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The selection principle and market failure in systems competition

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Abstract

If governments stepped in where markets failed, reintroducing markets through the backdoor of systems competition will again result in market failure. Three models are presented which illustrate this wisdom. The first is concerned with congestion-prone public goods and shows that fiscal competition may be ruinous for the governments. The second considers the insurance function of redistributive taxation and shows that systems competition may suffer from adverse selection. The third studies the role of quality regulation and shows that systems competition may be a competition of laxity resulting in inefficiently low quality standards. © 1997 Elsevier Science S.A.

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1. Introduction

Europe has dismantled its internal borders in order to grant the "four liberties" to its citizens and firms: capital, services, labour and goods are now allowed to move freely across borders. The new liberties will help improve the allocation of resources and exploit the gains from trade, but they may also have considerable

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repercussions on the European nation states because they initiate a period of intense systems competition. Countries will compete for mobile factors of production and tax bases and face strong pressures to reform their fiscal and regulatory systems.

It has often been argued that systems competition is comparable to competition in private markets. Indeed, following Tiebout (1961), a broad literature has developed which has tried to find the analogy to the Main Theorem of Welfare Economics or the Invisible Hand for the case of systems competition.[2] Governments are seen as firms which compete with one another by offering attractive packages of services and tax prices and, although they are driven by national goals, competition makes them behave in a way compatible with an international welfare optimum. Thus the new Europe should grow out of competition between the existing nation states. No central government is needed and harmonization of its fiscal and regulatory systems is in no way desirable. It is believed that a beneficial new order can emerge from the anarchy of uncoordinated national actions.

This paper comes to a different conclusion. It rejects the view that competition among governments resembles competition among private firms because governments undertake a variety of economic activities which cannot be handled satisfactorily by competitive markets. Since governments have stepped in where markets have failed, it can hardly be expected that a reintroduction of a market through the backdoor of systems competition will work. It is likely to bring about the same kind of market failure that justified government intervention in the first place.

Of course there are, in reality, many examples of government activities that could be, and should be, handled privately. After all, this is the argument of the privatization literature that has developed after Ms. Thatcher's courageous policy reforms. However, these are exceptions that prove the rule. Even the most stubborn critic of the state must admit that governments normally do not just replicate private activity, but offer services that fill the gaps left by private market operators. Even though the optimal selection of government activities may not yet have been found, a fundamental selection bias towards activities that have proved to be unsuitable for private markets should not be overlooked. The name "Selection Principle" seems to be an appropriate one for this phenomenon.

The paper will discuss three examples of the Selection Principle. The first concerns public infrastructure goods. Such goods cannot easily be produced privately since increasing returns to scale in the provision of these goods implies the non-existence of a competitive equilibrium. The problem of non-existence will be shown to reappear when states, rather than firms, compete with one another.

[2]For surveys see Sandler and Tschirhart (1980), and Mieszkowski and Zodrow (1989). A collection of articles on the issue was published in November 1991 in the Journal of Regional Science and Urban Economics. Seminal contributions include books by Oates (1972), and Wildasin (1986).

The analysis will include both pure and impure public goods in order to allow for a role of benefit taxation. The commonly held belief that fiscal competition implies an equilibrium with underprovision of these goods cannot be confirmed. If there is an equilibrium, there is no underprovision, but if all factors are mobile, there is no equilibrium.

The next example refers to the insurance market. A person's income is a random walk through the course of his life. At birth, or even before birth, a veil of ignorance still covers the person's innate abilities and the abilities to be acquired through education. Governments can therefore provide parents with insurance against the risks associated with their children's lifetime careers by implementing a system of redistributive taxation. By way of contrast, private insurance agencies cannot cover these risks because they can only make contracts with adults. For adults, the veil of ignorance has been lifted so that adverse selection renders a private solution impossible. It will be argued that the same kind of adverse selection problem that excluded private solutions in the first place will reappear at the level of public insurance if free migration between the states is feasible; i.e., if the states are subject to systems competition.

The third and final example discussed in this paper refers to the lemons problem. When buyers know less about the quality of the products consumed than the producers do, market equilibrium will cause qualities to be lower than people would like. To overcome the inefficiency, rational governments may intervene by specifying minimum quality standards in their consumer protection legislation. In the new Europe, the Cassis-de-Dijon principle, according to which a product that is legally produced in one country can be freely exported to any other country, will reintroduce the lemons problem through the back door. If consumers are unable to distinguish 15 different national quality standards per product, there will be a tendency for the individual states to undercut their rivals' standards to give their own industries a competitive advantage. As a result Europe will settle at an equilibrium in which quality standards are inefficiently low.

The examples are discussed in this paper to illustrate the implications of the Selection Principle. They build on existing knowledge and should mainly be seen as an attempt to synthesise divergent strands of economic thought under the common theme of systems competition. The purpose of this paper is not to make a technical point, even though it offers a number of new propositions.

There are different views about how the decisions of national governments engaged in systems competition should be modelled. For the sake of argument, this paper adopts a Public Finance rather than a Public Choice view of the state.[3] Following the traditions of Wagner (1876), and Musgrave (1959), the state is seen as a rational institution which corrects market failure and acts in the interest of its

[3]This does not trivially bias the results against systems competition, since even with an extreme Public Choice view where governments are seen as Leviathans trying to exploit their taxpayers, favourable implications of tax competition are far from self-evident. See Edwards and Keen (1996).

citizens. This view is comparable to the assumptions of rational households and firms in the economic theory of private markets. While the assumption of rational behaviour makes psychologists and business economists nervous, it has proved to be a useful abstraction that prevents economists from confusing the failures of markets and minds or systems and people.[4] Studying systems competition under the assumption of rational states is the same as studying private competition under the assumption of rational individuals. Both are useful abstractions that help identify the sources of market failure.

2. Public goods, congestion charges and systems competition

The discussion begins by studying the role of fiscal competition for the provision of public goods. Can we expect that the competition between rational states which act in the national interest settles at an equilibrium where efficient levels of public goods are produced or is a more pessimistic expectation justified? There is an extensive literature on this subject which has come to very different conclusions. Authors like Gerber and Hewitt (1987), Wildasin (1986), Oates and Schwab (1988), Wellisch (1995), Richter et al. (1996), Hoyt (1991), or Richter (1994), have identified conditions under which an optimistic view would be appropriate, but others have been rather pessimistic. Bewley (1981), argued that increasing returns to scale imply that no competitive equilibrium will exist and Pines (1991), showed that equilibrium may not exist because communities cannot be replicated. Zodrow and Mieszkowski (1986), argue that the mobility of tax bases will lead to an underprovision of public goods.

On the basis of the Selection Principle, the present analysis also comes to a pessimistic conclusion, but it does so for different reasons. It abstracts from Pines's replicability problem and it refutes the Zodrow/Mieszkowski proposition that there will be an underprovision of public goods. Basically, it can be seen as an extension of Bewley's analysis to the case of public goods. Bewley (like Zodrow/Mieszkowski) considered publicly provided private goods. In what follows we will consider genuine public goods instead; i.e. goods which are consumed in common and cannot be divided up among the users. To avoid any obvious bias against a market solution, the analysis will focus on a congestion prone club good which is used by a mobile factor of production. The model will be contrasted with the theory of clubs to specify the assumptions appropriate for systems competition (Section 2.2).

[4]A sociobiologist might argue that a human being is a competitive equilibrium between selfish genes whose efficiency properties are far from justifying the assumption of an economic man, and a business economist may have doubts about whether the internal incentive structures within a firm justify the assumption of profit maximizing behaviour.

2.1. *Fiscal competition with public infrastructure goods*

The club good is a public infrastructure like a highway. Let W denote the capacity (width) of the highway and K the number of uses, say the number of trips per unit of time. There is a unit capacity cost ρ and an average user cost c. The user cost is an increasing function of K and a decreasing function of W: $c = c(K,W)$, $c_K \geq 0$, $c_W < 0$, $c_{WW} > 0$. In the case $c_K = 0$ the good is a pure public good in the Musgrave–Samuelson sense without any rivalry in consumption, in the case $c_K > 0$ it is an impure public good which is subject to congestion. As $c \cdot K$ is the total user cost, the marginal social user cost resulting from an individual trip is $c_K K + c$ where $c_K K$ is the marginal crowding externality and c is the marginal private user cost. The specification is due to Mohring and Harwitz, 1962, and it is well known in the literature on crowding externalities.[5]

The public good is an intermediate good which complements a mobile factor of production, say capital, which, together with another factor, say labour, is used for the production of a final good. Assume that the number of uses of the intermediate public good, K, is equal to the amount of capital invested and denote the amount of labour L. The production function for the final good, $f(K,L)$, is linearly homogenous and well behaved.

The country considered is small and behaves competitively in the international capital market where it faces a given net-of-tax rate of interest r. Due to a lack of international cooperation, only a source tax on capital at rate τ and a wage tax at rate σ are available. Assume for a moment that labour is not internationally mobile and is inelastically supplied. Domestic residents own some given amount of wealth, $\bar{K}$, which they may or may not supply to the domestic market. Since all countries are assumed to be identical, any symmetric equilibrium will be characterized by equality between capital and wealth, $K = \bar{K}$.

Capital is invested up to the point where its marginal product equals the sum of the interest, private user and tax cost,

$$f_K(K,L) = r + c(K,W) + \tau, \tag{1}$$

and the wage tax is chosen so as to balance the budget:

$$\sigma L = \rho W - \tau K. \tag{2}$$

Taking (1) and (2) as a constraint, the government chooses τ and W so as to maximize the rent, R, that accrues to domestic residents. R equals the sum of labour and capital income minus the wage tax:

$$R = (f - f_K \cdot K) + r\bar{K} - \sigma L. \tag{3}$$

[5]Cf. especially Oakland (1972), and Boadway (1980). For formally somewhat different approaches to the congestion problem see Wildasin (1986), Richter (1994), or Berglas and Pines (1981).

Substituting from (1) and (2), Eq. (3) can be transformed into

$$R = f(K,L) - r(K - \bar{K}) - c(K,W)K - \rho W. \tag{4}$$

Due to the infinite elasticity of the international supply of capital, the fixed factor (labour) bears not only the cost of providing the public infrastructure, but also its user cost, $c \cdot K$.

Since (1) implies that K is a monotonically declining function of τ, an equivalent version of the government's optimization problem is the maximization of (4) with respect to K and W. The first-order conditions are

$$f_K = r + c + c_K \cdot K \tag{5}$$

and

$$-c_W \cdot K = \rho. \tag{6}$$

Eq. (5) equates the marginal product of capital with its social cost, where the social cost of capital is the sum of the interest cost and the marginal social user cost. Eq. (6) is the Samuelson condition for the provision of public goods. Increasing the capacity of the facility by one unit reduces the individual congestion cost by c_W and will thus increase capital's "willingness to pay" for the public good by the same amount. Summing up the marginal willingness to pay for a capacity increase over all units of capital and equating this sum to the marginal cost of capacity gives Eq. (6).

Comparing (1) and (5) shows that the government chooses a source tax rate that equals the marginal crowding externality:

$$\tau = c_K \cdot K. \tag{7}$$

The choice of the optimal tax rate is illustrated in Fig. 1. The figure refers to a symmetric equilibrium where $K = \bar{K}$. It shows the private marginal cost function $c(K,W) + r$ and the social marginal cost function $c + c_K K + r$. The white area between the latter and the horizontal line of height r is the total social user cost and the dark triangle above it is the tax revenue.[6] The other two shaded areas characterize the factor incomes. Given the capital income and given the capacity of the public facility, W, the government wants to choose τ or K so as to maximize the sum of labour income and source tax revenue. Obviously, this is the case when τ equals the marginal crowding externality $c_K K$.

An important question is whether the revenue generated by the optimal benefit tax is large enough to cover the cost of providing the public facility. In the case of pure public goods $c_K = 0$, and it follows from (7) that $\tau = 0$. The optimal benefit

[6] To see this note that $\tau K = (\tau + c)K - Kc = (\tau + c)K - \int_0^K [c(u,W) + c_u(u,W)u]\, du$. The integral is the white area in Fig. 1 which represents the total user cost, and $(\tau + c)K$ is the white area plus the dark triangle above it.

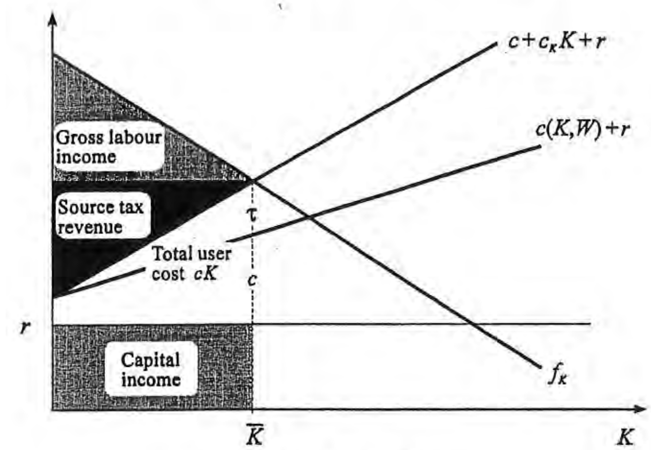

Fig. 1. The optimal benefit tax.

tax is zero and the government does not collect any revenue from capital taxation. The full cost of the public infrastructure provided to the mobile capital will be covered by the tax on the immobile factor.

However, public goods are rarely pure public goods in the Musgrave–Samuelson sense. Typically there is a congestion problem, and perhaps the optimal congestion charge will generate enough revenue. It follows from Euler's theorem that

$$c_K \cdot K + c_W \cdot W = \lambda c \tag{8}$$

where λ is the degree of homogeneity of the user cost function. Inserting the first order conditions (6) and (7) into (8) gives

$$\tau K = \rho W + \lambda c K. \tag{9}$$

This reveals a result which, in a somewhat different context, was first derived by Mohring and Harwitz, 1962, p. 85–87.

Proposition 1: *The optimal congestion charge will cover the cost of providing the public infrastructure if, and only if, $\lambda \geq 0$; i.e., if the congestion cost function has a degree of homogeneity of no less than zero. If $\lambda < 0$, there is a deficit which will have to be covered by the tax on the fixed factor.*

Proposition 1 shows that self-financing of the public infrastructure can be expected if and only if the production/congestion technology does not exhibit increasing returns to scale: doubling both the number of customers and the expenditure for the public good must not result in lower private user costs or, equivalently, doubling the number of customers must require a doubling, or more than a doubling, of the public expenditure in order for the private user cost to stay constant.

2.2. The selection principle and the club equilibrium

The problem is now to sign the degree of homogeneity λ. A look at the theory of clubs as developed by Buchanan (1965), Boadway (1980), Berglas and Pines (1981), and others will help clarify what the Selection Principle implies.

Suppose there are $i=1,.....,n$ identical private clubs that offer the public facility at the respective user charges $\tau_1,...,\tau_n$. In a competitive equilibrium the users are indifferent between the clubs supplying the facilities. The sum, P, of the user charge τ_i and the private user cost $c(K_i, W_i)$ must therefore be the same for all clubs:

$$P \equiv \tau_i + c(K_i,W_i) = \tau_j + c(K_j,W_j)\ \forall i,j = 1,...,n.$$

The single club takes P as given and chooses K_i and W_i so as to maximize its profit, $\max_{K_i,W_i} [P - c(K_i,W_i)]K_i - \rho W_i$. Necessary conditions for an interior optimum are $-c_W K_i = \rho$ and $\tau_i = c_K K_i$. They fully parallel conditions (6) and (7). The private club, too, charges a fee that incorporates the crowding externality and it provides a capacity that satisfies the Samuelson condition for the optimal provision of public goods. Since an application of Euler's theorem again implies an equation like (9), it follows that competitive private markets require $\lambda \geq 0$. If $\lambda < 0$, there is destructive competition. Given the number of uses, K_i, the best a club can do is choose a capacity that satisfies the Samuelson condition. And given the capacity, W_i, the best it can do is charge a fee that fully internalizes the marginal crowding externality. However, neither policy avoids bankruptcy.

If governments do what they ought to do, they will not rival private clubs, but concentrate on the production of those public goods which cannot be supplied privately. Thus the only reasonable assumption for the case of systems competition is $\lambda < 0$

Proposition 2: *The Selection Principle implies that governments concentrate on public goods with $\lambda < 0$. Thus an efficiently chosen congestion charge for the use of public infrastructure does not generate enough revenue to cover the cost of providing this infrastructure.*

While **Proposition 2** was derived by comparing public with private production, the spirit of this proposition can easily be extended to the case of multiple levels of government. Even if infrastructure goods with $\lambda \geq 0$ can be found in the public sector, they should be expected with lower levels of governments, such as local communities or provinces, rather than central governments.[7] The central government will concentrate on goods with scale economies, and hence the assumption $\lambda < 0$ will be appropriate for an analysis of international systems competition.

2.3. Distributional problems

There will be a fiscal deficit from providing the public infrastructure, but why is this a problem? The deficit can be covered by a wage tax, and indeed this is optimal from the workers' point of view. Paying the wage tax necessary to attract capital at dumping prices is a strategy that maximizes the net-of-tax labour income.

One obvious problem concerns the distribution of factor incomes. Even though the policy is optimal for the workers given the competitive environment under which their country operates, they would clearly be better off in the absence of systems competition. Suppose capital owners and wage earners are separate groups, where the latter hold the median voter position and determine the government's policy. In this case, none of the above conclusions would change, however the governments of different countries would have an incentive to collude. A harmonized increase in the source taxes would increase the net-of-tax labour incomes in all countries at the expense of net-of-tax profit incomes without changing national income as a whole.

2.4. Underprovision of public goods?

Another problem may arise if, for whatever reason, the immobile factor cannot be taxed as was assumed by Zodrow and Mieszkowski (1986). It is tempting to believe that this case will result in an underprovision of public goods, and indeed this is what the authors found. However, the result is less robust than it seems. In the present model there is no underprovision.

To see why set $\sigma = 0$ in Eq. (2) and differentiate Eq. (1) and (2) totally to obtain the reaction of capital, K, to an increase in the source tax rate, τ, which is compatible both with the self-financing constraint and the single firm's optimal investment strategy:

[7] The available empirical evidence is confined to local governments, but even there it is ambiguous. The seminal paper on this issue is that by Borcherding and Deacon (1972), who did not find scale economies. Observing a rough proportionality between public expenditure and city size, these authors argued that local governments were typically offering private rather than public goods. However, they did not control for the quality of public goods provided. More recent studies such as that of Brueckner (1981), which include exogenous measures of quality, tend to find scale economies even on the local level. Cf. also Holocombe and Sobel (1995), or Walzer (1972).

$$x \equiv \frac{\mathrm{d}K}{\mathrm{d}\tau} = \frac{1 + c_W \dfrac{K}{\rho}}{f_{KK} - c_K - c_W \dfrac{\tau}{\rho}}. \tag{10}$$

Differentiating (3) with $\sigma = 0$ and setting the result equal to zero gives the following first-order condition for a maximum of total rents:

$$\frac{\mathrm{d}R}{\mathrm{d}\tau} = -x \cdot f_{KK} \cdot K = 0. \tag{11}$$

Assuming that the second-order condition is satisfied,[8] Eq. (11) implies $x = 0$ which according to (10) requires again the Samuelson condition, Eq. (6). While this confirms that an underprovision of public goods does not have to be feared it will of course no longer be true in general that the optimal source tax equals the marginal crowding externality. Inserting (6) into the Euler Eq. (8) and using the self-financing constraint $\rho W = \tau K$ shows that

$$\tau = c_K \cdot K - \lambda c.$$

In the realistic case $\lambda < 0$, τ has to exceed the marginal externality in order to satisfy the self-financing constraint. Thus less capital is employed than in the first best optimum, and with it the volume of public goods provided may also be different. However, given the lower stock of capital the volume of public goods continues to be chosen in line with the Samuelson condition which characterizes a first best optimum.

Of course, this is only a partial equilibrium reaction. If all countries impose a self-financing constraint on their infrastructure policy, they will reduce the world market rate of interest rather than their employment of capital. Thus it follows from (6) that, in the new equilibrium, the same amount of public infrastructure is available as without the constraint, and the only difference is that the fiscal deficit which an efficient source tax would imply is born by capital owners instead of wage earners.

Proposition 3: *Under the assumptions of the present model, a self-financing constraint will not result in an underprovision of public infrastructure even when there are scale economies. It will however increase net-of-tax wage incomes at the expense of capital incomes.*

An intuition for the neutrality result can best be gained by noting that $\mathrm{d}K/\mathrm{d}\tau = 0$ when the infrastructure is optimal and that $\mathrm{d}^2K/\mathrm{d}\tau^2 < 0$ (from footnote 8). In the

[8]The second order condition is $\mathrm{d}^2R/\mathrm{d}\tau^2 < 0$ or, equivalently, $\mathrm{d}x/\mathrm{d}\tau = \mathrm{d}^2K/\mathrm{d}\tau^2 < 0$. Noting that $W = \tau K/\rho$ the condition becomes $\mathrm{d}x/\mathrm{d}\tau = c_{WW}(K/\rho)^2/D < 0$ where D is the denominator of (10). Since $c_{WW} > 0$, the second order condition is satisfied if $D < 0$ as will be assumed.

case of an underprovision of infrastructure an increase in the source tax attracts capital since the benefit from an improved infrastructure more than offsets the deterrence of the tax as such. Thus the fixed factor which is a complement to capital will gain if the tax rate is increased. The rent accruing to this factor is maximized when a marginal tax increase is unable to attract more capital, and this is the case when the Samuelson condition for an optimal supply of public infrastructure is met.[9]

2.5. Existence problems

The problem of systems competition is not the underprovision of public goods. The true problems arise from its distributional implications (Section 2.3.) and, in particular, the risk of destructive competition. Thus far it was assumed that only capital is mobile. The immobility of labour prevented scale economies in the public sector from being translated to the whole economy. What if labour is mobile, too?

It is easy to see that, when labour and capital are mobile factors, a competitive equilibrium will be difficult to achieve. Let us abstract from the self-financing constraint and return to the conditions of Section 2.1. Suppose there is an equilibrium where the net-of-tax wage rate in the country considered equals the respective rate in the international labour market. Let l^*, K^*, L^* and W^* indicate the equilibrium values of this wage rate, the stock of capital, the employment and the public infrastructure. The rent that accrues to the domestic population in this equilibrium is

$$R^* = r\bar{K} + l^* \cdot L^*$$

where, from (4),

$$l^* = [f(K^*, L^*) - rK^* - c(K^*, W^*)K^* - \rho W^*]/L^*.$$

If the equilibrium exists, it must not be possible for the government to increase the income that accrues to the existing population L^*. However, this condition is clearly violated, because the government can always make the existing population better off by increasing the size of the economy. Suppose the government increases W to αW^*, allows an increase in the population to αL^* and chooses τ in

[9]Since Zodrow and Mieszkowski do not consider genuine public goods and abstract from crowding externalities, their analysis is not easily comparable to the one presented here. However, it should be noted that their result is based on the strange *assumption* that a balanced budget increase of the source tax will always drive out capital without seeing that this assumption has direct implications for the question of whether there is an under or oversupply of public goods. Their production function is $F(K, W)$ and their crucial condition (16) which implies that $\mathrm{d}K/\mathrm{d}\tau < 0$, is $KF_{KW} < 1$. Suppose that $F_{KWK} = 0$ and $F_W(0, W) = 0$ which is a special though possible case. Since $KF_{KW}(K, W) = \int_0^K F_{KW}(u, W)\,\mathrm{d}u = F_W(K, W)$ the condition $KF_{KW} < 1$ is equivalent to $F_W < 1$. The authors use this condition to prove that $F_W > 1$ (underprovision condition), which is a striking contradiction.

Eq. (1) such that $K=\alpha K^*$ if $L=\alpha L^*$, where α is a constant greater than one. Because of the homogeneity assumptions for f and c ($\lambda<0$) the net-of-tax wage rate will rise to

$$l=[f(K^*,L^*)-rK^*-\alpha^{\lambda}\cdot c(K^*,W^*)K^*-\rho W^*]/L^*>l^*,$$

where $f_{LL}<0$ ensures that the immigration constraint αL^* becomes binding. The income of the existing population will increase to the level

$$R=r\bar{K}+l\cdot L^*>R^*=r\bar{K}+l^*\cdot L^*.$$

This contradicts the assumption that l^*, K^*, L^* and W^* characterize an equilibrium.

Proposition 4: *When all factors are mobile and the Selection Principle holds a competitive equilibrium among governments which provide public infrastructure for one of the mobile factors of production does not exist.*

Judged by the current situation of western Europe, **Proposition 4** may seem overly pessimistic since labour mobility of the existing population is rather low. Note, however, that there is a persistent inflow of immigrants from third countries whose *differential* mobility among potential host countries is close to being perfect. The fact that scale economies tend to concentrate these immigrants in only a few countries is a visible implication of the non-existent equilibrium. For Germany, which absorbs the lion's share of the immigration flow, **Proposition 4** is a matter of real concern.

3. Redistribution, insurance and fiscal competition

The second important fiscal activity of the state in addition to the production of public goods is the redistribution of incomes. Redistribution can have many reasons including charity, social and political stabilization, or ethics and justice.

Arguably the most important reason is the insurance it provides in an uncertain world. Redistribution and insurance are two sides of the same coin, their difference lies primarily in the point of time at which they are evaluated. Ex post, every insurance contract involves redistribution. Ex ante, before the dice of destiny are cast, much of the foreseen redistribution can be seen as insurance against the risk of income variations. Many authors including Friedman (1953), Harsanyi (1953), and Rawls (1971), have pointed this out.

Given that there are private insurance markets that offer protection against risk, the crucial question is what is the borderline the Selection Principle establishes between public and private insurance. Why are insurance markets imperfect and to what extent can governments do better than the market?

While there are hardly any possibilities for governments' overcoming moral hazard problems,[10] the literature has shown that adverse selection offers some scope for Pareto improving policy actions.[11] However, as Pareto optimality is typically defined taking the pre-existing inequalities among agent types as given, the necessary conditions for welfare improvements are rather restrictive. There is much more scope for welfare improving policy actions if account is taken of the fact that the pre-existing inequalities may themselves be realisations of earlier random processes. This section constructs a model where the government insures pre-existing inequalities and is then confronted with fiscal competition. Fiscal competition will be shown to create severe problems for public redistribution and insurance, destroying any advantages the public sector may have over the private market.

The difficulty of carrying out redistributive taxation in the context of international taxation has been observed by a number of authors, including Musgrave (1969, 1991), Oates (1972), and Wildasin (1991, 1992), but typically non-Paretian motives for redistribution were assumed.[12] The model presented here combines this literature with the insurance view of redistributive taxation, which is strictly based on Paretian ethics.

3.1. A simple model of useful public insurance

Arguably, the main reason why the government can do better than private insurance markets is that it can introduce its insurance protection earlier, before the "good risks" and the "bad risks" have been sorted out. Redistribution through the government budget can be seen as insurance against being a bad risk and as such it may be welcomed by all citizens before destiny has lifted its veil of ignorance.

To be more specific, consider the preferences of parents or parents to be. At or before the time of birth the parents do not know whether their child will be handicapped or healthy, gifted or untalented. They are therefore interested in obtaining insurance against the lifetime income variation resulting from these differences. The market cannot provide this insurance since this would imply that the parents sign a bondage contract for their children from which these children could not escape even if they wished to do so. Whether the absence of bondage is a market failure or the result of a government intervention that requires another intervention to patch up the consequences can be left open here. Historically a decision about the matter has been made and, given this decision, there is little doubt that private markets cannot provide the type of career insurance which is the essence of income redistribution through the government budget.

[10] One exception is Arnott and Stiglitz's (1989) suggestion of taxing the consumption of dangerous commodities like alcohol or tobacco.

[11] See Pauly (1974), Rothschild and Stiglitz (1976), Wilson (1979), Eisen (1979), and Barr (1992).

[12] An exception is a non-formal discussion in Sinn (1990), which anticipates part of the following model.

Private insurance markets simply come in too late. The "children" have to be adults to obtain insurance, but then their differences are already visible. If both the insurer and the potential insurees can monitor the differences, they will never agree to a contract that eliminates them, and if only the insurees can, adverse selection may prevent insurance markets from coming into existence.[13]

The impossibility of signing bondage contracts on behalf of one's children explains the borderline between private and government insurance. A redistributive tax system provides insurance against a bad endowment of innate abilities and bad luck during the process of becoming an adult, including the severe lifetime consequences this may have. Private insurance markets cover only some of the minor risks that remain.

Consider a simple insurance model that illustrates the issue. Suppose for a moment that the economy considered is closed and assume again that output is produced with capital, K, and labour, L, where L is measured in terms of efficiency units of labour rather than real persons. As before, $f(K, L)$ is a linear-homogenous production function. The wage of an efficiency unit of labour is fixed at its marginal product, $l = f_L(K, L)$, and the rate of interest is fixed at the marginal product of capital, $r = f_K(K, L)$. Let the number of efficiency units supplied by one worker be $\theta_1 \cdot \theta_2$ where θ_1 and θ_2 are arbitrarily distributed random variables with a mean of one: $E\theta_1 = E\theta_2 = 1$. θ_1 is the risk arising from innate abilities that become known only at the beginning of adulthood and θ_2 reflects later reasons for wage variations such as promotion, employment or health risks. Assume that the θ's are stochastically independent across time and individuals, but are identically distributed for all individuals in the economy. If the economy is large, these assumptions are compatible with the assumption that f_L, and hence l, are non-stochastic.

Assume that a worker faces an additional stochastically independent risk in terms of a random loss C, $C \geq 0$, which is deducted from his wage income. Moreover, let every worker own a capital endowment $\bar{K}$. Without taxation and market insurance, his total income will be

$$Y = \theta_1 \cdot \theta_2 \cdot l - C + r\bar{K}. \tag{12}$$

Obviously the risk involved in C is insurable since it is the same for all workers. Because of the Selection Principle the government will therefore not include this risk in its redistribution policy. In a competitive private market fair insurance will be available at a premium $P = \beta EC$ where β is the degree of coverage. A globally risk averse individual will chose a full coverage contract ($\beta = 1$), and Eq. (12) becomes

$$Y = \theta_1 \cdot \theta_2 \cdot l - EC + r\bar{K}.$$

[13]See Riley (1979). For a related discussion of public insurance see Sinn (1996).

Things are different with θ_1 and θ_2. As explained above, the riskiness of innate abilities, θ_1, cannot be privately insured since the contract can only be made after θ_1 has become known to at least one of the parties. The contract would involve a known resource transfer from one part of the society to another to which the net contributors of funds would never agree. θ_2 may also not be insurable. θ_2 is a multiplicative factor for θ_1 which augments the differences in innate abilities adding more randomness at a later period of time. Insurance is possible if the realization of θ_1 is visible to both parties because the premium can then be conditioned on the value of θ_1. However, if only the workers know their types while the insurance companies cannot distinguish between them, there is the typical adverse selection problem.

Because of the stochastic independence of θ_1 across the workers, the realized distribution of θ_1 is identical with the probability distribution of θ_1 as seen from an ex ante perspective. If θ_1 has a small, and θ_2 a large, variance, adverse selection is not very strong and a private insurance solution, albeit with less than full coverage for the better risks, is possible. However, if the variance of θ_1 is large relative to that of θ_2, the market will break down at least for the better risks and perhaps even for all risks. The appendix presents an example where θ_1 and θ_2 are such that none of the workers will be able to find wage insurance in the private market.

In line with the Selection Principle, the non-insurability of θ_1 and θ_2 is the justification for government insurance through the redistributive tax system. Assume there is a linear labour income tax at rate σ and a lump sum rebate in the form of a monetary transfer or a public good which equals the expected tax revenue:

$$T = \sigma \cdot l. \tag{13}$$

The probability distribution of after-tax income will then be given by

$$Y = \theta_1 \cdot \theta_2 \cdot l(1 - \sigma) + T - EC + r\bar{K}.$$

The first two moments of this distribution are

$$EY = l - EC + r\bar{K}$$

and

$$SY = (1 - \sigma) \cdot S(\theta_1 \cdot \theta_2) \cdot l$$

where E and S are the expectation and standard deviation operators, respectively.[14] The expected income is not changed due to the government intervention and the standard deviation shrinks to $(1 - \sigma)$ times its pre-tax value. Since the distributions which are attainable with alternative values of σ all belong to the same linear class

[14]Note that the assumptions made about θ_1 and θ_2 imply that $E(l \cdot \theta_1 \cdot \theta_2) = l \cdot E\theta_1 \cdot E\theta_2 = l$.

it is clear that expected utility will increase for a globally risk averse worker when a redistributive tax system is introduced.[15]

Proposition 5: *By redistributing incomes the government can provide Pareto improving insurance against the riskiness in innate abilities and other exogenous influences on a person's income, because private insurance markets do not open early enough to avoid the problem of adverse selection.*

3.2. Why competition reduces expected utility

To bring about a Paretian welfare increase by way of redistributive taxation it is not necessary for the government to have better information than the private insurance market has. However two important assumptions have to be met. First, the redistribution scheme must be known before θ_1 becomes known. Second, the government must be able to force the "good risks", i.e. those with a high level of θ_1, to participate by paying their taxes.

The second condition is crucial for understanding the implications of fiscal competition among redistributive tax systems. Suppose the country's borders are opened and both capital and labour can freely migrate across them. This liberty will not affect private insurance contracts, but it will affect insurance through redistributive taxation since the government loses its power to enforce the payment of taxes. People can migrate between countries after θ_1 and/or θ_2 have become known, but they cannot "migrate" between insurance contracts after C has become known. Let $i=1,...,n$ denote the set of competing countries and suppose there is a migratory equilibrium. All countries will have the same rate of interest

$$r_i = r_j \quad \forall i,j = 1,...,n, \tag{14}$$

and the wage income net of redistribution will also have to be the same in all countries:

$$\theta_1 \cdot \theta_2 \cdot l_i \cdot (1-\sigma_i) + T_i = \theta_1 \cdot \theta_2 \cdot l_j \cdot (1-\sigma_j) + T_j \quad \forall i,j = 1,...,n, \ \forall \theta_1 \cdot \theta_2. \tag{15}$$

Note that it is not sufficient that the expected utility is the same in each country. Since migration is not limited to the ex-ante phase, the realized utility ex post must also be the same everywhere, and this is only the case if the realized net-of-tax labour income is the same for each realization of $\theta_1 \cdot \theta_2$. This becomes clear if (13) is used to write (15) in the form

$$l_i[\theta_1 \cdot \theta_2 - \sigma_i(\theta_1 \cdot \theta_2 - 1)] = l_j[\theta_1 \cdot \theta_2 - \sigma_j(\theta_1 \cdot \theta_2 - 1)] \quad \forall i,j = 1,...,n, \ \forall \theta_1 \cdot \theta_2. \tag{16}$$

Obviously, this equation can hold uniformly for all realizations of $\theta_1 \cdot \theta_2$ if, and only if, $l_i = l_j$ and $\sigma_i = \sigma_j$ $\forall i,j = 1,...,n$.

While a symmetric solution with redistributive taxation is the only possible candidate for an equilibrium, it is easy to show that such an equilibrium does not, in fact, exist if governments act on behalf of their citizens. Note that the linear homogeneity of the production function implies that a migration of workers will always be coupled with a migration of capital so as to keep the factor prices fixed at the international level.

Consider an initial situation with $\sigma_i = \sigma_j > 0$ where condition (16) holds. The single country will have an incentive to deviate from this condition by reducing its tax rate σ a little and reducing the transfer T because this will attract net contributors of public funds and deter the net receivers. Suppose σ and T are varied so as to satisfy the budget constraint (13) for a given size and composition of the population. Then there is clearly a *national* Pareto improvement with regard to all those people the national government could possibly care about. "Rich" domestic residents with $\theta_1 \cdot \theta_2 > 1$ will be better off since they pay less, and so it will be with the rich who immigrate from other countries. The "poor" with $\theta_1 \cdot \theta_2 < 1$ would lose from the tax cut if they stayed, but they will not stay. By migrating to other countries they can maintain their income position. The government which finds itself only with net contributors of public funds could even afford to subsidize the emigration of the poor. This makes it obvious that a redistributive equilibrium in systems competition will not exist. The welfare state has no survival chance when unbridled tax competition is allowed.

The breakdown of the welfare state leads to a clear efficiency loss. Despite the fact that there is a Pareto improvement from a single country's point of view, given the behaviour of all other countries, there is a Paretian welfare loss if all countries behave in the way described. The increase in expected utility which redistributive taxation generates from an ex ante point of view is no longer available. The only stable equilibrium with fiscal competition is one where $\sigma_i = \sigma_j = 0$ $\forall i,j = 1,...,n$. A single country that deviates from this equilibrium by raising σ to positive values would deter the rich and attract the poor thus creating a fiscal deficit. And a single country that deviates by lowering σ below zero would deter the poor and attract the rich, which again implies a fiscal deficit since it would now be the rich who are net receivers and the poor who are net contributors of public funds.

Proposition 6: *With free factor movements and governments that seek redistribu-*

[15] In the model as set up the optimal tax rate would be 100%. A more sophisticated model would have to include a counterweight to the direct welfare gain from insurance by allowing for a moral hazard effect, but it would also have to include the beneficial risk taking effects that can be expected from redistributive taxation (see Sinn, 1996). With moral hazard the optimal tax rate is typically less than 100%, but it is also more than 0%. As the welfare loss due to moral hazard is a second-order effect while the insurance benefit is a first-order effect, it always pays to introduce some government insurance through redistributive taxation.

tion policies which are Pareto optimal from a national point of view the only existing equilibrium in systems competition is one without redistributive taxation. The equilibrium is Pareto inferior to the situation where the borders are closed.

The deeper economic reason for the efficiency loss resulting from systems competition is again the Selection Principle, the fact that the government insures those risks which cannot be insured privately. A private solution is infeasible because private redistribution contracts cannot be written early enough, and without a contract, redistribution cannot be enforced. Adverse selection becomes unavoidable. In a closed economy, the government can remedy the situation because it can provide insurance through the tax law. It has the power to enforce the necessary resource transfer between the lucky and the unlucky without having to rely on voluntary private contracts. In an open economy, however, this power vanishes with the right to migrate across the borders. The good risks leave the insurance state just as they leave the insurance company. Obviously, systems competition suffers from the same type of adverse selection that justified the government intervention in the first place. Only if the government did not respect the Selection Principle and offered signed insurance contracts under the rules of the civil law as private companies do, would competition between insurance states be able to work.

4. Cassis-de-Dijon, the lemons problem and competition of laxity

Consider now the final example for the role of the Selection Principle: the competition of quality standards. The establishment of the origin principle for product standards is often seen as one of the great achievements of the Common European market. A commodity that has been legally produced in one country which respects all the existing product regulations there can be freely exported to any other country in the community. The importing country cannot, in general, require its own product specifications to be met. The breakthrough came with the Cassis-de-Dijon judgement of the European Court in Straßburg in 1979 which has since been applied to a number of other cases, including beer imports into Germany and pasta imports into Italy.

The great advantage of the Cassis-de-Dijon judgement is that it helps prevent the single states engaging in protectionist practices. However, there may not only be advantages. The drawback is a potential erosion of consumer protection standards which may result from the national governments attempting to give their industries a competitive lead by relaxing their regulatory constraints. *Competition of laxity* is an appropriate description of this phenomenon.

Whether or not the competition of laxity can be seen as welfare reducing depends again very much on the role of the state. If the Selection Principle is violated there are cases in which a relaxation of regulatory constraints improves

the efficiency of the system. However, if the government does what it ought to do, then consumer protection laws correct market failure, and if they correct market failure, it may not be wise to subject these laws themselves to a market's decision. The market for consumer protection laws may again suffer from market failure.

4.1. The lemons problem

The kind of market failure justifying consumer protection laws is Akerlof's (1970) lemons problem. If consumers cannot distinguish product qualities, sellers cannot convincingly differentiate the price of a product according to quality. Sellers, who are better informed than the consumers, will therefore undersupply high quality products and oversupply bad quality products. Consumers will know what the average quality supplied in the market is and will therefore not pay too much, but, as long as they cannot determine the quality of the goods before they buy, the market will be trapped in a low quality equilibrium.

The lemons problem is often presented as an adverse selection problem, where the sellers have a given set of consumer durables which they can either use themselves (existing cars!) or sell in the market.[16] However, there are equally severe moral hazard problems in production involved. If the consumers cannot distinguish qualities, the producers will save production cost by reducing their product quality, and, in equilibrium, the qualities produced will be lower than those that would have been offered to informed buyers. The national consumer protection laws and guide lines set out regulatory measures to avoid this welfare loss. In many cases the measures include the obligation to inform the consumers, but often they simply define minimum quality standards.

With most of the millions of products traded in a market economy such standards may not be necessary since consumers are sufficiently well informed about qualities. This is the case with products whose quality can be detected by using them and which are frequently purchased. Expensive products also do not suffer much from the lemons problem since it pays for the consumers to acquire the relevant information before making a purchase. However, the lemons problem may be severe with other products. These are products which are not frequently purchased, whose quality can only be detected with a small probability with use or whose value is too low to justify intensive information gathering. Food is a good example. Here, minimum quality standards are often defined in terms of maximum content of dangerous ingredients. These can be very harmful but are difficult to detect by experience since there is only a small probability that the damage (cancer!) will occur. Also, food is relatively cheap. Typically, the variety of food products bought by a single person is so large, and the value per item so small, that it would not be worth becoming a specialist in food chemistry before going to

[16] Cf. Allen (1984), Klein and Leffler (1981), or Shapiro (1983).

the supermarket. Hiring a food specialist through the government may be the more efficient solution.

4.2. A simple model of private quality choice with asymmetric information

The rationale for consumer protection and the risks involved with systems competition can easily be demonstrated by a simple model. Let x be the quantity of a lemon good and y the quantity of another good that can be transformed into x, say leisure. The unit cost of producing x by giving up y is $c(q)$, where q is the quality chosen. It is assumed that $c(q)$ is continuously differentiable, is strictly convex, i.e. $c''>0$, and has a minimum at $q=q^*$, $q^*>0$. Let y be the numeraire and P the price of x. Assume the consumer can observe the average quality, $\bar{q}$, in the market, but not the quality of the single item he buys. The consumer's utility function is $U(x)\cdot V(q)+y$ where both U and V are non-negative and strictly concave increasing functions. Of course, x, y and q are assumed to be non-negative. The consumer's problem is to maximize his utility function,

$$\max_{x,y} U(x)\cdot V(q)+y, \tag{17}$$

subject to the budget constraint

$$\bar{y}=y+Px. \tag{18}$$

The consumer cannot choose q but assumes that q equals $\bar{q}$. The first order condition for his problem is simply Gossen's second law:

$$U'(x)\cdot V(q)=P. \tag{19}$$

The producer's problem is

$$\max_{q,x}[P-c(q)]x, \tag{20}$$

and the corresponding first-order conditions are

$$P=c(q) \tag{21}$$

and

$$c'(q)=0 \quad for\ x>0. \tag{22}$$

Eq. (19) and (21) imply that

$$U'(x)\cdot V(q)=c(q). \tag{23}$$

Eq. (22) and (23) define the market equilibrium under moral hazard. Eq. (22) shows that the firm makes no effort to increase quality which implies that $q=q^*$, and Eq. (23) ensures that the consumer's marginal willingness to pay for a unit of the commodity equals marginal cost. The solution is illustrated in Fig. 2.

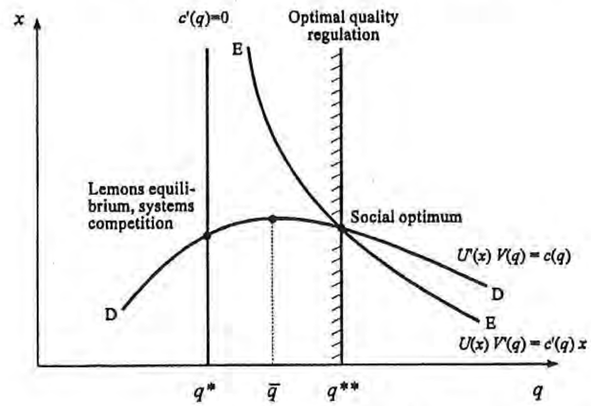

Fig. 2. The competition of laxity.

The curve DD is the geometrical locus of points where (23) is satisfied. Implicit differentiation of (23) shows that its slope is given by

$$\left.\frac{dx}{dq}\right|_{(36)}=A(x,q)/[-U''(x)\cdot V(q)]$$

where

$$A(x,q)\equiv U'(x)\cdot V'(q)-c'(q). \tag{24}$$

Since the term in square brackets is positive the sign of the slope equals the sign of A. The above assumptions about the utility and cost functions imply that $A>0$ for $q\leq q^*+\varepsilon$ where ε is a strictly positive constant. Thus the curve is increasing left of q^* and in some neighborhood right of q^*. Assuming that marginal utilities decline towards zero, the curve DD has a maximum to the right of q^*. Let the maximum be at a quality level $\bar{q}$.

The vertical line at q^* is the geometrical locus of points where (22) is satisfied. The intersection of the vertical line and curve DD defines the lemons equilibrium.

To see that the equilibrium is inefficient, consider the social planner's problem

$$\max_{x,q} U(x)\cdot V(q)+\bar{y}-c(q)x.$$

The necessary conditions for this problem are (23) and

$$U(x)\cdot V'(q)=c'(q)x. \tag{25}$$

Eq. (25) shows that it is efficient to balance the marginal utility from a quality increase with its marginal cost. Since $U\cdot V'>0$ while $c''>0$, a higher quality than the one chosen by the market turns out to be optimal. In Fig. 2, the social optimum is characterized by the intersection between the curve DD which represents condition (23) and the curve EE which represents (25). Assume that the point of intersection exists; i.e., that there is a social optimum. Then this point must be to the right of $\bar{q}$.

To see this write (25) in the form $U(x)/x=c'(q)/V'(q)$. Since $U(x)/x$ is a positive declining function of x, c' approaches zero as q approaches q^* from above and V' is positive and bounded away from zero in the neighbourhood of q^*, it is clear that curve EE is located to the right of q^* and will asymptotically approach the vertical above q^* as x goes to infinity. It is also clear that x is a function of q so that EE cannot be backward bending. However, it is unclear where curve EE intersects curve DD. Implicit differentiation of (25) gives the slope of curve EE,

$$\left.\frac{\mathrm{d}x}{\mathrm{d}q}\right|_{(25)} = [c''(q)x - U(x)\cdot V''(q)]/A,$$

where A was defined in (24). Since the term in squared brackets is positive, the sign of the slope of EE equals the sign of A. It follows that A is negative where the curves DD and EE intersect. As shown above this can only be the case to the right of the maximum of curve DD; i.e., in the range where $q>\bar{q}$.[17] This proves that the quality chosen in market equilibrium is inefficiently low. There is indeed a lemons equilibrium.

An optimal kind of government intervention to correct the market failure is the introduction of a minimum quality standard q^{**} equal to the socially optimal quality level, as given by the intersection of curves DD and EE. Since quality is costly the firm will choose $q=q^{**}$ and the equilibrium will continue to satisfy Eq. (23). The following proposition is a straightforward implication of this analysis.

Proposition 7: *Under the assumptions made the economy settles to a lemons equilibrium where the product quality is inefficiently low. The government can increase welfare by imposing a minimum quality standard.*

4.3. Regulatory competition

What if free trade according to the Cassis-de-Dijon principle is introduced? An optimistic view would be that the consumers could now freely choose among national regulations knowing what quality standards they imply. The price of x would be conditioned on the respective national standard of consumer protection as defined by q^{**}. In Eq. (18) the fixed price P would be replaced with a price

[17] Note that $u''<0$ implies that A can be negative left of $\bar{q}$ in the area *above* the curve DD.

quality schedule $P(q^{**})$ specifying a price for every country's regulated level of quality and the household would assume that $q=q^{**}$.

The household now chooses among the different quality levels provided by countries. In the household's optimum, the marginal utility from choosing a better standard would have to be equal to the marginal expenditure increase this would involve:

$$U(x)\cdot V'(q^{**}) = P'(q^{**})x. \tag{26}$$

The national government, on the other hand, would choose q^{**} so as to maximize the profits earned by its firms. The government would not have to consider its national consumers' preferences. Since the competitive country is a price taker in the international market for consumer goods, its consumers would not be affected by the change in the national standard. As always in competitive markets, production and competition decisions would be perfectly separated. The government's profit maximizing choice would be characterized by equality of the marginal revenue from raising the national standard and the marginal production cost incurred by doing so:

$$P'(q^{**})x = c'(q^{**})x. \tag{27}$$

Taken together, Eq. (26) and (27) imply the efficiency condition (25). Thus it seems that a competition of national quality standards could work and bring about the optimal quality level.

Again, however, the assumptions underlying such an optimistic result violate the Selection Principle. There are certainly many commodities about which consumers could be expected to be sufficiently knowledgeable to choose between different national quality standards. However, when the Selection Principle is valid these are exactly those commodities where the government does not intervene. Consumer protection is instead limited to those goods where consumers can be expected to have an informational deficit: the goods with low values, the rarely purchased goods, and the goods whose harmful properties will only be detected with a small probability. These are precisely the goods for which a choice between a multitude of national quality standards would be utterly confusing for the consumers. The same difficulties which justified government intervention in the closed economies of the old Europe reappear when governments rather than firms compete with one another in the open economies of the new Europe.

Obviously, with confused consumers, P cannot be conditioned on the national standard q^{**} and hence the profit maximizing government will choose q^{**} so as to minimize production cost; i.e., it will set

$$c'(q^{**}) = 0$$

which implies that $q^{**}=q^*$, just as the firms would do if left to themselves [see (22)]. Again there is an underprovision of quality as illustrated in Fig. 2.[18]

Proposition 8: *If the Selection Principle holds the consumers will not be able to distinguish between national quality standards and a competitive equilibrium between regulatory governments will be characterized by inefficiently low quality standards. It is itself a lemons equilibrium.*

5. Conclusions

For the sake of argument this paper pursued the implications of two strong, but straightforward assumptions. One assumption was that the Selection Principle holds in a strict form and that the government is an institution which acts on behalf of its people and helps them overcome the collective irrationalities associated with their individual choices. The other assumption was that governments act competitively. The paper has shown that competition is bad, when government intervention is good. In general, an efficient equilibrium in systems competition does not exist when the Selection Principle holds.

It follows that economists should be cautious when trying to model systems competition. It is not legitimate to make assumptions about the information and production possibilities of governments which are usually considered plausible in the modelling of private market economies. There is a selection bias, at least in the weak sense that more of the governments' numerous activities are unsuitable for a competitive environment than are those carried out by private agents.

The analysis also has consequences for the design of the new Europe. A corner solution, where no central government is formed and all policy decisions are left to the nation states and voluntary contracts between them, is not suggested by the model. It may be useful to further discuss the question of whether at least some sort of centralization may be necessary to take the implications of this analysis into account.

Europe still is a long way from such a situation. It is entering a difficult phase where some of the dangers described in this paper may soon become virulent before countervailing measures are in place. The future will show how this experiment ended.

[18]Even in models with less than perfect competition where the government would have to take the benefit of its households explicitly into account, there would be underprovision since it would still be true that the government which lowered the national standard would impose a negative externality on consumers from other countries who purchase the domestic products.

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Appendix 1

The non-existence of a market for wage insurance

This appendix shows that under the assumptions of the model of Section 3 the market for wage insurance may break down completely, leaving no market for bad risks. Assuming that individuals can simultaneously buy contracts from different competitive firms, the analysis can be confined to the possibility of pooling equilibria.

Assume that the utility function exhibits constant relative risk aversion between zero and one and is identical for all individuals. Let $EC=r\bar{K}$ so that the individual's income is $l\cdot\theta_1\cdot\theta_2$. The insurance market opens after θ_1 and before θ_2 has been revealed. Let θ_1 be uniformly distributed in the range $0\leq\theta_1\leq\theta_1^{\max}$ and assume that $\theta_2\geq 0$.

If an equilibrium in the insurance market exists, there is a critical value $\bar{\theta}_1$ with $0<\bar{\theta}_1\leq\theta_1^{\max}$ such that the "good" risks with $\theta_1>\bar{\theta}_1$ buy no insurance and the "bad" ones with $\theta_1\leq\bar{\theta}_1$ buy at least some insurance. Using these properties it will be proved by contradiction that an equilibrium may not exist at all.

Let β be the degree of insurance coverage and assume for a moment that all bad risks choose the same degree of coverage. Note that the average "quality" of abilities as measured by θ_1 is $\bar{\theta}_1/2$. When fair insurance is available, the income distribution of individuals of type $\bar{\theta}_1$ will be characterized by a mean of

$$EY=\beta l\bar{\theta}_1/2+(1-\beta)l\bar{\theta}_1=l\bar{\theta}_1\left(1-\frac{\beta}{2}\right)$$

and a standard deviation of

$$SY=(1-\beta)l\bar{\theta}_1S\theta_2.$$

Since the distribution class to which all distributions attainable by varying b belong is a linear one and relative risk aversion is constant, an expected utility maximizer has a homothetic indifference curve system as shown in Fig. 3.

Let point A characterize the distribution attainable by the best of the bad risks (i.e., those with $\theta_1=\bar{\theta}_1$) when $\beta=0$ and B the one attainable when $\beta=1$. The

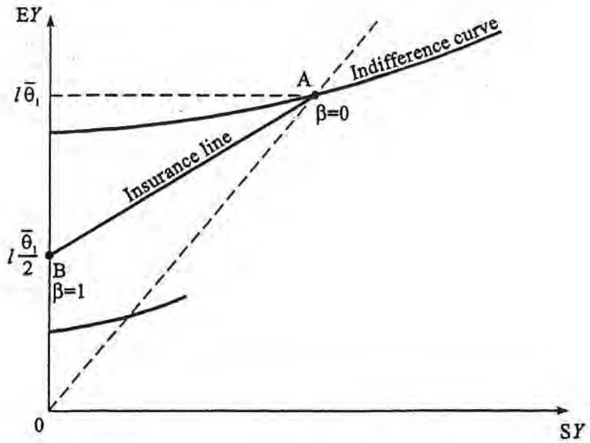

Fig. 3. The non-existence of a market for wage insurance.

distributions located on the straight line between A and B – the insurance line – are attainable for risks of type $\bar{\theta}_1$ by varying β in the range between zero and one.

Suppose now individuals of type $\bar{\theta}_1$ are allowed to vary β arbitrarily while all others choose a given non-negative value of β. Since individuals of type $\bar{\theta}_1$ have a density mass of zero, this will not affect the conditions under which they can buy insurance. If they decide to buy some insurance, the slope of the indifference curve passing through A must be higher than that of the insurance line. However, in the case considered in the figure, risk aversion is so low that the opposite is true. Risks of type $\bar{\theta}_1$ will stay uninsured if all risks with $\theta_1 < \bar{\theta}_1$ choose a given (identical) non-negative degree of insurance coverage. They will a fortiori stay uninsured if the assumption that β is the same among the other risks (i.e., those with $\theta_1 < \bar{\theta}_1$) is relaxed. Whatever the exact participation pattern of the other risks: because of the assumption of identical preferences it will always be true that the preferred degree of coverage is a declining function of the quality of innate abilities as measured by θ_1. Thus the conditions under which individuals of type $\bar{\theta}_1$ can find insurance will be even worse than assumed in the figure. This proves that they will not participate, which contradicts the assumption that they will.

Note that no particular value of $\bar{\theta}_1$ has been assumed for this proof other than the assumption that $0 < \bar{\theta}_1 \leq \theta_1^{max}$. It is easy to see that the non-existence of an equilibrium for a particular value of $\bar{\theta}_1$ implies the non-existence for all other feasible values of $\bar{\theta}_1$ in this range. In Fig. 3, a variation of $\bar{\theta}_1$ will move point A along a ray through the origin and point B along the ordinate in a way that keeps the slope of the insurance line unaffected. Due to the assumption of constant relative risk aversion the slope of the indifference curve remains constant along a ray through the origin. Thus, when the indifference curve is flatter than the slope

of the insurance line at one particular position of A, this will be true for all feasible positions of A along a ray through the origin. This completes the proof that under the assumptions of the paper adverse selection may be strong enough to prevent an insurance market for wage risks from coming into existence. Even a market for the worst of the bad risks would then not be available.

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