Selfish Bakers, Caring Nurses?
A Model of Work Motivation

Karine Nyborg and Kjell Arne Brekke*

Abstract

Work contributes to people's self-image in important ways. We propose a model in which effort is unobservable and where individuals have a preference for *being important to others*. This gives the following predictions: 1) If a worker's effort is paid by his marginal productivity (bakers), effort is just like in the standard model. 2) If a worker's wage is unaffected by his effort (nurses), more effort is provided than in the standard model. 3) To prevent that shirkers become nurses, nurses' wages must be kept strictly lower than bakers' income. At this wage level there will be too few nurses. 4) Overinvestment in nursing equipment can be justified as a means to attract motivated nurses. 5) Even with full income compensation, both nurses and bakers may experience a net utility loss when losing their job. 4) Similarly, both nurses and bakers may prefer work to welfare, even with full income compensation.

*Both authors: Department of Economics, University of Oslo, P.O.Box 1095 Blindern, NO-0317 Oslo, Norway. E-mails: k.a.brekke@econ.uio.no, karine.nyborg@econ.uio.no.

"*It is not from the benevolence of the butcher, the brewer, or the baker, that we expect our dinner, but from their regard to their own interest*" (Smith 1776, par. I.2.2).

"*How selfish soever man may be supposed, there are evidently some principles in his nature, which interest him in the fortune of others, and render their happiness necessary to him.*" (Smith 1759, par. I.I.I)

1 Introduction

The *Homo Oeconomicus* model, which assumes that individuals care only about their own access to goods and services while keeping their own efforts low, has long been the benchmark for economic analyses of labor markets and worker behavior. In many contexts, empirical evidence has indeed proved to be nicely consistent with this model (e.g. Lazear, 2000). Nevertheless, in other cases the *Homo Oeconomicus* predictions seem too stark. Specifically, if a worker's effort does not affect his pecuniary payoff, a *Homo Oeconomicus* employee will shirk as much as possible – regardless of the possible concequences for others. Anyone who has spent some time at a hospital, a school, or a university, knows that although this description might fit the behavior of some individuals, it definitely does not fit all (Heyes, 2004). Within health economics, the need to reconcile theoretical predictions with empirical evidence has in fact led numerous scholars to assume that physicians have altruistic preferences towards their patients.[1] This approach, however, may be considered somewhat *ad hoc*, since it is not clear why physicians would generally be more altruistic than others.

Similarly, the *Homo Oeconomicus* predictions make Scandinavian welfare states appear almost as logical inconsistencies. While studies indicate that social insurance generosity does increase the number of recipients and spell duration (e.g. Røed and Zhang 2005, Johansson and Palme 2005), such effects are much less pronounced than one might expect. In Norway, for example, employees have the right, within certain limits, to claim sickleave with full wage compensation based only on self-declared sickness (no physician's sickness certificate); still such self-declared sickleaves constitute only about 10% of the total level permitted by the rules (Eielsen 2008; see also e.g. Aronsson et al. 2000).

For *Homo Oeconomicus*, work affects utility only in terms of lost leisure (and, of course, through the income it generates). Thus, any utility loss associated with unemployment must be due to income loss. If unemployment benefits provided full income compensation, becoming unemployed would necessarily increase *Homo Oeconomicus*' utility, due to increased leisure. Substantial empirical evidence,

[1] "A substantial part of the physician's satisfaction with practice is fulfilled by serving successfully as the patient's advocate. (...) The unifying hypothesis is that physicians do have personal utility for their patients' benefit" (Eisenberg 1986, pp. 57 and 61). See, e.g., Ma (2007), Jack (2005), Grytten and Sørensen (2001), Sørensen and Grytten (2003), De Jaegher and Jegers (2000), Chalkley and Malcomson (1998), Farley (1986), Woodward and Warren-Bolton (1984).

however, shows that while the relationship between income and happiness seems surprisingly weak, unemployment is a major cause of reduced happiness and life satisfaction (see, for example, Dolan et al. 2008, Theodossiou 1998, Oswald 1997). All this may indicate that some aspect of work, wage payment aside, is valued by workers.

In the present paper, we propose a model of work motivation. In our model, workers have a preference for a self-image as someone who is important to others. The strength of this preference, however, may vary between individuals. These assumptions are in line with evidence reported by, among others, Crewson (1997),[2] and lead to predictions consistent with the phenomena discussed above.

When effort is remunerated by its marginal productivity, workers' choice of effort will be equivalent to the *Homo Oeconomicus* predictions. However, in jobs where neither individual effort nor individual productivity is verifiable, workers will exert more effort than *Homo Oeconomicus*. Thus, a given person's effort choice may be quite consistent with the traditional model if she works as a baker, but not if she switches jobs and becomes a nurse. Turning next to the issue of self-selection into different occupations, we show that under plausible conditions, those with intermediate preferences for being important will seek employment in the sector where effort is rewarded by its marginal productivity, while individuals with the *highest* and *lowest* work motivation are attracted to jobs where effort cannot be verified: The highly motivated are attracted by the opportunity to be important; the poorly motivated are attracted by the opportunity to shirk.

Since behavior in perfectly competitive market jobs is unaffected by the preference to be important, it is socially desirable that poorly motivated workers choose employment in jobs where economic incentives prevent shirking (bakers). This can be achieved by keeping wages low in jobs with unverifiable effort (nurses). Hence, while both the profit maximizing behavior of the baker and the other-regarding behavior of the nurse are consistent with the same underlying preferences, low wages can make strongly other-regarding individuals self-select into the nursing sector.

If nurses' wage is kept sufficiently low to keep shirkers out, the nursing sector will be strictly smaller than the first-best optimum. We show, however, that there may be other ways to recruit the highly motivated than increasing the wage: Nursing jobs will become more attractive, but only to motivated workers, if one invests in capital equipment that increases nurses' efficiency in helping others. This, in fact, provides an argument for overinvestment in certain types of public sector capital; for example

[2] Crewson (1997) reports, for example, that in a 1994 survey among 600 engineers, 63 percent of private sector employees and 74 percent among public sector employees rated "useful to society" as an important or very important aspect of a job; see also Lewis and Frank (2002). In a Public Agenda Foundation report presented by Yankelovich et al. (1984, as quoted in Lane, 1991), 51 percent of respondents in the US, 57 percent in Israel, and 17 percent in Britain reported to have a "strong inner need to do the very best I can regardless of pay".

better diagnostic equipment in hospitals, or library resources in universities and schools.

Living off welfare instead of working is detrimental for the sense of being important to others: the welfare recipient produces nothing, and his consumption must be financed by others' tax payments. The gain in terms of increased leisure must thus be weighted against the self-image loss. We show that workers with a sufficiently strong work motivation, including both nurses and bakers, will experience a strict utility loss if they lose their job, even in the case of full wage compensation. Such individuals will prefer work to living off welfare if they have the choice. Thus, they will not, for example, claim sick just in order to shirk.

Several researchers have recently proposed models of altruistic or social preferences (e.g. Ellingsen and Johannesson 2008, Benabou and Tirole 2006, Konow 2006, Rauscher 2006, Brekke and Nyborg 2008, Brekke et al. 2003, Andreoni 1990, Sugden 1984). Our approach is closely related to this research. Moreover, the ideas put forward in the present paper have much in common with an interesting recent strand of literature on public service motivation (Delfgaauw and Dur 2008, Francois 2000, 2007, Dur and Glazer 2007, Prendergast 2006, Besley and Ghatak 2005, Heyes 2004, Frank 2003, Handy and Katz 1998). A typical finding in the latter literature is that while the public sector (or an employer with a specific mission) may be attractive to highly motivated employees, a high wage will also attract "the wrong types" (Delfgaauw and Dur 2008, Francois 2007, Prendergast 2007, Heyes 2004). Nevertheless, in spite of its intuitive appeal, the above-mentioned papers rely on particular model assumptions that limits the applicability of the conclusion. Delfgaauw and Dur (2008), for example, assume exogenously that workers receive a private benefit from effort, but only if employed by the public sector. One consequence is that, in contrast to the model presented below, Delfgaauw and Dur's model would imply that a nurse's work motivation vanishes completely if the publicly owned hospital she worked for were privatized. In Francois (2007), a strong work motivation originates from a strong private preference for the public good produced by the public sector. It has been shown by a number of authors that this kind of 'pure altruism' motivation is, typically, unable to explain substantial voluntary contributions to public goods (Warr 1983, Bernheim 1986, Andreoni 1988). In Francois (2007), voluntary contributions result from combining pure altruism with a rather particular production function: If the individual worker doesn't contribute, the public good might not be provided at all. With a production function implying, instead, that a worker's shirking changes public good supply only marginally, it is hard to see how the motivation structure proposed by Francois (2007) could produce more than negligible voluntary contributions of unobservable effort. The model presented below, however, can explain voluntary effort even with more standard production functions.

The general model of work motivation presented in the current paper yields similar conclusions concerning recruitment and self-selection of motivated workers as Delfgaauw and Dur (2008) and

Francois (2007). In addition, it can explain a number of phenomena that cannot be analyzed within the framework of those models. Specifically, our model can explain the fact that many individuals prefer working to living off welfare, as well as the detrimental well-being effects of unemployment. Moreover, it provides new policy recommendations concerning alternative ways to attract motivated workers to jobs where performance pay cannot be used.

Pure transfers do not represent real costs for an economy as a whole. Nevertheless, net transfers to an individual may well represent welfare changes for *others*. One distinguishing feature of our model – unlike any other model we know of – is that pure transfers, for example in terms of sickness benefits, unemployment insurance, or tax payments, will matter for a person's perceived importance and thus his self-image and utility. This is important for several of our conclusions, for example the welfare effects of unemployment.

In the model, workers may have a preference for regarding themselves as someone who is important to others. In social psychology, self-image is recognized as an important determinant of human behavior. Aronson et al. (2005, p.166) summarize the findings as follows: "During the past half-century, social psychologists have discovered that one of the most powerful determinants of human behavior stems from our need to preserve a stable, positive self-image". While self-image is still not a standard ingredient in economic analysis, a number of economic models involving the concept of self-image or identity have recently been developed (Akerlof and Kranton 2000, 2005, Benabou and Tirole 2002, 2003, 2006, Brekke et al. 2003, Brekke and Nyborg 2008, Bruvoll and Nyborg 2004, among others). While "being important" is hardly the only aspect of self-image that people care about, it is the only aspect we focus on here; note, in particular, that we abstract from any preferences for social approval.[3]

In the literature on voluntary contributions to public goods, it is common to model preferences either through "pure" or "impure" altruism (Andreoni 1990). Pure altruism means that one cares about final outcomes in terms of public good supply, but not at all about one's own effort to provide it (like in Francois 2007). An impure altruist, on the other hand, derives a private benefit – the warm glow of giving – from *his own* contribution or effort. Several authors, like Delfgaauw and Dur (2008), assume that work motivation is caused by warm glow, while workers are not assumed to be concerned about the social consequences of their efforts.[4] Each of these approaches are somewhat unsatisfactory: As mentioned above, pure altruism cannot generally explain substantial contributions; on the other hand, it does not seem reasonable that an altruist would only care about his own effort, independently of its consequences. The self-image approach presented below reconciles these concerns: A given effort produces the private good of a better self-image, but only to the extent that the effort is thought of

[3] As pointed out by Benabou and Tirole (2006) and Ellingsen and Johannesson (2008), the desire for a good self-image and social approval can sometimes be modelled in similar ways.

[4] See e.g. Konow (2006) or Nyborg and Rege (2003) for further discussions of warm glow, pure and impure altruism.

as important to others' welfare.

Our aim has been to propose a model of work motivation which is applicable for almost any kind of job, not requiring *ad hoc* differentiation between types of jobs (physicians versus others, public versus private services, caregiving versus industrial production, etc.). In our model the crucial aspect of "importance" is not linked to specific characteristics of job tasks, enterprise organization, or ownership, as such, but to whether the employee's efforts yield social welfare effects over and above the compensation she receives.

2 The model

Assume that every individual $i = \{1, ..., n\}$ has preferences of the following type:

$$U_i = u(b_i) - c(e_i) + \theta G + S_i \tag{1}$$

where b_i is i's consumption of a (numeraire) private good (for example, bread); e_i is i's effort; G is the level of a pure public good (for example, preventive public health care), and S_i is i's self-image; u is a strictly concave and increasing function, while c, the cost function for effort, is strictly convex, increasing in e_i, satisfying $c(0) = 0$. Effort levels are unobservable. $\theta > 0$ is the fixed marginal utility of the public good. The functional form is chosen for simplicity.

We assume that individuals have identical skills. Each individual i is either a "baker" (denoted $\tau_i = B$) and works in the sector producing the private good, the baking sector; or else he is a "nurse" ($\tau_i = N$) and is employed by the sector producing the public good, the nursing sector. Bakers are paid according to their marginal productivity; nurses are not. The latter is the crucial distinction between the two sectors. Thus, although convenient, it is not of essential importance that one sector produces a private good and the other a public good; nor is public or private ownership as such crucial. Our main results would hold also if nurses produced a private good (for example individual health care), or if the nursing sector were privately owned (e.g. private nursing homes), as long as effort and productivity of individual nurses are non-verifiable.

For bakers, individual output can be observed and verified, and performance pay can thus be used even if effort is unobservable. It may be instructive to think of self-employed businesspeople who produce and sell a homogeneous good of perfectly observable quality to consumers at the current market price (normalized here to 1). We assume that the consumption good market is perfectly competitive, implying that all producers and consumers take the price of consumer goods as exogenously given.

Person i's production of the consumption good (bread) is given by

$$\beta(e_i, \tau_i) = \begin{array}{c} 0 \text{ if } \tau_i = N \\ f(e_i) \text{ if } \tau_i = B \end{array} \tag{2}$$

where $f' > 0, f'' < 0$ (primes denote derivatives), and $f(0) = 0$. The individual is paid the market value of his production, which is $f(e_i)$.[5]

For nurses, individual production cannot be observed by others. Only the aggregate level G can be measured, so even though the worker herself knows how much she contributed, this cannot be verified, because the number of nurses is large.[6] Person i's production of the public good is

$$\gamma(e_i, \tau_i) = \begin{array}{c} 0 \text{ if } \tau_i = B \\ g(e_i) \text{ if } \tau_i = N \end{array} \tag{3}$$

where $g' > 0$, $g'' < 0$, and $g(0) = 0$.[7] Total supply of the public good equals $G = \sum_i \gamma(e_i, \tau_i)$ for all i. Individuals regard the public good provision by others, $G_{-i} = \sum_{j \neq i} \gamma(e_i, \tau_i)$, as exogenously fixed. We will also assume that $\theta g'(0) < c'(0)$, that is, the marginal public good benefit to i herself is never large enough to outweigh her effort costs.

Nurses are paid a fixed wage w. These wages are financed through a lump sum tax $t < w$, which is, for simplicity, assumed to be equal for everybody (hence, we implicitly assume either public ownership or public financing of privately produced nursing):

$$t = \frac{mw}{n} \tag{4}$$

where n is the number of individuals in society, and m is the number of nurses.

The budget constraint for individual i is now

$$b_i + t = y(e_i, \tau_i), \text{ where } \begin{array}{c} y(e_i, \tau_i) = f(e_i) \text{ if } \tau_i = B \\ y(e_i, \tau_i) = w \text{ if } \tau_i = N. \end{array} \tag{5}$$

Market clearing for the private good, $\sum_i b_i = \sum_i \beta(e_i, \tau_i)$, follows from (4) and (5).

Now, let us turn to the self-image preference. "Being important" must certainly mean being important to *someone*. In economics, the most common way to formalize importance is by means of a social welfare function. Since we will be considering a Nash equilibrium, we are interested in the effects

[5] For simplicity, this set-up presumes that the worker is, essentially, self-employed. The results would also hold, of course, if he were employed at a wage reflecting the value of his output.

[6] If the nurses employees produced, instead, a private good, the problem of individual output measurement could for example arise from limited verifiability of product quality (childcare), or from limited knowledge of the production function for people outside a specialized profession (advanced medicine).

[7] Note that a given employee's contribution depends only on her own effort, which simplifies the analysis.

of an agent's action when everybody else's actions are assumed to be fixed. Our basic assumption will thus be as follows: *Self-image is increasing in one's net contribution to others' welfare, taking others' behavior as fixed.*[8]

To be operational, this criterion must be specified further. First, assume that every individual i agrees that *others'* welfare can be specified as

$$W_{-i} = \sum_{j \neq i} [u(b_j) - c(e_j) + \theta G] \tag{6}$$

Here, others' self-images are assumed not to be included in i's judgement of their welfare. We believe that there exist very good arguments for including self-image in social welfare judgements, but also for excluding it. There may be an element of circular reasoning in letting the definition of "being important" depend on the very same concept. On the other hand, it is hard to claim that self-image benefits are less "real" than other benefits. Assuming that $W_{-i} = \sum_{j \neq i} U_i$ would, however, complicate the analysis considerably; we have thus chosen to keep with the tractable specification.[9]

Let $W^0_{-i}(e_i, \tau_i)$ denote others' welfare as a function of i's choices when others' behaviors are kept fixed at their status quo levels $e_j = e^0_j$ and $\tau_j = \tau^0_j$ for every $j \neq i$. Next, note that a baker who consumes exactly his own production of bread, and who pays no taxes, contributes exactly nil to others' welfare; hence, this is a natural benchmark. Let the constant W^{bm}_{-i} denote others' welfare in the benchmark case, i.e. when i is a baker consuming exactly his own production, again assuming that $e_j = e^0_j$ and $\tau_j = \tau^0_j$ for every $j \neq i$. [10] We are now in a position to formally define our self-image function:

$$S_i = \alpha_i (W^0_{-i}(e_i, \tau_i) - W^{bm}_{-i}) \tag{7}$$

Thus, self-image is proportional to the social value of i's production, minus the social value of i's private consumption. The subtraction of W^{bm}_{-i} in (7) secures that self-image is determined by i's own contribution, and not by, for example, a policy change influencing others' welfare.[11] The proportionality factor α_i is assumed to be exogenous, but may vary between individuals. To rule out the case in which people care more about others' welfare than their own, we impose the restriction

[8] As pointed out by a referee, the "taking others' behavior welfare as fixed" part should be modified if studying, for example, managers whose task is to change other people's behavior. In the current model such issues do not arise since we have abstracted from social interaction effects and since individuals' productivity is independent of others' effort. In general, however, this assumption implies that when assessing their self-image, individuals disregard general equilibrium effects.

[9] Including self-image in (6) would leave the analysis basically unaffected under the assumption that self-image is assessed taking others' *behavior and self-image* as fixed.

[10] That is, $W^{bm}_{-i} = \sum_{j \neq i} [u(b_i) - c(e_i) + \theta G]$ s.t. $\tau_i = B$, $b_i = f(e_i)$, and $e_j = e^0_j$ and $\tau_j = \tau^0_j$ for every $j \neq i$.

[11] The subtraction of W^{bm}_{-i} in (7) does not affect behavior.

$0 \leq \alpha_i < 1$. If $\alpha_i = 0$, our model corresponds to the standard *Homo Oeconomicus* model, while $\alpha_i = 1$ would imply that the individual cares just as much for anyone else's welfare as his own.[12]

3 Choosing effort levels

For a given type of employment τ_i, individuals maximize their utility with respect to effort e_i. Their preferred type of employment is determined by the maximum utility level attainable in the two sectors. Let $U_i(e_i, \tau_i)$ denote the utility individual i will get from choosing effort e_i given the type of employment τ_i.

Consider first the effort choice of bakers ($\tau_i = B$). To avoid unnecessary complications, we will assume in the following that the optimal effort level is sufficiently high to cover the lump-sum tax, so that the tax does not impose a binding restriction on the optimal choice of effort. For a baker, $G_{-i} = G$, and utility is given by

$$U_i(e_i, B) = u(f(e_i) - t) + \theta G - c(e_i) + \alpha_i(\sum_{j \neq i}[u(y(e_j^0, \tau_j^0) - t) + \theta G - c(e_j^0)] - W_{-i}^{bm}) \tag{8}$$

Differentiation of this with respect to e_i gives the following first order condition for bakers' utility maximization:

$$u' f' = c' \tag{9}$$

This expression is independent of α_i; indeed, it is exactly the same first order condition which would have emerged from the *Homo Oeconomicus model*, corresponding to $\alpha_i = 0$ in our model: For the baker, a preference to be important to others *does not* affect the optimal effort level.

To see this, note that in the present model there is only one private good (bread), which is also the numeraire. Hence, any purchases of bread must be paid by an exactly equivalent amount of bread, implying necessarily just a barter of equally valued goods, producing no real transfer of resources. Consequently, the baker's production always just covers his own consumption and his tax payment, and on the margin, any changes in his production will be mirrored by corresponding changes in his

[12] Dur and Glazer (2007) propose that workers have a preference to "make an impact", and assume that "a person measures his impact of any action he may take by comparing output in the current period to what it would have been had he unexpectedly ceased to exist an instant before" (p.4). Their specification is different from ours in several important ways, and consequently yield quite different results. For example, workers are assumed to be concerned with their contribution to production, not others' welfare; further, they assume that a worker feels important only to the extent that others cannot replace his effort. In their approach, work will thus only yield self-image benefits when a worker's effort cannot easily be replaced by someone else. We believe, however, that "importance" is not necessarily related to not being replacable, but can also be conceived as "taking part in the functioning of society" in the sense that one fulfills an important, albeit not necessarily irreplacible, function.

consumption. This result is not an artifact of the assumption of a single private good. In a model with several consumer goods, a similar result would obtain: In competitive markets, where the baker takes prices as given, marginal values are equalized in equilibrium, ensuring that the market value of one's production equals its social value for consumers. On the margin, market exchanges are simply barters of resources of equal value, and the marginal transaction does not increase or decrease the welfare of others.[13]

How about the nurse ($\tau_i = N$)? Utility is, in her case, given by

$$U_i = u(w-t) + \theta(G_{-i} + g(e_i)) - c(e_i) + \alpha_i(\sum_{j \neq i}[u(y(e_j^0, \tau_j^0) - t) + \theta(G + g(e_i)) - c(e_j^0)] - W_{-i}^{bm}) \quad (10)$$

Differentiation with respect to e_i thus yields the first order condition

$$\theta g'[1 + \alpha_i(n-1)] = c' \quad (11)$$

A nurse with $\alpha_i = 0$ will exert no effort at all: The only reason to do so would be the resulting extra public good benefits to herself, but since, by assumption, $\theta g'(0) < c'(0)$, this is not, for her, worth the required effort. However, for the nurse with $\alpha_i > 0$, our model is obviously not behaviorally equivalent to *Homo Oeconomicus.* When $\alpha_i > 0$, the nurse will attach a strictly positive weight to the marginal public good benefits accruing to others, since this stimulates her sense of being important; hence, her preferred effort level is higher than it would have been if $\alpha_i = 0$. However, due to the restriction $0 \leq \alpha_i < 1$, we can conclude that she will only partially internalize this externality: The nurse will exert (weakly) more effort than predicted by the Homo Oeconomicus model, but not enough to secure a socially optimal public good provision.[14]

For future reference, denote the utility-maximizing effort for an individual with occupation τ_i and motivation strength α_i by $e^*(\tau_i, \alpha_i)$. In Lemma 1 in the Appendix, we show that $e^*(N, \alpha_i)$ is increasing in α_i. The baker's effort is independent of α_i, so we can also write $e^*(B, \alpha_i) = e^{*B}$. To summarize:

Proposition 1 *The baker's effort is independent of α_i, while the nurse's effort is increasing in α_i.*

[13] See Dufwenberg et al. (2008). If taxes were increasing in income, α_i would enter the baker's first order condition for optimal effort. Nevertheless, if α_i is sufficiently small, the baker would still prefer to keep his income rather than paying taxes, and most of our results would be unchanged. Further, we have simplified by not allowing the baker to give away bread for free, since our focus is work motivation rather than charity; however, if allowed, baker i would choose to do this only if there is a j such that $\alpha_i u'(b_j) > u'(b_i)$, where $\alpha_i < 1$. This might hold if the income distribution is sufficiently unequal, α_i is sufficiently large, u sufficiently curved and, in addition, giving away bread is a more efficient way to improve one's self-image than becoming a nurse.

[14] Here, "socially optimal" should be interpreted as the level maximizing $W = \sum_{j=1}^{N}[u(b_j) - c(e_j) + \theta G]$.

We cannot say whether, in general, $e^*(N, \alpha_i) \gtrless e^*(B, \alpha_i)$, i.e. whether a given individual will exert more effort when employed by the nursing or baking sector. In the nursing sector there is no economic incentive to exert effort, so if α_i is low, effort can be negligible or even zero. On the other hand, if α_i is large, the desire to be important may push the individual to very high effort levels.

The conclusion so far is that even if businessmen and bakers – in general, those who are paid by their marginal productivity – behave in line with predictions from the standard *Homo Oeconomicus* model, while nurses and physicians might not, this need not imply that bakers and nurses, or businessmen and physicians, have different preferences. They might all prefer to keep a self-image as someone who is important to others, but this preference has no behavioral consequences for those whose marginal effort is compensated by its marginal social value. As pointed out by Adam Smith, acting according to one's own material interests is also in society's interest in a perfectly competitive market; the preference to be important will hence not push the baker in a different direction than market incentives do. On the other hand, for those whose efforts are beneficial to society over and above the compensation they receive, the desire to be important gives an extra incentive to work hard.

In the next section, however, we will show that due to self-selection into occupations, systematic differences in intrinsic work motivation between sectors may still prevail in labor market equilibrium.

4 Choosing type of employment

When considering which type of employment to seek, the worker will compare the maximum utility he can obtain in each type of job. Assume that i is a baker, that there is a vacancy in the nursing sector, and that he is considering whether to apply for it. If he switches jobs, he gets the opportunity to be important through producing the public good, to the benefit of everyone in society. He also, however, gets the opportunity to shirk. Finally, his income may of course change, depending on the public wage w and his productivity as a baker.

Consider, first, the effects on self-image as important to others. We will show that self-image can either increase or decrease, depending on whether his effort in the new position will be sufficiently high to justify the increased tax burden he imposes on others.

Let $\Delta W^0_{-i}(\alpha_i)$ denote the increased welfare for others if i moves from the baking to the nursing sector, all else given, i.e., $\Delta W^0_{-i}(\alpha_i) = W^0_{-i}(e^*(N, \alpha_i), N) - W^0_{-i}(e^*(B, \alpha_i), B)$. The gain in self-image for individual i by becoming a nurse is given by

$$\Delta S_i = \alpha_i \Delta W^0_{-i}(\alpha_i) \tag{12}$$

If i becomes a nurse, the number of nurses m will increase by one, and public good production will weakly increase; by how much depends on α_i, the strength of his work motivation. On the other hand,

taxes must finance wages for one more nurse. Recall that $t = \frac{mw}{n}$, so $\frac{\Delta t}{\Delta m} = \frac{w}{n}$ is the tax increase required to finance i's entry into the nursing sector.

Assume that Δt is marginal in the sense that the resulting change in utility Δu is approximately $-u'\Delta t$. Then, the increase in others' welfare due to i's becoming a nurse can be written

$$\begin{aligned} \Delta W^0_{-i}(\alpha_i) &= \sum_{j \neq i} [u\{y(e^0_j, \tau^0_j) - t - \Delta t\} - u\{y(e^0_j, \tau^0_j) - t\} + \theta g(e^*(N, \alpha_i))] \\ &\approx (n-1)\theta g(e^*(N, \alpha_i)) - \Delta t \sum_{j \neq i} u' \end{aligned} \tag{13}$$

where u' is evaluated at $y(e^0_j, \tau^0_j) - t$.

This expression can be positive or negative, depending on the level of α_i. First, it can easily be shown that $\Delta W^0_{-i}(\alpha_i)$ is nondecreasing in α_i and strictly increasing for positive effort (see Lemma 2 in the Appendix): The stronger i's desire to be important, the harder he will work in the nursing sector, and the more useful it is to others that he moves there. Moreover, it is evident that $\Delta W^0_{-i}(0) < 0$: If a worker with no concern for being important ($\alpha_i = 0$) becomes a nurse, he will produce nothing, while still claiming his wage, which must be financed by others' increased tax payments; hence the change in others' welfare will be strictly negative. Consequently, there must be an $\hat{\alpha} \in [0, \infty]$ such that $\Delta W^0_{-i}(\alpha_i) > 0$ for $\alpha_i > \hat{\alpha}$, $\Delta W^0_{-i}(\alpha_i) = 0$ for $\alpha_i = \hat{\alpha}$, and $\Delta W^0_{-i}(\alpha_i) < 0$ for $\alpha_i < \hat{\alpha}$.[15] In the following, we will assume that $\hat{\alpha} < 1$, which we believe to be the most interesting case: If this did not hold, no-one, not even the most strongly motivated, would consider work in the nursing sector socially beneficial.

This leads to the following preliminary conclusion: Self-image increases when i becomes a nurse if his work motivation is strong ($\alpha_i > \hat{\alpha}$), but decreases if his motivation is weak ($\alpha_i < \hat{\alpha}$).

However, it is not only self-image which counts: An individual with work motivation α_i will prefer to be a nurse if his maximum *utility* as a nurse exceeds the maximum utility he can attain as a baker. Let $U^N = \max_{e_i} U_i(e_i, N)$, $U^B = \max_{e_i} U_i(e_i, B)$ and $\Delta U(\alpha_i) = U^N - U^B$. Then, i will prefer the nursing sector if the following expression is positive:

$$\Delta U(\alpha_i) = u(w - t - \Delta t) - u(f(e^{*B}) - t) - c(e^*(N, \alpha_i)) + c(e^{*B}) + \theta g(e^*(N, \alpha_i)) + \alpha_i \Delta W^0_{-i}(\alpha_i) \tag{14}$$

Proposition 2 establishes that $\Delta U(\alpha_i)$ is U-shaped, and specifies the values of α_i for which $\Delta U(\alpha_i)$ is positive, implying that the individual prefers being a nurse.

[FIGURE 1 APPROXIMATELY HERE]

This is illustrated in Figure 1. The intuition is as follows: For a worker with very low motivation, nursing is attractive because it enables him to shirk. The negative $\Delta W^0_{-i}(\alpha_i)$ is no substantial worry

[15] Note that $\hat{\alpha}$ is a function of model parameters such as w and M. To simplify notation, we disregard this here.

to him, since he cares little about others' welfare. If α_i is very high, being a nurse is attractive because it offers the opportunity to be important to others. For intermediate values of α_i, however, being a baker is most attractive: For low, intermediate values, $\Delta W^0_{-i}(\alpha_i)$ (the impact on others' welfare) is negative, and this bothers the individual enough that he prefers being a baker. For high, intermediate values, his effort as a nurse would increase others' welfare and thus self-image, but the self-image gain is insufficient to justify the required effort costs.[16]

Proposition 2 *a)* $\Delta U(\alpha_i)$ *is declining in* α_i *for* $\alpha_i < \hat{\alpha}$ *and increasing in* α_i *for* $\alpha_i > \hat{\alpha}$*, while for* $\alpha_i = \hat{\alpha}$*,* $\partial \Delta U(\alpha)/\partial \alpha_i = 0$*. b) Moreover, there exist* $\bar{\alpha} \geq \underline{\alpha} \geq 0$ *such that* $\Delta U(\alpha_i) < 0$ *for* $\alpha_i \in (\underline{\alpha}, \bar{\alpha})$*, while* $\Delta U(\alpha) \geq 0$ *for* $\alpha_i \in [0, \underline{\alpha}] \cup [\bar{\alpha}, 1]$*.*

Proof. See the Appendix. ■

Note that $\Delta U(\alpha_i)$ depends on the tax level t, which in turn depends on the number of nurses. A Nash equilibrium is then a tax level and corresponding $\underline{\alpha}, \bar{\alpha}$ such that all i with $\alpha_i \in [0, \underline{\alpha}] \cup [\bar{\alpha}, 1]$ are nurses and all others are bakers, and such that the tax level is consistent with these choices.[17]

5 Attracting the devoted nurses

Assume, now, that $\alpha_i \in [0, 1\rangle$ is drawn from an approximately continuous distribution[18], and that α_i is unobservable. Different individuals then have different incentives to seek the two types of jobs. Since effort among bakers is unaffected by work motivation, while nurses' effort is increasing in work motivation, it would be socially preferable if the highly motivated could somehow be attracted to the nursing sector. However, since motivation is unobservable, and public jobs can also be attractive to poorly motivated shirkers, this is not trivial.

The lower nurses' wage w is, the less attractive are nursing jobs to shirkers. Denote by $\bar{w}$ the wage for which the very least motivated ($\alpha_i = 0$) is exactly indifferent between the nursing and baking sectors, i.e. a wage such that $\Delta U(0) = 0$. We will now explore whether a regulator can set the wage w such that nursing jobs are attractive only to the highly motivated, while keeping the poorly motivated in the sector with performance pay. In the following, we will focus on situations such that if $w = \bar{w}$, then $\bar{\alpha} < 1$.[19]

[16] This corresponds to the findings of Francois (2007), Delfgaauw and Dur (2008) and Prendergast (2006).

[17] That this is a Nash equilibrium follows since self-image is defined taking others' behavior as fixed.

[18] That is: the distribution covers the entire interval $[0, 1)$.

[19] If $\bar{\alpha} < 1$ does not hold, the desire to be important, although present, is too weak to compensate workers for their effort, and no highly motivated worker will apply for a job as a nurse. Hence, this case reproduces the *Homo Oeconomicus* prediction that any nurse will be a shirker. While this is certainly conceivable, we will focus on the case where $\bar{\alpha} < 1$ for $w = \bar{w}$ precisely because this is when our approach differs from the standard model.

If one more person becomes a nurse, every member of society has to pay slightly more taxes, Δt. Assume that $\Delta t \cdot u' < c(e^{*B})$, which seems a very reasonable assumption. Then, it follows, as we show formally in Lemma 4 in the Appendix, that

$$\bar{w} < f(e_B^*). \tag{15}$$

In words: To make the very least motivated indifferent between the two types of jobs, bakers' income must be *higher* than nurses' – to compensate bakers for the inconvenience of not being able to shirk, like they could have done in the nursing sector. Hence, in a world with only dedicated nurses, those nurses must necessarily earn less than employees in the private sector.

What happens if the regulator sets the wage equal to $w = \bar{w}$? For a person with $\alpha_i = 0$, the benefit of moving to the nursing sector, $\Delta U(0)$, is then, by definition, zero. According to Proposition 2, we know that as α_i increases, $\Delta U(\alpha_i)$ will then first be decreasing and then increasing. When α_i reaches $\bar{\alpha}$, $\Delta U(\alpha_i)$ is, again, zero. When α_i exceeds $\bar{\alpha}$, however, $\Delta U(\alpha_i)$ becomes strictly positive. Hence, when $w = \bar{w}$, only those with a motivation higher than $\bar{\alpha}$ will prefer being nurses.

It turns out, however, that for any distribution of α_i satisfying our assumptions, setting $w = \bar{w}$ will lead to a suboptimally low production of the public good: To avoid attracting at least some shirkers, the size of the nursing sector has to be kept too low compared to the first-best.

First, define social welfare as[20]

$$W = \sum_{j=1}^{n} [u(b_j) - c(e_j) + \theta G] \tag{16}$$

Further, define the the first-best social optimum as the hypothetical situation in which W is maximized with respect to e_i and τ_i, disregarding any incentive problems.[21] Then, we have the following result:

Proposition 3 *If α_i is approximately continuously distributed, then for $w = \bar{w}$ public good provision is smaller than the first-best optimum.*

Proof. See the Appendix. ■

The intuition behind this result can be seen as follows: Consider the move from baker to nurse for an individual with motivation $\alpha_i = \bar{\alpha}$. Since $\Delta U(\alpha_i) = 0$, the private costs in terms of reduced

[20] Alternatively we could define total welfare to include self image:

$$W = \sum_{j=1}^{N} [u(b_j) - c(e_j) + \theta G + S_j]$$

Including self-image in the social welfare function would have negligible effects on the ranking of social states as long as the policy to be evaluated does not change the benchmark state. However, many policies will affect the benchmark, and in such cases the choice of social welfare function matters for normative conclusions.

[21] Note that we have not claimed that $\bar{w}$ is a second-best optimal wage level. This requires further analysis since w affects not only efficiency, but also the income distribution.

income and hard work, net of private benefits of increased G, just balance the boost in self-image, ΔS_i. If maximizing total welfare, however, we would trade off the private cost to i not against her self-image gain, but against the welfare increase for others. Since a person with $\alpha_i = \bar{\alpha}$ would work sufficiently hard to contribute positively to social welfare ($\Delta W^0_{-i}(\bar{\alpha}) > 0$), and, by assumption, $0 \leq \alpha_i < 1$, it follows that $\Delta S_i = \bar{\alpha}\Delta W^0_{-i}(\bar{\alpha}) < \Delta W^0_{-i}(\bar{\alpha})$. Thus, although a person with $\alpha_i = \bar{\alpha}$ is exactly indifferent between being a baker or a nurse, the welfare of others would strictly increase if she became a nurse. By continuity the same argument applies to individuals with motivation slightly less than the marginal person, thus with $\alpha_i < \bar{\alpha}$. These individuals will strictly prefer to be bakers; in a first-best equilibrium, however, they should be nurses.[22]

5.1 Changing the wage

For $w > \bar{w}$, the nursing sector will hire both the least and the most motivated (see also Delfgaauw and Dur, 2008). There are two marginal individuals, one with low and one with high work motivation. For the least motivated marginal individual, $\Delta W_{-i} < 0$. Thus, others' welfare declines as this individual moves into the nursing sector.

As the wage level increases, and more people are attracted to nursing, taxes will increase. Eventually, $y_j - t$ will become very low. Hence, if the wage is too high, it could happen that *only* the least motivated prefer to work as nurses, while highly motivated individuals feel more useful as bakers. Let w^* denote the *highest* wage level where the most motivated still prefer being nurses, and where at least one individual prefers being a baker. The next Proposition is illustrated by Figure 2.

[FIGURE 2 APPROXIMATELY HERE]

Proposition 4 *For any wage level $w^* > w > \bar{w}$, at least one individual i exists who will be attracted into the nursing sector by a wage increase, such that*

$$\Delta W^0_{-i}(\alpha_i) < 0,$$

while at the same time there exists at least one worker j, not attracted by a wage increase and thus left in the baking sector, such that

$$\Delta W_{-j}(\alpha_j) > 0.$$

Thus, because work motivation α_i is unobservable, the allocation of workers between the two sectors will never be first-best optimal.

[22] Note that this argument only applies when the wage is set at $w \leq \bar{w}$, since then there is no additional provision of public goods from individuals with $\alpha_i \in [0, \underline{\alpha}]$.

Proof. See the Appendix. ■

The above proposition establishes that when $w > \bar{w}$, the nursing sector always attracts some shirkers, while some relatively highly motivated workers are left in the baking sector. In fact, our next proposition demonstrates that increasing nurses' wage has a stronger recruitment effect for potential shirkers than for highly motivated workers.

Proposition 5 *Assume that $w^* > w > \bar{w}$. Then, a marginal increase in w increases $\Delta U(\alpha_j)$ more than $\Delta U(\alpha_i)$ if $\alpha_i > \alpha_j$.*

Proof. See the Appendix. ■

This result differs from, for example, Francois (2007), and occurs because in our model, motivated individuals experience a self-image loss by living off others' contributions. More motivated individuals care more about this than others; the unmotivated ($\alpha_i = 0$) do not care at all. When nurses' wage is increased, this just increases consumption possibilities for the unmotivated; for the highly motivated, however, there is, in addition, a strictly negative effect arising from the increased income transfer from others (decreasing one's net contribution to others' welfare).[23]

5.2 Improving nurses' working conditions

If the regulator cannot hire a sufficiently large number of devoted nurses by increasing their wage, without at the same time attracting even higher numbers of shirkers, one may want to look for alternative policy tools. Are there available instruments which would make working as a nurse more attractive to the highly motivated, but not to the shirkers?

Intuition suggests that this might be the case. Consider, for example, a devoted nurse who tries to prevent the spread of an infectious disease, and who wants to provide important information to high-risk groups who do not visit her office on their own initiative. However, the government has provided her with very poor working conditions: she has neither a car nor internet access from her office. Such working conditions must obviously be unattractive for a worker who cares about being important. For a worker who doesn't care, and who simply wants to shirk and collect her wage, the opportunity to do a good job will not matter much.

Let κ be an investment which has a "public good" property in the sense that once the investment has been made, it increases the marginal productivity of all nurses (think of, for example, roentgen equipment; to make the example clear-cut, the capital input should improve nurses' productivity while

[23] Note that if nurses were uncertain about the actual social welfare effects of their effort, it is conceivable that they could interpret the wage as a signal of the job's social importance. If present, such effects would modify the above argument.

not affecting their material utility directly, implying that standard fringe benefits, for example, will not do). Thus, in the production function for the public good (3), replace $g(e_i)$ by a function $\hat{g}(e_i, \kappa)$, such that each nurse's production is given by $g_i = \hat{g}(e_i, \kappa)$ where $\hat{g}'_e > 0$, $\hat{g}'_\kappa \geq 0$, $\hat{g}''_{ee} < 0$, and $\hat{g}''_{\kappa\kappa} < 0$. Moreover, assume that $\hat{g}(0, \kappa) = 0$, i.e. capital investment is of no use unless nurses exert at least some effort. (This implies that $\hat{g}'_\kappa(0, \kappa) = 0$; but we will assume that $\hat{g}'_\kappa > 0$ for every $e_i > 0$.) To balance public budgets, the tax equation (4) must now be replaced by

$$t = \frac{mw + \kappa}{n} \tag{17}$$

It follows readily that for a nurse who initially provides a strictly positive effort, an increase in the capital input κ increases effort if $\hat{g}''_{e\kappa} > 0$; it leaves effort unchanged if $\hat{g}''_{e\kappa} = 0$, and decreases effort if $\hat{g}''_{e\kappa} < 0$. This is similar to the result of Glazer (2004). With no intrinsic motivation, the worker will provide no effort as a nurse, independently of κ. Capital input that increases nurses' marginal productivity ($\hat{g}''_{e\kappa} > 0$) does not only motivate devoted nurses to work harder, however: It also makes it more attractive to become a nurse, but *only for those with high motivation.* Intuitively, such investment improves the opportunity to be important as a nurse, and thus makes nursing more attractive to motivated individuals. Proposition 6 establishes this result formally.[24]

Proposition 6 *For a worker with $\alpha_i = 0$, an increase in the capital input κ does not affect the attractiveness of nursing employment. For a worker with $\alpha_i > 0$, who would exert a strictly positive effort level if employed as a nurse, being a nurse becomes strictly more attractive when the capital input κ increases, provided that $\hat{g}''_{e\kappa} \geq 0$. If $\hat{g}''_{e\kappa} < 0$, being a nurse could become either more or less attractive when κ increases.*

Proof. See the Appendix. ■

For a given wage, more devoted workers can be recruited by increasing nurses' opportunities to do a good job: The higher the investment κ, the more attractive it is for motivated workers to be a nurse; and the higher one's work motivation α_i, the stronger is the motivational effect of increasing investments. The exception is if $\hat{g}''_{e\kappa} < 0$, which means that the capital input makes the nurse's work, on the margin, *less* useful. This should be no surprise. Of course, the reverse also holds: If the government reduces capital input, making devoted nurses' working conditions harder (assuming that $\hat{g}''_{e\kappa} \geq 0$), being a nurse will become less attractive; the more so for the highly motivated workers. Consequently, there are two good reasons for the government to provide capital: First, it is productive

[24] In the model by Delfgaauw and Dur (2008), capital investments would make no impact on recruitment to the public sector, since motivation is linked to one's own efforts, not its conseqences. In Dur and Glazer (2008), capital investments may improve worker motivation in private firms, but only when the worker cannot easily be replaced by someone else.

per se; but secondly, it improves recruitment of motivated workers to the public sector. The latter provides, in fact, a reason for the government to "overinvest" in the nursing sector.

If the investment were, instead, worker specific (i.e. a fixed capital input per worker), i's choice to become a nurse would imply a marginally higher tax payment for every individual. In this case, the motivational effect of increased capital input works only up to the point where it would anyway be socially efficient to increase capital input; thus, with fixed per worker capital input there is no argument for overinvestment. For a formal analysis of this case, see the Appendix.

6 The detrimental self-image effect of welfare dependency

In the above model, the labor marked cleared and there were no unemployment. We also implicitly abstracted from disease, disability, and other problems that have motivated, in practice, social security systems. Below, we will explore the implications of the motivational assumptions proposed above for unemployment and welfare dependency. If someone loses her job, how will that affect her utility? If a person has a choice between working and living off welfare, what will she prefer?

In this part of the analysis, the self-image impact of net transfers play an important role. In this respect, our model differs from any other model we know of, in the public service motivation literature or elsewhere.

Assume, now, that in addition to employment either as a nurse or a baker, there is a third possibility, namely not participating in work, being a welfare recipient. Formally, $\tau_i = \{B, N, Z\}$, where $\tau_i = Z$ denotes not working. For simplicity, let $\beta(e_i, Z) = \gamma(e_i, Z) = 0$, that is, the effort of the welfare recipient has no productive use; thus we can write the utility-maximizing effort of a welfare recipient as $e^*(Z, \alpha_i) = 0$.

Let the fixed welfare payment, for example unemployment or sickness benefits, equal $\lambda > 0$. We assume, again for simplicity, that individuals living on welfare do pay taxes, and that the welfare payment exceeds the tax; thus the net transfer to a welfare recipient is $\lambda - t > 0$. Then, to balance public budgets, we must have

$$t = \frac{l\lambda + mw}{n}. \tag{18}$$

where l is the number of people living off welfare. Let us first discuss the case of involuntary unemployment, and then return to the case where a worker can choose whether or not to be a welfare recipient.

An unemployed worker receives λ from the government, but does not have any income of his own. Thus, when a baker becomes unemployed, public expenses increase by λ, and the tax increase for every member of the population is $\frac{\lambda}{n} > 0$. Production of bread also decreases; however, since others

pay for the baker's goods, and the market price for bread corresponds exactly to its social value, the lost production has no net welfare effects for others. Any self-image impacts for the baker must thus be associated with the changes in net transfers.

When employed, the baker paid net taxes to the government; when unemployed, he receives net transfers, financed by others' tax payments. Thus, he goes from being a net contributor to others' welfare (in terms of being a tax payer) to contributing negatively (by living off others' tax payments). Consequently, for every baker with $\alpha_i > 0$, unemployment leads to a loss of self-image.

If a nurse gets unemployed, she also receives λ; however, her wage must no longer be financed through public budgets, so the tax increases only by $\frac{\lambda - w}{n}$. The sign of the tax change now depends on whether the welfare payment λ is higher or lower than the nurse's wage w. If $\lambda < w$, the nurse will be a larger burden for tax payers when employed than when unemployed.

However, the welfare effects for others depend, also, on how much public good supply decreases when the nurse stops working. This depends on how much effort the nurse exerted, which depends, in turn, on α_i. If she exerted low effort, her net contribution to society may actually have been negative initially. In this case her self-image will in fact be higher as unemployed than as employed. Thus, a nurse's self-image may increase or decrease when she loses her job, depending on whether she was, initially, a shirker or not.

Let us use a linearization like in (13), with $\bar{u} = \frac{1}{n-1} \sum_{-i} u'$ denoting average marginal utility. Then, the following Proposition summarizes the effect of unemployment on self-image:

Proposition 7 *a) The change in self-image for a baker who becomes unemployed is*

$$\Delta S_i^B \approx -\alpha_i \lambda \bar{u} \leq 0.$$

b) The change in self-image for a nurse who becomes unemployed is

$$\Delta S_i^N \approx -\alpha_i \left[(n-1)\theta g(e^*(N, \alpha), N)) + (\lambda - w)\bar{u} \right] \lesseqgtr 0.$$

Proof. See the appendix. ■

Even for those who lose self-image, however, *utility* may still increase, due to the lower effort costs as unemployed. The size of the unemployment benefit also matters, of course, for the unemployed's utility. So can we be more precise about net utility changes?

One particularly simple case is when the unemployment benefit provides exact income compensation. The Proposition below establishes that *every* nurse who provides a strictly positive effort experiences a net loss of utility when losing her job. That is, with full income compensation, no nurse can strictly benefit from becoming unemployed.

Concerning the bakers, the highly motivated (high α_i) would also experience a net utility loss if losing their job; the most poorly motivated bakers, however, can actually achieve a net utility gain.

Proposition 8 *a) Let $\lambda = w$. Then, every nurse for whom $e^*(N, \alpha_i) > 0$ would experience a utility loss if she lost her job. For a nurse with $e^*(N, \alpha_i) = 0$, utility is unaffected by becoming unemployed. b) Let $\lambda = f(e_B^*)$. Then, a baker will lose utility when losing his job if α_i is sufficiently high, that is, if $\alpha_i > c(e_B^*)/\lambda\bar{u}$.*

Proof. See the Appendix. ■

The intuitive explanation is easiest to see for the shirking nurses, i.e. nurses who provide no effort at all while employed. For them, in the case of full income compensation, employment and unemployment are perfectly equivalent. They exert no effort and provide no public good; hence becoming unemployed has no effects at all.

For a nurse who provides effort, however, others' welfare decreases when she becomes unemployed. This yields a loss of self-image. The question is whether this self-image loss is larger than the gain of lower effort costs. For a nurse who did, initially, exert effort, the answer must be yes: Otherwise she would not, initially, have chosen to exert effort. For the baker, there will always be a (weak) self-image loss, as shown above; however, for those bakers who care the least about others' welfare, this loss is outweighed by the gain in terms of reduced effort. This thus provides one possible explanation for the well documented negative correlation between unemployment on the one hand and happiness and life satisfaction, as well as more objective measures like health and longevity, on the other (Oswald 1997, Theodossiou 1998).

In our model framework, being unemployed is formally equivalent to living off any kind of tax-financed social security payments, such as sickness or disability benefits (not taking into account, of course, the welfare effects of actually becoming sick or disabled *per se*). The above results can thus be used directly to predict behavior in situations where individuals actually have a choice between being welfare recipients and working.

Proposition 7 and 8 implies, consequently, that in the case where welfare payments perfectly compensate the welfare recipient's working income, many individuals will prefer to work.[25] Specifically, among workers paid by a fixed wage (nurses), being a welfare recipient does not in our model provide opportunities they did not have before; they could, if preferring to do so, have shirked anyway. For those who work under perfect market conditions with performance pay (bakers), only the least motivated will prefer to be welfare recipients: Bakers, too, may take pleasure in being net contributors to society. Thus, even if our model is behaviorally equivalent with the Homo Oeconomicus model when

[25] For an analysis of social interaction effects in norms to live off welfare, see Lindbeck et al. (1999).

it comes to bakers' provision of effort, the models are not behaviorally equivalent when it comes to bakers' choice between work and receiving welfare payments.

Hence, our model provides one possible explanation to the fact that even in the Scandinavian countries, with their relatively generous social security systems, many individuals do not exploit the welfare state to the extent they actually could. In Norway, for example, employees have the right to be absent from work a certain number of days[26] with full wage compensation, just by submitting a self-declaration of being sick (no sickness certificate from a physician required). If all workers spent their entire "quota" of self-declared sick leave days, this would amount to about 7-8 percent of total working days. The number of days actually lost due to self-declared sick leaves, however, has been quite stable at about 0.8 percent for several decades (Eielsen, 2008). Thus, although some individuals might well be exploiting the system, this does not seem very common.[27]

Similarly, Aronsson et al. (2000) asked almost 3801 Swedish respondents whether they had been at work recently at occasions when their health condition, in their own view, indicated that they ought to have stayed home, concluding as follows: "Members of occupational groups whose everyday tasks are to provide care or welfare services, or teach or instruct, have a substantially increased risk of being at work when sick" (p. 502). This seems to fit nicely with Proposition 8: While nurses (employees with unobservable productivity) cannot, in equilibrium, strictly gain by living off welfare rather than working, bakers with low work motivation can.

The conclusions above depend, of course, on the way we have modelled self-image, namely as being important in the sense that one's effort increases others' welfare; given others' behavior. In reality, several additional self-image concerns would presumably influence individual decisions too. One such concern might be to think of oneself as important in a different sense, namely as unique, or irreplacable: "If I did not exist, the world would be a different place". The latter is essentially the approach taken by Dur and Glazer (2007). Our guess would be that most people do care, to some extent, about both aspects of "being important"; however, formalizing both simultaneously would result in an exceedingly complex model, and since most of us are hardly irreplacable at work, while intrinsic work motivation still seem rather common, we have chosen to focus on the first of the two.

[26] The number of days per year is currently either 12 or 24, depending on whether the firm participates in the "inclusive workplace agreement" between labor market organizations and the government (see also Gaure et al., 2008).

[27] Failure to exploit fully the opportunities for paid sick leave could be caused by concern for one's future career. This incentive is smaller for older workers. Although data for the age profile of self-reported sick leaves is unavailable, young employees have far more frequent physician-certificated short term sick leaves than older workers (Gaure et al, 2008). Physicians' certificates, however, seem to be issued more or less at patients' demand, with very little gatekeeping effort from physicians (Carlsen 2006, Wahlström and Alexanderson 2004). Thus, career concerns can hardly be the only reason for work presence.

7 Conclusions

Above, we have formalized the idea that work is not only motivated by its monetary compensation, but also by a desire to be important to other people. We have shown that with lump-sum taxation, the desire to be important does not change the effort of workers receiving performance pay (bakers); it does, however, change the effort of those whose performance cannot be efficiently monitored and who thus are not paid according to their marginal productivity (nurses). Moreover, it affects behavior in both groups when it comes to the choice (whenever such a choice is available) between working and living off welfare: Many individuals, including both bakers and nurses, will prefer to work even if welfare payments provide full income compensation.

With the preference structure proposed above, nursing jobs – or rather, jobs where effort is not paid according to its marginal productivity – may be attractive for two very different reasons: They provide the opportunity to shirk, but also the opportunity to be important. Thus, unless nurses' wage is kept strictly lower than wages in the baking sector (i.e. the sector where effort is paid by its marginal productivity), shirkers will be attracted to the nursing sector. If the wage is kept low enough to keep shirkers out, however, the public sector will be suboptimally small. One way to improve on this situation is to increase nurses' social productivity through fixed capital investments. The easier it is for nurses to do a good job, the more attractive will the nursing profession be – but only for those who really want to do a good job. This argument provides a rationale for overinvestment in certain types of public good production capital, such as libraries in schools and universities, or diagnostic equipment in hospitals.

Our model also provides one possible explanation for the detrimental effects of unemployment. Workers' self-image loss when losing their job is not necessarily compensated by the decreased cost of effort. In fact, we show that in the case of full income compensation through unemployment benefits, every nurse would become weakly worse off if losing her job; the highly motivated bakers experience a net loss, while only the poorly motivated bakers can gain.

The type of work motivation modelled here depends on the individuals' perception of how important her effort is to others, not whether the firm she works in in publicly or privately owned, whether it is a profit or non-profit firm, or whether the worker herself has strong preferences for the good she produces. The crucial distinction between what we have called the "baking" and "nursing" sectors is that individual effort and/or productivity can be monitored in the former, but not in the latter sector. Interpretations of these two sectors as private and public, or profit and non-profit, are thus only valid to the extent that effort is more easily observable in private than in the public sector, or more so in profit than non-profit firms.

Finally, our model of work motivation has been presented in terms of an exogenously fixed, internalized moral norm. Over time, such norms may be eroded or strengthened, depending, for example, on others' behavior and the relative payoffs of available alternatives (see, for example, Lindbeck et al., 1999). While outside the scope of the present paper, integrating such dynamic aspects with our approach would be an interesting topic for future research.

References

[1] Akerlof, G. A., and R. E. Kranton (2000): Economics and Identity, *Quarterly Journal of Economics* 115(3), 715-53.

[2] Akerlof, G. A., and R. E. Kranton (2005): Identity and the Economics of Organizations, *Journal of Economic Perspectives* 19(1), 9-32.

[3] Andreoni, J. (1988): Privately Provided Public Goods in a Large Economy: The Limits of Altruism, *Journal of Public Economics* 35(1), 57-73.

[4] Andreoni, J. (1990): Impure Altruism and Donations to Public Goods: A Theory of Warm-Glow Giving, *The Economic Journal* 100, 464-477.

[5] Aronson, E., T.D. Wilson, and R.M. Akert (2005): *Social Psychology.* Fifth Edition. New Jersey: Pearson Educational International.

[6] Aronsson, G., K. Gustavsson, and M. Dallner (2000): Sick but Yet at Work. An Empirical Study of Sickness Presenteeism, *Journal of Epidemiology and Community Health* 54, 502-509.

[7] Benabou, R., and J. Tirole (2002): Self-Confidence and Personal Motivation, *Quarterly Journal of Economics* **117** (3), 871-915.

[8] Benabou, R., and J. Tirole (2003): Intrinsic and Extrinsic Motivation, *Review of Economic Studies* **70** (3), 489-520.

[9] Benabou, R., and J. Tirole (2006): Incentives and Prosocial Behaviour. *American Economic Review* 96(5), 1652-1678.

[10] Bernheim, B.D. 1986. "On the voluntary and Involuntary Provision of Public Goods." *American Economic Review* 76: 789-793.

[11] Besley, T., and M. Ghatak (2005): Competition and Incentives with Motivated Agents, *American Economic Review* 95 (3), 616-636.

[12] Brekke, K. A., S. Kverndokk and K. Nyborg (2003): An Economic Model of Moral Motivation, *Journal of Public Economics* 87 (9-10): 1967-1983.

[13] Brekke, K. A., and K. Nyborg (2008): Attracting Responsible Employees: Green Producion as Labor Market Screening, *Resource and Energy Economics* 30, 509-526.24.

[14] Bruvoll, A., and K. Nyborg (2004): The Cold Shiver of Not Giving Enough: On the Social Cost of Recycling Campaigns, *Land Economics* 80(4), 539-549.

[15] Carlsen, B. (2006): The Changing Role of Gatekeepers: Rationing and Shared Decision-Making in Primary Care. PhD dissertation, University of Bergen, available at http://hdl.handle.net/1956/1557.

[16] Chalkley, M., and J.M. Malcolmson (1998): Contracting for Health Services when Patient Demand Does Not Reflect Quality, *Journal of Health Economics* 17, 1-19.

[17] Crewson, P.E. (1997): Public-Service Motivation: Building Empirical Evidence of Incidence and Effect, *Journal of Public Administration Research and Theory* 4, 499-518.

[18] De Jaegher, K. and M. Jegers (2000): A model of physician behaviour with demand inducment, *Journal of Health Economics* 19, 231-258.

[19] Delfgaauw, J. and R. Dur (2008): Incentives and Workers' Motivation in the Public Sector. *Economic Journal* 118(525), 171-191.

[20] Dolan, P., T. Peasgood, M. White (2008): Do We Really Know What Makes Us Happy? A Review of the Economic Literature on the Factors Associated with Subjective Well-Being, *Journal of Economic Psychology* 29, 94-122.

[21] Dufwenberg, M., P. Heidhues, G. Kirchsteiger, F. Riedel, and J. Sobel (2008): Other-Regarding Preferences in General Equilibrium. Unpublished note.

[22] Dur, R., and A. Glazer (2007): The Desire for Impact, *Journal of Economic Psychology* 29(3), 285-300.

[23] Eielsen, L. (2008): Sosiale normer som disiplinerende faktor på det egenmeldte sykefraværet ("Social Norms as a Disciplining Factor in Self-Declared Sick Leave". In Norwegan). Master thesis, Department of Economics, University of Oslo.

[24] Eisenberg, J.M. (1986): *Doctors' Decisions and the Cost of Medical Care.* Ann Arbor, Michigan: Health Administration Press.

[25] Ellingsen, T., and M. Johannesson (2008): Pride and Prejudice: The Human Side of Incentive Theory, *American Economic Review* 98(3), 990–1008.

[26] Farley, P. J. (1986): Theories of the price of physician services, *Journal of Health Economics* 5, 315-333.

[27] Francois, P. (2000): 'Public Service Motivation' as an Argument for Government Provision, *Journal of Public Economics* 78 (3), 275-299.

[28] Francois, P. (2007): Making a Difference, *RAND Journal of Economics* 38(3), 714-732.

[29] Frank, R.H. (2003): *What Price the Moral High Ground?* Princeton University Press.

[30] Gaure, S., S. Markussen, K. Røed, O.J. Røgeberg (2008): The Anatomy of Absenteeism. Unpublished note, Oslo: The Ragnar Frisch Center for Economic Research.

[31] Glazer, A. (2004): Motivated Devoted Workers, *International Journal of Industrial Organization* 22, 427-440.

[32] Grytten J, Sørensen R. (2001): Type of contract and supplier-induced demand for primary physicians in Norway. *Journal of Health Economics* 20, 379-393.

[33] Handy, F., and E. Katz (1998): The Wage Differential between Nonprofit Institutions and Corporations: Getting More by Paying Less? *Journal of Comparative Economics* 26, 246-261.

[34] Heyes, A. (2004): The Economics of Vocation or 'Why is a Badly Paid Nurse a Good Nurse'? *Journal of Health Economics* 24 (3), 561-569.

[35] Jack, W. (2005): Purchasing Health Care Services from Providers with Unknown Altruism, *Journal of Health Economics* 24, 73-94.

[36] Johansson P., and M. Palme (2005): Moral hazard and sickness insurance, *Journal of Public Economics* vol 89, 1879-1890.

[37] Konow, J., (2006): "Mixed Feelings: Theories and Evidence of Warm Glow and Altruism," Layola Marymount University, http://myweb.lmu.edu/jkonow/Mixed%20Feelings.pdf.

[38] Lane, R.E. (1991): *The Market Experience*. Cambridge: Cambridge University Press.

[39] Lazear, E.P. (2000): Performance Pay and Productivity, *American Economic Review* 90(5), 1346-1361.

[40] Lewis, G.B., and S.A. Frank (2002): Who Wants to Work for the Government? *Public Administration Review* 62 (4), 395-404.

[41] Lindbeck, A., S. Nyberg and J. W. Weibull (1999): Social Norms and Economic Incentives in the Welfare State, *Quarterly Journal of Economics* 114 (1), 1-35.

[42] Ma, A.C. (2007): "Altruism and Incentives in Public and Private Health Care", in A. Suvanto and H. Vartiainen (eds.): *Finance and Incentives of the Health Care System*, Proceedings of the 50th Anniversay Symposium of the Yrjö Jahnsson Foundation, Government Instittute for Economic Research, Helsinki, 79-104.

[43] Nyborg, K., and M. Rege (2003): Does Public Policy Crowd Out Private Contributions to Public Goods? *Public Choice* 115 (3), 397-418.

[44] Oswald, A.J. (1997): Happiness and Economic Performance, *Economic Journal* 107(445), 1815-1831.

[45] Prendergast, C. (2007): The Motivation and Bias of Bureaucrats. *American Economic Review* 97(1), 180-196.

[46] Rauscher, M., 2006. "Voluntary Emission Reductions, Social Rewards, and Environmental Policy," CESifo Working Paper Series CESifo Working Paper No. 1838.

[47] Røed, K., and Zhang, T., 2005: Unemployment duration and economic incentives - A Quasi Random-Assignment Approach, *European Economic Review* 49, 1799-1825.

[48] Smith, A. (1776): *An Inquiry into the Nature and Causes of the Wealth of Nations*. London: Methuen and Co. (Fifth edition 1904).

[49] Smith, A. (1759): *The Theory of Moral Sentiments.* London: A. Millar. (Available at http://www.econlib.org/Library/Smith/smMS.html).

[50] Sugden, R. (1984). Reciprocity: The supply of public goods through voluntary contributions. *The Economic Journal* 94, 772-787.

[51] Sørensen, R. and J. Grytten (2003): Service Production and Contract Choice in Primary Physician Services, *Health Policy* 66, 73-93.

[52] Theodossiou, I. (1998): The Effects of Low-Pay and Unemployment on Psychological Well-Being: A Logistic Regression Approach, *Journal of Health Economics* 17(1), 85-104.

[53] Wahlström, R., and K. Alexanderson (2004): Physicians' Sicklisting Practices, *Scandinavian Journal of Public Health* 32, 222-255.

[54] Warr, P.G. 1983. The private provision of a public good is independent of the distribution of income, *Economics Letters*, 13: 207-211.

[55] Woodward, R. and F. Warren-Boulton (1984): Considering the effects of financial incentives and professional ethics on "appropriate medical care", *Journal of Health Economics* 3, 223-237.

[56] Yankelovich, D., et al. (1984): *The World at Work. An International Report on Human Values, Productivity and its Future*. New York: Octagon.

A Proofs

Lemma 1 *For nurses, the optimal effort $e^*(N,\alpha_i)$, and hence also provision $g(e^*(N,\alpha_i))$, are non-decreasing in α_i and strictly increasing if $e^*(N,\alpha_i) > 0$.*

Proof. Consider first the internal solution, $e^*(N,\alpha_i) > 0$. In this case effort is the solution to the equation

$$(1+\alpha_i(n-1))\theta g'(e^*(N,\alpha_i)) = c'(e^*(N,\alpha_i)).$$

Differentiation with respect to α_i yields

$$(n-1)\theta g' + (1+\alpha_i(n-1))\theta g'' \frac{\partial e^*}{\partial \alpha_i} = c'' \frac{\partial e^*}{\partial \alpha_i}.$$

Thus

$$\frac{\partial e^*}{\partial \alpha_i} = \frac{(n-1)\theta g'}{c'' - (1+\alpha_i(n-1))\theta g''} > 0$$

since $c''(e_i) > 0$, $g'' < 0$ and $g' > 0$. When the constraint $e \geq 0$ is binding, $e^* = 0$ and $\frac{\partial e^*}{\partial \alpha_i} = 0$. ■

Lemma 2 *The change in others' welfare if i moves from the baking to the nursing sector, $\Delta W^0_{-i}(\alpha_i)$, is non-decreasing in the strength of i's motivation α_i, and increasing for $e^*(N,\alpha_i) > 0$.*

Proof. We know from (13) that $\Delta W^0_{-i}(\alpha_i) = \sum_{j\neq i}[u\{y(e^0_j,\tau^0_j) - t - \Delta t\} - u\{y(e^0_j,\tau^0_j) - t\} + \theta g(e^*(N,\alpha_i))]$. Differentiation gives

$$\frac{\partial \Delta W^0_{-i}(\alpha_i)}{\partial \alpha_i} = \sum_{j\neq i} \theta g' \frac{\partial e^*(N,\alpha_i)}{\partial \alpha_i} = (n-1)\theta g' \frac{\partial e^*(N,\alpha_i)}{\partial \alpha_i}$$

Since $\partial e^*(N,\alpha_i)/\partial \alpha_i > 0$, for $e^*(N,\alpha_i) > 0$ as shown in Lemma 1, it follows that $\partial \Delta W^0_{-i}(\alpha_i)/\partial \alpha_i > 0$. For small values of α_i we know as shown in Lemma 1, that $\partial e^*(N,\alpha_i)/\partial \alpha_i = 0$ and hence $\partial \Delta W^0_{-i}(\alpha_i)/\partial \alpha_i = 0$ ■

Lemma 3

$$\frac{\partial}{\partial \alpha_i}\left[\Delta U(\alpha_i)\right] = \Delta W^0_{-i}(\alpha_i).$$

Proof. By definition

$$\Delta U(\alpha_i) = \max_{e_i} U(e_i, N; \alpha_i) - \max_{e_i} U(e_i, B; \alpha_i)$$

and since e^*_B is independent of α_i, we can write, using (14)

$$\begin{aligned}\Delta U(\alpha_i) &= \max_{e_i}\left[U(e_i, N; \alpha_i) - U(e^*_B, B; \alpha_i)\right] \\ &= \max_{e_i}\left[u(w - t - \Delta t) - u(f(e^{*B}) - t) - c(e^*(N, \alpha_i)) + c(e^{*B}) + \theta g(e^*(N, \alpha_i)) + \alpha \Delta W^0_{-i}(\alpha_i)\right]\end{aligned}$$

Hence, by the envelope theorem,

$$\frac{\partial}{\partial \alpha_i}\left[\Delta U(\alpha_i)\right] = \Delta W^0_{-i}(\alpha_i).$$

■

Proof of Proposition 2. a) By lemma A 3

$$\frac{\partial}{\partial \alpha_i}\left[\Delta U(\alpha_i)\right] = \Delta W^0_{-i}(\alpha_i).$$

Since $\Delta W^0_{-i}(\alpha_i)$ is nondecreasing, and increasing for $e^*(N, \alpha_i) > 0$, as in stated in Lemma 2, it follows that $\Delta U(\alpha_i)$ is weakly convex, and strictly convex for $e^*(N, \alpha_i) > 0$. Similarly it follows that $\Delta U(\alpha_i)$ is decreasing for $\alpha_i < \hat{\alpha}$ and increasing for $\alpha_i > \hat{\alpha}$.

b) From a) and Lemma 2, we know that $\Delta U(\alpha_i)$ is linear and declining for small α_i until $e^*(N, \alpha_i) > 0$ and then strictly convex. It follows that $\Delta U(\alpha_i) = 0$ for at most two different values of α_i. Define a threshold value $\underline{\alpha}$ such $\underline{\alpha} = 0$ if $\Delta U(0) < 0$ and otherwise $\Delta U(\underline{\alpha}) = 0$. Similarly, $\bar{\alpha} = 1$ if $\Delta U(1) < 0$ and otherwise $\Delta U(\bar{\alpha}) = 0$. Then, also by the concavity of $\Delta U(\alpha_i)$, it follows that $\Delta U(\alpha_i) < 0$ for $\alpha_i \in (\underline{\alpha}, \bar{\alpha})$, while $\Delta U(\alpha_i) > 0$ for $\alpha_i \in [0, \underline{\alpha}) \cup (\bar{\alpha}, 1]$. ■

Proof of Proposition 3. Note that with a continuous distribution and $\bar{\alpha} < 1$, there will be an individual such that $\alpha_i = \bar{\alpha}$. This i will be indifferent between nursing or baking sector employment ($\Delta U(\bar{\alpha}) = 0$). For the individual with $\alpha_i = 0$ we know that he is indifferent when $w = \bar{w}$, thus

$$u(\bar{w} - t - \Delta t) = u(f(e^*_B) - t) - c(e^*_B)$$

Now, e^*_B is independent of α_i, so this equality holds for all α_i. Inserting in (14), using $\Delta U(\bar{\alpha}) = 0$, we get

$$-c(e^*(N, \bar{\alpha})) + \theta g(e^*(N, \bar{\alpha})) + \bar{\alpha} \Delta W^0_{-i}(\bar{\alpha}) = 0$$

When $\bar{\alpha} < 1$, this implies that the welfare effect for others is stricly larger than the private net cost

for the marginal nurse: The "first" baker, i.e. the baker with the highest α_i, agrees that the increased welfare for others, had he chosen to move to become a nurse, would have exceeded the private net costs for himself. However, since his $\alpha_i < 1$, he places less emphasis on others' welfare than on his own; consequently, he is not willing to move. From a social point of view, thus, the size of the nursing sector is too small.[28] ■

Proof of Proposition 4. By Proposition 2, ΔU is U-shaped, and as $w^* > w > \bar{w}$ it follows from the definition of w^* and $\bar{w}$, that $\Delta U(0) > 0$ and $\Delta U(1) > 0$, and $\Delta U(\alpha_i) < 0$ for some α_i. As seen in figure 2, this implies that $\Delta U(\alpha_i) = 0$ for two values of α_i, one (α_i) where ΔU is downward sloping, and one (α_j) where it is upwardsloping. Next, by lemma A 3 in the appendix, $\frac{\partial}{\partial \alpha}\left[\Delta U(\alpha_i)\right] = \Delta W^0_{-i}(\alpha_i)$. The claim follows. ■

Lemma 4 . *Denote by $\bar{w}$ a wage such that $\Delta U(0) = 0$, then if $c(e^{*B}) > u(\bar{w} - t) - u(\bar{w} - t - \Delta t)$*

$$\bar{w} < f(e^*_B). \tag{19}$$

Proof. This implies that

$$\begin{aligned} u(\bar{w} - t - \Delta t) &= u(f(e^{*B}) - t) + c(e^*(N,0)) - c(e^{*B}) - \theta g(e^*(N,0)) - \alpha_i \Delta W^0_{-i}(0) \\ &\Longrightarrow \quad u(\bar{w} - t - \Delta t) = u(f(e^{*B}) - t) - c(e^{*B}) \\ &\Longrightarrow \quad u(\bar{w} - t) - u(f(e^{*B}) - t) = -c(e^{*B}) + u(\bar{w} - t) - u(\bar{w} - t - \Delta t) \end{aligned}$$

Since, by assumption, $c(e^{*B}) > u(\bar{w} - t) - u(\bar{w} - t - \Delta t)$, if follows that $u(\bar{w} - t) < u(f(e^{*B}) - t)$, and hence

$$\bar{w} < f(e^*_B). \tag{20}$$

■

Proof of Proposition 5. of Differentiation of $\Delta U(\alpha_i)$ (eq. (14)) with respect to w, using (13) and (4), yields

$$\begin{aligned} \frac{d\Delta U(\alpha_i)}{dw} &= \frac{du(w - \frac{(m+1)w}{n})}{dw} - \frac{du(f(e^{*B}) - \frac{mw}{n})}{dw} + \frac{d\alpha_i[(n-1)\theta g(e^*(N,\alpha_i)) - \frac{w}{n}\sum_{j\neq i} u']}{dw} \\ &= (1 - \frac{(m+1)}{n} + \frac{m}{n})u' - \alpha_i \frac{1}{n}\sum_{j\neq i} u' \\ &= (1 - \frac{1}{n})u' - \alpha_i \bar{u} \end{aligned}$$

assuming that u' is unaffected by the required marginal increase in taxes. The first part of this, $(1 - \frac{1}{n})u'$, is unaffected by α_i, while the latter part, $-\alpha_i \bar{u}$, is decreasing in α_i. Hence $\frac{d\Delta U(\alpha_i)}{dw}$ is decreasing in α_i. ■

[28] Note that even if we have, for simplicity, assumed a linear utility of the public good, the socially optimal size of the nursing sector is limited by the concave and increasing utility of income.

Proof of Proposition 6. a) Nurses' first order condition for utility maximization with respect to effort is now

$$\theta\hat{g}'_e(1+\alpha_i(n-1)) = c' \tag{21}$$

To find the effect on effort of increased investment, we differentiate (21) with respect to κ. This yields

$$\frac{de_i}{d\kappa} = \frac{\theta(1+\alpha_i(n-1))\hat{g}''_{e\kappa}}{(c'' - \theta(1+\alpha_i(n-1))\hat{g}''_{ee})} \tag{22}$$

Since $c'' > 0$, and $\hat{g}''_{ee} < 0$, the denominator is strictly positive. The numerator has the same sign as $\hat{g}''_{e\kappa}$. Hence, for interior solutions, the change in individually optimal effort when κ increases has the same sign as $\hat{g}''_{e\kappa}$.

b) If i decides to become a nurse, the required change in taxes per person equals $\frac{w}{n} = \Delta t$. i will prefer being a nurse if the following expression is positive:

$$\Delta U(\alpha_i) = u(w-t-\Delta t) - u(f(e^{*B})-t) - c(\hat{e}^*(N,\alpha_i,\kappa)) + c(e^{*B}) + \theta\hat{g}(\hat{e}^*(N,\alpha_i,\kappa),\kappa) + \alpha_i\Delta W^0_{-i}(\alpha_i) \tag{23}$$

where $e_i = \hat{e}^*(N,\alpha_i,\kappa)$ is the utility maximizing effort for a nurse with motivation α_i when the capital input equals κ, implicitly given by (21). Differentiation of $\Delta U(\alpha_i)$ with respect to κ, using (13) and where $\frac{de_i}{d\kappa}$ is given by (22), gives

$$\begin{aligned}
\frac{d\Delta U(\alpha_i)}{d\kappa} &= -c'\frac{de_i}{d\kappa} + \theta(\hat{g}'_e\frac{de_i}{d\kappa} + \hat{g}'_\kappa) + \alpha_i[(n-1)\theta(\hat{g}'_e\frac{de_i}{d\kappa} + \hat{g}'_\kappa) && (24)\\
&= \frac{de_i}{d\kappa}([1+\alpha_i(n-1)]\theta\hat{g}'_e - c') + \theta\hat{g}'_\kappa[1+\alpha_i(n-1)] && (25)\\
&= \alpha_i[\frac{de_i}{d\kappa}\theta\hat{g}'_e(n-1) + \theta\hat{g}'_\kappa(n-1)] + \theta\hat{g}'_\kappa && (26)
\end{aligned}$$

By assumption, $\hat{g}(0,\kappa) = 0$. Hence, if $e_i = 0$, $\theta\hat{g}'_\kappa$ must equal zero. Recall that workers with $\alpha_i = 0$ provide no effort. Eq. (24) then shows that if $\alpha_i = 0$, $\frac{d\Delta U(0)}{d\kappa} = 0$. For those with $\alpha_i > 0$ and an interior utility maximum in effort ($e_i > 0$), $\frac{d\Delta U(\alpha_i)}{d\kappa}$ is always strictly positive if $\frac{de_i}{d\kappa} \geq 0$, i.e. when $\hat{g}''_{e\kappa} \geq 0$, and the value of $\frac{d\Delta U(\alpha_i)}{d\kappa}$ is then increasing in α_i. If $\hat{g}''_{e\kappa} < 0$, however, $\frac{d\Delta U(\alpha_i)}{d\kappa}$ may be either positive or negative. ■

Proof of Proposition 7. a) Let Δ_{BZ} denote changes when an individual moves from the baking sector to unemployment. The change in others' welfare is

$$\begin{aligned}
\Delta_{BZ}W^0_{-i}(\alpha_i) &= \sum_{j\neq i}[u\{y(e^0_j,\tau^0_j) - t - \Delta_{BU}t\} - u\{y(e^0_j,\tau^0_j) - t\} && (27)\\
&\approx -\Delta_{BU}t\sum_{j\neq i}u'
\end{aligned}$$

where $\Delta_{BU}t$ is the change in tax required to maintain budget balance. Now, since the person now

receives unemployment benefits λ, to maintain budget balance the tax changes for others are $\Delta_{BU}t = \lambda/(n-1)$. Thus

$$dS^B = \alpha_i \Delta_{BZ} W^0_{-i}(\alpha_i) \approx -\alpha_i \Delta_{BU} t \sum_{j \neq i} u' = -\alpha_i \frac{\lambda}{(n-1)} \sum_{j \neq i} u' = -\alpha_i \lambda \bar{u}.$$

b) Similarly, the change in others' welfare when the individual moves from the nursing sector to unemployment is

$$\begin{aligned} \Delta_{NZ} W^0_{-i}(\alpha_i) &= \sum_{j \neq i} [u\{y(e^0_j, \tau^0_j) - t - \Delta_{NZ} t\} - u\{y(e^0_j, \tau^0_j) - t\} + \theta g(e^*(N, \alpha_i))] \\ &\approx (n-1)\theta g(e^*(N, \alpha_i)) - \Delta_{NZ} t \sum_{j \neq i} u' \end{aligned} \tag{28}$$

As a nurse, the net transfer from others to the individual is $w - t$, while when unemployed, the net transfer is $\lambda - t$. Thus $\Delta_{NZ} t = (\lambda - w)/(n-1)$, and we get

$$dS^N = \alpha_i \left[(n-1)\theta g(e^*(N, \alpha_i)) - (\lambda - w)\bar{u}\right]$$

■

Proof of Proposition 8.

a) Note first that a nurse who provides no effort will have exactly the same utility as an unemployed who receives the same public income and also makes no contribution to society. A nurse who chooses $e^*(N, \alpha_i) > 0$ does so because this yields a higher utility than $e_i = 0$. Hence her utility must be higher as a nurse than it would have been as unemployed, since in the latter case her effort is unproductive.
b) For a baker with $\alpha_i = 0$ the only utility change caused by unemployment is due to a reduction in the effort cost, $c(e^*_B)$. Hence he is strictly better off as unemployed. But the cost of effort is independent of α_i, while the change in self-image is $dS^B_i \approx -\alpha_i \lambda \bar{u} < 0$, which depends on α_i. It follows that the baker will lose utility if

$$\alpha_i > \frac{c(e^*_B)}{\lambda \bar{u}}.$$

■

B Fixed capital investment per nurse

Assume that there is a fixed capital input K per nurse, so that (3) is replaced by

$$\gamma(e_i, \tau_i) = \begin{array}{c} 0 \text{ if } \tau_i = B \\ g_i = \tilde{g}(e_i, K) \text{ if } \tau_i = N \end{array} \tag{29}$$

where $\tilde{g}'_e > 0$, $\tilde{g}'_K > 0$, $\tilde{g}''_{ee} < 0$, and $\tilde{g}''_{KK} < 0$. For simplicity, assume that $\tilde{g}''_{eK} = 0$. Further, let (4) be replaced by

$$\tilde{t} = \frac{m(w+K)}{n} \tag{30}$$

Then, the first order condition for utility maximization with respect to effort is

$$[(1+\alpha_i(n-1))\theta\tilde{g}'_e(e_i,K) = c'(e_i)] \tag{31}$$

and nurses' effort is unaffected by changes in K, due to the assumption $\tilde{g}''_{eK} = 0$ and similar arguments as above.

Assume that i is a baker. If he becomes a nurse, the number of nurses m will increase by one, and taxes increase by $\Delta\tilde{t} = \frac{w+K}{n}$. Let $\Delta\tilde{t}$ be marginal in the sense that for every j, we can neglect its impact on the marginal utility of income. i will prefer being a nurse if the following expression is positive:

$$\Delta U(\alpha_i) = u(w-\tilde{t}-\Delta\tilde{t}) - u(f(e^{*B})-\tilde{t}) - c(\tilde{e}^*(N,\alpha_i,K)) + c(e^{*B}) + \theta\tilde{g}(\tilde{e}^*(N,\alpha_i,K),K) + \alpha_i\Delta W^0_{-i}(\alpha_i) \tag{32}$$

where $\tilde{e}^*(N,\alpha_i,K)$ is implicitly determined by (31). To see how the choice of occupation varies with K, we differentiate this expression:

$$\frac{d\Delta U(\alpha_i)}{dK} = \theta\tilde{g}'_K - \frac{1}{n}u' + \alpha_i[(n-1)\theta\tilde{g}'_K - \bar{u}] \tag{33}$$

If the public good benefits for others exceed the value of others' increased tax costs, then $\alpha_i[(n-1)\theta\tilde{g}'_K - \bar{u}] > 0$ for every $\alpha_i > 0$. $\theta\tilde{g}'_K$ is the increase in the individual's own public good benefit; and $\frac{1}{n}u'$ is the consumption loss in terms of her own extra tax payment to finance the increase in K. The two latter are independent of α_i, but are presumably both small, possibly negigible. Thus, when K increases, it becomes relatively more attractive to be a nurse, provided that $[1+\alpha_i(n-1)]\theta\tilde{g}'_K > \alpha_i\bar{u} + \frac{1}{n}u'$ (that is, the individual thinks the extra tax payments are worth it); and the increase is larger the higher α_i. Note, however, that if $[(n-1)\theta\tilde{g}'_K - \bar{u}] > 0$, the capital investment would be socially efficient even in the absence of self-selection problems. With a fixed per nurse investment, thus, overinvestment in capital is never a good idea.

Assuming a fixed capital per nurse, let us see how $\Delta U(\alpha_i)$ varies with w:

$$\frac{d\Delta U(\alpha_i)}{dw} = (1-\frac{1}{n})u' - \alpha_i\bar{u}$$

assuming that u' is unaffected by the required marginal increase in taxes. If the regulator decreases w marginally, while increasing K marginally, exactly balancing the budget, the resulting change in $\Delta U(\alpha_i)$ is thus

$$\frac{d\Delta U(\alpha_i)}{dK} - \frac{d\Delta U(\alpha_i)}{dw} = \alpha_i(n-1)\theta\tilde{g}'_K + \theta\tilde{g}'_K - u'$$

For an individual with $\alpha_i = 0$, $\frac{d\Delta U(\alpha_i)}{dK} - \frac{d\Delta U(\alpha_i)}{dw} = \theta\tilde{g}'_K - u'$. It seems reasonable to assume that $\theta\tilde{g}'_K < u'$. Then $\frac{d\Delta U(\alpha_i)}{dK} - \frac{d\Delta U(\alpha_i)}{dw}$ will always be negative for a person with $\alpha_i = 0$. However, there will be a threshold value

$$\alpha^* = \frac{u' - \theta\tilde{g}'_K}{(n-1)\theta\tilde{g}'_K}$$

such that for every $\alpha_i > \alpha^*$, a decrease in the wage by one dollar, along with an increase in the capital input per worker by one dollar, would make being a nurse more attractive, while for $\alpha_i < \alpha^*$, being a nurse would become less attractive. For this to be relevant, we must have $\alpha^* < 1$. This implies that $n\theta\tilde{g}'_K > u'$, which seems reasonable.