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Social Insurance, Incentives and Risk Taking

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Abstract

From the perspective of parents, redistributive taxation can be seen as social insurance for their children, for which no private alternative exists. Because private insurance comes too late during a person's life, it cannot cover the same risks as social insurance. Empirically, 85% of social insurance covers risks for which no private insurance would have been available. Redistributive taxation can be efficiency enhancing, because it creates safety and because it stimulates income generating risk taking. However, it also brings about detrimental moral hazard effects. Both the enhancement of risk taking and the moral hazard effects tend to increase the inequality in the economy, and, under constant returns to risk taking, this increase is likely to be strong enough even to make the net-of-tax income distribution more unequal. Optimal redistributive taxation will either imply that the pie becomes bigger when there is less inquality in pre-tax incomes or that more redistribution creates more post-tax inequality.

Key words:

1. Introduction

The welfare state has come under heavy attack in recent years. It has been blamed for reducing international competitiveness, for lowering work incentives and for reducing the economy's growth rate. In short, the welfare state is seen as an institution that makes the distribution of the slices more equal, but incurs a large cost in terms of reducing the size of the cake.

Economists have not always held such a negative view. In the fifties, most economists saw the welfare state as a useful and necessary historical development. Atkinson (1991, 1995) is right when he argues that it is time to reconsider the basic functions of the welfare state and warns on the economic consequences of "rolling back" this state. Apart from the benefit of stabilizing the political system and avoiding social unrest, the welfare state's main achievement is the social insurance it provides in an uncertain world. Social insurance (as defined in this paper) cannot be equated with, or limited to, the activities which legally are subsumed under this term. Instead, it includes all redistributive budget flows that reduce the variance in peoples' real living standards. The risk of not having a successful career is substantial for young, and even more so for unborn, children. Knowing these risks, parents may well opt for a program of income redistribution to insure their children against bad luck in terms of missed opportunities, illness, injuries and an unfavourable endowment of innate abilities. The whole system of redistributive taxation involves social insurance,

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as does the provision of public goods. Every road and every school building can be seen as part of social insurance if it is financed with taxes that deviate from the benefit taxation criterion by making the rich net contributors and the poor net receivers of economic resources.[1] In modern societies, the government budget is by far the largest risk absorption device available, generating a protection similar to, but larger than, the protection offered by private insurance companies (see section 2).

Ironically, in some countries, the largest part of what is phrased "social insurance" does not, in fact, contain many insurance elements. In Germany, for example, the pay-as-you-go public pension system is based on a strict equivalence principle implying that a person's pension is proportional to his previous contributions to the system. The pension system is primarily an intergenerational transfer device, its insurance aspects are of secondary importance.

It is often argued that the welfare state has to trade off equity against efficiency goals, that inefficiency is the cost of charity. This view is not compatible with the social insurance interpretation since redistribution is itself an efficiency enhancing activity. The redistribution of market incomes through the government budget can be justified and explained on the basis of individual ethics without resort to utilitarian assumptions.

While the insurance against various kinds of risks is the main allocative function of the welfare state, it would be too narrow to see this function in the context of given risks only. Typically, insurance stimulates risk taking and induces various kinds of moral hazard effects. Social insurance can hardly be an exception.

Up to a certain extent, risk taking is the beneficial part of the behavior changes brought about by redistributive taxation. It has many dimensions. The most important one is probably a person's educational or occupational choice. A young person faces a large variety of options differing with regard to the expected lifetime income and the riskiness of this income. In many countries, one end of the spectrum is defined by tenured employment in the government sector with low pay, few opportunities for advancement, and nearly perfect security. The other end of the spectrum consists of entrepreneurial activites that involve both a large risk of failure and the chance of winning a fortune. Between these extremes there is a multitude of other options densely covering the whole range.

Social insurance, like private insurance, makes people more daring since the government takes an equal share in the gains and losses resulting from their economic decisions. It makes people jump the dangerous chasms which otherwise would have put a halt to their economic endeavors.

It may, in fact, make them too eager to jump. The safety net provided by social insurance may actually imply that people do not try hard enough to succeed, become careless, and take too dangerous short-cuts in the mountainous life paths. This is the moral hazard problem that limits the usefulness of any insurance contract.

Surprisingly, there is not much literature on the welfare economics of risk taking and redistributive taxation. It is true that there are many contributions on taxation and risk taking including Ahsan (1974, 1976), Allingham (1972), Atkinson and Stiglitz (1980, ch. 4), Bamberg and Richter (1984), Buchholz (1987), Kanbur (1979), and Sandmo (1977). The literature dates back to Domar and Musgrave's (1944) paper and extends it in various directions. However, it concentrates on fiscal rather than redistributive taxation and is, with few exceptions, not concerned with welfare judgements.

There is also a more recent strand of literature including contributions by Diamond, Helms and Mirrlees (1980), Eaton and Rosen (1980), Varian (1980), Rochet (1991), and Mirrlees (1995) which studies the problem of optimal redistributive taxation in the context of various types of income and health risks. This literature is explicitly concerned with welfare judgments, but it is silent about the issue of risk taking. In Varian's important paper, for example, there is an exogenous additive income risk whose size cannot be manipulated by individual action.

This paper tries to reconcile the two apparently unrelated strands of literature by studying the allocative implications of redistributive taxation in the context of risk taking and moral hazard effects. Among other things it will analyze a problem of optimal taxation with endogenous risk taking.[2]

The lack of interest in the welfare state's influence on risk taking may result from an ambiguity in the effect of fiscal taxation on risk taking once found by Feldstein (1969) and Stiglitz (1969) as well as from the more technical aspect that two-parametric characterizations of probability distributions and preference functions are perceived as inferior to direct expected utility maximization. The paper offers a solution to both problems. The ambiguity will be shown to disappear under redistributive taxation, and the use of the linear distribution class methodology of Meyer (1987) and Sinn (1983, 1990) will make it possible to use a $\mu-\sigma$ approach with only a little loss in generality.

2. Social Insurance, Market Insurance, and Redistribution: Some Fundamental Issues

Social insurance systems in the narrower sense of the word are often criticized on the grounds that they involve redistributive elements. Redistribution and insurance, it is maintained, are two completely distinct activities that should not be confused, since inequality is not the same as risk.

This view sharply contradicts the insurance interpretation of the welfare state, and it is misleading for at least two reasons. First, risk taking has implications for the realized degree of inequality in the economy, because the more people dare the larger will be the income gap between those who succeed and those who fail. If the redistribution of incomes stimulates risk taking it will therefore also bring about a more unequal pre-tax distribution of incomes. The paper will study some of the relevant problems involved.

Second, an unequal society involves a substantial risk for a young entrant who does not know which position he will take over. Admittedly, even such a person's prospects may be partly determined through his inherited endowment. But the younger the person, the larger will be the uncertainty and the greater the need for insurance.

Life is a random walk whose path can only partly be manipulated by men's decisions. By the very nature of this random walk, a person's income is more predictable in the short run than in the long run. Seen from today, next year's income is not very risky and so it may appear difficult to interpret income redistribution as insurance. But the income 40 years from now is much less predictable, and many people would agree that a redistribution of that income would be insurance.

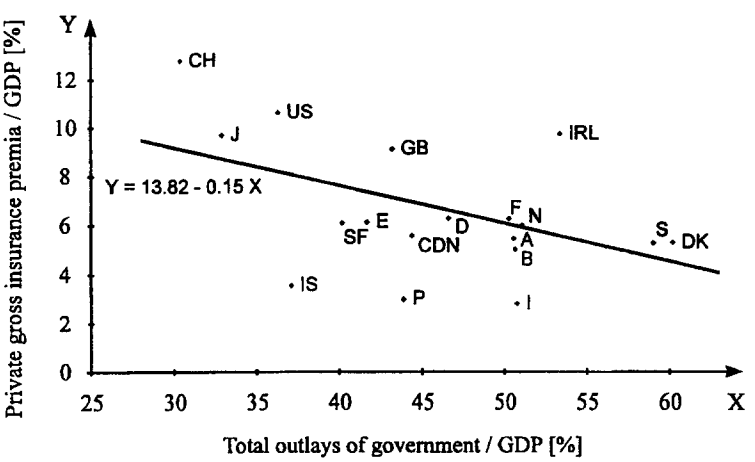
Insurance and redistribution are two sides of the same coin. Every insurance contract involves a redistribution from the lucky to the unlucky, and most redistributive measures

can be interpreted as insurance when the time span between assessing and taking these measures is sufficiently long. Understanding redistribution as insurance is simply a matter of making the judgement before the veil of ignorance has been lifted.

Writers like Friedman (1953), Harsanyi (1953, 1955), Rawls (1971), and Buchanan and Tullock (1962) have earlier clarified this issue in somewhat different contexts, and, in a sense, the principle of judging behind the veil of ignorance can even be attributed to Kant's (1785) *categorical imperative*. The crucial point to note here is that it is not only necessary to make the judgment *behind* a fictitious veil of ignorance, but *before* the veil is actually lifted. For everyone in the society, there was a time where the veil still hid his destiny.

The issue is less philosophical than it seems because it has very practical implications for the relationship between private and social insurance. A number of authors including Bulow and Summers (1984), Gordon (1985), Kaplow (1991, 1992), and Konrad (1991) have demonstrated that, under certain conditions, social insurance cannot improve the allocation of risks beyond what the markets can do. With perfect risk markets, the government cannot improve the allocation of resources, and even with imperfect markets it may not do better if the reasons for the imperfection, typically problems of asymmetric information, apply to the government as well as private insurers. If the government decides nevertheless to introduce additional insurance it will simply crowd out private insurance one by one.

There is some empirical evidence for a crowding out effect. While there is no significant cross-country correlation between the size of social security transfers and the revenue of the private insurance business, there is a significant negative relationship between total government outlays and private insurance revenue.[3] An increase in the government share in GDP by one percentage point reduces the share of private insurance premia in GDP by 0.15 percentage points. Figure 1 illustrates the findings.



Source: OECD, Historical Statistics 1960–1968 table 6.5, p. 68, Paris 1990. OECD, Insurance Statistics Yearbook 1985–1992, table 1.1, p. 18, Paris 1994. OECD, National Accounts: Main Aggregated 1960–1992, vol. 1, table 13, p. 124–125, Paris 1994.

Legend: The Data include all countries for which OECD statistics are available. All data refer to the year 1988.

Figure 1. Private insurance vs. social insurance.

The empirical findings reemphasize the point made in the introduction that social insurance in the narrower sense of the word often does not include much insurance and that all government outlays, even public expenditure for goods and services, should be considered as part of social insurance. They also show, however, that the crowding out effect is far from perfect. It is true that some government insurance competes with private insurance, but the crowding out effect is 15% rather than 100% as predicted. Obviously, by far the largest part of social insurance covers risks for which otherwise no private insurance would be available.

Private insurance covers specific contingencies. Typically there is a very narrowly defined set of circumstances under which a private insurance company pays indemnification. Social insurance, by way of contrast, is an all-inclusive insurance that protects against the risks of lifetime careers. The two kinds of insurance are not easily comparable.

The timing problem could be the reason why private insurance is not available for the kinds of risks covered by redistributive taxation. The issue can best be understood from the perspective of parents with young children or even parents-to-be because for them the veil of ignorance has not yet been lifted. These parents do not know which innate abilities their children have been endowed with, they may fear that their children suffer from illnesses and injuries, they are afraid of bad teachers and friends, they are concerned about missing job opportunities and bad choices, they are afraid that their children may become unemployed, and they hope, but cannot be sure, that a successful marriage will be possible. The welfare state cannot eliminate these risks, but, by offering a redistribution contract between successful and unlucky children, it can help mitigate the consequences.

Under the present liberal constitutions prevailing in Western countries, similar private redistribution contracts are inconceivable. They would not be allowed since they would come close to bondage, a system long overcome in these countries by the course of history. It would have to be acceptable for parents to allocate substantial fractions of their children's incomes to private institutions without their offspring having the chance to modify, or even nullify, the decision when they become adults.

Private redistribution contracts have to "wait" until a person has reached the legal state of adulthood, but by then most of the veil of ignorance will have been lifted. When both the insurer and the insuree have the same knowledge about the inequalities then existing they will not be able to find a mutually agreeable redistribution contract. And when the insuree has superior knowledge, there will be the typical adverse selection problem, analyzed so frequently in the insurance literature. Full coverage pooling equilibria are not feasible since the good risks will not participate, and, at best, there can be a separating equilibrium where only bad risks find enough coverage. All too often, insurance for the good risks will not be available at all.[4]

Barr (1992) has recently argued that the non-existence of risk markets due to adverse selection is the major explanation and justification for social insurance. Unlike private companies, he maintains, the government can force individuals to participate and thus avoid adverse selection. This argument is correct, but incomplete, since it neglects the timing problem.

Judged at the time where private contracts can be settled (i.e. after adulthood has been reached), the imposition of force by the government is not a Pareto improvement since it makes the good risks worse off. At best, the government intervention can be defended

with the Kaldor criterion, that the good risks lose less than the bad risks gain from enforcing a pooling equilibrium so that compensation would be theoretically feasible. Judged at a time early enough before adulthood, when the veil of ignorance has not yet been lifted, the same kind of force may be a Pareto improvement, because all parents welcome the insurance which the enforced redistribution implies. Adverse selection becomes a convincing allocative argument for government intervention if social insurance can cover a longer time span than private insurance so that part of the inequality hampering the latter can be insured as risk by the former.

The reason societies have excluded bondage contracts and rely so much on an individual's voluntary decision at the time of adulthood is a deep sociological and legal question. But it is a matter of fact that this exclusion has made it necessary to develop career insurance through the welfare state rather than through the private insurance market.

Apart from the legal difficulties of having private "career insurance" contracts, a crucial aspect contributing to the historical development of the welfare state can probably be seen in the growing importance of the provision of public goods motivated by other reasons. As was described so vividly by Wagner (1876) and Timm (1961), industrialization, urbanization and the general development of the exchange economy required a more than proportional increase in public expenditure for infrastructure, justice, and education. Given that this expenditure was necessary it was plausible to finance it with redistributive rather than poll or benefit taxes. Introducing redistributive elements into the tax system had the advantage of providing social insurance without involving additional transactions or administrative costs. The marginal administrative cost of making an existing tax system redistributive may have been negligible or even negative. Setting up a private insurance solution from nothing would certainly have been the more expensive solution.[5]

3. Risk Taking, Insurance and Redistributive Taxation

Social insurance through redistributive taxation cannot be well understood if it is seen as the insurance of given risks. The behavioral changes induced by social insurance must also be taken into account. It is frequently argued that these behavior changes are a sign of moral hazard which, as such, reduces the benefit from insurance. However, this view does not harmonize well with the beneficial effects that the Domar-Musgrave literature attributes to risk taking. Indeed it is one of the great advantages of insurance that it makes risks bearable that otherwise would have prohibited economic activities. Henry Ford once said that New York would not have been built without the help of the insurance system, and it seems appropriate to add that the rise of Venice to the world's richest city in the 14th and 15th centuries is inconceivable without the invention of a modern insurance system. Under the protection of the *foenus nauticum* and the various derivatives invented at the time the Venetian merchant fleet risked making journeys to the most remote corners of the Mediterranean (later even to the Atlantic), collecting astronomical gains from trade.[6]

The beneficial effects of insurance are not limited to cases of active entrepreneurship. Even a reduction in loss prevention brought about by insurance can, in principle, be seen as a beneficial effect. When insurance under equivalence rating is cheaper than prevention there is no reason to denounce a substitution of these two activities a moral hazard. Cruciger

(1921, p. 6n.) reports an interesting example from Hamburg's merchant fleet. For a long time, the fleet used to be accompanied by convoy ships whose task was to protect it against piracy. The maintenance of the convoy ships was expensive, though, and so there is small wonder that the introduction of an efficient insurance system in the 18th century rendered the convoy ships superfluous. Substituting insurance for convoys increased the profitability of Hamburg's merchant fleet and contributed to its success as continental Europe's most important habour.

Equally spectacular examples do not seem to be available for social insurance, since social insurance helps with many different and diffuse risks rather than with well-specified and particular economic risks. Still, there is every reason to suspect that, in principle, beneficial risk taking effects of a similar kind can be expected from social insurance, too. Under the protection of the welfare state people can avoid costly private protection measures like precautionary saving, job diversification, ultra-tenured employment contracts, offspring maximization or health fetishes. And they can dare to change jobs, to move to another house, to seek employment in risky industries, to open their own business, or to engage in a risky but profitable investment in human capital. The persistent structural change associated with industrial development would certainly face more resistance than it does if the welfare state did not spread its safety net to protect the large numbers of losers typically brought about by such a change. Interestingly enough, even the Venetian merchant fleet was not protected only by the newly created private insurance business, it received substantial public protection, too. While private insurance covered the loss of cargo, the galleys were owned by the state, which completely absorbed their risk of loss and destruction.

The risk taking effects of market and social insurance are similar but not identical. To analyze the differences formally, let us assume a conventional formulation of a decision problem under uncertainty well known in the insurance literature,[7] but represent the choice problem in $\mu-\sigma$ space in order to be able to speak meaningfully about "risk taking." The $\mu-\sigma$ formulation can be used without any loss of generality, if it is assumed that all distributions belong to the same linear distribution class. Any von Neumann-Morgenstern utility function can be exactly represented by indifference curves in $\mu-\sigma$ space that are well behaved and have properties that relate in an obvious way to the properties of the respective von Neumann-Morgenstern function.[8] Neither quadratic utility nor normality in the distributions has to be assumed.

Let m be a family's income in the case of good luck, e its effort in the sense of loss prevention expenses, and L the random loss. "Prevention expenses" should, in the present context, best be thought of as a family's educational effort before the adulthood of its offspring. For the time being effort is assumed to be a loss of (taxable) market income. Section 4. analyzes the case where effort is a loss of (non-taxable) non-market income. Without insurance, income is

$$Y = m - e - L \qquad \text{(no insurance)}. \tag{1}$$

It is assumed that

$$L = \lambda(e)\,\theta \tag{2}$$

where λ ($\lambda' < 0$, $\lambda'' \geq 0$, $\lambda' \to -\infty$ as $e \to 0$) is a function reflecting diminishing marginal returns to effort and θ ($\theta \geq 0$) is the random state of nature.

Now suppose there is an ideal *market insurance* covering the fraction τ of the losses and costing a premium p. An ideal market insurance is defined such that the premium is "fair" in the sense of covering the individual's expected loss, not only in a symmetrical market equilibrium, but also when the individual decides to deviate from this equilibrium. With ideal insurance, income becomes

$$Y = m - e - L(1 - \tau) - p \qquad \text{(market insurance)} \tag{3}$$

where[9]

$$p = \tau \cdot EL \qquad \text{(market insurance).} \tag{4}$$

Abstract from the fact that, for the reasons explained, market insurance is not available for the kinds of risk considered.

Suppose alternatively that there is *social insurance* through redistributive taxation where is now the tax rate. Post tax income is

$$Y = (m - e - L)(1 - \tau) + t \qquad \text{(redistributive taxation).} \tag{5}$$

The variable t is a non-stochastic transfer (monetary and public goods) from the state, which has to satisfy a balanced budget requirement. In the case of a symmetrical equilibrium with identical individuals this requirement becomes

$$t = \tau(m - e - EL) \qquad \text{(redistributive taxation).} \tag{6}$$

Equation (6) ensures that each individual receives a fair transfer in the sense that its expected net contribution of resources to the state is zero. This resembles the fair insurance condition (4). A crucial difference, however, is that, unlike the insurance premium p, the transfer t cannot be tailored to the individual's behavior. If one individual deviates from the other individuals' prevention behavior, it will have to reckon with a violation of equation (6) in the sense that its expected net contribution of resources to the state deviates from zero.

It is assumed that the individual risks are stochastically independent so that the law of large numbers ensures that any residual risk remaining with the insurance companies or the government is negligible in a large economy. With positively correlated risks there is no, or only little, scope for insurance, and with negatively correlated risks consolidation is particularly easy. The assumption of stochastic independence is a special, but not an implausible, assumption, lying in the middle of the spectrum of possibilities.

Equations (1)–(6) imply different choice sets in $\mu-\sigma$ space whose shapes depend on the way effort affects the loss distribution and the way losses are insured.

Consider first the problem of how the individual's probability distribution of income gross of insurance is affected. The pre-insurance mean and standard deviation are given by

$$\mu = m - e - \lambda(e)E\theta \qquad \text{(no insurance)} \tag{7}$$

and

$$\sigma = \lambda(e)R\theta \qquad \text{(no insurance)} \tag{8}$$

where R is the standard deviation operator. Denote the opportunity set described by (7) and (8) the "self-insurance line." The self-insurance line is represented in Figure 2. Its slope is

$$\frac{d\mu}{d\sigma} = \frac{\partial\mu/\partial e}{\partial\sigma/\partial e} = \frac{-\dfrac{1}{\lambda'(e)} - E\theta}{R\theta} \qquad \text{(no insurance).} \tag{9}$$

Obviously, the self-insurance line is concave and has a maximum where $\lambda'(e)E\theta = -1$. This is the point where the cost of a marginal unit of effort equals the expected loss reduction it brings about. Increasing effort means moving from right to left along the self-insurance line. There is always a reduction in risk and in the expected loss with such a move, but the reduction in the expected loss will only be able to overcompensate the cost of effort in some initial range.

In the absence of insurance the individual will pick a point like T where an indifference curve is tangent to the self-insurance line. The point is to the left of the maximum, indicating that the individual choses more effort than necessary to maximize income. Obviously, risk aversion—the positive slope of the indifference curve—implies that some expected income is sacrificed in order to lower the risk. To turn it the other way round, the individual operates at a point of his efficiency frontier where a little more risk tolerance would generate a little more expected income.

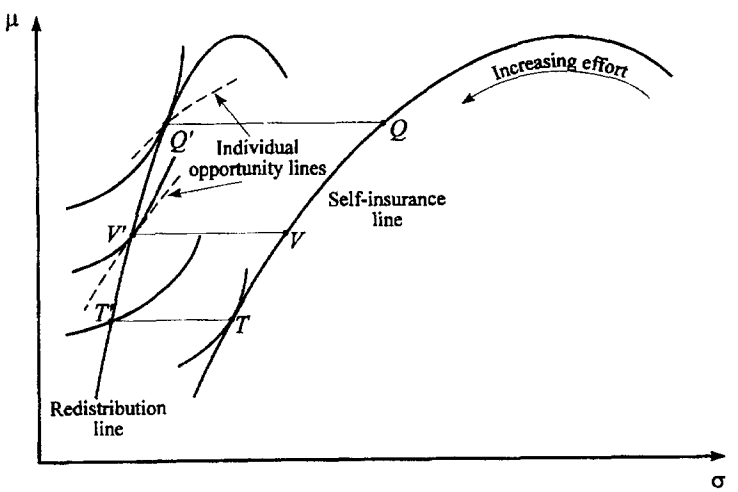


Figure 2. Risk productivity, ideal insurance, and redistributive taxation.

There are two interesting aspects of this simple result. The first aspect is that risk taking is productive. The reason for the productivity of risk taking is the same as the reason why, in general, the marginal productivity of factors of production is positive. Because the use of a factor is an unwanted activity, a firm operates at a point of its opportunity set where it compromises between the goal of minimizing this activity and maximizing another activity which is wanted. Increasing the unwanted activity a little makes it possible to increase the wanted one too: the unwanted activity is productive. Think of the old debate between von Böhm-Bawerk (1888, pp. 328–362) and Fisher (1907, pp. 64 n.) about the productivity of "waiting" (which we today call capital). Fisher showed nicely that it is only the preference for not waiting which explains why waiting is productive. Seen this way, Pigou (1932, pp. 771–781) was right when he called risk a "factor of production" with the same status as the better known factors like capital and labor.

The second interesting aspect of the result is that market insurance and redistributive taxation may be able to bring risk productivity into operation. If risk aversion is the reason for a positive marginal productivity of risk, then an effective reduction of this aversion through insurance will increase the expected income.

Consider the ideal market insurance first. From (2), (3), and (4) it follows that expected income and its standard deviation are given by

$$\mu = m - e - \lambda(e)E\theta \qquad \text{(ideal market insurance)} \tag{10}$$

and

$$\sigma = (1 - \tau)\lambda(e)R\theta \qquad \text{(ideal market insurance).} \tag{11}$$

The equations indicate that ideal market insurance does not change the mean, but reduces the standard deviation of income. For reasons that will become clear in a moment denote the opportunity set resulting from (10) and (11) the "redistribution line." With ideal market insurance, the redistribution line is the individual opportunity locus of decision alternatives as perceived by the insuree. The redistribution line is represented in Figure 1. It can be constructed from the self-insurance line by shifting each point horizontally towards the abscissa where the percentage move equals the degree of coverage. The slope of the redistribution line equals

$$\frac{d\mu}{d\sigma} = \frac{1}{1 - \tau} \cdot \frac{-\dfrac{1}{\lambda'(e)} - E\theta}{R\theta} \qquad \text{(ideal market insurance).} \tag{12}$$

A comparison with (9) shows that, with any given effort level, the slope is $1/(1 - \tau)$ times the slope of the self-insurance line. The individual's optimum on this line is a point like Q' which is the analogue of point Q on the self-insurance line. If the individual did not change his behavior, insurance would result in point T'. Q' is above T', since at point T' the indifference curve is flatter and the redistribution line is steeper than at T, indicating that the point of tangency is above T'.

Before this result is interpreted, consider the case of *redistributive taxation* next. If (6) is inserted into (5) the individual's choice problem obviously becomes isomorphic with the choice problem under ideal insurance, as represented by (3) and (4). However, as noted already, such procedure would not make sense since it is the characteristic of redistributive taxation that the individual cannot affect the amount of transfers or public goods received through a manipulation of the taxes he pays. Thus the "individual opportunity line" in the case of redistributive taxation is only given by (5) where (6) is just an equilibrium condition which has to hold but which the individual cannot incorporate into his own decision problem other than by taking the right amount of t as given. The mean and standard deviation of (5) are given by

$$\mu = [m - e - \lambda(e)E\theta](1 - \tau) + t \qquad \text{(ideal redistribution)} \tag{13}$$

and

$$\sigma = (1 - \tau)\lambda(e)R\theta \qquad \text{(ideal redistribution).} \tag{14}$$

Depending on the level of t, these equations imply alternative individual opportunity lines as illustrated in Figure 1. The slope of these lines is again given by

$$\frac{d\mu}{d\sigma} = \frac{-\frac{1}{\lambda'(e)} - E\theta}{R\theta} \qquad \text{(ideal redistribution),} \tag{15}$$

as in the absence of taxation [see equation (9)]. Thus the slope at any given point of the individual opportunity line is equal to the slope at the corresponding point of the self-insurance line. This is illustrated in Figure 2 for two alternative positions of the individual opportunity line. The individual opportunity line can be seen as resulting from a parallel leftward shift of the self-insurance line.

A redistributive equilibrium is a situation where the individual has made his optimal choice and the government has chosen its transfer so as to balance its budget. In the figure this is a situation where an individual opportunity line is tangent to an indifference curve and where, at the same time, this point of tangency is located on the redistribution line. It must be on the redistribution line since (5) and (6) imply that only on this line is the government budget balanced, given the tax rate. The redistributive equilibrium is in a point like V'. V' is above T' since at T' the indifference curve is flatter than at T while the individual opportunity line has the same slope as at T. V' is below Q', since at Q' the redistribution line has the same slope as the indifference curve, but the individual opportunity line has always a lower slope than the redistribution line.

The interpretation of this result is straightforward if one decomposes the move from T to V' into a move from T to T' and from T' to V'. The two components indicate a double benefit from redistributive taxation. The first is the insurance effect. People's expected utility increases, since part of their uncertainty is removed. The second is the risk taking effect. People prefer to translate part of the gain in safety into a higher expected income by taking more risks. This in itself increases expected utility a second time. Although in the case

considered the increase in risk taking comes about through a reduction in the self-insurance effort, the effect cannot be considered as a moral hazard effect. A moral hazard effect would reduce everyone's expected utility in a symmetrical equilibrium. The risk taking effect makes everyone better off. Both the insurance effect and the risk taking effect are strict Pareto improvements.

While the risk taking effect is welfare increasing it is not large enough. This becomes clear if the allocation is compared with a Pareto optimal allocation. Given the rate of coinsurance τ, the constrained Pareto optimum is at Q', the point reached with ideal insurance. Ideal insurance is one where the insurer tailors the premium precisely to the action the individual choses. This implies that insurance creates a double incentive for risk taking: the required marginal compensation for risk taking (the indifference curve slope) declines with a reduction in risk and the marginal return to risk taking [the right-hand side of (12)] increases. The individual perceives the redistribution line as his feasible opportunity set.

In contrast, redistribution only creates the first type of incentive, the decline in the required marginal return to risk taking. In order for redistributive measures to create the second type as well it would be necessary to tailor the public transfer t to the individual action, which is an unrealistic requirement.

While risk taking is too small under redistributive taxation, the effect as such is unambiguous. This is in striking contrast to the verdict by Feldstein (1969) and Stiglitz (1969) that once ended the discussion about the Domar-Musgrave effect. Both authors found the risk taking effect to be ambigous under a general class of von Neumann-Morgenstern utility functions, but it is important to realize that they considered fiscal rather than redistributive taxation; i.e., a taxation where the tax payer does not in any sense enjoy the benefits from the public expenses which he finances. Under fiscal taxation the expected income declines which, in itself, increases the required marginal compensation to risk taking when the utility function exhibits decreasing absolute risk aversion. Under redistributive taxation this effect is absent since the expected income is not changed. A formal proof that the required marginal compensation to risk taking will indeed fall when σ decreases while μ is constant is given in Sinn (1990).[11]

4. Moral Hazard

The previous section analyzed risk taking under idealized conditions. The ideal insurance was one with equivalence rating where the premium was tailored to the individual decision, and the ideal redistribution was such that the tax base was identical with the argument of the individual's utility function. The tax that comes closest to the one analyzed is a cash flow tax for business investment where, however, all variables would have to be interpreted in present value terms.

In many respects, reality is remote from the ideal situation analyzed. Community rating is typical for many market insurance situations, because the insurer has inferior knowledge of the individual's actions, and imperfect deductibility of effort is a typical problem for tax systems.

Effort can have many more dimensions than are captured by equation (2). Equation (2) depicts the role of effort ex ante, before the dice of destiny are cast. Equally important

is effort ex post, when the uncertainty has been resolved. Actually, most of the conventional theory of tax distortions concentrates on this type, and to analyze it here would mean bringing coals to Newcastle. In principle, ex post moral hazard (or tax distortions under certainty) would have to be represented by downward shifts of the self-insurance and redistribution lines.

For the purposes of this exposition, it may instead be useful to concentrate on the problems resulting from distorting ex-ante effort as analyzed in different contexts by Ehrlich and Becker (1972), Shavell (1979) and Sinn (1978). Assume that effort is no longer a loss of market income but leisure or non-market income given up for the purpose of controlling risk. Let n be the total amount of leisure or non-market income available. Abstract from the multidimensionality of the problem by assuming that income, effort, leisure or non-market income, losses, and public transfers can all be expressed in terms of the same good. Admittedly this is a courageous assumption for a tax theorist, but it is one that helps concentrate on the distortion in risk taking. The tax is now an idealized version of a labor income tax with a labor-leisure distortion. Instead of (5) and (6) one gets

$$Y = (m - L)(1 - \tau) + n - e + t \tag{16}$$

and

$$t = \tau(m - EL). \tag{17}$$

Using (2), the mean and the standard deviation become

$$\mu = [m - \lambda(e)E\theta](1 - \tau) + n - e + t \tag{18}$$

and

$$\sigma = (1 - \tau)\lambda(e)R\theta. \tag{19}$$

The corresponding slope of the individual opportunity line is

$$\frac{d\mu}{d\sigma} = \frac{1}{1 - \tau} \cdot \frac{-\frac{1}{\lambda'(e)} - (1 - \tau)E\theta}{R\theta}. \tag{20}$$

Note that t has to be taken as given in the derivation of the individual opportunity line. A redistributive equilibrium, however, must satisfy (17) and so the solution where an indifference curve is tangent to the individual opportunity line must again be on the redistribution line. [Equations (16) and (17) yield the same opportunity set in $\mu-\sigma$ space as (3) and (4) or (5) and (6)]. Figure 3 illustrates the solution.

A comparison between (20) and (12) shows that with $\tau > 0$, the slope of the individual opportunity line with moral hazard will always be larger than that of the redistribution line which, as was shown earlier, itself exceeds that of the individual opportunity line without moral hazard. This implies that effort is too small relative to a constrained Pareto optimum

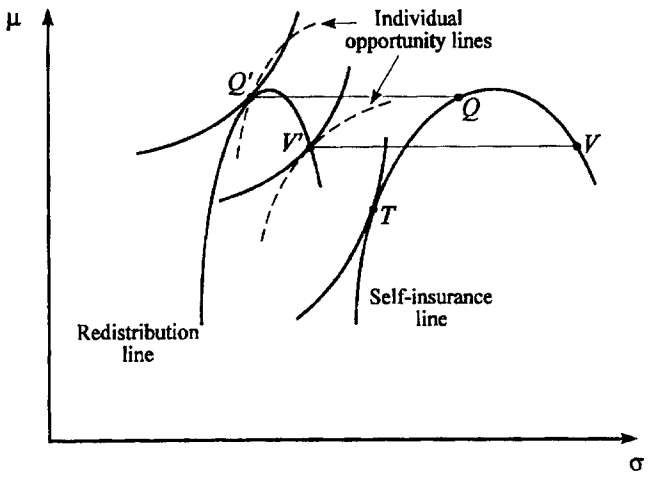


Figure 3. Moral hazard.

given the tax rate, and there is too much risk taking. The solution may even be to the right of the maximum of the redistribution line (and of the self-insurance line) as illustrated in the figure.

It is now no longer clear that risk taking is beneficial, and it is even possible that there is a net loss of utility from the imposition of the welfare state. Figure 4 illustrates this. In the limit as $\tau \to 1$, the redistribution line converges to a straight line on the ordinate such as $B'V'$ where the indifference curve slope is zero.[12] Clearly, setting (20) equal to zero and letting τ approach unity implies that $\lambda' \to -\infty$ and $e = 0$. The individual makes no effort, the pre-tax distribution is represented by V, and the post-tax distribution is rep-

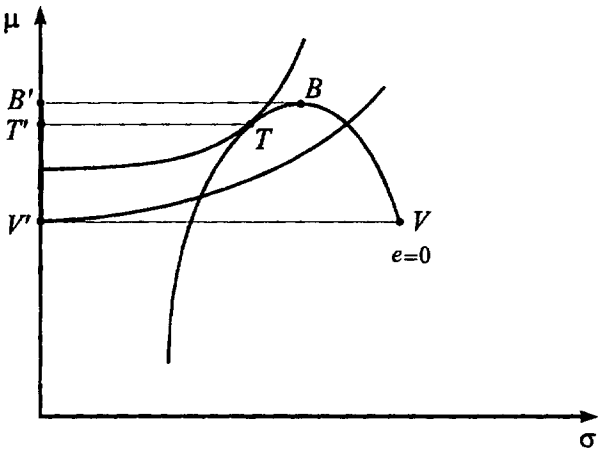


Figure 4. The execessive welfare state.

resented by V'. V' is on a lower indifference curve than the laissez-faire optimum T. The overdrawn welfare state creates net welfare losses which is what the critics of the welfare state seem to have in mind.

To conclude the discussion of moral hazard note that in this case, and only in this case, the tax problem becomes isomorphic with the insurance problem. Moral hazard in the insurance problem results from community rating which implies that the premium is not tailored to the individual action while the insurance company's budget constraint, equation (4), still has to hold in an insurance equilibrium. If the companies cannot observe the individual actions, they can still use experience rating to make sure that (4) is satisfied and their expected indemnification costs are covered. Calculating μ and σ for (3) with given p gives the same expression for the slope of the individual insurance line under market insurance as (20) and therefore the same type of excessive risk taking solution as under redistributive taxation without deductibility of effort.

Taken together, the results of this and the previous section suggest that there is a chance to design a tax system where, despite imperfect deductibility of effort, the optimal amount of risk taking may be generated. With a full deductibility, there is too little risk taking. With no deductibility, there is too much risk taking. There should be an intermediate solution where redistributive taxation is able to generate the optimal amount of risk taking as could be expected from ideal insurance with equivalence rating.

5. Redistribution and Inequality

There is an extensive literature on the effect of taxation on inequality, but nearly all contributions assume a fixed pre-tax distribution and disregard possible repercussions from redistributive taxation to the pre-tax distribution of incomes.

There are a number of possibilities for such repercussions, all having in common that pre-tax incomes become more unequal when the government tries to equalize post-tax incomes. One possibility is simply that the supply of the taxed factors of production is elastic so that the tax burden can be fully shifted to the inelastic factors and the net-of-tax rewards of the taxed factors stay constant. A small open economy is a particularly good example for this case. Another possibility is that efficiency wages require a given net-of-tax distribution of incomes so as not to violate the non-shirking constraints. A third possibility is that tax-induced risk taking makes the pre-tax distribution more unequal. Kanbur (1979) has considered this case in a model with risky occupational choices and intersectoral migration, and there is also a discussion of related phenomena in Boadway and Wildasin (1990). The first to have used this argument seems to have been Friedman (1953).

The easiest possibility for modelling the problem is to assume that there is an economy with ex-ante identical individuals who have the same preferences and who are endowed with the same set of probability distributions from which they can make their choices. If it is assumed that the probability distributions are stochastically independent across the individuals, in a large economy it will turn out that the realized income distribution is identical with each person's chosen probability distribution. If, say, the chosen probability distribution indicates that the probability of having an income of between \$100.000 and \$101.000 is three percent, then the percentage of people whose income turns out to be

in this range is just this three percent. The law of large numbers converts a probability ex ante into a relative frequency ex post.

If we apply this idea to the choice problems analyzed in the two previous sections it turns out that μ and σ are not only the mean and standard deviations of the probability distributions faced ex ante, but also the average per-capita income and its standard deviation as realized ex post. The trade-off between expected income and risk turns out to be a trade-off between average income and equality, and the indifference curves become social indifference curves representing unambiguously the society's evaluations of income distributions. The point where an indifference curve enters the ordinate indicates Atkinson's (1970) "equally distributed equivalent income" for all income distributions located on this indifference curve.

Ideal redistribution as analyzed in section 3, makes the pie bigger and its pre-tax distribution more unequal. Moral hazard as analyzed in section 4, may or may not bring about further increases in the size of the pie, but it will definitely make pre-tax inequality even larger.

However, how post-tax inequality will be affected, is not clear because the insurance and risk taking effects counteract one another.

If the self-insurance line is strongly curved in the relevant range there is little scope for changes in pre-tax risk, and the insurance effect will dominate. In the extreme case one may think of a kink in the self-insurance line which implies that the individual does not react to an increase in redistributive taxation, and only the insurance effect prevails. If, on the other hand, the self-insurance line is sufficiently straight, i.e. if there are approximately constant returns to risk taking, the opposite may be true. Figure 5 illustrates this case.

Abstract for a moment from moral hazard and consider the case of ideal redistribution. The redistribution line is now linear, too, and it has a slope $1/(1 - \tau)$ times that of the self-insurance line [c.f. (12) and (15)]. While the laissez-faire solution is T on the self-insurance line, the redistributive equilibrium is characterized by a point on the redistribution

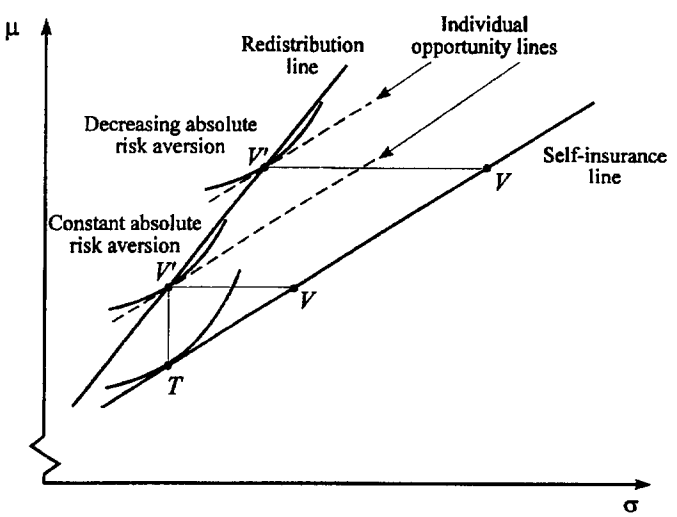


Figure 5. The redistribution paradox.

line where an indifference curve is tangent to one of the dashed individual opportunity lines. The individual opportunity line has the same slope as the self-insurance line [c.f. (9) and (15)] but, depending on the level of public transfers, it can have different positions.

The interesting question is whether the solution point is to the right or to the left of the laissez-faire point T; i.e., whether redistributive taxation increases or decreases post-tax inequality. The answer depends on whether absolute risk aversion is an increasing or a decreasing function of expected income, because the direction in which absolute risk aversion changes with an increase in μ is the same as the direction in which the indifference curve slope changes when μ increases, given σ.[13] In the borderline case where absolute risk aversion is constant, the point of tangency, V' in the figure, happens to be vertically above the laissez-faire point T, which indicates that redistributive taxation will not affect the post-tax inequality of incomes.

In the realistic case of decreasing absolute risk aversion, the indifference curve slope declines if μ increases with given σ, and so the point of tangency with an individual opportunity line must be to the right of the laissez-faire point T. There is a "redistribution paradox." Redistributive taxation makes the post-tax income distribution more unequal because people prefer to translate more than 100% of the increase in safety and equality into risk taking in order to be able to enjoy a larger size of the pie.[14]

While this paradoxical result has been derived under the assumption of ideal redistributive taxation, it is immediately obvious from the discussion of the previous section that it will hold a fortiori if there is a moral hazard effect in terms of excessive reduction in prevention effort and, correspondingly, excessive risk taking and inequality. Thus it seems that, under the conditions analyzed in this paper, the only crucial assumption necessary for the taxation paradox to hold is constant returns to risk taking. Future research will have to clarify to what extent this particular feature can be expected in real choice problems under uncertainty.

Regardless of how post-tax inequality changes, it will always be true in the present model that pre-tax inequality rises when there is more redistributive taxation. This aspect sheds new light on the positive correlation between income inequality and redistributive taxation that has found so much attention recently in papers by Alesina and Rodrik (1994), Perotti (1992), and Persson and Tabellini (1994). These authors argue that a high level of pre-tax inequality implies a political equilibrium with high redistributive taxes which, since taxes on capital income are included, tends to reduce the growth rate of the economy. The present analysis is not a contradiction to this view since an optimally designed welfare state may indeed react to an exogenous increase in the riskiness of the individual's pre-tax opportunity set (a rightward shift of the self-insurance line) with a tax increase. However the present analysis makes it clear that the causality could also be the reverse of how the authors interpret their empirical findings. More inequality in pre-tax incomes may well be the result rather than the cause of more redistributive taxation.

6. The Optimal Tax Problem

What do we learn from the foregoing analysis for the design of an optimal redistributive tax system?

An important, but not very surprising lesson is that the tax base should coincide as closely as possible with the argument of people's utility function. This means, in particular, that

effort should be deductible. It is true that risk taking would be too small under such conditions, but the policy would definitely avoid the severe allocation problems that otherwise will have to be expected. It would err on the right side, since risk taking would always be welfare increasing relative to the situation where tax payers do not change their behavior. Cash flow taxes, and all taxes that allow for an immediate deduction of investment expenses and other outlays, would be optimal, but the income tax in its usual form would be less desirable. On the one hand, depreciation pro rata temporis means that, in present value terms, there is imperfect deductibility of "effort" in terms of investment outlays. On the other hand, labor income taxation fails to make allowance for the leisure given up, perhaps the most important "effort" involved.

As little can be done about the distortions in the labor leisure choice and a number of other distortions, there is a problem of optimal redistributive taxation balancing the advantages and disadvantages at the margin.

Suppose, the moral hazard model of section 4 applies and the government wants to choose a tax rate so as to maximize the representative agent's expected utility, knowing what this agent's reactions are. Clearly it will be true, as is well-known from similar problems in the insurance literature,[15] that the optimal coinsurance rate is between zero and one. In the present context, the first bit of redistributive taxation has a positive first order effect on utility via the insurance effect but, since risk taking is optimal when there is no taxation, only a second order effect via the resulting change in risk taking. And the last bit of redistributive taxation, when τ has approached unity, will reduce utility via a reduction in expected income but will not be able to change utility due to a change in post-tax risk, because there is no risk aversion in the small (the indifference curves enter the ordinate perpendicularly).

A more interesting question is what the optimality condition says. In principle, there are two possibilities for an optimal redistributive tax system. They are illustrated in Figures 6 and 7. For any given tax rate τ there is a well-specified redistribution line as illustrated

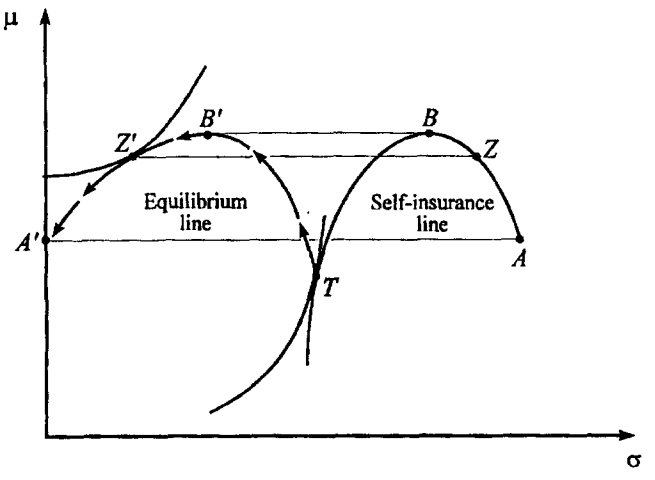


Figure 6. The optimal tax problem.

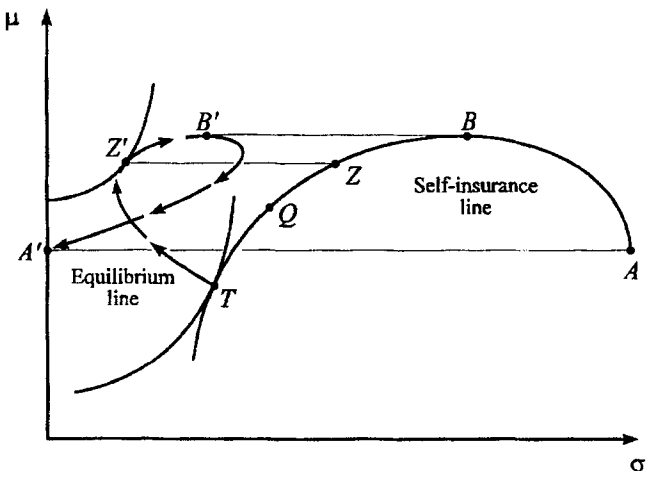


Figure 7. Optimal taxation and the redistribution paradox.

in Figures 2 and 3 with a unique redistributive equilibrium. Plotting the alternative equilibria resulting from different tax rates gives the arrowed curves shown in Figures 6 and 7 which may be called "equilibrium lines." A movement along an equilibrium line following the arrows indicates an increase in the tax rate. The optimal tax rate is reached in a point like Z' where the equilibrium line is tangent to an indifference curve.

A continued increase in the tax rate τ implies that the pre-tax distribution changes as described by a rightward movement along the self-insurance line, while the post-tax distribution changes as described by the equilibrium line. In Figure 6, the optimal pre-tax distribution is characterized by a point like Z which is to the right of the maximum. In the optimum, a small tax increase reduces average income, increases pre-tax inequality and reduces post-tax inequality.

In Figure 7, the optimum is to the left of the maximum of the self-insurance line, because the equilibrium line performs a loop. Such a loop is possible if the self-insurance line is, in parts, fairly straight so that the conditions for the taxation paradox apply. By definition, the taxation paradox characterizes a situation where the arrowed equilibrium line bends to the right. In an optimum like that shown in Figure 7, a small tax increase will increase average income as well as pre-tax and post-tax inequality.

It is unclear which of these two constellations will hold in reality. However, whichever does, it is clear that in an optimal redistributive tax system one of two seemingly paradoxical constellations must prevail. Either it is true that the economy operates at a point of its technological efficiency frontier (the self-insurance line) where less inequality results in a larger pie, or it is true that more redistribution makes post-tax incomes more unequal.

7. Conclusions

This paper has adopted the view that redistributive taxation can be seen as social insurance that provides protection against the risks of lifetime careers for which, for the reasons given

in section 2, no private insurance is available. Social insurance is a mutual assistance that involves a resource transfer from the lucky rich to the unlucky poor which is welcomed by parents before the veil of ignorance covering the destiny of their children has been lifted. It cannot be provided privately unless the fundamentals of western civil law are called into question.

While much is known about a myriad of negative incentive effects created by the welfare state, it seems that its more beneficial risk taking effects have not been well understood. This paper has tried to shed some light on the issue. At a time when the welfare state is being rolled back in many countries, this may be an effort worth undertaking.

Notes

1. Sandmo (1991) shows that because of the distortions created by income transfers an efficient redistribution system will always include the free provision of public goods. The question of whether income distribution should or will be carried out in the form of cash, in-kind transfers or genuine public goods is not treated in this paper.
2. A related analysis without a consideration of optional tax problems can be found in Sinn (1981).
3. The t-value for the latter regression is 1.94 while it is only 0.6 for the former. The crowding out effect in the former (non-significant) case is only 7%. When only private health, accident, and life insurance is considered, the regression coefficient with regard to total government outlays is more significant (t = 2.2), but has only a value of 0.11.
4. Atkinson (1991) denies this argument pointing to the fact that often bad risks are rejected by the insurance companies. This observation is probably due to pooling contracts enforced by the government and regulating agencies. It does not contradict the fact that adverse selection is a major reason for the non-existence of risk markets. For an explicit treatment of adverse selection in a two-stage lifetime-risk model see Sinn (1996).
5. A related argument has been made by Christiansen (1990).
6. A more detailed discussion of the role of insurance for the Venetian development can be found in Sinn (1988).
7. See, e.g., Ehrlich and Becker (1972), Shavell (1979), and Sinn (1978).
8. The probability distributions among which an individual can choose form a linear redistribution class if they are all similar in the sense that they can be transformed into one another by shifts of, and proportional expansions around, the mean. More technically speaking y' and y'' belong to the same linear class if $y' = \mu' + \sigma' z$ and $y'' = \mu'' + \sigma'' z$ where z is a common standardized distribution and the μ's and σ's represent the respective means and standard deviations. Most theoretical decision problems under uncertainty analyzed in the literature using the expected utility approach are confined to linear distribution classes. See Meyer (1987) and Sinn (1983, 1990) for the details.
9. Throughout the paper E is the expectation and R is the standard deviation operator.
10. For further discussions of this theme see Konrad (1992) and Sinn (1986).
11. The proof allows for declining, constant, and increasing absolute risk aversion provided that the increase is not "faster" than with the "fastest" quadratic utility function compatible with the assumption of increasing marginal utility in the relative range. Since no one ever has found, proposed, or used a utility function whose absolute risk aversion increases faster than with a quadratic utility function nearly perfect generality of the proof can be claimed.
12. This is a general property holding for all von Neumann-Morgenstern functions. See Sinn (1983).
13. See Sinn (1983, p. 116 n).
14. Note that inequality is here defined in absolute rather than relative terms. If inequality is measured by the coefficient of variation, μ/σ, the borderline case where μ/σ stays constant despite an increase in redistributive taxation is characterized by constant relative risk aversion which implies a homothetic indifference curve system.
15. See, e.g., Shavell (1979).

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