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RELATIVE STANDING COMPARISONS, RISK TAKING AND SAFETY REGULATIONS

Kai A. Konrad
Kjell Erik Lommerud

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Center for Economic Studies
University of Munich
Ludwigstr. 33
8000 Munich 22
Germany
Telephone: 089-2180-2747
Telefax: 089-397303

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1. Introduction

Economists have long been aware that people's utility and behaviour might be influenced by comparisons of some measure of relative standing, such as relative consumption or relative income. Among the classic references are Veblen (1899), Duesenberry (1949) and Leibenstein (1950). More recent key references include Easterlin (1974), Hirsch (1976), Boskin and Sheshinski (1978), Layard (1980), Sen (1983) and Gylfason and Lindbeck (1984).[1] We would also like to mention our own work in the field, Konrad (1990, 1992) and Lommerud (1989). However, we think it fair to say that the person who has contributed most in recent years to making status seeking and relative standing comparisons legitimate subjects for economic study, writing a whole series of articles and a book on the topic, is Robert Frank (1982, 1984a, 1984b, 1985a, 1985b, 1989).

Comparisons of relative standing lead to negative external effects arising. Someone who succeeds in moving upwards in a relative income hierarchy necessarily pushes others downwards. Individual agents therefore stand to gain if they can develop cooperative arrangements which can lead to the internalisation of these external effects. Frank concludes that, within models of status seeking, phenomena such as the following might be efficiency improving: redistributive income taxation; union egalitarianism; social security programs; ethical sanctions against the sale of transplantable organs, babies, and sex; overtime laws; safety regulation; and forced savings programs. In general, status seeking is an example of mutual negative externalities in consumption –and typical policy recommendations that come out of these models are Pigovian taxes or corresponding quantity regulations.

The safety regulation argument is perhaps not intuitively obvious[2]. Take, e.g., Frank's example of hazardous working conditions: if you are willing to take risks, you will receive higher pay today and can now climb up the relative consumption ladder. On the other hand, if you are unlucky and have an accident, you will also lose *relative* income or "status"[3]. One could think that the fear of loosing out in status position leads status seekers to choosing overly safe projects. This intuition, however, is flawed. A key issue will be that one has to distinguish closely between the issues of whether status seeking leads to *more* risk taking and whether risk taking is *excessive*. E.g., it turns out that it is perfectly possible that risk taking is lower with status seeking than without, but that risk taking nevertheless is excessive from an individualistic social welfare perspective. For the case when utility is separable in consumption and status, our main results can be summarized as follows (with general utility functions some qualifications must be added): if risks are wholly non–systematic, concerns for relative consumption might lead to more risk taking but the opposite might also hold true. In the case where all risks are systematic, though, it is certain that relative consumption concerns lead to more risk taking. However, in both cases we find that risk taking is socially excessive.

The organisation of this paper is as follows. In section 2 we critically review relevant earlier work, for the most part written by Robert Frank. Section 3 contains our analysis and results. Section 4 concludes the paper.

2. Earlier work on status and risk taking

There exists little previous literature on status seeking and risk taking apart from Robert Frank's work. Let us therefore start out by critically reviewing Frank's writings on the topic.

Frank (1982) develops a model of "positional" and "non–positional" goods[4], and then claims that safety is unobservable and therefore a non–positional good, and hence underconsumed. As it stands, we find this argument somewhat vague – and think that the use of a more formal model can help sharpen the understanding of the issue.[5]

In his later work Frank presents an additional argument. People might care

about relative instantaneous income, because they are contesting for goods whose supply is fixed. Relative ability to pay, rather than any absolute measure of income, determines who will get these goods.[6] If such contests occur at certain given points during the life–cycle, a person would care more about his relative means at those points than at others.[7] Now Frank argues that the contest for good neighbourhoods and good schools among families bringing up children is one such case. Taking an occupational risk might mean higher wages when the children are young, whereas the consequences in the form of ruined health would show up perhaps decades later.

This point may be valid, but some remarks should be added. First, only in a few cases do the consequences of occupational risks occur *only* after decades of exposure to an unhealthy environment. An accident which occurs when the children still are small might have devastating effects on the children's future, so for this reason status seeking might lead to *less* risk taking. Further, even though the contest for setting children on the path to independence is an important one, other contests for fixed–supply goods also exist. We would like to draw attention to the contest for the best medical services and the best doctors, a contest which occurs late in life and might be especially important when a person's health has been damaged by years of unhealthy working conditions. Lastly, Frank's argument implies that safety regulations would be less important, for example, in some European countries with a free educational system, and further that safety regulations should only apply for young parents but not for older workers. These implications do not seem, at least, to be able to explain actual patterns of safety regulation.

However, in spite of these remarks we have no major quibbles with these Frank's later arguments. Our aim is, within a formal model of status seeking and risk taking, to show that *without* assuming that safety purchases are unobservable, *without* assuming that relative income matters more at some moments in time than at others, and *without* necessarily assuming status risk aversion, we *still* get that status seeking leads to excessive risk taking –with one qualification to be presented below. We think this complements Frank's analysis, and, in our opinion it considerably strengthens the case for status seeking providing a rationale for safety regulations.

An unpublished paper by Arthur Robson (1990) should also be mentioned. Robson considers the impact of status on the incentive to gamble. This is distinct from, but clearly related to problems such as the choice of the safety level of an activity, or the investment in exogenous risky projects that pay a risk premium that are studied here. Robson's focus is rather different from ours, with an emphasis on trying to explain why individuals can be risk–lovers concerning small gambles, but risk averse when it comes to large gambles. His choice of assumptions, e.g., working with an assumption of status–risk loving, makes it difficult to compare his results with ours.

3. The model

Consider an economy where all individuals are identical regarding preferences and endowments. An individual has a utility function

$$U = U(C,S), \tag{1}$$

i.e., utility depends on the absolute amount of consumption, C, and on relative standing or *status position* S with regard to consumption. Relative standing can be described by the relative amount of consumption, compared with the average amount of consumption of all other individuals. It is defined here to be

$$S \equiv C - \overline{C}, \tag{2}$$

with $\overline{C}$ being the anticipated average consumption level of the other individuals in

the equilibrium[8]. To derive simple interpretable comparative static results regarding the impact of status seeking on risk taking, the utility function is sometimes specified as

$$U(C,S) = v(C) + g\,w(S). \tag{1'}$$

This means that U is additively separable in its arguments C and S, the intermediate case between absolute consumption and relative standing as complements and as substitutes. The scalar $g \in \mathbb{R}^+$ describes the "weight" or importance that is given to relative standing compared to pure consumption. Varying this parameter g will be a useful procedure for evaluating the impact of status seeking in a comparative static analysis.[9]

The individual has an initial amount of resources A, that can be allocated between a safe and a risky investment technology. Let $(A - a)$ be the amount of safe investment, yielding $(1 + i)(A - a)$, and a be the amount of resources allocated to risky investment, yielding the return $a(1 + \vartheta)$. To make the choice problem non–trivial for the case of risk aversion, ϑ is a random variable with $E\vartheta > i$. This is structurally identical with the usual Domar–Musgrave framework with regard to risk–taking[10]. The individual's consumption and, therefore his status postition, are determined by the choice of a,

$$C = (1 + i)A + (\vartheta - i)a. \tag{3}$$

Consider the optimising problem

$$\max_a EU(C,S) \tag{4}$$

subject to (1), (2), (3) and $\overline{C} \in \mathbb{R}^+$.

Assume first that the random variables ϑ for different individuals are identically and independently distributed such that, by the law of large numbers, the anticipated equilibrium average level of consumption is a non-random constant, i.e., systematic risk is negligible. In principle, with aggregate consumption being constant, well functioning insurance markets could absolve private agents from all risk bearing. However, we will here assume that there is incomplete risk sharing owing to transaction costs. In fact, we will for simplicity concentrate on the case of prohibitive transaction costs: no insurance possibilities at all are available. This means that final consumption levels are described by (3). – One could alternatively argue that the lack of insurance possibilities is due to informational problems, as moral hazard or adverse selection. This would require some changes in our model though. To allow for moral hazard, the distribution of ϑ should be modelled as endogenous. To allow for adverse selection, we must assume ϑ to differ between agents. But as long as the market outcome is a constrained Pareto optimum for preferences without desire for status, the thrust of our analysis goes through. We have chosen to concentrate on the assumption of transaction costs as the source of incomplete risk sharing to keep matters simple. We will, of course, assume that the government is not endowed with a superior insurance technology. In the absence of status seeking the risk allocation therefore is Pareto efficient.

Solving problem (4) yields the first-order condition

$$E\{U_c(\vartheta - i) + U_s(\vartheta - i)\} = 0 \tag{5}$$

with $\frac{\partial U}{\partial X} \equiv U_x$, and $\frac{\partial^2 U}{\partial X \partial Y} \equiv U_{xy}$ for X and Y taken from {S,C} here and in what follows. Using (1') we get

$$E\,\{v'(\vartheta - i) + g\, w'(\vartheta - i)\} = 0. \tag{5'}$$

The second-order condition[11] is

$$E\{U_{cc}(\vartheta - i)^2 + 2U_{cs}(\vartheta - i)^2 + U_{ss}(\vartheta - i)^2\} < 0, \tag{6}$$

or, using (1'), $E\{v''(\vartheta - i)^2 + g\, w''(\vartheta - i)^2\} < 0$.

Proposition 1 Consider the case of additive separability. Let a^* be the equilibrium amount of risky investment. For the dependence of a^* on the importance of relative standing the following equivalence holds:

$$da^*/dg \left\{ \gtreqless \right\} 0 \Leftrightarrow (-w''/w') \left\{ \lesseqgtr \right\} (-v''/v'). \tag{7}$$

This sounds intuitive. If, e.g., $(-w''/w') > (-v''/v')$, $dg > 0$ makes U(C,S) more concave, and less risk taking should result. One should, however, remember that when everyone's risk taking changes, $\overline{C}$ changes too. A formal proof of Proposition 1 is found in the appendix.

To interpret Proposition 1, consider first two otherwise identical persons, one who cares about status ($g > 0$) and one who does not ($g = 0$). We see that status seeking behaviour does not necessarily increase risk taking. This will only be the case if the status seeking individual is less risk averse with regard to status than with regard to pure consumption. If w is "more concave" than v, status seeking behaviour decreases risk taking. However, Proposition 1 is a little more general than this, as it addresses not only the question of having or not having status preferences, but also the effect of an increase in the importance of status. More weight on status in the utility function increases (decreases) risk taking if the individual is less (more) risk averse with regard to status than to pure consumption.

Consider now the impact of status seeking on risk taking from the social planner's point of view. The question of whether status seeking ($g > 0$) increases or decreases risk taking relative to what it would have been when $g = 0$, should not be confused with the issue of social optimality. A social planner would want to internalise the externalities stemming from status seeking, but not pretend that people have preferences other than those they actually have. In the present case, there are seemingly two sources of "market failure". First, there are the negative external effects of status seeking. Secondly, risk markets are lacking. With transaction costs as the reason for incomplete risk diversification as assumed, and, with government having no superior insurance technology, the risk allocation with incomplete insurance markets is efficient except for the externalities of relative standing comparisons. Government regulation on a^* (e.g., a subsidy on choosing the safer technology, or safety regulation) does not have additional (potentially adverse) behavioral effects, in particular, does not change the nature or distribution of ϑ. The status seeking externality is the only externality and therefore standard welfare analysis applies. The task of government will then be to correct for the external effects from status seeking, e.g., via taxing or subsidising risk taking, *given* that insurance markets are absent.

The efficiency question can be solved for the general specification of U(C,S) as in (1). The planner maximises the utility of a representative individual:

$$\mathcal{U} = \Sigma_{n=1}^{N} EU(C^n,S^n) = N\, E[U(C,S)]. \qquad (8)$$

It should be stressed that the planner's choice variable a refers to *all* individuals' common level of risk taking. We want to determine the sign of

$$d\,\mathcal{U}/da\Big|_{a^*} = N\,\{E[U_c(\vartheta - i) + U_s(\vartheta - i)] - EU_s(E\vartheta - i)\}. \qquad (9)$$

The third term in (9) is the effect of an increase of $\overline{C}$ resulting from an increase of the general risk–taking level. We made use of $(\partial S/\partial\overline{C})(\partial\overline{C}/\partial a) = -(E\vartheta - i)$. Using the general first order condition in (5), (9) can be written as

$$d\,\mathcal{U}/da\Big|_{a^*} = -N\, EU_s\,(E\vartheta - i) < 0. \qquad (10)$$

Inequality (10) implies that the social planner can increase social welfare by *decreasing* the amount of risk taking. In this sense, individually chosen risk taking is excessive.

Proposition 2 If there is only non–systematic risk, with $U_s > 0$, a decrease of risk taking of all individuals is welfare improving.

Let us try to explain this result intuitively. The basic externality in this model is an "arms race" externality of income: by earning more, you push up the average income in society, and thereby reduce the status value others get from their income. Accepting a risk can *ex post* lead to a higher or lower income than if you had invested safely. If you are lucky, $\vartheta > i$ –and the negative external effect of income is aggravated. Conversely, with bad luck $\vartheta < i$ –the importance of the negative external effect is reduced relative to what it would have been with risk–free investment. However, we have assumed that $E\vartheta > i$. The risk premium is assumed positive in Domar–Musgrave models to make the risky asset attractive to risk averse agents. This means that, *in expectation*, increased risk taking *increases* the negative external effects of income, because expected gain exceeds expected loss.

It might be instructive to note that this result is unaffected qualitatively by risk aversion which concerns status. As long as $U_s > 0$, we see that the expression in (10), which represents the marginal external effect of risk taking, will only be zero when $E\vartheta = i$. For $E\vartheta > i$ the externality term is negative regardless of the shape of U.

Propositions 1 and 2 showed that increased concern for status can lead to less risk taking – but at the same time risk taking is excessive. This seemingly paradoxical result can be explained by the fact that social optimality cannot in general be found simply by ignoring the individual's preferences for status. Consider the case of additive separability. The first–order condition of an individual with $g = 0$ is

$$E(v'(\vartheta - i)) = 0. \tag{11}$$

The first–order condition of the social planner, using the additively separable specification of individual utility, is

$$N\,\{E[v'(\vartheta - i) + w'(\vartheta - i)] - w'(E\vartheta - i)\,\} = 0. \tag{12}$$

In general, the amounts of risk taking which solve (11) and (12) are different. Imposing $g = 0$, therefore, would misrepresent people's total risk aversion. The status–risk burden of risky investment is added to the consumption-risk burden of risky investment. Both burdens really have to be borne by investors and the social planner has to take these real costs into account. In the case when individuals are status–risk neutral, social optimality *does* coincide with private choices for $g = 0$. Formally, for status–risk neutrality, w' = constant, and (12) reduces to (11). When individuals, e.g., are status–risk averse, this is not any longer true. So even if status concerns can bring private risk taking *below* the level corresponding to $g = 0$, the socially optimal level will be still lower. Even if a high degree of status–risk aversion results in people wanting to invest very safely, the negative externality is still not internalised. So risk taking is also in this case excessive.

With Proposition 2 we have confirmed Frank's conjecture in a formally more rigorous choice theoretic framework under uncertainty. It shows that Frank's conjecture is right, here not because safety and insurance are unobservable, "non–positional" goods, but because income has external effects in a status model, and *expected* monetary income increases with risk taking due to the risk premium.

So far, only the question of non–systematic risks has been considered. It may be of interest to ask if status seeking changes the amount of aggregate (*systematic*) risks which a status–seeking society is willing to assume. As mentioned earlier in this paper, the Domar–Musgrave model is meant to describe any form of risky investment. With this wide perspective, it should be uncontroversial that risks may be systematic. The study of systematic risk may as well be of relevance for the particular example of occupational hazards. Assume that one's reference group mainly consists of work colleagues and neighbours. A catastrophic accident at the chemical plant or a nuclear power plant might then hit everyone in the reference group in a highly correlated manner.

We now assume that ϑ is the same for all individuals in an economy, possibly because capital markets are complete. An individual cannot determine ϑ in advance, so there is income uncertainty. However, it is known to all individuals that *ex post* the realization of ϑ will be the same for everyone. In this case, the status of an individual is

$$S(\vartheta,C) = C(\vartheta) - \overline{C}(\vartheta). \tag{13}$$

Proposition 3 If U is additively separable, if risk is systematic, and if individuals are risk averse with regard to pure consumption ($v'' < 0$), then an increase in the importance of status increases risk taking.

Proof. If all risk is systematic, in a symmetric world, $\overline{A} = A$, and, in equilibrium, $a = \overline{a}$. The individual's first–order condition is again given by (5'). The optimal a^* is implicitly determined by (5'). A change of g implies

$$da^*/dg = -\frac{E\{w'(S)\ (\vartheta - i)\}}{E\{v''(\vartheta - i)^2\} + g\ E\{w''(S)(\vartheta - i)^2\}} > 0. \qquad (14)$$

The denominator of (14) is negative. It equals the second order condition (6). The numerator is strictly positive as w' is positive and is not a random variable: as there is only systematic risk, in a symmetric world all individuals end up with the same absolute amount of consumption, i.e., in the end status is not random in the equilibrium. Therefore, w' can be factored out in (14), and $w'(S)\ E(\vartheta - i) > 0$. ∎

If utility is additively separable, the risk-taking decision of an individual does not affect his status risk. He is "risk neutral" with regard to status, implying that a relative increase of importance of status causes him to incur a higher pure consumption risk.

With a general utility function, a qualification is needed to show that risk taking is excessive:

Proposition 4 If all risk is systematic, a reduction of risk-taking increases welfare if C and S are (weak) complements, i.e., if $U_{sc} \geq 0$.

Proof. Consider

$$d\,\mathcal{U}/da\Big|_{a^*} = N\{E[U_c(\vartheta - i) + U_s(\vartheta - i)] - E(U_s(\vartheta - i))\}. \qquad (15)$$

By (5), this is equal to

$$d\,\mathcal{U}/da\Big|_{a^*} = -N\ E(U_s(\vartheta - i)). \qquad (16)$$

But, $E(U_s(\vartheta - i)) > 0$ if $U_{sc} \geq 0$, because this makes the covariance between U_s and $(\vartheta - i)$ non-negative. ∎

In contrast to the case of non-systematic risk, where risk taking always is socially excessive, here this result is obtained only under the qualification that U_{cs} is not too negative. In the case with non-systematic risk, an increase in risk taking by all others simply increases $\overline{C}$ non-randomly. The external effect on the status of a particular individual is non-random. All risk stems from the individual's own risk-taking decision. In the case of systematic risk, $S \equiv 0$ in the symmetric equilibrium. Status is non-random. However, C is random, and its randomness is higher, the higher the general level of risk taking. For U_s = constant, the standard arms-race effect for status leads to an overinvestment in status-generating activities, i.e., in too much risk taking. With $U_{sc} \neq 0$, the outcome of ϑ also matters for U_s. If U_s and ϑ have positive covariance, then $E(U_s(\vartheta - i)) > EU_sE(\vartheta - i) > 0$. Large ϑ makes C large and large C makes U_s large if $U_{sc} > 0$. In case of complementarity, although the status position is non-random, the utility of status is positively correlated with the utility of consumption. In fortunate states, consumption utility and status utility are both high, and, in bad states, both are low. Complementarity therefore extends consumption risk to status utility risk, and, thereby increases the real private cost of risk taking. If large ϑ makes U_s small, i.e., if $U_{sc} < 0$, then negative values of $(\vartheta - i)$ are multiplied with large values of U_s and positive values of $(\vartheta - i)$ are multiplied with small values of U_s. Fluctuations of consumption utility and status utility tend to compensate each other. A general increase of a for all individuals except, say i, now reduces expected status position of i and has the standard arms-race effect, providing an incentive for i also to increase his risk taking. But if $U_{sc} > 0$, the risk premium for the riskiness of the status externality is negative: it reduces the overall riskiness of utility. This effect can even overcompensate the basic arms-race effect.

4. Concluding remarks

With some qualifications found above, our results can be summarized as follows. In the case of non-systematic risk, status seeking leads to more (less) risk taking only when the utility of status is "less (more) concave" than the utility of consumption. However, we have found that risk taking will always be excessive from a social viewpoint. When risks are systematic, status seeking leads to more risk taking, and excessively so if higher consumption does not decrease marginal utility of status too much. The Frank conjecture that status seeking behaviour provides a rationale for safety regulation is therefore confirmed – but with the mentioned qualification for the systematic–risk case. In our model, the reason for this is that risk taking increases expected individual income, because of the risk premium. Seeking income, however, has negative external effects on other individuals. As an additional source of expected income, risky investment opportunities therefore aggravate the externality problem. As we see it, this result considerably strengthens the argument that status seeking leads to excessive risk taking, thus providing a rationale, for instance, for safety regulation.

Appendix

Assume that a^* fulfills $E\{ v'(\vartheta - i) + g\, w'(\vartheta - i) \} = 0$ for given g. The functions $E\{ v'(\vartheta - i)\}$ and $E\{ w'(\vartheta - i) \}$ are monotonically decreasing in $a \in [0,1]$ and change sign only once from positive to negative for increasing a, if v and w are strictly concave (i.e., exhibit risk aversion).

Assume first that $(-w''/w') > (-v''/v')$, i.e., higher status–risk aversion. Pratt[12] (1964) showed that this is equivalent to

$$w(\vartheta) = k(v(\vartheta)) \tag{A1}$$

with k being a strictly concave, increasing and twice continuously differentiable function.

The first order condition (5') can be reformulated using (A1),

$$E\{(1 + g\, k')\, v'(\vartheta - i)\} = 0. \tag{5''}$$

Differentiation of (5'') with respect to g yields

$$\frac{da^*}{dg} = -\frac{E\{k'v'(\vartheta - i)\}}{E\{(1+gk')v''(\vartheta - i)^2\} + E\{gk''(v')^2(\vartheta - i)^2\}}. \tag{A2}$$

This expression is negative. To verify this notice that

$$E\{(1+g\, k')v''(\vartheta - i)^2\} < 0 \tag{A3}$$

$$E\{g\, k''\, (v')^2(\vartheta - i)^2\} < 0 \tag{A4}$$

and

$$E\{k'v'(\vartheta - i)\} < 0 \qquad \text{for } a^*. \tag{A5}$$

Inequalities (A3) and (A4) are immediate. Notice that all factors constituting (A3) and (A4) are positive, except for v'' and k'' which are both negative. To verify (A5), remember that for a^* equation (5'') holds, i.e., $E\{(1+gk')v'(\vartheta-i)\} = 0$. For $g > 0$, $k' > 0$ and $k'' < 0$ this implies that $E\{v'(\vartheta-i)\}$ and $E\{gk'v'(\vartheta-i)\}$ are of different sign for this a^*. As $k'' < 0$, $E\{v'(\vartheta-i)\} > E\{[k'/Ek']\, v'(\vartheta-i)\}$. This shows $E\{k'v'(\vartheta-i)\} < 0$.

Assume now that $(-w''/w') < (-v''/v')$. In this case v can be written as a concave function k of w (see Kihlstrom and Mirman (1974), p. 164f.). Using $v = k(w)$, the first order condition can be written as

$$E\{(g+k')w'(\vartheta-i)\} = 0. \qquad (A6)$$

with $k' > 0$, $k'' < 0$. Differentiating (A6) with respect to g yields

$$da^*/dg = -\frac{E\{w'(\vartheta-i)\}}{E\{(k'+g)w''(\vartheta-i)^2\} + E\{k''(w')^2(\vartheta-i)^2\}}. \qquad (A7)$$

This expression is positive, as

$$E\{(k'+g)w''(\vartheta-i)^2\} < 0 \qquad (A8)$$

$$E\{k''(w')^2(\vartheta-i)^2\} < 0 \qquad (A9)$$

and

$$E\{w'(\vartheta-i)\} > 0 \qquad \text{for } a^*. \qquad (A10)$$

(A8), (A9) and (A10) hold by similar reasons as (A3), (A4) and (A5).

Footnotes

1. In a labor market context also the "fair wage" variant of the efficiency wage hypothesis is relevant; see, e.g., Solow (1979), Akerlof and Yellen (1990), and Agell and Lundborg (1991a, 1991b).

2. The safety regulation argument is central both in Frank (1982) and Frank (1985a), and is also treated in Chapter 7 of Frank (1985b) and mentioned in Frank (1989). To be precise, the essence of Frank's arguments is that risk taking is socially excessive. Of course, both price and quantity measures can be used to correct for this.

3. We consider a one-period model and so use "income" and "consumption" interchangeably.

4. A "positional good" is a good where the relative amount consumed yields status. Presumably there is a close link between whether or not a good is strongly positional and to what extent its consumption can be observed by others.

5. Frank (1982) models "safety" as a good in a static certainty model. We think that, instead, risk taking is best portrayed as choosing or influencing a probability distribution over future outcomes. This is precisely what Frank does in an unpublished (1983) paper. He gives an example of risk taking as a binary choice between probability distributions over outcomes where excessive risk taking occurs. This suggests that the difference of opinion between Frank and ourselves is not major, but that a more general approach is justified, to show that the outcome of Frank's example is not singular.

6. Cf. Hirsch (1976) and Sen (1983).

7. The argument of course presumes limited access to capital markets.

8. Ideally, status should be measured by how one's own income compares with that of any other individual, but this would be hopelessly inoperational. Working with simpler measures inevitably involves throwing away information in one way

or another. Alternatively, one could assume that individuals' utility depends on their rank number in the income distribution. The analysis would roughly give the same results as here, but it could then for example be that an increase in expected income does not lead to an increase in status, if an individual is placed in a "sparsely populated" area of the income distribution. We think that the intuitive appeal of our distance measure of status at least matches that of any rank measure.

9. We want to study how risk taking is influenced by people "caring more" for status. However, using the general functional form $U(C,\gamma S)$, and increasing γ does not only increase the marginal rate of substitution between status and consumption (which would make status 'more important') but also changes all higher order derivatives of u with respect to the status argument. To get a 'clean' comparative static experiment, where people's concern for status relative to consumption is increased, but where this does not change risk aversion with regard to status risk, we need to work with a more special utility function: this is why we sometimes concentrate on the additively separable case.

10. Cf, e.g., Sandmo (1985). The original reference is Domar and Musgrave (1944), even though this model deviates a little from what has later become known as the Domar–Musgrave framework.

11. Condition (6) is assumed to hold throughout. A sufficient condition for (6) is U to be concave.

12. For a short proof of this equivalence see Kihlstrom and Mirman (1974, p. 164n.)

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