The Economics of Rising Stars

MacDonald, Glenn M.

Working Paper No. 78
April 1987

THE ECONOMICS OF RISING STARS*

Glenn M. MacDonald

University of Western Ontario,
Economics Research Center/NORC,
and
Rochester Center for Economic Research

Working Paper No. 78

April 1987

*Comments from Jim Davies are gratefully acknowledged.

This essay is an exploration of what might be called "dynamic stochastic hedonics". The vehicle utilized is a simple Superstars (Rosen (1981)) model embedded in an environment in which information on talent emerges over time.

Why integrate dynamic information accumulation models with hedonics? The basic message of hedonics is that if efficiency units-type assumptions are relaxed in a structured manner, and nonconvexities in consumption rule out "arbitrage" activities, then prices are related to the underlying characteristics of agents nonlinearly. In the Superstars model, for example, more talented producers obtain higher unit prices in equilibrium. In conjunction with the different output choices induced by distinct prices, net returns are an increasing and convex function of talent, producing the positive skewness in the earnings distribution relative to the distribution of talent that is thought to be a feature of the data. The theory's main deficiency is that it treats the underlying heterogeneity as given. In particular, it is not able to address dynamic issues associated with production of heterogeneity via various kinds of capital accumulation; earnings growth, job mobility, occupational choice, and so on.

In contrast, information accumulation models generate heterogeneity over time and offer a fairly rich menu of dynamic implications, but, being (effectively) efficiency units models, do not succeed in producing a nonlinear relation between heterogeneity and net returns.

The model explored here is much in the spirit of Rosen (1981), Jovanovic (1982), and MacDonald (1982). Consumers are heterogeneous in terms of their ability to appreciate the output produced by what will be called performers, and thus, for given information on any performer, have different willingness to pay. Performers enter the industry in an untried state; i.e. no reviews. The quality of the performances is an imperfect but useful indication of what future performances are likely to offer consumers.

The model's steady state equilibrium looks as follows. Performers only enter the industry when young, and stay only if they get good reviews. Net returns more than compensate for differences in information across performers, so that those who receive good reviews over time serve vast audiences and experience dramatic income growth; i.e. the Superstars emerge over time. Those who fare less well exit the industry. Younger performers, in hopes of making it big, perform to small audiences and earn net returns below what they could earn outside the industry--i.e. starving artists, etc.

Comparing steady states yields some unfamiliar results, due to the intertemporal linkages on the supply side. To illustrate, an increase in the variable cost of serving audiences may well raise audience size for young performers. The reason is that one of the benefits gleaned from being a young performer is the value of perhaps becoming a Superstar. The cost change can be disasterous for Superstars, who serve a big audience. Thus to attract the young to the industry, the young must fare better while they are young, which may mean a much higher price for their performances, and a larger audience despite the cost increase.

The next section lays out the model and its implications. A brief second section sketches some relevant extensions.

I. BASIC MODEL

This model is the most austere environment that contains the elements of the approach being followed.

The agents in the model are performers and consumers. Firms, or "promoters", are also present, but most of their behavior is trivial and is thus suppressed. The behavior of typical performers and consumers is first set out. Subsequently, a steady state competitive equilibrium is constructed. Finally, the main features of the model's equilibrium are discussed along with the impact of altering some of the exogenous paramenters.

A. An Individual Performer

Performers (P) are risk neutral maximizers of expected wealth. They may perform in either or both of two periods.

Should P decline to perform in any period, he participates in some other activity, the value of which is $\bar{w}$ (that may include the value of the difference in utilities associated with performing and not).

When P performs, his rendering of the program is either unambiguously good (g) or bad (b). Which of these outcomes occurs is stochastic, and common knowledge. Irrespective of age, performers having no track record are all regarded (by everyone, themselves included) as equally likely to produce a good performance, the probability of this outcome being $p \in (0,1)$. This structure does not imply that all P are in fact identical, but rather that the current information on an untried P is the same for all agents. Thus, for example, if there are n levels of unobservable talent, with the probability of a good performance being θ_i $(i=1,\ldots,n;\ \theta_i < \ldots < \theta_n)$, and the fraction of the untried P who have talent level i being f_i, then

$$p = \sum_{i=1}^{n} f_i \theta_i .$$

Those P who have performed in the past have a track record which is assumed to be useful for predicting their current behavior. Those who gave a good (bad) performance in the initial period will do so in the current period with probability $p_g > p$ ($p_b < p$). In the example given above, $P_g = (1/p) \sum_i \theta_i^2 f_i$, where $P_g > p$ follows immediately from Jensen's inequality. Serially correlated luck, with no underlying heterogeneity, also yields the same specification.

Suppose ticket prices to see performances by P having the various (including null) track records are t_g, t, and t_b (corresponding to p_g, p and p_b), with $t_g > t > t_b$. This pattern of prices will turn out to be consistent with equilibrium.

Assuming free entry to the concert promotion business, in equilibrium P will necessarily receive the excess of gate receipts over the other costs of putting on the show. The most straightforward route is thus to suppose that performers undertake this activity themselves and receive the net revenue from doing so. Assume the cost of organizing the performance, advertising, selling tickets, and hall rental etc. can be represented as F+c(a), where $F > 0$ is a fixed cost, including the cost of advertising etc., c(a) the variable cost function, and a is the size of the audience. For simplicity, suppose $c(a) = \alpha a^2/2$ for same parameter $\alpha > 0$.

For an untried P then, net revenue given a is given by

$$ta - F - \alpha \frac{a^2}{2},$$

in which case the profit-maximal audience size is

$$A \equiv \frac{t}{\alpha},$$

yielding net revenue

$$\pi \equiv t^2/2\alpha - F.$$

Similarly, P who performed well (poorly) earlier serve an audience of size $A_g \equiv t_g/\alpha$ (resp. $A_b \equiv t_b/\alpha$) and obtain net revenue

$$\pi_g \equiv t_g^2/2\alpha - F \qquad \text{(resp. } \pi_b \equiv t_b^2/2\alpha - F\text{).}$$

As indicated above, P are assumed to be risk neutral maximizers of expected wealth. Thus, one who might have performed in the first period, but chose not to, will perform in the second depending on whether

$$\pi \gtreqless \bar{w}.$$

Similarly, for those who did perform, the decision involves one of the comparisons

$$\pi_g \gtreqless \bar{w}.$$

and $\pi_b \gtreqless \bar{w},$

depending on the first period reviews. Thus the issue of whether to perform in the first period turns on $\pi + \rho\ [p \max \{\pi_g, \bar{w}\} + (1-p) \max \{\pi_g\ \bar{w}\}]$

$$\gtreqless \bar{w} + \rho \max \{\pi, w\}, \qquad (1)$$

where ρ is the discount factor; $\rho \in (0, 1)$.

B. The Supply of Performances

It is assumed that there is free entry of untried P in any period, and that performing is the only way to obtain a track record. An obvious consequence of the first restriction is $\pi \le w$, for otherwise arbitrarily many untried P would plan to perform in their second period. Moreover, $\pi = w$ is ruled out as well, since $t_g > t > t_g$ implies $\pi_g > \pi > \pi_b$, in which case $\pi = w$ yields (1) as

$$p\ \pi_g + (1-p)\ \bar{w} > \bar{w},$$

so arbitrarily many young untried performers would plan to enter. Thus

$$\pi < \bar{w} \qquad (2)$$

must be part of any equilibrium. Therefore, any P who chose not to perform at the first opportunity will never do so. Henceforth, "untried" will refer to "young."

Next, $\pi_b < \pi$ implies $\pi_b < \bar{w}$ given (2), so any P who performed badly in the first period will not perform in the second. Thus, the condition implied by free entry is that a young P must be indifferent between the present value of permanent attachment to his alternative, and the expected present value of performing in the first period, doing so again if and only if he receives good reviews, and otherwise taking his alternative:

$$\pi + \rho[p\,\pi_g + (1-p)\bar{w}] = \bar{w}(1 + \rho) \qquad (3)$$

For any t and t_g satisfying (3), with $\pi < \bar{w}$, young P will be different about entry (and strictly prefer to perform again when older if they were given good reviews earlier). As a consequence, demand determines the number of young P, say N. The total number of performances by all young P is therefore

$$NA = \frac{Nt}{\alpha}\ . \qquad (4)$$

The fraction p of the N young P receive good reviews, thus there are pN older P giving

$$pNA_g = pNt_g/\alpha \qquad (5)$$

performances.

C. An Individual Consumer

Each C has the very simple decision of whether to see a performance this period, and what type of P to watch. This decision does not depend on expenditures on other goods or the quality of past performances observed (if there were any).

A good performance yields extra utility valued at $v > 0$, and a bad performance gives utility normalized to zero, equal to the utility value of not observing a performance at all. Assuming risk neutrality, C will choose the type of performance which solves

$$\max \{p_b v - t_b,\ pv - t,\ p_g v - t_g,\ 0\} \quad (6)$$

where 0 is the value of the null performance "stay home." Recalling that free entry precludes performances by those who received bad reviews earlier on, the element $p_b v - t_b$ may be ignored.

D. The Demand for Performances

Consumers are heterogeneous in terms of the effect of a good performance, v. It is assumed that there is a continuum of consumers with v distributed uniformly on $[\underline{V}, \bar{V}]$ with $0 < \underline{V} < \bar{V} < \infty$. Define $\Delta \equiv \bar{V} - \underline{V}$.

In what follows attention will be confined to equilibria in which (a) there is positive demand for performances by both young and old P; and (b) not all C buy tickets. Both restrictions merely serve to eliminate repetitive discussion.

Note that both $(p_g v - t_g) - (pv - t)$ and $pv - t$ are rising in v. Consequently, C of type $\underline{v}$, with $\underline{v}$ defined by

$$p\underline{v} - t = 0,$$

are indifferent about whether to see a performance at all, and C for whom $v > \underline{v}$ strictly prefer to see some performance. Consumers of type $\bar{v}$, with $\bar{v}$ defined by

$$p_g \bar{v} - t_g = p\bar{v} - t,$$

are indifferent about which type of performance to see, with $v > \bar{v}$ implying a preference for watching older performers who have performed well earlier. The restrictions mentioned above are then

$$\underline{V} < \underline{v} < \bar{v} < \bar{V}.$$

Note that since

$$\bar{v} = \frac{t_g - t}{p_g - p}$$

and $\underline{v} = \frac{t}{p}$,

$\bar{v} > \underline{v}$ gives

$$\frac{t_g}{t} > \frac{p_g}{p} .$$

That is, relative ticket prices t_g/t must exceed relative talent p_g/p. Should this condition fail, every C who plans to see a performance would prefer to see a more experienced performer.[1]

Given the distribution of v in the population, demand for young performers is

$$\int_{\underline{V}}^{\bar{V}} \frac{1}{\Delta} dv = \frac{1}{\Delta} \left[\frac{t_g - t}{p_g - p} - \frac{t}{p} \right] , \tag{7}$$

while demand for older, successful performers, is

$$\int_{\bar{V}}^{\bar{V}} \frac{1}{\Delta} dv = \frac{1}{\Delta} \left[\bar{V} - \frac{t_g - t}{p_g - p}\right]. \tag{8}$$

E. Equilibrium

Collecting the information described so far, steady state equilibrium is characterized by the three equations

$$\frac{1}{\Delta}\left[\bar{V} - \frac{t_g - t}{p_g - p}\right] = \frac{pNt_g}{\alpha}, \tag{9}$$

$$\frac{1}{\Delta}\left[\frac{t_g - t}{p_g - p} - \frac{t}{p}\right] = \frac{Nt}{\alpha},$$

and

$$\rho p t_g^2 + t^2 = 2\alpha(\bar{w} + F)(1 + \rho p). \tag{11}$$

(9) and (10) equate supply and demand in the markets for old and young P respectively, and (11) restates the entry condition (3), with substitution for π and π_g in terms of t and t_g. Variables to be determined are the ticket prices t_g and t, and the number of young P, N.

The system (9)-(11) does not always have a solution. Two problems may arise. It is not hard to show that for any N, (9) and (10) always have solutions, say t(N) and $t_g(N)$. Moreover both $t'(N) < 0$ and $t_g'(N) < 0$, with $\lim_{N\to\infty} t(N)=0=\lim_{N\to\infty} t_g(N)$, $\lim_{N\to 0} t(N) = p\bar{V}$ and $\lim_{N\to 0} t_g(N) = p_g\bar{V}$. One problem occurs if, for $N\to 0$, t and t_g do not rise enough to satisfy (11). In this case the alternative ($\bar{w}$) is too good for performing ever to attract any young P. It is therefore assumed that the model's parameters satisfy.

$$\rho p(p_g\bar{V})^2 + (p\bar{V})^2 \geq 2\alpha(\bar{w}+F)(1+\rho p). \tag{12}$$

At the other extreme, for $t = p\underline{V}$, all C will decide to attend a performance. This outcome is not troublesome except insofar as (10) must be replaced by

$$\frac{1}{\Delta}\left[\frac{t_g - t}{P_g - p} - \underline{V}\right] = \frac{Nt}{\alpha}, \tag{10'}$$

G. Comparisons of Steady States

The impact of altering the model's parameters can be derived in the usual manner. Doing so is simplified if (9)-(11) are manipulated first. To do so, let $\xi \equiv p_g - p$, $y \equiv \xi\Delta N/\alpha$, $\varphi \equiv \rho p$, and $w \equiv \bar{w}+F$. The system becomes

$$t_g(1+py)-t = \xi\bar{V}, \tag{13}$$

$$t_g - t\left(\frac{p_g}{p} + y\right) = 0, \tag{14}$$

and

$$\varphi t_g^2 + t^2 = 2\alpha w(1+\varphi). \tag{15}$$

Note, from (14), that $y = t_g/t - p_g/p$ is the "relative ticket price-relative talent" spread. Totally differentiating (13)-(15), and isolating changes in the endogenous variables (t_g, t and y) on the left hand side gives

$$\begin{pmatrix} 1+py & -1 & pt_g \\ 1 & -\left(\frac{p_g}{p}+y\right) & -t \\ 2\varphi t_g & 2t & 0 \end{pmatrix} \begin{pmatrix} dt_g \\ dt \\ dy \end{pmatrix}$$

on the left hand side. Calling the matrix D,

$$|D| = 2tt_g(p+\varphi)+2\varphi t_g^2(p_g+py) + 2t^2(1+py) > 0,$$

and

$$D^{-1} = \frac{1}{D}\begin{pmatrix} 2t^2 & 2ptt_g & t+pt_g(p_g/p+y) \\ -2\varphi tt_g & -2\varphi pt_g^2 & t(1+py)+pt_g \\ 2[t+\varphi t_g(p_g/p+y)] & -2[t(1+py)+\varphi t_g] & 1-(1+py)(p_g/p+y) \end{pmatrix}.$$

and the analysis carried out in terms of (9), (10') and (11). In order to remain within the setting characterized by (9), (10), and (11), a slightly more complicated parameter restriction is required. This restriction merely states that the alternative is not so poor that all C would wish to attend a performance given the ticket prices consistent with free entry.

F. Descriptive Features of Equilibrium

Simplistic as the model is, its equilibrium has some attractive features in terms of what it suggests should be observed.

On the consumer side, those C who are relatively undiscriminating--in the sense that they obtain little additional utility from a good performance (low v) -- do not participate in the market. The more discerning participate, but confine their attention to lower priced, less well established performers, and see more poor outcomes. The most discriminating C pay more and attend performances by performers with a solid track record, and witness few low quality outcomes.

On the performers' side, young P earn incomes π below what they could elsewhere, $\bar{w}$. This shortfall is the price of access to the stock of reviewers C and the possibility of stardom. Those who receive poor reviews perform no more and sell their skills elsewhere, where talent as a performer plays a lesser role. Recipients of good reviews remain in the business, and earn incomes in excess of what they could elsewhere. Also, young P play to smaller audiences ($A < A_g$) and cost less to see ($t < t_g$). Moreover, ticket prices differ more than the difference in talent -- $t_g/t > p_g/p$ -- and the difference in incomes is more exagerated still -- $\pi_g/\pi > t_g/t$.[2]

The Demand Side

Let $\mu \equiv (\bar{V}+\underline{V})/2$. Then, for given $\Delta = \bar{V}-\underline{V}$, an increment to μ represents a spread-preserving increase in the average value of v. From above,

$$\begin{pmatrix} dt_g \\ dt \\ dy \end{pmatrix} = D^{-1} \begin{pmatrix} \xi d\mu \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} > 0 \\ < 0 \\ > 0 \end{pmatrix}.$$

For given ticket prices, raising μ has the sole effect of increasing demand for performances by old P. Equilibrium t_g thus rises, and π_g along with it. Because the changes in π_g implies that performing when old is a more attractive option, free entry dictates that the return to performing when young, π, must fall, this decline being accomplished by lower t. The increase in the relative ticket price-relative talent spread y is immediate.

Other consequences follow readily. Because $A_g = t_g/\alpha$ and $A = t/\alpha$, larger μ yields bigger audiences for old P and smaller crowds for the young. This quantity adjustment, acting in conjunction with the change in ticket prices, produces the dramatic change in π_g and π characteristic of "superstars"--type models.

Finally, recall that the number of C who do not attend performances at all is $(\underline{v}-\underline{V})/\Delta$, where $\underline{v} = t/p$, and that the number attending performances by young P is $(\bar{v}-\underline{v})/\Delta$, with $\bar{v} = (t_g-t)/\xi$. The decline in t thus implies that fewer C choose not to see any performance. The rise in t_g, and hence t_g-t, then implies that more C view performances by young P. Since each young P serves a smaller audience, the number of young P (N) necessarily rises. It then follows that the number of old P (pN) is greater, and since each serves a larger audience, that the number of C attending performances by older P rises absolutely and in comparison with the number seeing performances by young P[3].

$$\varphi t_g A_g + tA = 2w(1+\varphi),$$

and since both t and t_g increase with α, it is clear that at most one of A and A_g can do so. If one of A_g or A in fact rises, it must be A, since $A_g/A = t_g/t$, which falls when α increases. Intuitively, the smaller scale at which young P operate implies that an increment to α raises marginal cost less. Thus if audience size rises for any P, it must do so for young P.

As regards compensation, π_g and π, (15) dictates that one must rise and the other fall. Since π=tA-F, when A rises, or falls proportionately less than t rises, it is π which must increase. However, when both audience sizes fall, that $A_g > A$ implies the absolutely higher ticket prices earned by older P may yield π_g rising instead.

A similar ambiguity enters discussion of the number of young and old P, N and pN. The number of performance by young (old) P must rise (fall) in total with α, in which case if A declines N must necessarily rise. But otherwise, N may rise or fall.

The Information Content of a Performance

p_g (p_b) is the probability that any P who has performed well (poorly) previously will perform well in the future. As indicated above, that $p_g > p > p_b$ may reflect talent, or serially correlated luck. In either case, p_g (or ξ, which is identical given p) is one index of the quality of the information contained in a good performance.

One point to note at the outset is that if $p = p_b$, the model's equilibrium is unchanged. While C would be willing to pay the same amount to hear P with null or poor reviews, those having poor reviews would be older, and lacking the option value aspect of performing, would find their alternative employment strictly more attractive. A corollary is that the value of p_b is irrelevant so long as $p_b \leq p$.

Alternative Opportunities

Any performer's alternative opportunity is valued at $\bar{w}$. An increment to $\bar{w}$ has effects

$$\begin{pmatrix} dt_g \\ dt \\ dy \end{pmatrix} = D^{-1} \begin{pmatrix} 0 \\ 0 \\ 2\alpha(1+\varphi)d\bar{w} \end{pmatrix} = \begin{pmatrix} > 0 \\ > 0 \\ < 0 \end{pmatrix} .$$

An improvement in alternative opportunities raises ticket prices for all performances, but lowers the relative ticket price-relative talent spread y. Intuitively, to attract young P prospects must improve, and better present and future opportunities both make a contribution. The decrease in y reflects the contraction in the industry resulting from what is essentially a factor price increase. That is, $y \equiv \xi\Delta N/\alpha$, in which case $dy/d\bar{w} \propto dN/d\bar{w}$.

The change in ticket prices raises audience sizes for all performers, with the proportional increase greater for young P (because $A_g/A = t_g/t$). Again the induced effect on π_g and π is large due to the combination of ticket price and audience size changes.

In terms of market level aggregates, the main implication is that the increase in t implies fewer C attend performances (since $\underline{v} = t/p$).

The Discount Factor

Changes resulting from an increase in the discount factor ρ are

$$\begin{pmatrix} dt_g \\ dt \\ dy \end{pmatrix} = D^{-1} \begin{pmatrix} 0 \\ 0 \\ (2\alpha wp-pt_g^2)d\rho \end{pmatrix} = \begin{pmatrix} < 0 \\ < 0 \\ > 0 \end{pmatrix} ,$$

since $\pi_g > w$ implies $2\alpha wp - pt_g^2 < 0$. Part of the payoff to entering the performance business is the chance of receiving a good review, and thus earning $\pi_g > \bar{w}$. An increment to ρ raises the current value of this prospect, and so has the same qualitative effect as a reduction in $\bar{w}$.

The Production Technology

The production technology gives rise to the cost function $F+\alpha a^2/2$, which has the two parameters F and α.

Changes in F have been derived already since $w = \bar{w}+F$ and changes in $\bar{w}$ were analyzed above. To reiterate, a higher fixed cost reduces the size of the industry and raises all ticket prices. Audience sizes for all performances must rise, with audiences for performances by young P being affected most in percentage terms. Fewer C attend in total.

Variations induced by changes in the efficiency parameter α are

$$\begin{pmatrix} dt_g \\ dt \\ dy \end{pmatrix} = D^{-1} \begin{pmatrix} 0 \\ 0 \\ 2w(1+\varphi)d\alpha \end{pmatrix} = \begin{pmatrix} > 0 \\ > 0 \\ < 0 \end{pmatrix}.$$

Raising α increases variable costs, and like an increase in $\bar{w}$ or F (see (15)), augments t_g and t, and lowers y. The market level implications are also qualitatively the same: fewer C attend performances.

At the level of individual P, the results are more ambiguous. (15) can be written

Varying p_g yields

$$\begin{pmatrix} dt_g \\ dt \\ dy \end{pmatrix} = D^{-1} \begin{pmatrix} \bar{V}dp_g \\ (t/p)dP_g \\ 0 \end{pmatrix} = \begin{pmatrix} > 0 \\ < 0 \\ \gtrless 0 \end{pmatrix} .$$

Increasing P_g lowers the level of v, $\bar{v}$, which induces indifference between seeing either type of P at given prices. It thus raises demand for performances by older P, and lowers demand for younger P. The increase t_g and decline in t are immediate.

The impact on y is, in general, indeterminate. y may be written

$$y = \frac{t_g}{t} - \frac{\xi+p}{p},$$

in which case it is clear that whether y rises or falls depends on how responsive t_g and t are to changes in ξ.

The indeterminacy of the change in y does not disturb results on most of the variables of interest. The change in ticket prices raises audience sizes for older P, and lowers them for the younger. As usual, these effects are reflected in the compensations π_g and π.

The main market level change is that the number of C who do not attend performances, $\underline{v}$, must fall when p_g rises, simply because t declines. The market split between old and young P may go either way, as can the number of performers.

<u>Talent in the Population</u>

The probability with which any untried P will put on a good show is p. Increments to p induce changes

$$\begin{pmatrix} dt_g \\ dt \\ dy \end{pmatrix} = D^{-1} \begin{pmatrix} -y-\bar{V} \\ -tp_g/p^2 \\ -pt_g^2+2\alpha w\rho \end{pmatrix} = \begin{pmatrix} < 0 \\ \gtreqless 0 \\ \gtreqless 0 \end{pmatrix}.$$

At given prices, raising p reduces demand for performances by old P, and increases supply by allowing more young P to perform well. Similarly, demand for performances by young P is augmented. These effects work to lower t_g and raise t, and in the case of t_g, produce a determinate result. The complication surrounding t arises from the free entry condition. When p is larger, although t_g (and hence π_g) is lower, it is more likely that any young P will obtain a good review. If this latter effect is sizeable, as it apparently may be for some parameter values, the performing industry may become a more attractive one, and t have to fall to satisfy the free entry condition. Thus while the leading case involves an increase in t, this outcome is not inevitable. When it does occur, the results parallel decline in p_g.

II. SKETCH OF TWO EXTENSIONS

Of the many modifications which might be made in this model, two appear most promising.

The first permits young performers to enter the industry and, perhaps as a by-product of costly (say time consuming) training, obtain private information on their talent prior to performing. One sequential equilibrium of this game involves those who receive indications that they are not likely very talented "bombing out" prior to performing, and the luckier proceeding just as above; a familiar phenomenon. The reason is simply that only those who know they are likely to do well are willing to pay the price associated with being a young performer.

Overall then, a spread-preserving increase in the pattern of demand raises the total number of performances and the share performed by older performers. The total number of performers must rise, but the young play to smaller audiences at lower ticket prices and earn a lower income. In contrast, older performers play to larger audiences at higher ticket prices, and earn much greater incomes.

Next consider a mean-preserving spread in the pattern of demand:

$$\begin{pmatrix} dt_g \\ dt \\ dy \end{pmatrix} = D^{-1}\begin{pmatrix} (\xi/2)d\Delta \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} > 0 \\ < 0 \\ > 0 \end{pmatrix}.$$

The effect of an increment to Δ on t_g, t, y, A_g, A, π_g and π are qualitatively identical to those induced by an increase in μ. The reasoning is simply that both changes raise the average value of v for C who would attend at initial ticket prices. The only notable difference is that the impact on the total numbers of performers (and hence on total performances given by the young, etc.) is now ambiguous, depending on the fraction of the C population who would attend any performance at initial ticket prices. When this fraction is small, $d\Delta > 0$ results in an increase in demand for performances by young and old P, and thus the same results as follow from an increment to μ. In the opposite case, demand for performances by young P may in fact fall, in which case the equilibrium number of young P may do likewise.

Last, a pure increase in demand due to an expansion of the number of C has the standard effect--N rises by the same proportion, and all else remains unaffected.

The other extension involves choice of repertoire. Suppose that some pieces are easy and others hard, but that the consumption value of a good or bad performance does not depend on difficulty per se. Assume though that a hard piece, while less likely to be played well by any performer, differentiates between talents much better than does an easy one. Under this specification, older P will never perform anything hard because the only thing that might be gained from doing so is information, which is not useful to older P. However, provided the hard piece is not too hard (i.e. does not make the chance of being a star too slim) young P will find it to their advantage to play the hard piece because they have the option of opting out should poor reviews be forthcoming.

Footnotes

1. Say $v > \underline{v} = t/p$. Then C's decision depends on

$$(p_g v - t_g) - (pv - t)$$

$$= vp(p_g/p - 1) - t(t_g/t - 1)$$

$$> t(p_g/p - 1) - t(t_g/t - 1)$$

$$= t(p_g/p - t_g/t)$$

$$> 0 \ \forall \ v \text{ if } p_g/p > t_g/t.$$

2. $$\frac{\pi_g}{\pi} = \frac{t_g^2/2\alpha - F}{t^2/2\alpha - F} > \frac{t_g^2/2\alpha}{t^2/2\alpha} > \frac{t_g}{t} \text{ since } \frac{t_g}{t} > 1.$$

3. i.e. $pNA_g/NA = pt_g/t$

References

MacDonald, G. M., "A Market Equilibrium Theory of Job Assignment and Sequential Accumulation of Information," American Economic Review, 72 (December 1982), 1038-55.

Jovanovic, B., "Selection and the Evolution of Industry, Econometrica, 50 (May 1982), 649-70.

Rosen, S., "The Economics of Superstars," American Economic Review, 71 (December 1981), 845-58.

Rochester Center for Economic Research
University of Rochester
Department of Economics
Rochester, NY 14627

1986-87 DISCUSSION PAPERS

WP#46 FORMULA BUDGETING: THE ECONOMICS AND ANALYTICS OF FISCAL POLICY UNDER RULES, by Eric A. Hanushek, June 1986

WP#48 EXCHANGE RATE POLICY, WAGE FORMATION, AND CREDIBILITY by Henrik Horn and Torsten Persson, June 1986

WP#49 MONEY AND BUSINESS CYCLES: COMMENTS ON BERNANKE AND RELATED LITERATURE, by Robert G. King, July 1986

WP#50 NOMINAL SURPRISES, REAL FACTORS AND PROPAGATION MECHANISMS by Robert G. King and Charles I. Plosser, Final Draft: July 1986

WP#51 JOB MOBILITY IN MARKET EQUILIBRIUM by Glenn M. MacDonald, August 1986

WP#52 SECRECY, SPECULATION AND POLICY by Robert G. King, (revised) August 1986

WP#53 THE TULIPMANIA LEGEND by Peter M. Garber, July 1986

WP#54 THE WELFARE THEOREMS AND ECONOMIES WITH LAND AND A FINITE NUMBER OF TRADERS, by Marcus Berliant and Karl Dunz, July 1986

WP#55 NONLABOR SUPPLY RESPONSES TO THE INCOME MAINTENANCE EXPERIMENTS by Eric A. Hanushek, August 1986

WP#56 INDIVISIBLE LABOR, EXPERIENCE AND INTERTEMPORAL ALLOCATIONS by Vittorio U. Grilli and Richard Rogerson, September 1986

WP#57 TIME CONSISTENCY OF FISCAL AND MONETARY POLICY by Mats Persson, Torsten Persson and Lars E. O. Svensson, September 1986

WP#58 ON THE NATURE OF UNEMPLOYMENT IN ECONOMIES WITH EFFICIENT RISK SHARING, by Richard Rogerson and Randall Wright, September 1986

WP#59 INFORMATION PRODUCTION, EVALUATION RISK, AND OPTIMAL CONTRACTS by Monica Hargraves and Paul M. Romer, September 1986

WP#60 RECURSIVE UTILITY AND THE RAMSEY PROBLEM by John H. Boyd III, October 1986

WP#61 WHO LEAVES WHOM IN DURABLE TRADING MATCHES by Kenneth J. McLaughlin, October 1986

WP#62 SYMMETRIES, EQUILIBRIA AND THE VALUE FUNCTION by John H. Boyd III, December 1986

WP#63 A NOTE ON INCOME TAXATION AND THE CORE by Marcus Berliant, December 1986

WP#64 INCREASING RETURNS, SPECIALIZATION, AND EXTERNAL ECONOMIES: GROWTH AS DESCRIBED BY ALLYN YOUNG, By Paul M. Romer. December 1986

WP#65 THE QUIT-LAYOFF DISTINCTION: EMPIRICAL REGULARITIES by Kenneth J. McLaughlin, December 1986

WP#66 FURTHER EVIDENCE ON THE RELATION BETWEEN FISCAL POLICY AND THE TERM STRUCTURE, by Charles I. Plosser, December 1986

WP#67 INVENTORIES AND THE VOLATILITY OF PRODUCTION by James A. Kahn, December 1986

WP#68 RECURSIVE UTILITY AND OPTIMAL CAPITAL ACCUMULATION, I: EXISTENCE, by Robert A. Becker, John H. Boyd III, and Bom Yong Sung, January 1987

WP#69 MONEY AND MARKET INCOMPLETENESS IN OVERLAPPING-GENERATIONS MODELS, by Marianne Baxter, January 1987

WP#70 GROWTH BASED ON INCREASING RETURNS DUE TO SPECIALIZATION by Paul M. Romer, January 1987

WP#71 WHY A STUBBORN CONSERVATIVE WOULD RUN A DEFICIT: POLICY WITH TIME-INCONSISTENT PREFERENCES by Torsten Persson and Lars E.O. Svensson, January 1987

WP#72 ON THE CONTINUUM APPROACH OF SPATIAL AND SOME LOCAL PUBLIC GOODS OR PRODUCT DIFFERENTIATION MODELS by Marcus Berliant and Thijs ten Raa, January 1987

WP#73 THE QUIT-LAYOFF DISTINCTION: GROWTH EFFECTS by Kenneth J. McLaughlin, February 1987

WP#74 SOCIAL SECURITY, LIQUIDITY, AND EARLY RETIREMENT by James A. Kahn, March 1987

WP#75 THE PRODUCT CYCLE HYPOTHESIS AND THE HECKSCHER-OHLIN-SAMUELSON THEORY OF INTERNATIONAL TRADE by Sugata Marjit, April 1987

WP#76 NOTIONS OF EQUAL OPPORTUNITIES by William Thomson, April 1987

WP#77 BARGAINING PROBLEMS WITH UNCERTAIN DISAGREEMENT POINTS by Youngsub Chun and William Thomson, April 1987

WP#78 THE ECONOMICS OF RISING STARS by Glenn M. MacDonald, April 1987

To order copies of the above papers complete the attached invoice and return to Christine Massaro, W. Allen Wallis Institute of Political Economy, RCER, 109B Harkness Hall, University of Rochester, Rochester, NY 14627. Three (3) papers per year will be provided free of charge as requested below. Each additional paper will require a $5.00 service fee which must be enclosed with your order. For your convenience an invoice is provided below in order that you may request payment from your institution as necessary. Please make your check payable to the **Rochester Center for Economic Research**. **Checks must be drawn from a U.S. bank and in U.S. dollars**.

W. Allen Wallis Institute for Political Economy

Rochester Center for Economic Research, Working Paper Series

OFFICIAL INVOICE

Requestor's Name ______________________________

Requestor's Address ______________________________

____

____

____

Please send me the following papers free of charge (**Limit: 3 free per year**).

WP# _______ WP# _______ WP# _______

I understand there is a $5.00 fee for each additional paper. Enclosed is my check or money order in the amount of $___________. Please send me the following papers.

WP# _______ WP# _______ WP# _______

WP# _______ WP# _______ WP# _______

WP# _______ WP# _______ WP# _______

WP# _______ WP# _______ WP# _______