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ABSTRACT

This paper describes a theory of rational emulation and deviance. It assumes that individuals care about relative position (or 'status'), and constructs a model of decision-making in social and economic settings. The analysis shows why individuals who want to be different from others will, paradoxically, find it rational to imitate other people. The model demonstrates that status-risk-averse individuals follow others while status-risk-lovers act deviantly. The paper also provides a choice-theoretic foundation for a number of ideas in the social psychology and economics literatures.

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Andrew E. Clark and Andrew J. Oswald*

1. Introduction

The aim of this paper is to develop a model of behaviour in which individuals care about, and respond to, the actions of others. The analysis begins with a question that is central to social and economic theory, namely, that of why individuals follow each other's actions. It develops a theory of conformity and deviance. A choice-theoretic rationale is given for the formulae contained in the social psychologist's models known as equity theory (Adams 1963, 1965) and social exchange theory (Homans 1961). Other sociological ideas, about the importance of status and the absence of a strong role for private rates-of-return, emerge from within the framework. The analysis also provides a choice-theoretic justification for a class of models exemplified by Akerlof (1980), Jones (1984) and Kandel and Lazear (1992).

Human beings seem to have a deeply rooted need to conform, to copy, and to act fashionably. Examples of this kind of behaviour are the stuff of everyday life. The desire to fit in and to follow others probably helps to determine, among other things, the clothes we wear, the length of our hair, our weight, how many children we raise, the depth of our sun-tan, the size of vehicle in our driveway, the colour of the garage to which that driveway leads, the number plate on the vehicle in front of the garage, the type of food we eat, the shape of our teeth, where we go on holiday, and our preferences about issues as diverse as religion and contact lenses. Herd behaviour in more narrowly economic

situations can be seen in, for example, commodity and financial markets, and in markets for collectibles such as art and antiques. Labour markets provide a rich array of further examples - including how hard to work, whether to join a union, and how large a pay rise to demand. A more sociological example is the twentieth century desire to be as thin as, or thinner than, one's neighbour. 'Following' behaviour appears to be ubiquitous in social and economic settings.

The economist's natural response to these observations is either to question their validity or to suggest that standard models may be able to explain them. This paper is based upon the view that there is something called fashion and that it enters both social and economic life. The paper recognises that people sometimes have good, non-mysterious reasons to imitate one another: changes in technology can generate apparent copying behaviour as agents all switch toward a new product or activity; and new information, about a coming thunderstorm or a political opinion poll, does the same. Yet people appear to emulate one another in too many situations to make such explanations sufficient.

The English language recognizes the importance of conformist behaviour. It contains a plethora of words to capture the idea: 'fads', 'trendy', 'modish', 'fashion', 'all the rage', 'peer pressure', 'in style', 'bandwagon effects', 'craze', 'cult' and 'vogue'. If reality corresponded to the world of the conventional economics textbook, it is not easy to see why these words would be needed in English (or any other language). Traditional economic models assume self-interest, rationality, and exogenous preferences. They do not lead one to expect human beings to be moulded by fashion.

It is tempting to see following behaviour, especially in social situations, as driven by a kind of irrational need to fit in. On this view, to keep up with the Jones' is a sign of weakness, an emotional response rather than a logical choice. Many economists might be willing to adopt a milder

version of this view, and to argue that emulation in economic situations can be explained by appropriately adapting standard theory, while imitative actions in sociological settings may be less explicable but are not the concern of economic theorists.

The object of the paper is to argue that a single model is capable of explaining a variety of emulative activity[1]. The model relies on two assumptions: the first is that utility depends in part upon relative position (or 'status') and the second is that individuals may be risk-averse over this 'status'. Under such assumptions, a common framework can be used to predict a range of imitative phenomena. Unlike the work by Akerlof (1980), Jones (1984) and Kandel and Lazear (1992), the paper does not assume that individuals wish to be similar.

The paper's broader purpose is to blend economic and sociological ideas within one framework. Section 2 sets out the basic model and shows how it predicts following behaviour. Section 3 presents some simulations of the model using quadratic functional forms, and demonstrates how fashion cycles may come about; it also shows that, with emulative behaviour, an increase in a good's marginal utility may reduce its consumption in equilibrium. Section 4 concludes.

2. A Model Encompassing Economic and Social Elements

To attempt to construct a theory of social and economic behaviour, it is necessary to blend two traditionally distinct ways of thinking[2]. The dichotomy is accurately and colourfully captured in a recent description by Jon Elster:

> "One of the most persistent cleavages in the social sciences is the opposition between two lines of thought conveniently associated with Adam Smith and Emile Durkheim, between homo economicus and homo sociologicus. Of these, the former is supposed to be guided by instrumental rationality, while the behaviour of the latter is dictated by social norms. The

former is 'pulled' by the prospect of future rewards, whereas the latter is 'pushed' by quasi-inertial forces ..... The former is easily caricatured as a self-contained, asocial atom, and the latter as the mindless plaything of social forces ..."

p.97, J. Elster (1991)

The model developed in the paper recognises this dichotomy. It assumes that individuals are motivated by two kinds of rewards (one direct, the other from social comparison). Within this framework, however, it assumes self-interest. Although one of the paper's aims is to explain behaviour that is traditionally thought of as sociological, the analysis posits no irrationality, nor any actions driven by an emotional requirement to conform. The actors in the model do, in general, abide by social and economic norms. The norms are equilibria produced by the independent actions of rational maximizers.

The framework to be constructed might be thought of as a formalization of the sociologist's long-standing concern with status, or as a generalization of the ideas of Veblen (1949):

"The complex of problems associated with patterns of class and status has always been a focal point of sociological inquiry, just as kinship patterns have been such a point for the social anthropologist in the study of tribal societies. In this sense we could say that sociology brought to the social sciences a new principle or point of view; namely, to observe social phenomena from the aspect of the ranking of individuals and groups in the social hierarchy."

p.84, T.B. Bottomore (1966).

"The end sought by accumulation is to rank high in comparison with the rest of the community ... So long as the comparison is distinctly unfavourable to himself, the normal,

average individual will live in chronic dissatisfaction with his present lot ..."

"Relative success, tested by an invidious pecuniary comparison with other men, becomes the conventional end of action."

p.33, T. Veblen (1949).

The paper assumes, following Veblen (1949) and Festinger (1954), that individuals constantly compare themselves to others. The most natural interpretation is that they feel in competition with human beings like themselves, and enjoy a sense of well-being when they out-perform their peers, or obtain a sense of failure and envy when they rank poorly besides those peers. Much of social psychology rests upon notions of this kind. Classic sources include Festinger (1954), Stouffer *et al* (1949), Homans (1961) and Adams (1963). Modern textbook treatments include Argyle (1989), Warr (1985) and Weyant (1986). Sociology, and a segment of economics, also takes seriously the assumption that feelings of relative deprivation are important. Sociological literature includes Davis (1959), Pollis (1968) and Runciman (1966). The economics literature includes Duesenberry[3] (1949), Layard (1980) and Frank (1985).

The Model

Let 'a' be an action of some economic or social kind. Assume that it gives utility both directly and, by affecting an individual's status, indirectly. Assume that status comes from relative position or rank. Assume that action a is costly. Let a* be the mean of other people's actions (or some other measure of what they do).

Define the agent's utility function in one of two ways. The first specification, which will be termed an *additive comparisons* model, has expected utility given by

$$EU = sv(a-a^*) + (1-s)u(a) - Ec(a,\theta) \tag{1}$$

The function v is to be thought of as capturing the utility from status. Its first derivative will be taken to be positive; its second derivative may be positive or negative (corresponding to risk-loving or risk-aversion with respect to status). Thus people enjoy surpassing others' actions. This is what gives status. The function u is increasing and concave in a. The cost function $c(a,\theta)$ is increasing and convex in a. A random variable affects costs, and the agent must decide upon his or her action before the actual level of θ is revealed. Even this assumption could be dispensed with in the first part of the paper. The variable s is a parameter in the unit interval.

An alternative specification, a *ratio comparisons* model, assumes expected utility:

$$EU = sv(\frac{a}{a^*}) + (1-s)u(a) - Ec(a,\theta). \tag{2}$$

In this case the determinant of status is the ratio (rather than the difference) of action a to others' actions a*. As before, an increase in a raises utility both through a direct effect upon u(a) and an indirect effect, acting through the relative value of the action, upon v(a/a*). For the sake of clarity, equations (1) and (2) assume more separability than is strictly required.

These specifications have the feature that expected utility depends upon a convex combination of a direct private component of utility and a status-oriented element of utility. The weights, (1-s) and s, provide a simple way to capture the mix of effects. As $s \to 0$, the traditional economist's model holds. Preferences are private and self-interested; agents do not look over their shoulders to see what other individuals are doing. As $s \to 1$, only status matters, and an extreme 'sociological' model applies. Relativities play a paramount role in such a model.

To choose his or her optimal action, the individual with concern for additive status comparisons maximizes expression (1). For an interior maximum

$$sv'(a-a^*) + (1-s)u'(a) - Ec_a(a,\theta) = 0. \tag{3}$$

The first term is the marginal benefit from status; the second is the direct marginal benefit from action a; the third is expected marginal cost.

The first analytical result stems from differentiating implicitly in equation (3) to give the individual's response to others:

$$\frac{\partial a}{\partial a^*} = \frac{sv''(a-a^*)}{sv''(a-a^*) + (1-s)u''(a) - Ec_{aa}(a,\theta)} \tag{4}$$

The denominator on the right-hand side of equation (4) is negative by the requirement that the maximization problem be concave. Hence the sign of the response of a to a* depends upon the negative of the numerator. Risk-aversion (with respect to status), defined as $v''(a-a^*) \leq 0$, therefore implies that a rise in others' actions leads the agent to increase his or her own action, a. Status-risk-neutral individuals act precisely independently of other people. Status-risk-loving agents, who have a convex v(a-a*) function, behave in a way that deviates from other agents' behaviour. Movements in a* induce them to alter their action in the opposite way from a*.

Proposition 1: *Under additive comparisons,*

(i) *status-risk-averse individuals follow others' actions;*
(ii) *status-risk-neutral individuals ignore others;*
(iii) *status-risk-loving individuals do the opposite of others.*

Proof: Direct from equation 4 and the concavity or convexity of v(.).

Intuitively, the reason for following behaviour is that, as actions elsewhere vary, the marginal utility of status changes. If other agents set high a*, that reduces a-a*, and this increases a risk-averse person's marginal benefit from action a. The chosen level of a therefore rises[4].

At a mathematical level, what determines the response of a to a* is the cross-partial derivative of that part of the utility function. One might argue, therefore, that it is the algebraic complementarity of a and a* that matters (Gary Becker has made this point to us). Formally this is clearly correct. However, the concept of status-risk-aversion seems the natural economic way to interpret the mathematical nature of complementarity in a function like v(a-a*). Status-risk-aversion is the equivalent in a model with social comparisons to the textbook notion of risk-aversion over income.

A natural benchmark case is linear following. Consider the special case of maximand (1) given by

$$\textit{Maximize} \quad s\log(a-a^{*}+\mu) + (1-s)a - ca \tag{5}$$

in which μ is a positive constant and c, expected marginal cost, is constant and greater than 1-s. The 'following rule' in this case is

$$a = a^{*} - \left(\frac{s}{1-c-s}\right) + \mu \tag{6}$$

so that the agent matches changes in others' behaviour one-for-one. It is the linearity of the last two terms in (5) that does this. More generally, if the agent solves

$$\textit{Maximize} \quad sv(a-a^{*}) + (1-s)a - ca \tag{7}$$

the first-order condition can be written as

$$v'(a-a^*) = \left(\frac{c+s-1}{s}\right), \tag{8}$$

which again implies one-for-one linear following. This requires v(a-a*) to be concave, to ensure a maximum. These establish the result below.

Proposition 2: *With status-risk-aversion, and maximand (7), there is linear one-for-one following. This is true for any weight on status, s>0.*

Proof: Direct from (8). It can be seen that a-a* equals a constant, so da=da*.

Many economists' intuition would be that this theory of herd behaviour requires agents to care a lot about status. The proposition shows that that intuition, however, is misleading. Equations (6) and (8) prove that one-for-one following exists even when the sociological weight, s, is small.

Another likely reaction from some economists is that the assumption that status matters is tantamount to assuming a taste for emulation (so making the model uninteresting). This is also incorrect: status-conscious risk-neutral people, for example, do not follow one another. The model derives conformity in a framework where agents want to be different from one another.

The analytical results illustrate a fundamental characteristic of the class of models studied in the paper. When people value their relative position in society, and so get utility from being towards the top of a hierarchy of levels of action a, the assumption of status-risk-aversion is sufficient to generate 'following'. It is not necessary to assume that individuals care solely about status: the proof goes through if the weight s on status is small. The detailed structure of the maximization problem is also unimportant to the derivation of imitative activity. Only the mild assumption of a local maximum is required. It is also straightforward to verify that the key result holds if the status utility

component, v(.), includes weighted levels of a and a*.

In this framework, not everyone copies and acts conventionally. Agents who enjoy risk (over relative position), and thus get increased utility from a mean-preserving increase in variability, act deliberately differently from the rest. Status-risk-loving generates deviant behaviour ($\partial a/\partial a^*<0$) which might be thought to conform to, and express formally, our intuitions about non-conformism in social and economic settings. The model therefore provides an account of deviancy, which has traditionally been a central issue in sociology.

Although the tenor of the results holds good for the case of ratio comparisons, the details of the argument are altered. The first order condition for a maximum of the function (2) is

$$sv'\left(\frac{a}{a^*}\right)\frac{1}{a^*} + (1-s)u'(a) - Ec_a(a,\theta) = 0 \tag{9}$$

The sign of the derivative of action a with respect to others' actions a* is then

$$sign\ \frac{\partial a}{\partial a^*} = sign\ \left\{-v''\left(\frac{a}{a^*}\right)\frac{a}{a^*} - v'\left(\frac{a}{a^*}\right)\right\}. \tag{10}$$

Hence, following behaviour emerges if the rate of relative risk aversion exceeds unity.

Proposition 3: *Under ratio comparisons, status-risk-aversion of unity marks the dividing line between followers and deviants.*

Proof: Direct from equation (10).

Although the paper has up to this point thought of emulation as the following by one individual of the direction of another's action, a more extreme case is where agents choose exactly

the same levels of action. The analysis suggests that this ought intuitively to correspond to the case of extreme status-risk-aversion, and so it proves. Consider the utility function

$$\frac{s}{(1-\tau)}(a-a^*)^{1-\tau} + (1-s)a - ca. \tag{11}$$

Proposition 4: *In the limit, as status-risk aversion $\tau \to \infty$*
(i) under ratio comparisons, $a \to a^*$;
(ii) under additive comparisons, $a \to a^*+1$.

Proof: For (ii), note that, by equation (8), log (a-a*)→0 in this case, which establishes a→a*+1. Applying the same method to the maximand in equation (2) gives a→a*.

If status-risk-aversion is sufficiently great, therefore, something akin to pure replication is the result. Individuals' overriding concern in such a world is to avoid falling behind others.

Altruism and Conformism

It might be argued that the model paints too gloomy a picture of human beings. As described, the function v(a-a*) implies that agents become happier as their own action a outstrips others' actions a*. Thus status operates through a form of envy effect.

The framework can be adapted, however, to an altruistic world. For example, consider the case in which individuals wish to maximize

$$EU = sv(ba^* - \beta a) + (1-s)u(a) + Ec(a,\theta) \tag{12}$$

where the comparison component of utility is now increasing in others' actions a* and decreasing in

the own action a, and the parameters b and β capture the strength of the effects. Action a still gives direct utility through the u(a) component. The first-order condition is derived in the usual way and the response of a to a* is determined by

$$sign \ \frac{\partial a}{\partial a^*} = sign \ - sb\beta v''(ba^* - \beta a). \tag{13}$$

Once again, therefore, the assumption of risk-aversion, this time with respect to the individual's concern for others, ensures that people follow one another. It is the sign of the second derivative, not of the first, that matters. Hence the key aspects of the analysis are not altered by allowing people to be pleased when others move ahead.

The model can be contrasted with the related theories of Akerlof (1980) and Kandel and Lazear (1992). These analyses assume that individuals experience direct disutility when they behave deviantly. In Akerlof (1982), reputation enters into the utility function, and reputation depends upon observance of a code of accepted behaviour. A theory of custom is thereby generated. In Kandel and Lazear (1992), the utility function includes a peer pressure function, by which non-conventional behaviour leads to costs for the individual. The authors' objective is to show how norms and the free rider problem interact.

While they deal with interesting issues, both studies are open to a traditional criticism. Akerlof (1982) and Kandel and Lazear (1992) effectively assume that economic and social agents enjoy conforming, and are aware that in doing so they depart from the standard economic approach of deriving behaviour from a set of more primitive axioms. The model developed in this paper pushes this process one stage further back. It does not assume that conformism enters the utility function.

Instead, the model makes the assumption that utility depends partly upon rank or status, and that it does so in a concave (risk-averse) way. If these assumptions are viewed as plausible and sufficiently primitive, the paper can be seen as offering a choice-theoretic explanation for the Akerlof - Kandel - Lazear framework.

Equilibria and Norms

It is natural to consider the properties of an equilibrium in which many decision-makers act as the model suggests. Social and economic outcomes are then appropriately thought of as Nash equilibria in which people choose their desired action, a, given what others are doing. An equilibrium is a vector of consistent actions.

Assume a continuum of decision-makers, differentiated by different cost parameters α. Let α be distributed in society $f(\alpha)$. Under additive comparisons, therefore, social welfare is given by

$$W = \int \{sv(a-a^*) + (1-s)u(a) - Ec(a,\theta)\} f(\alpha)d\alpha, \tag{14}$$

where the mean action is

$$a^* = \int af(\alpha)d\alpha. \tag{15}$$

For society to be at an optimum,

$$a(\alpha):\ sv'(a-a^*) + (1-s)u'(a) - Ec_a - \lambda = 0 \tag{16}$$

$$a^*:\ \lambda - \int sv'(a-a^*)f(\alpha)d\alpha = 0, \tag{17}$$

where λ is the multiplier on constraint (15). It follows, comparing (16) with the earlier equation (3) for privately rational actions, that equilibria are not optimal. By the concavity of equation (14), and from equations (16) and (17), socially desirable levels of action are below those that individuals take. This is because action affects the relative standing of others.

Although this is a familiar concept to economists, its application to social equilibria may be less conventional. The essential idea is that, when social comparisons motivate people, any form of social equilibrium will be inherently sub-optimal because people ignore the externalities their actions create.

When there are many decision-makers it is restrictive to assume that each compares himself or herself to the mean. Some agents' actions may be more important in forming comparisons than others. Rewrite the original agent's maximand as

$$EU = sv(a-j\hat{a}) + (1-s)u(a) - Ec(a,\theta,\alpha) \tag{18}$$

where j is a vector of coefficients, $\hat{a}$ is a vector of others' actions, and an agent's type depends on a parameter in the cost function α. In this formulation, the optimal action a depends on each of the other $\hat{a}$ actions being taken, where the size of each effect rests upon the relevant coefficient in the j vector.

Linearizing this system produces, as an approximation, a set of equations given by

$$\hat{a} = J\hat{a} + \hat{\alpha} = [I-J]^{-1}\hat{\alpha} = [\textstyle\sum_{t=0}^{\infty} J^{t}]\hat{\alpha} \tag{19}$$

in which $\hat{\alpha}$ is the vector of cost parameters for the different decision-makers, a is their chosen actions,

and J is a matrix of coefficients measuring how actions interact. The matrix $[I-J]^{-1}$, where I is the identity matrix, provides a method of capturing a form of *following multiplier*. It measures the way in which actions in one segment of society feed through into actions elsewhere. Some exogenous change (through $\hat{\alpha}$), for example, will permeate through society. The process of moving to the new equilibrium will look like the introduction of a new norm that most emulate.

Elster (1991) discusses a number of norms of behaviour that any satisfactory theory must be able to explain[5]. He argues (p.121) that acts of vengeance and rules of etiquette are classic, but different, examples of norm-guided action, and that the challenge to any theory is to be able to explain both. The analysis can go some way towards this goal. First, the model provides a theory of revenge. Even when an action, a, creates no direct utility, and is costly, people may still undertake it if that action lowers others' standing. The model thus predicts the existence of revenge (something conventional economic theory might find more difficult). Second, if the following of etiquette confers status, the model predicts that, even if intrinsically worthless, a rational decision-maker will be willing to face costs to emulate what is considered to be good taste.

It may be useful also to illustrate the model's application to economic following. One example is the Japanese-style case of corporate cultures in which everyone works at high levels of effort. When performance gives status, either directly or through added earnings, the model predicts effort-following of this sort. Another example is to investment by, for example, banks making loans to developing countries. When managers are rewarded on the basis of their success relative to other banks' managers, as is often supposed, the model predicts that, if risk-averse, these investors will exhibit herd behaviour. A third example is the emulative consumption behaviour discussed by Duesenberry (1949).

Equity Theory and Neutrality Results

Social psychology has two theories that are especially relevant to the model outlined earlier. One is equity theory, due to Adams (1963), which states that human beings strive in any relationship or exchange to ensure that, for person i and person j,

$$\frac{Outcome \quad (or \ reward) \ of \ j}{Input \quad (or \ effort) \ of \ j} = \frac{Outcome \quad (or \ reward) \ of \ i}{Input \quad (or \ effort) \ of \ i} \tag{20}$$

The idea is that individual i has a comparison or reference person, j, and reduces his or her own input until it is in line with that comparison person's ratio of reward to input[6]. Homans (1961) and Blau (1955) suggest similar theories of social exchange. Surveys of this work from the economist's perspective are given in Carruth and Oswald (1989) and Akerlof and Yellen (1990). The laboratory and field evidence is reasonably supportive of the theory: see Adams and Freedman (1976) for a review.

Economists have traditionally been hostile to formulations of this sort, seeing them as ad hoc and inconsistent with rational choice theory. However, the ratio rule of equity theory can be derived using the model developed earlier. It emerges, as might be expected, that a linear ratio rule is a special case.

The derivation of equity theory's formula begins by assuming that the utility function takes a (pure ratio comparisons) constant elasticity form:

$$U = \frac{1}{1-\gamma}\left(\frac{r(a)a}{\rho(a^*)a^*}\right)^{1-\gamma} - ca \tag{21}$$

where γ is constant and c is a constant measuring the marginal cost of actions. The function r(a) is

the average return to action a, and r(a)a is the total return. The representative other agent has average return $\rho(a^*)$ and total return $\rho(a^*)a^*$. This formulation assumes for simplicity that there is no cost uncertainty, although it could be incorporated.

Assume that the return function r(a) has constant elasticity η. Then the first order condition for a maximum is

$$\left(\frac{ra}{\rho a^*}\right)^{-\gamma}(1+\eta)\ \frac{r}{\rho a^*} - c = 0. \tag{22}$$

There is an equivalent condition for the representative other agent. Defining that agent's degree of relative risk aversion as $\varnothing$, and the elasticity of the return function as ψ, the other first order condition is

$$\left(\frac{\rho a^*}{ra}\right)^{-\varnothing}(1+\psi)\ \frac{\rho}{ra} - k = 0, \tag{23}$$

where k is the marginal cost of action a*. Multiply equation (22) throughout by a, and equation (23) throughout by a*, and rewrite as

$$\left(\frac{ra}{\rho a^*}\right)^{1-\gamma}(1+\eta) = ca \tag{24}$$

$$\left(\frac{\rho a^*}{ra}\right)^{1-\varnothing}(1+\psi) = ka^*. \tag{25}$$

Expressing these as a ratio of one to the other:

$$\left(\frac{ra}{\rho a^*}\right)^{2-\gamma-\varnothing} = m\frac{a}{a^*} \tag{26}$$

where m is a constant given by $c(1+\psi)/k(1+\eta)$. Here the first agent gets 'outcome' ra in return for 'input' a; the other gets ρa^* for a^*.

Equation (26) is a generalization of the formula proposed in equity theory (Adams 1963 *inter alia*) and social exchange theory. To see it in the exact form used in that literature, consider the case $\gamma=0.5$, $\varnothing=0.5$, $c=k$ and $\psi=\eta$. Hence, agents are identical and have square-root utility functions, and the model predicts:

$$\frac{ra}{a} = \frac{\rho a^*}{a^*}, \tag{27}$$

namely, the equality of outcome-to-input ratios. This is also the equality of average returns.

As the earlier quote from Elster implies, some sociologists have opposed the economist's notions of optimizing at the margin. To show that 'prices' like rates of return can have small effects here, consider the following version of the model. Let r be the rate of return to action a, and ρ be the rate of return to action a^*. The total returns to the agents are again ra and ρa^*, respectively. Rewrite the expected utility function, in terms of these levels of reward, as

$$EU = s\nu\left(\frac{ra}{\rho a^*}\right) + (1-s)\mu(ra) - Ec(a,\theta) \tag{28}$$

which implies that people use ratio comparisons. The neutrality of rates of return can be seen (without differentiation or further analysis) to result from two further assumptions. If $r=\rho$, so that agents face common incentives, the ratio r/ρ in the maximand becomes unity. If the weight s is large, so that considerations of status are important, the second term in the above equation is small. More formally, in the limit as $s \to 1$ and $r \to \rho$:

$$EU = \nu\left(\frac{a}{a^*}\right) - Ec(a,\theta) \tag{29}$$

and the marginal incentives r and ρ become irrelevant to decision-making.

Under additive comparisons, this neutrality result occurs less readily, because there is not automatic cancelling of r and ρ. Nevertheless, when ν is given by the log of the difference between the return to actions a and a*, and s=1 and $r=\rho$, the first-order condition is

$$\frac{1}{a-a^*} - Ec_a(a,\theta) = 0. \tag{30}$$

Once again, therefore, marginal incentives play no role.

This class of neutrality results has implications for a range of economic settings. Taxes on working income, the rate of interest on retirement savings, the size of piece rates within factories[7] - all these are subject to a general neutrality finding if relative status is sufficiently important[8].

Fads and Rational Noise Trading

A final economic illustration is as follows. In a well-known paper, Shiller (1984) has argued that the most plausible explanation for the volatile mean-reverting behaviour of asset markets is the existence of 'fads', caused by fashion and social pressure, in speculators' decisions. The author did not propose an optimizing model, but argued by analogy with social activity.

It is possible to use the paper's framework to provide a choice-theoretic foundation for Shiller's work, and for the interesting but ad hoc noise trading models (such as Cutler *et al* 1990) that came after it. The model is a special case of the earlier framework. It is essentially an application of Jensen's inequality.

Consider an investor choosing between a risky asset that will realize price p with probability density f(p) and a safe asset with return z. Let a be the share of the portfolio in the risky asset. Then the expected utility of an investor concerned with both absolute return (per dollar invested) and his or her relative return (where a* is what other investors do) is

$$EU = \int \{v(pa+z(1-a)-pa^{*}-z(1-a^{*})) + u(pa+z(1-a))\}\ f(p)dp. \tag{31}$$

Write this more succinctly as

$$\textit{Maximize} \quad E\{v+u\}, \tag{32}$$

which has first-order condition

$$E\{[v'(\cdot)+u'(\cdot)](p-z)\} = 0. \tag{33}$$

Hence

$$sign \ \frac{\partial a}{\partial a^*} = sign \ - E\{v''(\cdot)(p-z)^2\}, \tag{34}$$

which is positive under the assumption of risk-aversion with respect to relative return. Investors follow others. They do so because, in a world where relativities matter, emulation offers a kind of insurance.

This provides a model of rational noise trading, or herd behaviour, and rests upon the assumption that investors care in part about their performance relative to other investors. The common practice of linking fund managers' remuneration to their success relative to a market index will produce herd behaviour in financial markets.

3. Fads and Following: Some Simulations

This section describes the following behaviour that results from quadratic utility functions, and shows how cyclical behaviour may result from shocks.

The functional forms

It is assumed that there are time lags in information, which imply that individuals react to the value of a* in the past. There are two types of agent: 'leaders' (subscript 1) and 'followers' (subscript n). Both leaders' and followers' utility is defined by the weighted sum of two quadratic functions; the first represents their utility from the relative value of their action and the second their utility from the absolute value of their action. The unit costs of activity a are c_1 for leaders and c_n for followers:

$$U_1 = s_1\beta_0(a_{1t}-a_{nt-1}) + s_1\beta_1(a_{1t}-a_{nt-1})^2 + (1-s_1)\beta_2 a_{1t} + (1-s_1)\beta_3 a_{1t}^2 - c_1 a_{1t} \tag{35}$$

$$U_n = s_n\gamma_0(a_{nt}-\delta a_{1t-1}-(1-\delta)a_{1t-2}) + s_n\gamma_1(a_{nt}-\delta a_{1t-1}-(1-\delta)a_{1t-2})^2 + (1-s_n)\gamma_2 a_{nt}$$
$$+ (1-s_n)\gamma_3 a_{nt}^2 - c_n a_{nt} \qquad (36)$$

Utility is an increasing concave function of the absolute level of a for both leaders and followers, hence β_2 and $\gamma_2 > 0$, β_3 and $\gamma_3 < 0$. For the relative terms it is assumed that both leaders and followers gain utility from the relative level of their action. However, the leaders' utility function defined over their relative level of action is convex, so that β_0 and β_1 are both positive, whereas followers' returns to their relative action are concave, with γ_0 positive and γ_1 negative. Leaders are thus here assumed to be status-risk-loving while followers are status-risk-averse.

For tractability, a special assumption is useful. While leaders are assumed to compare their actions with only the most recent action of the followers, the followers themselves compare their actions to a weighted average of the two most recent actions of the leaders. This might be motivated by stating that followers' views of fashion extend over more than one time period, or by considering that some followers suffer larger time delays in observing what is fashionable (i.e. what the leaders have done) than do others.

The net marginal utility for leaders from 'a' is $(1-s_1)\beta_2 + 2(1-s_1)\beta_3 a_{1t} - c_1 + s_1\beta_0 + 2s_1\beta_1(a_{1t}-a_{nt-1})$. The first two terms reflect the direct utility from the action; concavity ensures that marginal utility is falling in the level of the action itself. The third term shows the cost of the action. Relativity effects work through the last two terms, which act like a tax on marginal utility. Leaders' marginal utility falls with the level of the action undertaken by followers: the higher is a_{nt-1}, the lower is the level of action chosen by the leaders. An analogous expression applies for followers, but, in this case, marginal utility rises with the weighted average of leaders' actions over the past two periods.

The choice of action according to the maximisation of (35) and (36) yields the following equations:

$$a_{1t} = (c_1-s_1\beta_0-(1-s_1)\beta_2+2s_1\beta_1 a_{nt-1})/(2s_1\beta_1+2(1-s_1)\beta_3) \tag{37}$$

$$a_{nt} = (c_n-s_n\gamma_0-(1-s_n)\gamma_2+2s_n\gamma_1(\delta a_{nt-1}+(1-\delta)a_{nt-2}))/(2s_n\gamma_1+2(1-s_n)\gamma_3) \tag{38}$$

The second order conditions ensure that the maximands are concave, and hence that the denominators of both equations are negative. Thus leaders' actions will move in the opposite direction to those of followers in the previous period, while followers' actions will move in the same direction as the weighted average of those of the leaders in the previous two time periods.

Combining (37) and (38) gives the following difference equations:

$$a_{1t} = [((c_1-s_1\beta_0-(1-s_1)\beta_2)G +s_1\beta_1(c_n-(1-s_n)\gamma_2))/2BG] + s_1\beta_1 s_n\gamma_1(\delta a_{1t-2}+(1-\delta)a_{1t-3})/BG \tag{39}$$

$$a_{nt} = [((c_n-s_n\gamma_0-(1-s_n)\gamma_2)B +s_n\gamma_1(c_1-(1-s_1)\beta_2))/2BG] + s_1\beta_1 s_n\gamma_1(\delta a_{nt-2}+(1-\delta)a_{nt-3})/BG \tag{40}$$

where $B=s_1\beta_1+(1-s_1)\beta_3$ and $G=s_n\gamma_1+(1-s_n)\gamma_3$[9]. The following propositions regarding the size of the coefficient multiplying the agents own lagged actions can be stated.

<u>Proposition 5</u>: *The effect of the agent's own lagged action on their current action is greater the higher are β_1, γ_1, s_1 and s_n, and the lower are β_3 and γ_3.*

<u>Proposition 6</u>: *Cycles will occur if the slope coefficient in equations (39) and (40) is negative, i.e. if either β_1 or γ_1, but not both, are negative.*

<u>Proof</u>: Directly from equations (39) and (40).

Thus cycles occur if one, but not both, of the types of agent is status-risk-averse.

The equilibrium values of these equations are

$$a_1^e = [(c_1-s_1\beta_0-(1-s_1)\beta_2)(s_n\gamma_1+(1-s_n)\gamma_3) + s_1\beta_1(c_n-s_n\gamma_0-(1-s_n)\gamma_2)]$$
$$/2(s_1\beta_1(1-s_n)\gamma_3+(1-s_1)\beta_3 s_n\gamma_1+(1-s_1)\beta_3(1-s_n)\gamma_3) \quad (41)$$

$$a_n^e = [(c_n-s_n\gamma_0-(1-s_n)\gamma_2)(s_1\beta_1+(1-s_1)\beta_3) + s_n\gamma_1(c_1-s_1\beta_0-(1-s_1)\beta_2)]$$
$$/2(s_1\beta_1(1-s_n)\gamma_3+(1-s_1)\beta_3 s_n\gamma_1+(1-s_1)\beta_3(1-s_n)\gamma_3) \quad (42)$$

It is not clear whether a_1^e is greater or less than a_n^e. With the assumptions that $c_1=c_n$, $\gamma_0=\beta_0$, $\gamma_2=\beta_2$ and $\gamma_3=\beta_3$, and that c_1 is less than β_0, which are made for the simulations, it is easy to show that a sufficient condition for a_n^e to be greater than a_1^e is that s_n is greater than s_1, i.e. that followers put more weight on the returns from absolute utility than do leaders.

Response to shocks

The following simulations show the cyclical movement towards equilibrium after a shock. The parameter values chosen are as follows. For the leaders' utility function, $\beta_0=0.5$, $\beta_1=0.1$, $\beta_2=0.5$ and $\beta_3=-0.1$; the weight on relative action, s_1, is set to ⅓ and the unit cost of action, c_1, equals 0.1. For the followers, $\gamma_0=0.5$, $\gamma_1=-0.1$, $\gamma_2=0.5$ and $\gamma_3=-0.1$; the weight on relative action, s_n, is set to ⅔ and the unit cost of action, c_n, also equals 0.1. The parameter δ is given a value of ⅔, implying that followers put twice as much weight on leaders' actions lagged one time period as on the corresponding actions two periods ago.

There are thus three differences between leaders and followers in these simulations. First, and

most importantly, leaders are status-risk-lovers, while followers are status-risk-averse. Second, leaders put less weight on the relative part of utility than do followers. Third, followers compare to a weighted average of leaders' past actions, while leaders compare only to what the followers did in the previous time period.

The following figures show the cyclical behaviour of leaders and followers in response to various shocks. Agents are initially in equilibrium and all shocks occur at time t=8.

Figure 1a shows the behaviour of this system when there is a negative shock to leaders' costs, which fall from 0.1 to 0.05. Initially leaders increase their level of action in response to the lower cost of doing so. But once followers emulate them, they reduce their level of 'a', which, however, remains above its old higher cost level. Again this action is imitated by followers, so leaders increase their action in response, and so on until the new equilibrium is reached. The chosen parameters of the model imply stability of his cyclical process, and the figure shows that the cycles largely die away about fifteen time periods after the initial shock. This new equilibrium entails greater levels of the action for both leaders and followers.

Similar cyclical responses come about if other parameter values are changed. For example, a fall in s_1 leads to higher equilibrium values of action for both leaders and followers and, as in Proposition 5, reduces the amplitude of the cycles such that the new equilibrium is quickly reached. On the other hand, a rise in s_n increases the amplitude of the cycles and leads to higher levels of action for leaders and lower levels for followers.

<u>The perverse response of demand to positive information or lower prices</u>

Now consider that new information becomes available regarding the attractiveness of a good. In equations (35) and (36) this can be reflected by an increase in the β_2 and γ_2 parameters. This

increase acts as a positive shock to the marginal utility of the action[10].

In a model without relativities, the response of all consumers would be to increase their level of the action until the concavity of the utility function bought marginal benefit back into equality with (unchanged) marginal cost. However, more complicated effects arise when others' actions enter into the individual utility functions. The immediate response of both leaders and followers is indeed to increase their level of action, but the story does not end there. In the first period after the shock to parameters, leaders, who see that followers increased 'a' in the previous period, reduce their level of action; followers increase theirs further in order to be more like leaders over the past two periods. The second period response of leaders is thus to further reduce their level of action, while that of the followers depends on the weighted average of leaders' actions over the previous two time periods and may be positive or negative. The cyclical pattern continues until convergence is reached.

It is quite possible in this model that a positive shock to the marginal utility of a good can lead to lower levels of consumption[11]. Some simple algebra shows that, if the marginal utility shock falls on β_2 and γ_2, then total consumption will fall as a result if $(1-s_1)\beta_2(2s_n\gamma_1+(1-s_n)\gamma_3) + (1-s_n)\gamma_2(2s_1\beta_1+(1-s_1)\beta_3) > 0$. The parameters γ_1, γ_3 and β_3 are negative, while β_2, γ_2 and β_1 are positive, so the first half of the above inequality is negative while the second half is ambiguously signed. Inspection reveals that a large value of γ_2 compared to β_2, and a small absolute value of β_3 compared to β_1 will ensure that this inequality holds. Some further constraints on acceptable parameter values result from the second order conditions and from the requirement that the level of actions implied by equations (41) and (42) are positive.

One example suffices to prove the existence of this phenomenon. Taking s_1=0.4, s_n=0.6, c_1=0.05, c_n=0.4, β_0=1.5, β_1=β_2=0.2, β_3=-0.2, γ_0=0.5, γ_1=-0.05, γ_2=1 and γ_3=-0.5, the equilibrium

value of a_1 is 1.079 and that of a_n is 3.648, for a total level of 'a' of 4.727. Increasing both terms in the level of absolute utility by 10% (i.e. β_2 rises to 0.22 and γ_2 rises to 1.1) raises a_n to 3.871, but reduces a_1 to 0.784, for a total level of action of 4.655. The total level of action falls after the positive shock to marginal utility.

The existence of this perverse demand effect depends crucially on the relative utility and cost parameters of the model. It also depends on the relative numbers of followers and leaders. In the above example it was assumed that there were equal numbers of both, but as the proportion of leaders falls then so does the likelihood of this fall in the total level of action.

Researchers in the field of drug policy have often wondered at the apparent fall in the use of cannabis in Holland following its 1976 decriminalisation (see van Kalmthout, 1989). One explanation is that the increased frequency of purchase raised sellers' risks and thus the price in the illegal market (Lee, 1993). This model in this paper suggests an alternative explanation. The positive signal about the effects of drugs that decriminalisation gave, or equivalently any accompanying fall in price, initially led both leaders and followers to increase use. However, if there are enough leaders, and if they are sufficiently sensitive to followers' actions, the substantial reduction of leaders' drug use may cause overall drug use to fall. In equilibrium, followers will exhibit slightly higher rates of use, but the desertion of drug use by leaders could account for this paradoxical overall fall in drug use.

Snob Effects

More complicated dynamics can be generated by specifying endogenous changes in behaviour within the above cycles.

First consider that certain leaders may not wish to be associated with an action that becomes 'too popular', even though the maximisation of (35) implies that they should; this is thus a kind of

snob effect. This behaviour is modelled in the following way. Imagine that for each leader i there is a threshold of the level of followers' actions, $\bar{a}_{ni}$, such that if $a_{nt} \geq \bar{a}_{ni}$ then $a_{1it+1}=0$. Let $\bar{a}_{ni}$ be distributed uniformly between a lower threshold $\bar{a}_n$ and an upper limit $\beta\bar{a}_n$, where $\beta>1$. If $\beta\bar{a}_n > a_{nt} > \bar{a}_n$ then a fraction $(a_{nt}-\bar{a}_n)/(\beta\bar{a}_n-\bar{a}_n)$ of the leaders reduce their level of action to zero, as they feel that the phenomenon is too widespread for them to be associated with it[12]. Thus the total level of leaders' actions is $\hat{a}_{1t+1} = 0[(a_{nt}-\bar{a}_n)/(\beta-1)\bar{a}_n] + a_{1t+1}[1 - (a_{nt}-\bar{a}_n)/(\beta-1)\bar{a}_n] = a_{1t+1}[(\beta\bar{a}_n-a_{nt})/(\beta-1)\bar{a}_n]$. $\hat{a}_{1t+1} = 0$ if $a_{nt} > \beta\bar{a}_n$.

The implications of this structural break in leaders' preferences are shown in Figure 1b. Starting from the equilibrium values resulting from the old preferences, the new preferences are imposed at time t=8. The lower limit, $\bar{a}_n$, is set to 0.5, and $\beta=12$, so that $\beta\bar{a}_n=6$. As the old equilibrium value of a_n is above $\bar{a}_n$ the immediate response is a sharp fall in a_1, while there is no change in a_n. The same type of cyclical behaviour as discussed before ensues, but with cycles of greater amplitude and of longer duration. Followers are at times avidly engaged in activities which leaders are disavowing (see t=12 for example). The 'snob' behaviour of leaders has the effect of exacerbating the cyclical behaviour of the economy by exaggerating the downturn in leaders' actions when those of followers rise above a certain point, and analogously ensuring that there is a stronger take up of actions which followers are deserting than in the simpler model used for the previous simulation. The equilibrium values of both a_1 and a_n are lower than those which prevailed in the model without the snob effect. Some leaders who are sensitive to the popularity of the action among followers will have zero levels of action in equilibrium, as $a_n^e > \bar{a}_n$.

<u>It's never the same after the first time: popularity peaks and desertion</u>

Do leaders return to actions that have once been popularised with the same vigour that they

had before the action had been 'discovered'? The popularity of neighbourhoods, such as Islington in London or Bastille in Paris, suggests that, in the long run, they do. However, in the relatively short run a popularised action may become less attractive for those who consider themselves as at the cutting edge of fashion.

This desertion of popularised actions by leaders can be modelled in the following way: once an activity peaks in popularity then it becomes less attractive, both in the absolute and relative sense, to leaders, i.e. all of the β parameters in the leaders' utility function fall. In Figure 1c an action becomes initially popular due to a fall in c_1, as modelled in Figure 1a. In addition, it is assumed that once the total level of action, $a_T=a_1+a_n$, peaks, then all of the β parameters are reduced by 20%. This produces the familiar cyclical behaviour but with a downward trend in the level of action. The initial three periods after the shock to c_1 are identical to those in Figure 1. But at t=9 there has been a peak in popularity which reduces the attraction of this action for leaders and produces a sharp drop in their action at t=10. This fall is mimicked by followers in the ensuing periods which, in turn, produces an upturn in leaders' actions, although to a lower level (due to the lower values of the β's). As the followers increase their actions, once again following what the leaders have done previously, there is another peak and so another drop in the leaders' β parameters, leading to another sharp fall in leaders' actions.

This behaviour continues until the new equilibrium is established with both leaders and followers still pursuing the activity, but at a reduced level, as the successive peaks in popularity have substantially reduced the attraction of the activity for the leaders.

In the long run it may be that this low total level of the activity is what spurs leaders to take it up again. Leaders may be attracted to activities which have been out of fashion for a sufficiently

long period of time. Alternatively, this long run re-uptake may not work through a taste for the unpopular but instead through price. If the prices of activities are affected by the demand for them (as could well be the case in local housing markets or for certain bars or clubs) and leaders are relatively price sensitive (because they are young or poor) then they will be attracted back to unfashionable places more readily than are followers. One can argue that it was the initial influx of students and artists which sparked off the renaissance of areas such as Islington or Brixton in London. Although the above model does not explain this endogenous re-uptake of unpopular activities, it does help to show how a once-popularised action can be reduced to a level of unpopularity which might act as a precursor to its renewed popularity. A model which incorporated both of these features would be able to describe both short-run and long-run cycles in fashion.

4. Conclusion

This paper describes a theory of rational emulation and deviance. The model of social and economic action in the paper rests upon a simple point. Concern for status, coupled with a concave utility function, leads to 'following' behaviour. When their peers start to act in a particular way, individuals find, if they are status-risk-averse, that their own marginal utility from acting that way increases. To an outside observer, it will appear (wrongly) that individuals get utility from being the same as other people.

The paper studies and builds upon this theory of following behaviour. It treats the individual decision-maker as a convex combination of economic man and sociological man, and draws six main additional conclusions:

1. Status-risk-lovers (that is, those with convex utility from relative position) will act deviantly.
2. Private rates-of-return may have little effect upon decisions.

3. The analysis provides a choice-theoretic justification for the kinds of behavioural rules predicted by social psychologists (such as in Adams' equity theory and Homans' social exchange theory).

4. The paper demonstrates that models in which it is *assumed* that people have a taste for conformity can be justified at a more primitive axiomatic level by appealing to status-risk-aversion.

5. A simple model with relative utilities can lead to cycles in fashion.

6. Social and economic norms can be thought of as Nash equilibria of the following-game described in the paper. Social outcomes are generically sub-optimal.

The pivotal role in this paper's analysis is the concept of status-risk-aversion. We believe that it may turn out to be useful in other areas.

FOOTNOTES

* We began work on this some years ago while at the London School of Economics. Since then, a literature on herd behaviour has grown rapidly, but does not seem to have suggested the approach developed here. We are grateful to Daron Acemoglu for many discussions about herd behaviour and relative comparisons, and to Peter Abell, Gary Becker, Steve Jones, Bob Solow and Max Steuer for helpful advice. Bob Solow corrected a confusion in an earlier draft. The views expressed in this article are those of the authors and do not represent those of the OECD or of its member countries. This paper is part of an ESRC-sponsored project on inter-disciplinary research.

1. Earlier work in economics on this topic includes Akerlof (1980) and Jones (1984). A number of recent papers attempt to produce theories of herd behaviour and related phenomena: see Banerjee (1992), Bernheim (1994), Bulow and Klemperer (1991), Cole *et al* (1992), Fershtman and Weiss (1992) and Scharfstein and Stein (1990). These models stress informational issues: people learn from watching what others do. It is not clear the models can explain fashion in social settings. For a socio-biological model, see Steuer (1989). For a survey, and a number of extensions, see Sinclair (1990).

2. Akerlof (1980, 1982) and Frank (1984a, 1984b, 1985) have been prominent in the work introducing psychological and sociological ideas into economics. Becker's (1974, 1976) work helped to begin this movement. Abell (1971, 1992) and Coleman (1991) argue for the use of rational choice models in sociological analysis.

3. The literature on relative deprivation is large. Outside economics it includes Adams (1963, 1965), Bernstein and Crosby (1980), Crosby (1976), Davis (1959), Festinger (1954), Homans (1961), Lawler (1971), Pollis (1968), Pritchard (1969), Runciman (1966), Stouffer *et al* (1949), Walster *et al* (1973), and Weik (1966). Inside economics it includes, in addition to references cited earlier, Baxter (1988), Boskin and Sheshinski (1978), Clark and Oswald (1996), Duesenberry (1949), Gylfason and Lindbeck (1984), Hochman and Rogers (1969), Kapteyn and Van Herwaarden (1980), Kosicki (1987), Lommerud (1989), Layard (1980), Oswald (1979, 1983), Sen (1983), Scitovsky (1976), Trevithick (1976), Van de Stadt (1985), and Wood (1978). Robson (1992) is a recent application that discusses the curvature of the status utility function.

4. The book on economic behaviour and status by Frank (1985) does not cover the points made in this paper, but it does touch upon imitative strategies: "It seems plausible to think of imitative behaviour as reflecting an inner desire to be like other people. Yet this description seems to miss something important ... our tendency to behave as others do may spring ... from a very rational fear that their information is better than ours. From this perspective we can view the desire to imitate as merely a way of trying to avoid being outdone" (p.19). The paper shows that assumptions about information are not required, and that Frank's book could have explained imitation using the arguments he applied to explain many other phenomena.

5. Elster's (1991) main purpose is to object to the idea that norms of social behaviour might be viewed as the result of private maximizing behaviour. It is thus different from this paper. Nevertheless, Elster often argues in his book in a way that sounds compatible with the mathematical analysis developed here. For example, discussing how individuals in primitive societies feel it necessary to under-achieve for fear of envy and of being thought witches, Elster makes two points:

   (i) "there is certainly something to this picture ... it suggests a sense in which envy does indeed serve as the glue and cement of society, by relentlessly repressing deviants, and, more fundamentally, the desire to deviate in the first place."

   (ii) "... the would-be innovator is afraid that success will cause envy and that failure will expose him to spite. The over-arching norm, <u>don't stick your neck out</u>, acts as a deterrent ... (p.262).

   These loosely correspond to the two central formal assumptions used in this paper, namely, that people care about status and are risk-averse.

6. Furnham and Lewis (1986) contrast economic theory and social exchange theory. They say that "the difference lies in social exchange theory's interest in social norms and perception of individuals - it is not so much that an individual is maximizing self-interest, but bending to the wind of cultural norms and expectations of reasonable and fair behaviour" (p.20). This paper takes a different approach.

7. An analysis of how concern for status may affect a firm's internal wage structure is given in Frank (1985). Its predictions are not widely different, however, from those in some conventional models, like Carmichael (1983, 1989), Harris and Holmstrom (1982), Hutchens (1989), Lazear (1979, 1981), Malcomson (1984), and Oswald (1981, 1984). Marsden (1986) discusses how sociological ideas, and concepts of fairness, might be incorporated into labour market theory.

8. The following result illustrates how conventional life-cycle theory results can be overturned. Assume lifetime utility with periods 1 and 2:

$$V = V\left(\frac{c_1}{c_1^*}, \frac{c_2}{c_2^*}\right)$$

   where c* is others' consumption and c is the individual's consumption. Budget constraints are

$$y = c_1 + \frac{c_2}{1+r}$$

$$y_* = c_1^* + \frac{c_2^*}{1+r}$$

Hence

$$V = V\left(\frac{c_1}{c_1^*}, \frac{(y-c_1)(1+r)}{(y_*-c_1^*)(1+r)}\right)$$

Thus the interest rate, r, cancels out. This is a well-defined concave problem and the optimal choice of savings (given others' decisions) is independent of the rate of interest. Duesenberry (1949) was apparently unaware of this neutrality result, although he discusses others.

9. As the coefficients on the two and three period lags on the level of action in (38) and (39) are positive scalar functions of the same negative expression, and as there is no term in the one period lag, it is easy to show that these difference equations have one real and two complex roots.

10. Such an effect may not result from information, but simply from an exogenous shift in tastes for an action.

11. Obviously this cannot be the case if leaders increase their level of action, as followers then have two reasons, the rise in a_1 and the rise in γ_2, to increase their own level of action. It can come about if the equilibrium rise in followers' action is accompanied by a very large fall in that of the leaders.

12. The reduced level of action of zero is arbitrary; the same qualitative results ensue as long as there is any reduction in the level of leaders' actions below that implied by (37).

Figure 1a

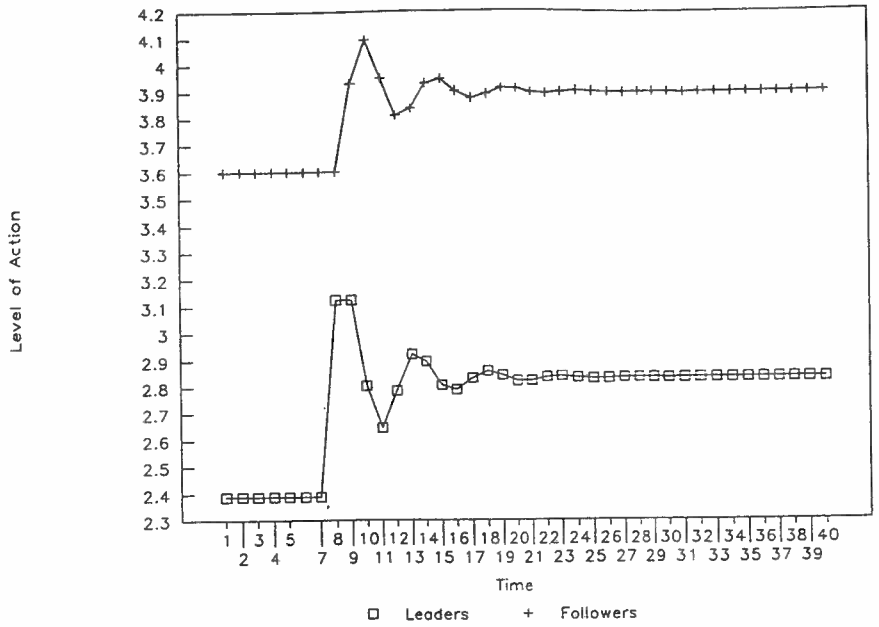


Figure 1b

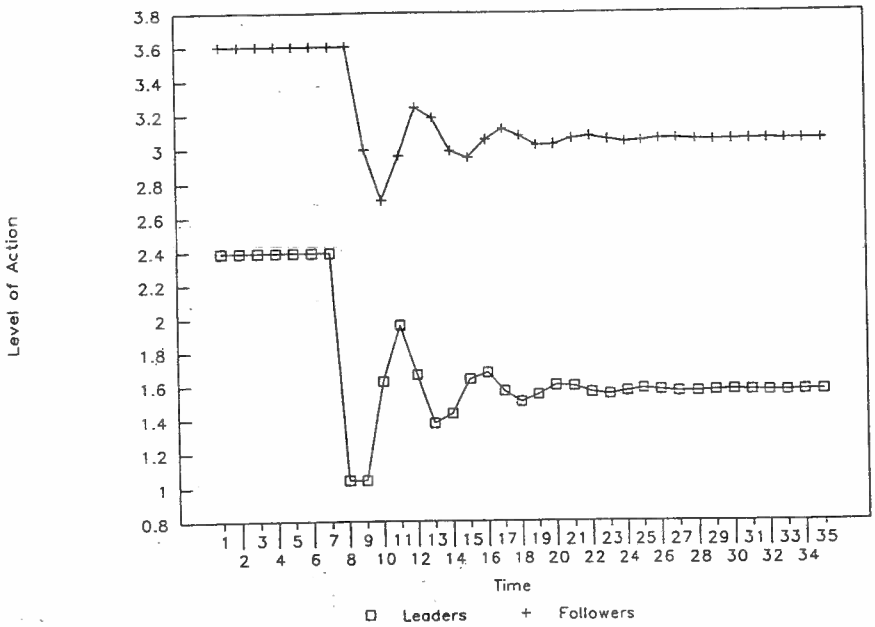
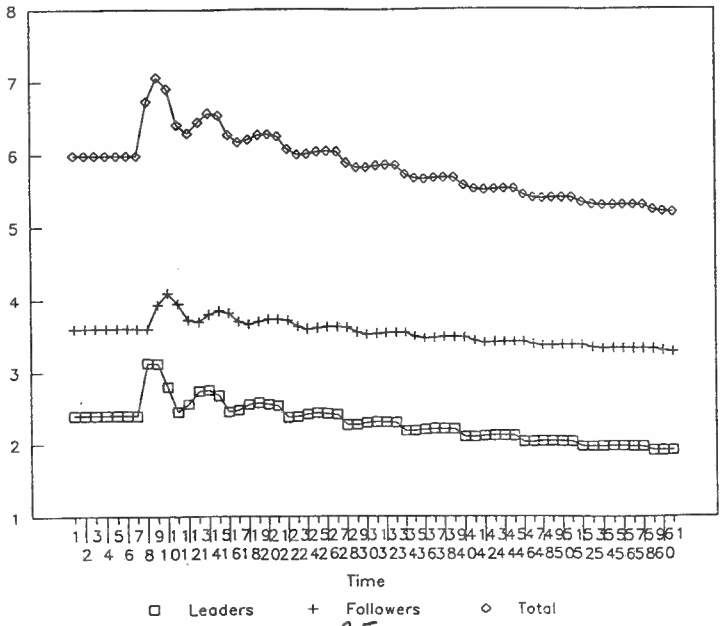


Figure 1c



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