Pol. Sci. Rev.* 80 (4): 1095-1111.

Becker, Gary S. 1965. “A Theory of the Allocation of Time”, *Econ. J.* 75 (4): 493-517.

Becker, Gary S. 1968. “Crime and Punishment: An Economic Approach”, *J.P.E.* 76 (2): 169-217.

Becker, Gary S. 1974. “A Theory of Social Interactions”, *J.P.E.* 82 (6): 1063-1093.

Bertrand, Marianne, Erzo F. P. Luttmer and Sendhil Mullainathan. 2000. ”Network Effects and Welfare Cultures”, *Q.J.E.* 115 (3): 1019-1055.

Besley, Timothy and Stephen Coate. 1992. “Understanding Welfare Stigma: Taxpayer Resentment and Statistical Discrimination”, *J. Public Econ.* 48 (2): 165-183.

Bicchieri, Christina. 2006. *The Grammar of Society: The Nature and Dynamics of Social Norms*, New York: Cambridge University Press.

Brock, William A. and Steven N. Durlauf. 2001. “Discrete Choice with Social Interactions”, *Rev. Econ. Studies* 68 (2): 235-260.

Coleman, James S. 1990. *The Foundations of Social Theory*, Cambridge, MA: Harvard University Press.

Diamond, Peter A. and James A. Mirrlees. 1978. “A Model of Social Insurance with Variable Retirement”, *J. Public Econ.* 10 (3): 295-336.

Fehr, Ernst and Simon Gächter. 2000. ”Cooperation and Punishment in Public Goods Experiments”, *A.E.R.* 90 (4): 980-994.

Glaeser, Edward L., Bruce I. Sacerdote and José A. Scheinkman. 2003. ”The Social Multiplier”, *J. European Econ. Association*, 1 (2-3): 345-53.

Golosov, Mikhail and Aleh Tsyvinski. 2006. “Designing Optimal Disability Insurance: A Case for Asset Testing”, *J.P.E.* 114 (2): 257-279.

Golosov, Mikhail, Maxim Troshkin and Aleh Tsyvinski. 2016., ”Redistribution and Social Insurance”, *A.E.R.* 106 (2): 359-386.

Halla, Martin and Friedrich G. Schneider. 2014. “Taxes and Benefits. Two Options to Cheat on the State”, *Oxford Bull. of Econ. and Stat.* 76 (3): 411-431.

Hechter, Michael and Karl-Dieter Opp (eds.). 2001. *Social Norms*, New York: Russell Sage Foundation.

Heinemann, Friedrich. 2008. “Is the Welfare State Self-destructive? A Study of Government Transfer Morale”, *Kyklos* 61 (2): 231-257.

Lindbeck, Assar. 1995. “Hazardous Welfare-State Dynamics”, *A.E.R.* 85 (2): 9-15.

Lindbeck, Assar and Sten Nyberg. 2006. “Raising Children to Work Hard: Altruism, Work Norms, and Social Insurance”, *Q.J.E.* 121 (4): 1473-1503.

Lindbeck, Assar and Mats Persson. 2013. “A Continuous Model of Income Insurance”, *Int. Tax and Publ. Finance* 20 (6): 938-960.

Lindbeck, Assar, Sten Nyberg and Jörgen W. Weibull. 1999. ”Social Norms and Economic Incentives in the Welfare State”, *Q.J.E.* 114 (1): 1-35.

Lindbeck, Assar, Mårten Palme and Mats Persson. 2016. “Sickness Absence and Local Benefit Cultures”, *Scand. J. Econ.* 118 (1): 49-78.

Moffitt, Robert. 1983. “An Economic Model of Welfare Stigma”, *A.E.R.* 73 (5): 1023-1035.

Opp, Karl-Dieter. 1979. “The Emergence and Effects of Social Norms. A Confrontation of Some Hypotheses of Sociology and Economics”, *Kyklos* 32 (4), 775-801.

Parsons, Talcott. 1952. *The Social System*, London: Tavistock Publications.

Rätzel, Steffen. 2012. “Labour Supply, Life Satisfaction, and the (Dis)Utility of Work”, *Scand. J. Econ.* 114 (4) : 1160-1181.

Rothschild, Michael and Joseph E. Stiglitz. 1976. “Equilibrium in Competitive Insurance Markets: An Essay on the Economics of Imperfect Information”, *Q.J.E.* 90 (4): 629-649.

Ullmann-Margalit, Edna. 1977, *The Emergence of Norms*, Oxford: Oxford Univ. Press.