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Mandated Benefits, Welfare, and Heterogeneous Firms

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by

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Abstract

The paper constructs an asymmetric information model to investigate the efficiency and equity cases for government mandated benefits. A mandate can improve workers' insurance, and may also redistribute in favor of more "deserving" workers. The risk is that it may also reduce output. The more diverse are free market contracts - separating the various worker types - the more likely it is that such output effects will on balance serve to reduce welfare. It is shown that adverse effects can be mitigated by restricting mandates to "large" firms. An alternative to a mandate is direct government provision. We demonstrate that direct government provision may be superior to mandates by virtue of preserving separations.

Non-technical Summary

Labor economists have typically provided rather flimsy theoretical justification for government mandates that require firms to provide their workers with certain benefits (e.g. dismissals protection or health insurance). This paper draws on the insurance literature and the notion of asymmetric information to provide a more satisfactory basis for discussion of the efficiency properties of mandates that have such insurance characteristics.

We report that governments may indeed raise welfare by requiring firms to provide insurance-type benefits to their employees. The result is derived for a world of homogeneous firms and two types of worker who differ in their degree of "riskiness" to the firm. The result holds both when the contracts offered by the firms distinguish between the two types of worker (a "separating" equilibrium) and when they do not ("pooling"). By improving worker insurance, mandates can achieve improvements in welfare (smooth the allocation of income across worker states). Moreover, the redistribution involved - from low-risk to high-risk workers - may favor "deserving" workers, as will occur where the transfer is from healthy to unhealthy workers, and hence accord with equity considerations.

But the efficiency result is by no means guaranteed. Mandates impose pooling contracts given their typical one-size-fits-all nature. If we relax the assumption that firms are homogeneous and instead allow the costs of worker "failure" to differ between firms, then real-world contracts need to differentiate between types of workers to reflect such cost differences. For example, small firms may have greater difficulty when a woman takes maternity leave than their larger counterparts. Small firms may therefore need to offer a "no frills" contact (with high pay but no maternity leave) in order to deter applications from high maternity-risk workers. Larger firms may be less concerned. Under these circumstances, we show

that that the pooling occasioned by a mandate will lower output and reduce average income. Small firms will then have a random mix of workers. Restricting the reach of a mandate to large firms in such circumstances can preserve efficiency. In short, targeting is required.

Interestingly, mandates are often depicted as superior to direct government provision because of the tax distortions associated with the latter. However, we are able to show that direct provision can dominate the outcomes associated with mandates, and even yield Pareto improvements. For example, government funding of maternity pay can dominate mandates requiring firms to fund such pay. This result obtains because (some) government provision does not interfere with contractual diversity.

1

2 Introduction

In recent years, the case for government regulation of labor markets has been supplemented by a new literature that exploits asymmetric information. Thus Summers (1989, 179) has argued that government mandates requiring firms to provide benefits can bring about an improvement in welfare in circumstances in which company schemes would be overwhelmed by adverse selection stemming from workers' or firms' private information.

Summers sees adverse selection as relevant specifically to each of the fringes: health insurance, parental leave, and dismissals protection. In each of these cases the worker may suffer some unforeseen contingency, and the employer then provide a "wage" or "benefit" not matched by work done. This may be an insurance payout (health insurance); or an insurance payout and a guarantee of the job on return to work (parental leave); or the job and a wage when the employer's ability to fire at will is restricted (dismissals protection). In each case, adverse selection due to asymmetric information may discourage firms from providing the fringe benefit. In the ensuing labor literature, Levine (1991) on dismissals protection and Ruhm (1998) on parental leave develop the point, while Krueger (1994, 300) has also contended that solving adverse selection may be one of the functions that in the labor market context government does best. Aghion and Hermalin (1989) is another progenitor of the basic idea.

The labor market literature is closely related to the literature on adverse selection in insurance markets - for which the seminal work is by Rothschild and Stiglitz (1976) and Wilson (1977) - even if the latter literature is much more developed. The insurance literature finds that the problem of adverse selection is reduced if insurance companies can offer loss-making contracts subsidized by profit-making contracts (Cave, 1984, and Stewart, 1994); or again if in a multiperiod framework insurance companies can use loss experience to reclassify policy holders (Dione and Lasserre, 1987, and Cooper and Hayes, 1987).

The discussion of labor market mandates has mostly proceeded informally. Summers (1989, 182) has however called for more formal analysis, the provision of which is a principal task of our paper. The models we build for this purpose are in direct line of descent from Wilson (1977). We follow Hellwig's (1987) game theoretic development of Wilson, translating the model to a labor market context that is richer than the original in view of its technological complexity. We also make central the issue of the role of government.

We have not thought it appropriate to incorporate the refinements found in the insurance market literature, noted earlier. These would imply that a firm routinely offers any group of its workers a menu of contracts embracing differing levels of health insurance, parental leave, dismissals protection, and so on. Such menus are not observed in practice. Indeed, adopting a variety of standards for a fringe benefit would typically conflict with "norms of fairness" (Levine, 1991, 296) and also confront legal constraints.

The question at issue is: can government by mandating labor market benefits increase welfare? In our simplest model with homogeneous firms, in both the separating and pooling cases, a mandate can achieve efficient allocation of income across states (i.e. secure "full insurance"), accompanied by a redistribution of income among workers. In some instances, this redistribution also appears to be equitable and thus to favor "deserving" workers. In this way, the Summers (1989) case for mandates is formalized. However, in the more general model that allows heterogeneous firms, the mandate is shown to reduce output in the separating case. This is because, whereas the free market exploits separation to match worker types efficiently to firms, a mandate imposes pooling and substitutes a random allocation of workers to firms. Whenever a sorting mechanism based on separation exists, it is necessarily eliminated by the imposition of a mandate. In the separating case, then, a loss of productive efficiency results, making it less likely that the mandate is desirable.

One may be able to get round this misallocation when, for example, heterogeneity is restricted to the distinction between "small" and "large" firms, and the government is able to target large firms. Under such a "restricted" mandate, there may be no loss of output. In the most likely scenario, incomplete coverage can short-circuit adverse effects on labor allocation, thereby providing a rather strong case for restricting any mandate to large firms. It is clear though that the general problem of firm heterogeneity remains.

Summers (1989) discusses the advantages of a mandate over direct government provision in terms of it not distorting prices. We can, however, point to a disadvantage: we are able to show that the adverse effects on labor allocation described above are avoidable through direct government provision of the benefit.

The outline of the paper is as follows. Section II provides a basic statement of the asymmetric information model with homogeneous firms. The scope for achieving welfare improvements within this framework is examined in Section III. The effects of introducing firm heterogeneity are discussed in Section IV. Section V tackles the issue of government provision as an alternative to mandates. Section VI concludes.

3 The Model

We start with the general case. There are r types of firms, each type producing a different good, and n types of worker (as defined below). Many firms of each type and many workers of each type play a 3-stage game. In stage 1, each firm offers a contract; in stage 2, each worker accepts one of the contracts on offer; and in stage 3, a firm may if it wishes withdraw the contract offered in stage 1. (Allowing firms to withdraw contracts is consistent with the notion of long-run competitive behavior. It also ensures that the game has a solution: see Hellwig, 1987.) There are two states of nature for each worker. After completion of the game's three stages, the state of nature is in each case realized and firms and workers receive their payoffs.

The two states of nature correspond to "success" or "failure" on the part of the worker, where for example a worker may fail because of ill health, maternity leave, or an inability to cope with the job. The effect is that a worker's product is less in the "bad" state (failure) than the "good" state (success).

A worker has a continuously differentiable Neumann-Morgenstern utility function, U(.) (the same for all workers), that is separable in income and prices. Thus, fixing the general level of prices (defined appropriately), the worker's utility depends, ex ante, only on the probability of failure and the income received in the different states. Suppose that if a worker accepts a contract (b,w), $U=U_F(b)$ if the bad state occurs and $U=U_S(w)$ in the good state. That is, ex post, utility is state-dependent. Further, suppose that workers are risk averse and worker types distinguished by the probability of failure.

Labor is the only factor of production. For a given state of nature each of the r goods is produced under constant returns. Thus, for a given type of firm, a worker's product in the bad state is a constant proportion of the worker's product in the good state. This proportion varies, however, with the type of firm. Intuitively, this is because the failure of a worker may cause greater difficulties for some types of firm than others. For example, we would argue that absence through illness is more disruptive in small firms than in large firms, where it is easier to arrange cover for absence.[1]

Firms are competitive and risk neutral, and competition in the markets for goods and labor drives their expected profits - revenue minus wages - to zero. Thus,

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[1] The OECD (1995, 190) surveys parental leave in 19 countries, and states that the absence of a key worker for a long period creates difficulties for small firms. Hence the exemption, for example, of firms employing less than 50

the price of a good is in each case determined by average (equal to marginal) cost, which in turn depends on the mix of workers, their probabilities of failure, their productivities in good and bad states, and their wages in these states. In Section IV we will see how policy may affect this mix of workers, costs and the structure of prices.

Assume for the present the specialization of our model to r=1, that is, homogeneous firms and just one produced good, and n=2, namely, two types of worker. Given the price of the good, in the good state a firm receives a fixed revenue of S per worker, and in the bad state a fixed revenue of F per worker, where $0 \leq F < S$. Both S and F are independent of the number of workers hired, given constant returns.

According to the terms of a contract, the firm pays wages b in the bad state and w in the good state. Thus a contract is a pair of values, (b,w), where b may include a "benefit". Define this benefit as b-F - a benefit is paid if the wage in the bad state is greater than the worker's revenue product. Assuming the benefit cannot be negative, we have

(1) $$b \geq F.$$

In addition, however, a higher minimum level for b - fixed either in absolute terms or as a proportion of w - can be mandated by the government. (The government could also provide the benefit directly; this issue is taken up in Section V.)

The two types of worker are a "low-risk" type for whom the probability, P_L, of the bad state is low, and a "high-risk" type for whom the probability, P_H, is high. The corresponding "odds ratios" are $Q_L=P_L/(1-P_L)$ and $Q_H=P_H/(1-P_H)$. An indifference curve for the low-risk type is described by

(2) $$P_L U_F(b) + (1-P_L)U_S(w) = k,$$

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workers from the provisions of the 1993 U.S. Family and Medical Leave Act.

where k is a constant. Differentiating with respect to b gives

$$P_L U_F' + (1-P_L)U_S'(dw/db) \quad = 0. \tag{3}$$

As $Q_L=P_L/(1-P_L)$, the indifference curve's slope is, from (3),

$$dw/db \quad = - Q_L U_F'/U_S'. \tag{4}$$

Similarly, an indifference curve for the high-risk type has slope

$$dw/db \quad = - Q_H U_F'/U_S'. \tag{5}$$

As $Q_L<Q_H$, at any point in (b,w) space the low-risk worker's indifference curve is flatter than that of the high-risk worker - the "single crossing property" holds. In Figure 1, these indifference curves are convex to the worker origin O. $U_L=U_L^*$ and $U_H=U_H^*$ (on which more below) are examples.

Three zero profit lines, necessarily radiating from the firm origin O′, are also shown in Figure 1. Of these,

$$R_L \;= P_L(F-b) + (1-P_L)(S-w) = 0 \tag{6}$$

describes contracts for which firms break even on average when only low-risk types choose them, and

$$R_H \;= P_H(F-b) + (1-P_H)(S-w) = 0 \tag{7}$$

describes contracts for which firms break even, again on average, when only high-risk types choose these contracts. Finally, the "pooling line" is

$$R \;= P(F-b) + (1-P)(S-w) = 0, \tag{8}$$

where $P=\theta P_L+(1-\theta)P_H$ and θ is the proportion of low-risk workers. The pooling line describes the corresponding break-even contracts when both types are equally likely to choose the contract. On the pooling line, firms break even on average on the presumption that the probability of the bad state is P. For P, the corresponding odds ratio is $Q=P/(1-P)$.

In each case, the zero profit line passes through the firm origin O′. The respective slopes of the three zero profit lines are $-Q_L$, $-Q_H$ and $-Q$, where $Q_L<Q<Q_H$ and $Q_L=P_L/(1-P_L)$, etc. This means the pooling line has a slope which is steeper than $R_L=0$ and flatter than $R_H=0$. Since P approaches P_L as $\theta\rightarrow 1$, we have also the results that Q approaches Q_L and R=0 approaches $R_L=0$, as $\theta\rightarrow 1$.

The model is one of asymmetric information. Workers know their own type, but since this is private information firms cannot distinguish among workers. There are two possible solutions to this informed worker/ignorant firm model - a separating equilibrium and a pooling equilibrium. But before describing these, it is helpful to begin by defining four special contracts, which we denote by E_H, E_L', E_L and E.

First, contract E_H is the contract that maximizes the high-risk type's utility

$$(9) \qquad U_H = P_H U_F(b) + (1-P_H)U_S(w),$$

subject to $R_H=0$ (equation (7)). E_H is the best the high-risk worker can do, given that the firm knows the worker's type and breaks even. Let $E_H=(b_H,w_H)$. E_H is characterized by[2]

$$(10a) \qquad U_F'(b_H) = U_S'(w_H)$$

$$(10b) \qquad w_H = S - Q_H(b_H-F).$$

We denote by U_H* the level of utility attained by the high-risk type at E_H.

Second, and analogously, contract E_L' maximizes the low-risk type's utility

$$(11) \qquad U_L = P_L U_F(b) + (1-P_L)U_S(w),$$

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[2] The Lagrangean is

$$P_H U_F(b) + (1-P_H)U_S(w) + \lambda\,[P_H(F-b)+(1-P_H)(S-w)].$$

Differentiating with respect to b and w and equating to zero,

(F1) $\qquad P_H U_F'(b) = \lambda P_H$

(F2) $\qquad (1-P_H)U_S'(w) = \lambda\,(1-P_H)$.

(10a) follows from (F1) and (F2). The constraint gives (10b).

subject to R_L=0 (equation (6)). E_L' is the best the low-risk worker can do, given that the firm knows the worker's type and breaks even. Let $E_L'=(b_L',w_L')$. Accordingly, E_L' is characterized by

(12a) $$U_F'(b_L') = U_S'(w_L')$$

(12b) $$w_L' = S - Q_L(b_L'-F).$$

E_H and E_L' are the points where R_H=0 and R_L=0, respectively, intersect the "full insurance" line. Shown as the dashed line in Figure 1, the full insurance line is defined by

(13) $$U_F'(b) = U_S'(w),$$

and its slope is

(14) $$dw/db = U_F''/U_S''.$$

In the case of state-independent utility, we have $U_F(.)=U_S(.)$ and the full insurance line becomes a 45-degree line through the worker origin O.

Because workers are assumed to be risk averse, both U_F'' and U_S'' are negative and the full insurance line has a positive slope. To the left of the line, $U_F'(.)<U_S'(.)$; and to the right, $U_F'(.)>U_S'(.)$. We assume $U_F'(F)>U_S'(S)$, that is, workers are underinsured at the firm origin - where they are paid according to their productivity in the two states. This means the firm origin is to the right of the full insurance line.

Given $Q_L<Q_H$ (flatter zero profit line associated with the low-risk worker), the full insurance line's positive slope implies $b_L'>b_H$ and $w_L'>w_H$. Thus, as drawn in Figure 1, wages are higher at E_L' than at E_H in both good and bad states, and at E_L' we have $U_H>U_H^*$ (the high risk-type's utility at E_H).

Third, consider the contract, E_L, which comes into play when the firm does not know the worker's type. E_L maximizes the low-risk type's utility, U_L, subject to R_L=0 and $U_H \leq U_H^*$, the incentive compatibility condition. The significance of the latter condition is that, if it holds, high-risk types have no incentive to switch from contract E_H to E_L and mimic the behavior of low-risk types. Since U_H>U_H* at E_L', the condition is binding. It follows that E_L is determined by the intersection of the indifference curve, $U_H=U_H^*$, and the zero profit line, $R_L=0$, and lies between E_L' and the firm origin, O′.[3] Let $E_L=(b_L,w_L)$. By equations (6) and (9), E_L is characterized by

$$(15a)\qquad U_H^* = P_HU_F(b_L) + (1\text{-}P_H)U_S(w_L)$$

$$(15b)\qquad w_L = S - Q_L(b_L\text{-}F).$$

We denote by U_L* the level of utility attained by the low-risk type at E_L.

Finally, E is the contract that maximizes the low-risk type's utility, U_L, subject to R=0, namely, the pooling line given by equation (8). Let $E=(b_P,w_P)$. Using equation (11), and proceeding as in footnote 2, E is characterized by

$$(16a)\qquad Q_LU_F'(b_P)= QU_S'(w_P)$$

$$(16b)\qquad w_P = S - Q(b_P\text{-}F).$$

Since $Q_L<Q$, (16a) implies that $U_F'>U_S'$ at E, and E lies on the pooling line to the right of the full insurance line. We will denote by U_L** and U_H**, respectively, the levels of utility attained by low-risk and high-risk types at E.

We now describe the two possible solutions. First of all, a separating equilibrium occurs when $U_L^*>U_L^{**}$, as depicted in Figure 1. In this equilibrium, firms offer workers the pair of contracts (E_L,E_H), with all low-risk types accepting E_L and all high-risk types accepting E_H. Competition ensures that (E_L,E_H) is the pair of contracts offered. Because firms are risk neutral, in equilibrium they bear all the

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[3] We can show that U_L declines to the right of E_L' on the line $R_L=0$ (Figure 1). From equation (11), since $R_L=0$ has slope $-Q_L=-P_L/(1\text{-}P_L)$,

$$(F3)\qquad dU_L/db = P_LU_F' + (1\text{-}P_L)U_S'(dw/db) = P_L(U_F'\text{-}U_S').$$

As E_L' lies on the full insurance line, to the right of E_L', $U_F'>U_S'$. Thus, by (F3), to the right of E_L', $dU_L/db>0$, and U_L declines as benefits are reduced. U_H likewise declines to the right of E_L' on the line $R_L=0$, and declines also to the right of E_H on the line $R_H=0$ (the proofs are similar).

risk in relation to high-risk types, who are fully insured at the point E_H. If worker types were known to firms, so that each type was offered his or her "full information contract", firms would similarly bear all the risk in relation to low-risk types at the point E_L'. However, with asymmetric information, firms need to identify low-risk types by offering E_L, a contract with a high wage in the good state and a low benefit in the bad state. E_L and E_H both lie on the indifference curve U_H=U_H*, so that high-risk types have no incentive to "mimic" the behavior of low-risk types.[4] A pooling equilibrium does not result in Figure 1 because U_L=U_L*, the low-risk type's indifference curve through E_L, does not intersect the pooling line. In other words, there is no contract on the pooling line that the low-risk types prefer to E_L. (Recall that the pooling line is the relevant constraint when firms draw workers randomly.)

Second of all, a pooling equilibrium occurs when U_L*<U_L**, as depicted in Figure 2. In this equilibrium, only one contract is offered, contract E. The difference between Figure 2 and Figure 1 is that U_L=U_L* now intersects the pooling line. This means that, in comparison with the separating contracts (E_L,E_H), both types now do better at E. Firms can "deviate" profitably from (E_L,E_H), and so (E_L,E_H) is not the equilibrium. Low-risk types do better at E than at E_L, even though mimicked at E by the high-risk types, and accordingly a pooling equilibrium results.

In determining whether pooling rather than separation obtains, the magnitude of θ is critical. The larger θ, the more likely is pooling. If θ is close to one, so that the pooling line is close to R_L=0, low-risk types suffer little from being pooled with their high-risk counterparts (who are relatively few in number), and low-risk types find separation is not worth its cost in the form of low insurance against the bad state.

[4] An assumption here is that the high-risk type cannot obtain insurance outside the firm (cannot "top up" with insurance), on terms that, starting from E_L, allow the high-risk type to attain levels of utility higher than U_H*.

In sum, there are two possible solutions to the model. In the case of a separating equilibrium (Figure 1), low-risk types are identified by their choice of contract, namely, a high-wage/low-benefit contract. This is an example of "screening" which benefits low-risk types even if they face a cost in that they cannot be fully insured. In the case of a pooling equilibrium (Figure 2), high-risk types mimic the behavior of their low-risk counterparts and gain in comparison with their full information contract, E_H. High-risk types gain by pooling. We now proceed to examine the justification for a government mandate in these two situations.

4 Improvements in Welfare

It is clear in our model that, since a firm is free to offer any contract it wishes, no government-mandated floor can engineer a Pareto improvement. Rather, competition will ensure that opportunities to make workers better off while firms still break even are not neglected. The mandate can only restrict the set of contracts on offer, transforming a separating equilibrium into a pooling equilibrium (Figure 1), or a pooling equilibrium into a pooling equilibrium with a higher level of benefit (Figure 2). In either case, low-risk workers are made worse off. In Figure 1 they are better off at E_L than at any point on the pooling line; and in Figure 2 better off at E than at any different point on the pooling line.

However, Summers' (1989) point is that unregulated labor markets with asymmetric information fail to achieve efficiency across states (which requires workers to be fully insured). A mandate can achieve this outcome by imposing as a minimum the benefit corresponding to A in Figures 1 and 2, where A is the point where the pooling and full insurance lines intersect. Such a mandate may be desirable even though it also has a redistributive effect that needs to be taken into account.

To formalize the discussion, we adopt a generalization of Harsanyi's (1977) social welfare function due to Blackorby et al. (1997), namely,

(17) $$W = \theta f(U_L) + (1-\theta) f(U_H).$$[5]

Such a social welfare function may be thought to overstate utilitarian principles at the expense of individual rights, which figure so much in the recent social choice literature (see for example Pattanaik, 1994). But it has the advantage of simplicity and will provide us with insights. Varying our previous notation, let (b_L,w_L) denote the contract accepted by low-risk types and (b_H,w_H) that accepted by high-risk types. Maximizing social welfare subject to the population, risk, and productivity conditions, the Lagrangean is

(18) $$\theta\,[P_L U_F(b_L)+(1-P_L)U_S(w_L)] + (1-\theta)[P_H U_F(b_H)+(1-P_H)U_S(w_H)]$$
$$+ \lambda\{\theta\,[P_L F+(1-P_L)S] + (1-\theta)[P_H F+(1-P_H)S]$$
$$- \theta\,[P_L b_L+(1-P_L)w_L] - (1-\theta)[P_H b_H+(1-P_H)w_H]\}.$$

The first order conditions then give

(19) $$U_F'(b_L) = U_S'(w_L) = U_F'(b_H) = U_S'(w_H),$$

together with the zero profit condition. From equations (19), the "first-best" outcome assigns contract A to each worker (recalling that $U_F'(b)=U_S'(w)$ defines the full insurance line).

Thus, given our social welfare function, the government can achieve the first-best outcome by mandating full insurance. Mandating A is optimal for two reasons. First, A is on the full insurance line and so we have efficiency across states. Second, A is common to all workers and so we also have efficiency across workers. The

[5] An alternative approach that might be considered relies on the concept of a "potential" Pareto improvement. (A potential Pareto improvement occurs when "winners" can compensate "losers" and still come out ahead.) However, when applying this concept in our context, intransitivities arise. A in Figure 1 is a potential improvement on (E_H,E_L), since redistribution is possible from A to (E_H,E_L') which itself is a Pareto improvement on (E_H,E_L). Thus A is "better" than (E_H,E_L). On the other hand, redistribution is possible also from (E_H,E_L) back to A, so that (E_H,E_L) is no worse than A. A second problem with the concept of a potential Pareto improvement, in our context, is that winners compensating losers would in practice be impossible. When for example A is mandated, forcing pooling, low-risk types cannot be compensated by high-risk types, since the latter are not identifiable. Though a popular tool in many contexts, the concept of a potential Pareto improvement is not useful here.

redistribution (neglected by Summers) which accompanies the mandate, from low-risk to high-risk workers, is optimal because it equalizes the marginal utility of income across workers.

It is worthwhile analyzing the change which a mandate brings about. Starting from (E_L,E_H) in Figure 1 or from E in Figure 2, we may think of movement to A as taking place in two steps. There is an initial shift for each type along corresponding "actuarially fair" isoprofit lines, which takes them to the full insurance line. This is a Pareto improvement. Then there is a second shift for each type which unites them at A. Define "redistribution" as the latter movement.

Under (17), redistribution is good because high-risk types are relatively deprived and therefore also good "utility generators" (that is, they have a high marginal utility of income). An illustration is Summers' example of mandated company health insurance. Here it seems right for the unhealthy to benefit at a minor cost to the healthy. Note, however, that were one to introduce moral hazard into the discussion, high-risk types would no longer automatically emerge as "deserving". Society might prefer to reward a worker for his or her achievement of low risk.

It remains that, with homogeneous firms, mandates can improve efficiency across worker states, and will have redistributive effects that in many cases are seen as desirable. The policy implications are indeed quite striking. Yet, as we shall see, the picture can alter quite dramatically once we relax the assumption of identical firms.

5 Heterogeneous Firms

The problem in a nutshell is that enforced pooling may lead to the misallocation of workers in a world of heterogeneous firms. As noted earlier, employing high-risk workers creates greater difficulties for some firms than others. To demonstrate that misallocation may occur, we generalize the model to the case r=2; that is, there are now two types of firm. To fix ideas, we call these "large" and "small" firms, even though strictly within the terms of the model the size of firms is for simplicity indeterminate.

Assume there is a separating equilibrium. Let the revenue box for large firms be (F,S), and the corresponding box for small firms (F_m,S_m) (Figure 3). In general, these boxes have different dimensions, and for reasons suggested earlier we suppose that small firms have elongated boxes and large firms have squarer boxes. We know that the boxes are not "nested" in the sense that one wholly contains the other. If for instance we had $F_m<F$ and $S_m \leq S$, small firms could not break even employing workers of either type and would not exist. Accordingly, we have $F_m<F$ and $S_m>S$. Intuition suggests that now, with the generalized model, efficiency requires differences in contracts between small and large firms so as to bring about an appropriate matching of workers to firms. We explore this.

As before, let the separating contracts be (E_L,E_H), where $E_L=(b_L,w_L)$ and $E_H=(b_H,w_H)$. Firms are competitive and cannot make positive profits employing either worker type. Thus,

(20a) $$P_Lb_L + (1-P_L)w_L \geq P_LF + (1-P_L)S$$

(20b) $$P_Hb_H + (1-P_H)w_H \geq P_HF + (1-P_H)S$$

(20c) $$P_Lb_L + (1-P_L)w_L \geq P_LF_m + (1-P_L)S_m$$

(20d) $$P_Hb_H + (1-P_H)w_H \geq P_HF_m + (1-P_H)S_m.$$

Suppose, hypothetically, that low-risk types work for large firms and high-risk types for small firms. We can replace weak inequality in (20a) and (20d) by equality. Substituting into (20b) and (20c) gives

(21a) $$P_HF_m + (1-P_H)S_m \geq P_HF + (1-P_H)S$$

(21b) $$P_LF + (1-P_L)S \geq P_LF_m + (1-P_L)S_m.$$

Adding, we have

(22) $$(P_L-P_H)(F-F_m) \geq (P_H-P_L)(S_m-S).$$

Since $P_L<P_H$, $F_m<F$ and $S_m>S$, the left-hand side is negative and the right-hand side positive, a contradiction. Low-risk types working for large firms and high-risk types for small firms does not occur.

We are therefore left with just three possibilities:

(A) only high-risk types work for large firms and only low-risk types for small firms;

(B) a mix of low- and high-risk types works for large firms, but only low-risk types for small firms;

(C) a mix of low- and high-risk types works for small firms, but only high-risk types for large firms.

Case (B), which seems the most likely, is illustrated in Figure 3. Since both types of firm employ low-risk workers, the zero profit line, $R_L=0$, is common to the two types of firm and touches the corner of both boxes. Large firms offer both E_L and E_H, separating the low-risk from the high-risk types. Small firms offer only E_L.

It is useful to our purpose to investigate what happens to prices and the dimensions of the revenue boxes when pooling replaces separation. In general, prices and box dimensions alter. Let us take case (B). Denote the dimensions of the revenue boxes under pooling by (F',S') for large firms and (F_m',S_m') for small firms, where as before, $F_m'<F'$ and $S_m'>S'$. Since low-risk types work for both large and small firms, we can replace weak inequality in (20a) and (20c) by equality. Subtracting gives

(23) $$S_m-S = Q_L(F-F_m).$$

The break-even relations under pooling are, from equation (9), (24a) $Pb_P + (1\text{-}P)w_P = PF_m' + (1\text{-}P)S_m'$

(24b) $Pb_P + (1\text{-}P)w_P = PF' + (1\text{-}P)S'.$

Subtracting, we have for pooling,

(25) $S_m'\text{-}S' = Q(F'\text{-}F_m').$

Thus, since $Q>Q_L$, it follows from equations (23) and (25) that

(26) $(S_m'\text{-}S')/(S_m\text{-}S) > (F'\text{-}F_m')/(F\text{-}F_m).$

Recall that when prices vary the dimensions of the corresponding revenue boxes vary in proportion. The two prices vary in opposite directions (for a given general level of prices). Thus, (26) implies that, if separation is converted into pooling, prices will fall in the large-firm sector and rise in the small-firm sector. The effect on box dimensions is $F>F'$, $S>S'$, $F_m<F_m'$ and $S_m<S_m'$, making the left hand side of (26) greater than one and the right hand side less than one. Intuitively, prices for small firms are higher because they now employ some high-risk workers; prices for large firms are lower because they now have a better mix of workers.

Diagrammatically, the squarer box contracts and the elongated box expands to a point where the pooling line touches the corners of each. (The large-firm sector expands and the small-firm sector contracts.) In relation to the revenue boxes obtaining under separation, the pooling line passes above the corner of the squarer box and below the corner of the elongated box (Figure 3). Under pooling, competition requires the two types of firm to have a common pooling line.

A similar argument applies in case (C). A switch from separation to pooling causes prices now to rise in the large-firm sector and fall in the small-firm sector, with corresponding box changes. In general, adjustments also take place in case (A).

We now come to the important result we wish to prove, which is that in any of the three cases the switch in regime from separation to pooling causes a decline in output and average income. A common factor in (A), (B), and (C) is that high-risk types work for large firms and low-risk types for small firms, so that we can replace weak inequality in (20b) and (20c) by equality. In addition, we have shown that in one or the other, or both, of (20a) and (20d) inequality must be strict (see (22)). Variation occurs depending on which of the three cases, (A), (B), or (C), is operative.

In case (A), for instance, inequality is strict in both (20a) and (20d), so that

(27a) $$P_L F_m + (1-P_L)S_m > P_L F + (1-P_L)S$$

(27b) $$P_H F + (1-P_H)S > P_H F_m + (1-P_H)S_m.$$

(27) shows that at the margin low-risk types are more productive working for small firms and high-risk types for large firms. This suggests that when a worker's sector is randomized by pooling - such that low-risk types move from small to large firms and high-risk types gravitate in the opposite direction, output will fall. Rigorously, we can show a fall in income. To show this, note first that by (27) average income under separation is greater than $PF+(1-P)S$, and also greater than $PF_m+(1-P)S_m$. Since both sectors break even, average income under pooling is $PF' +(1-P)S'=PF_m'+(1-P)S_m'$. We know that either $F\geq F'$ and $S\geq S'$, or else $F_m\geq F_m'$ and $S_m \geq S_m'$. (If prices rise in the large-firm sector, they fall in the small-firm sector.) It follows that average income is greater under separation than under pooling.

In case (B), since low-risk types now work in both sectors, equality replaces strict inequality in (27a); (27b) still applies, however, and randomization again causes income to fall. In this case average income under separation is $PF+(1-P)S$, while average income under pooling equals $PF'+(1-P)S'$. This shows a fall in income, since we know that $F>F'$ and $S>S'$ (see (26) and the ensuing discussion). An analogous argument holds for case (C). Thus, in all three cases, the reallocation of labor induced by pooling reduces output and average income.

The situation is different where market forces have already resulted in pooling. If workers are randomly allocated to begin with, designers of mandates do not have this type of misallocation to worry about.

Our discussion suggests that it may be desirable to restrict the coverage of mandates. We focus on case (B), which as we have said seems the most likely of the three cases. Suppose in case (B) that the mandate is restricted to large firms. Although such firms will be required to offer a contract with a high level of benefit, small firms will be free to screen out high-risk types. We can show that the interesting theoretical consequence here is that small firms will now offer a contract that, though identical to that offered by large firms, successfully creams off low-risk workers. Although the allocation of workers is efficient (small firms employ only low-risk types), the contracts offered are distinguished only by which type of firm makes the offer!

To demonstrate this, denote the contract which small firms offer by E_L and that which large firms offer by E'. As low-risk workers are employed by both types of firm, an equilibrium condition is that they are indifferent between E_L and E'. Referring to Figure 4, E_L lies on the low-risk type's indifference curve through E', which is flatter than the high-risk type's indifference curve through E'. Call these curves $U_L=U_L'$ and $U_H=U_H'$. By the incentive compatibility condition, $U_H \leq U_H'$, E_L either coincides with or lies to the right of E', on $U_L=U_L'$. Assume E' is located on or to the right of the full insurance line - that is, the mandate does not impose over-insurance on workers, forcing E' to the left of this line. It follows that the slope of $U_L=U_L'$ (which is Q_L on the full insurance line) is in absolute terms greater than Q_L to the right of E'. However, the isoprofit lines of small firms have slope equal to Q_L, and so $U_L=U_L'$ to the right of E' is steeper than these isoprofit lines. Profit maximization of small firms therefore determines that $E_L=E'$.

Even though $E_L=E'$, small firms are able to screen out high-risk types when the mandate is restricted. Intuitively, this is because small firms can threaten to deviate from the common contract by offering a high-wage/low-benefit contract that is unattractive to high-risk types. Large firms cannot follow suit. A universal mandate would eliminate the "deviation" option for small firms, leading to a random allocation of workers in this case.

The restricted mandate benefits small firms since low-risk types, pooled with high-risk types in large firms, are cheaper. (The pooling of low-risk and high-risk types in large firms reduces the wages of low-risk types in large firms, and, by the same token, in small firms as well.) The prices of products produced by small firms fall (in Figure 4, the small-firm revenue box shrinks), and the small firm sector expands. Moreover, there is no loss of output when the mandate is restricted, as exempted small firms continue to employ only low-risk types. The restricted mandate thus avoids misallocation of workers in spite of firm heterogeneity.

The caveat in all of this is that there may be additional forms of heterogeneity, other than the small firm/large firm distinction. Mandates may need to be restricted in further and more complex ways if misallocation is to be avoided.

6 Government Provision

As an alternative to mandates, governments may themselves provide the fringe benefit directly. For expositional convenience, we will analyze such provision in the framework of the simpler one-box model.

Suppose the government pays the worker a benefit z in the bad state, so that the worker's utility becomes $U_F(b+z)$. This provision is financed by a break-even tax of Qz on the worker in the good state, so that in the good state the worker's utility is $U_S(w-Qz)$. (Recall that $Q=P/(1-P)$.) Diagrammatically, an increase in government provision shifts the worker origin, O, rightward and downward in relation to the revenue box (see Figure 5).

We investigate first the effect of varying government provision on E, the low-risk worker's preferred contract on the pooling line. Referring to (1), E is constrained to be on or to the left of the firm origin O′. Thus, E can be either an interior solution or the corner solution, E=O′. As an interior solution, E is characterized by[6]

(28a) $$Q_L U_F'(b_P+z) = QU_S'(w_P-Qz)$$

(28b) $$w_P-Qz = S - Q(b_P+z-F).$$

Equations (28) determine b_P+z and w_P-Qz uniquely. Thus, when E is an interior solution, any variation in government provision of the benefit is exactly offset by a compensating variation in firm provision. Increasing z affects neither the total benefit, b_P+z, nor the net wage w_P-Qz, and the workers' utilities at E, U_L** and U_H**, are likewise unaffected. Intuitively, the explanation for this result is that E is governed by the low-risk type's preferences, and the terms on which the low-risk type obtains additional benefits are the same irrespective of whether these are provided by firms or by government. In either case, cost is based on *average* risk. Consequently, as z increases, b_P is reduced until eventually $b_P=F$. Diagrammatically, E moves toward the revenue box until it coincides with the firm origin O′ (Figure 5). Ultimately, if not initially, we arrive at the corner solution, E=O′.

We can also investigate the effect of varying government provision on the pair of separating contracts, E_H and E_L (as defined in Section II), and on the worker utilities associated with these contracts. Omitting proofs (which are available from the authors on request), the results are:

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6 Adapting equations (8) and (11), the Lagrangean for the determination of E is
$P_L U_F(b+z) + (1-P_L)U_S(w-Qz) + \lambda\,[P(F-b) + (1-P)(S-w)]$.
Differentiating with respect to b and w, and equating to zero,
(F4) $P_L U_F' = \lambda P$
(F5) $(1-P_L)U_S' = \lambda\,(1-P)$.
Dividing gives (28a). The constraint gives (28b).

(A) At E_H, the utility of high-risk types increases with government provision z, and total benefit, b_H+z, also increases. The intuitive explanation for this increased utility of high-risk types is that they obtain additional benefits on good terms. Although they experience greater than average risk of failure, they are taxed at just average risk.

(B) At E_L, the utility of low-risk types may or may not increase with government provision z, although total benefit, b_L+z, will again increase. The redistributive effect in this case operates against low-risk types - experiencing lower than average risk of failure, they are taxed at average risk. However, there is a further effect. As z increases, low-risk types can receive a higher level of benefit without being mimicked by high-risk types, and paradoxically, this beneficial effect can more than offset the pure redistributive effect.[7]

We now draw some conclusions about the effects of direct government provision on labor markets. Absent government provision, there can be either pooling or separation, but for the sake of argument let us suppose pooling. Figure 6 illustrates.

Equations (28) show that, as z increases from zero, there is at first no net effect on workers' benefits, wages, or welfare. But this situation does not persist. With increasing z, there will occur a switch in regime from pooling to separation: as E moves toward the revenue box, eventually E=O′ at which point there is separation. Workers are now better off with the separating contracts (E_L,E_H) than with pooling at O′. Low- and high-risk types each gain from obtaining insurance at a cost that is actuarially fair. Interestingly, as depicted in Figure 6, there may be a range within which increases in z achieve Pareto improvements (see (A) and (B)

[7] This Pareto improvement result is also derived heuristically by Wilson (1977, 200), though he errs in claiming that Pareto improvements can always be achieved. A similar effect occurs when a firm, which is able to offer more than one contract, uses a profit-making contract aimed at low-risk types to balance a loss-making contract designed for high-risk types. The advantage gained is that the subsidized high-risk types are less inclined to mimic the low-risk

above). Beyond this, increases in z, by subsidizing high-risk types at the expense of their low-risk counterparts, continue to make high-risk types better off but now penalize low-risk types.

We see that government provision has the advantage over a mandate that it is able to retain separation and also to convert pooling into separation. Losses which arise under mandates due to the misallocation of labor (documented in Section IV) are avoidable with government provision. Another advantage is that the taxes which fund government provision can be progressive. However, taxes are distortionary. These distortions, which are crucial to the argument of Summers (1989), fail to appear in our model because of the full employment assumption and also by reason of the focused nature of the taxes concerned. Relaxation of these assumptions means that distortions would surface. That said, we have demonstrated that government provision has certain advantages over mandates ignored in the extant literature.

7 Conclusion

This paper has provided a formal underpinning for recent arguments in the labor economics literature, based on asymmetric information, for government-imposed mandates. We have shown that mandates may improve welfare. They can bring about an efficient allocation of income across worker states, and the accompanying redistribution of income across workers will in some instances accord with notions of equity. Mandates may of course also reduce output. Specifically, where worker types are separated in a world of heterogeneous firms, mandates may lower productive efficiency, substituting a random allocation of labor for the purposive sorting mechanism that in regular markets exploits separation. We have reported that targeting may be able in some measure to side-step these inefficiencies.

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types (see Cave, 1984, in the insurance market context).

A further concern of the paper has been the issue of direct provision of the benefit by government. It is conventional to argue that mandates dominate government provision by reason of the greater tax distortions associated with the latter. Against this, we were able to show that direct provision can have the advantage of avoiding any misallocation attendant upon pooling and the consequent randomization of labor allocation. Direct provision may thus be a more efficient redistributive tool, less costly in its implied output losses.

To conclude, our framework has been broad. An important task for the future is to identify and parameterize those mandates that do fit the mold of adverse selection. Other issues that may need to be accommodated within the existing insurance framework include the availability of external insurance (allowing workers to top-up their firm benefits), and cross-subsidization (which was ruled out here on fairness grounds).

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9 References

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Figures