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THE WEALTH EFFECT IN OCCUPATIONAL CHOICE

Yoram Weiss*

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Introduction

".. The higher the real income of a society, the greater the weight that the society as a whole is likely to put on the nonmonetary side of occupational choice. The president of an American university remarked not long ago that as real income continues to rise we may well see the day when a garbage collector is paid more than a full professor"

W. Bowen [5 ,P. 19]

Despite its simple and static nature, conventional leisure income analysis seems to be useful in the interpretation of long-run trends in labor supply. Thus, the shortening of the working week is explained by a dominant income effect in the demand for leisure (see Lewis [11]). The emphasis of this approach is on the quantity of work while the quality of work is often neglected. The purpose of this paper is to indicate similar regularities in the area of occupational choice.

A simple one-period model is used to examine the effect of changes in nonhuman and human wealth on the choice of an occupation. Just as in usual income-leisure analysis we have two alternative interpretations of the one-period model in mind. One is the allocation of time in the short run among work activities within an occupation and for a given level of skill. A switch from one such job to another is assumed to have a negligible effect on future earnings opportunities. Another interpretation is based upon viewing a whole lifetime as a single period. In this approach the relevant wages are "permanent," that is, proportional to present value of lifetime earnings.

The results of the paper are summarized in five simple propositions on the wealth effects under conditions of certainty and uncertainty. It is argued that under certainty: An increase in nonwage income will increase the propensity to choose pleasant low paying work activities. An increase in human capital, which

we define to be a uniform proportional increase in wage earnings capacity, will also induce a choice of pleasant work activities if the income effect is dominant. Under conditions of uncertainty an increase in nonwage income will tend to encourage the choice of risky high-paying work activities if their monetary returns are uncertain. If the nonmonetary returns of an occupation are uncertain the propensity to choose it will tend to decrease with wealth. Finally, an increase in human capital is likely to discourage the choice of occupations with risky monetary returns.

None of the above propositions is particularly novel or surprising.^{1/} It is hoped however that bringing them under a unified treatment will be useful.

The understanding of the income effect may be helpful in explaining long run and short run changes in labor supply and the corresponding changes in wage differentials. Furthermore, since wage earnings are endogenous within the model it is natural to inquire into the (reduced) relation between nonwage and wage earnings. Clearly, if wealthy individuals also earn higher monetary returns on their human capital, then, other things being equal, the distribution of transferable wealth becomes less equal as time passes and generations evolve. The reverse may be true if originally wealthy individuals prefer jobs in which relatively low monetary returns are expected. It will be shown that the relation between wage and nonwage income is likely to be of a different sign under conditions of certainty and uncertainty.

The Model Under Certainty

Consider an individual who allocates a given amount of time among m time activities. Let t_i be the portion of the period spent at activity i and let w_i be the real wage per period in activity i . In this section we assume that wages are known with certainty. We assume that activity m is a leisure activity

with $w_m = 0$, all other activities are work activities and offer a positive wage. The amount of time spent on consumption activities is assumed to be predetermined. Throughout the discussion we shall assume that prices of goods are given and known with certainty. All goods can therefore be aggregated into a single composite commodity ("consumption") which we shall denote by x . The price of x will be set at 1.

We restrict the discussion to a one-period model in which savings are taken to be predetermined. The budget constraint assumes the form

$$1. \quad x = A + \sum_{i=1}^m t_i w_i$$

where the period's real nonwage earnings are denoted by A .

Jobs are of different quality and the amounts of time spent at different jobs are treated as different commodities. The individual's preferences with respect to the various consumptions and allocations of time are represented by an ordinal utility function:

$$2. \quad u = u(x, t_1, t_2 \dots t_m)$$

It is essential for our analysis that an unambiguous common ranking of occupations exist in terms of their "pleasantness." For this purpose we shall assume that preferences are identical across individuals. Furthermore, we require that the ranking is independent of the market wage structure. A necessary condition is that utility will be separable and an aggregate $n(t_1 \dots t_m)$ exist such that:

$$3. \quad u = u(x, n(t_1, t_2 \dots t_m)).$$

Further restrictions depend on the "degrees of freedom" which we allow in the allocation of time. Through most of the analysis we shall assume that individuals can choose only one work activity, and that the amount of work in each job is fixed. Let us denote by n_i the level of n when $t_i = t_i^0$, $t_m = 1 - t_i^0$, and the rate of work in all other activities is put at a zero level. We shall say that job i is more pleasant than j if $\frac{\partial u}{\partial n} > 0$ and $n_i > n_j$. The numbers $n_1, n_2 \dots n_m$ may be interpreted as the nonmonetary returns associated with the various time activities. We may thus distinguish jobs in terms of their, exogenously given, nonmonetary returns as well as on the basis of the wage rate which they offer. The operational meaning of the above definition is quite clear. Job i is more pleasant than j if when the wages (and thus consumptions) of the two jobs are set equal, then job i is chosen. Due to the separability assumption this choice is invariant with the level at which the two wages are set equal. We may thus assign numbers $n_1, n_2 \dots n_m$ and an appropriate utility index to represent this ranking. The choice of these indices must, however, satisfy one further restriction. The rate of substitution between the monetary and nonmonetary returns of any two jobs must be invariant under all admissible transformations on $n(\)$ and $u(\)$. Operationally, this rate of substitution is revealed by the wage compensation which is required for unpleasant work.

It should be emphasized that in the present analysis nonmonetary returns are viewed as an ordinal index which is associated with the alternative occupations. This reflects our distinction between the quality and quantity of work. In some cases it is, of course, possible to ascribe differences in nonmonetary returns to differences in measurable (up to a linear or a ratio scale) "objective" quantities, such as, hours of work, or temperature and level of noise at the place of work.^{2/} In general however, it is not operationally feasible to produce

objective and separate measures of factors such as effect on health, effort, repetitiveness, challenge, and other working conditions which are known to be "relevant." We therefore restrict the discussion to propositions which do not depend on the assumption of measurable characteristics of jobs.^{3/}

Consider any two jobs i and j such that job i is more pleasant. It is clear that for anyone to choose occupation j we must have $w_j > w_i$.^{4/} However, not all individuals require the same compensation. Since by assumption tastes are identical the only source of variation lies in the presumed unequal distribution of wealth.

Let q_{ij} denote the compensating wage change (in job j) which will induce indifference between the two jobs. That is q_{ij} is defined as the solution of^{5/}

$$4. \quad u(A + w_i, n_i) = u(A + w_j + q_{ij}, n_j) .$$

Clearly, q_{ij} depends on w_i, w_j, n_i, n_j and A . The testable properties of this function depend upon the restrictions imposed on the utility function. In particular it can be shown^{6/} (See Rosen [16]) that:

Proposition 1. If nonmonetary returns are viewed as a "normal good"

$$(i.e. \quad \frac{\partial}{\partial x} \left(\frac{u_n}{u_x} \right) > 0) \text{ then } n_i > n_j \text{ implies } \frac{\partial q_{ij}}{\partial A} > 0.$$

Wealthier individuals will require a higher wage compensation for unpleasant work.

Note that the assumed normality of nonmonetary return is invariant under monotone transformation on n .^{7/}

If nonhuman wealth is the only source of variation across individuals then it follows from proposition 1 that there exists a unique level of nonwage income A' , such that every one with a higher income will prefer the pleasant low-paying job i to the unpleasant high-paying one, j . All individuals with lower nonwage income will prefer the high-paying unpleasant job.

The analysis can be extended to cover individual differences in human wealth. In the present context we may identify human capital with general earning capacity. An increase in human capital is assumed to be equivalent to a uniform proportional increase in the earning capacity in all jobs. (An increase by the same absolute magnitude is, of course, equivalent to an increase in nonhuman wealth).

A proportional wage increase involves a price effect. If the individual is to switch from job i to j he will gain more in terms of consumption for the same loss in nonmonetary returns. Due to the opposing income and substitution effects^{8/} the net result is ambiguous. As in standard leisure-income analysis we may tentatively assume that the income effect is dominant.

It may be argued that an increase in human capital opens new opportunities for more pleasant work activities. In other words nonmonetary returns are also likely to increase with variables such as ability and schooling which are summarized in the human capital concept. This leads to a more complicated analysis which we shall not pursue.

The choice of leisure in each job can also be incorporated in the analysis. Let $n_i(t)$ denote the value of n when the individual works at the rate t in occupation i (i.e. $t_i = t$, $t_m = 1-t$ and $t_j = 0$ for $j \neq i, m$). In the present context we shall say that job i is more pleasant than j if $n_i(t) > n_j(t)$ for $1 \geq t > 0$. Again, a higher wage must be paid to induce any individual to work at the unpleasant work. To see this note that if $w_i = w_j$, the individual can always "buy" the optimal (x_j^*, t_j^*) while working in job i and thus be better off.

Consider any two jobs i and j such that i is more pleasant (i.e. $n_i(t) > n_j(t)$). Define a compensating wage differential by

$$5. \quad u(x_i(A, w_i), n_i(t_i(A, w_i))) = u(x_j(A, w_j + q_{ij}), n_j(t_j(A, w_j + q_{ij})))$$

Note that (x_i, t_i) and (x_j, t_j) are now subject to choice, hence the appearance of their demand function in 5. The effects of changes in nonwage income on the choices within each occupation and on the propensity to switch jobs are summarized in proposition 2.

Proposition 2 If work satisfaction is a normal good (i.e. $\frac{\partial}{\partial x} \left(\frac{u}{x} \right) > 0$) and if the relatively pleasant work activities are normal inputs in the 'production' of work satisfaction (i.e. $n_i(t) > n_j(t)$ and $n_i(t_i) = n_j(t_j)$ imply $\frac{\partial n_i}{\partial t_i} < \frac{\partial n_j}{\partial t_j}$) then $n_i(t) > n_j(t)$ implies $\frac{\partial q_{ij}}{\partial A} > 0$.^{9/}

The definition of normal "inputs" requires further explanation. Consider the sub-problem of maximizing x for a given level of n (i.e. $n_i(t_i) = n_j(t_j) = n_0$). Clearly job i will be chosen depending upon whether $w_j n_j^{-1}(n_0) \geq w_i n_i^{-1}(n_0)$. By normality in the context of exclusive alternatives, we mean that as n_0 increases, wages remaining the same, the propensity to choose the pleasant work activity increases. Formally, this is equivalent to the requirement which appears in proposition 2.

As in the fixed leisure case for any given wages w_i, w_j there is a critical level of nonwage income A' such that every individual with a lower wealth will prefer the relatively unpleasant high paying job. Consider an individual with $A < A'$. As his wealth increases wages remaining the same he will purchase more work satisfaction that is more n . Initially this is achieved by reducing the number of hours at the job at which he currently works. Eventually, however, as A increases above A' more work satisfaction is achieved by switching to a more pleasant low paying job. It is quite possible that upon switching he will decide to work more hours.^{10/} Such a pattern may in fact be observed over some phases of the individual's life cycle. A similar observation may apply to a cross section. Wealthy individuals will tend to work at more pleasant work

activities and earn less, but they may work longer hours. It is of course, not surprising that such "anomalies" may exist in the relation between hours of work and income. The reason is that in the present analysis hours of work are not homogenous.

If one is willing as a first approximation to ignore the effects of risk then the following rather obvious implications follow. Over time the exogenous increases in nonhuman wealth and in productivity will tend to increase the (real) absolute wage differentials between pleasant and unpleasant jobs or occupations.^{11/} Provided, of course, that demand conditions / ^{remain} roughly the same. In jobs or occupations which are both unpleasant and "nonprogressive" (i.e. have slow rate of technological advance, see Baumol [3]) considerable wage hikes will be necessary to attract labor. Thus, we expect garbage collectors, plumbers, construction workers, police and firemen to be paid an increasingly higher absolute real wage compensation as time passes. If due to budgetary constraints or moral codes there is a fixed or slowly adjusting upper bound on real wages in these low status jobs, shortages will develop. Of course, the quality of jobs need not be a datum. Employers may substitute investment in improving working conditions for wage hikes. We shall, therefore, expect some decrease in the quality differences among jobs as productivity and nonhuman wealth increase.

Similar implications may be tested across countries or states. The often mentioned shortage of domestic servants, waiters, nurses, plumbers, construction workers, etc. in advanced economies may be ascribed to an income effect which reduced the supply of these presumably unpleasant or socially inferior occupations.^{12/}

The implications regarding the distribution of transferable wealth are less clear. The reason is that human wealth is not independent from the initial stock of nonhuman wealth. Mainly due to imperfections in the capital market we expect

that individuals with more inherited wealth will also acquire a higher stock of human capital. At the same time, due to the assumption that wealthy individuals have a higher propensity to forego monetary returns in favor of more pleasant work activities, we expect them to have lower monetary return on their human capital. The net effect on earnings is therefore ambiguous.

The Effects of Risk

The analysis of the previous section was seen to yield some plausible implications of broad scope. Admittedly, many important aspects of the occupational choice problem such as life cycle patterns were neglected or "maximized out" of the problem. Our decision to single out the effects of risk for further discussion is not necessarily a reflection of a taste for complicated analysis with ambiguous results. Our purpose is to point out some observable regular wealth-type of job patterns. Indeed, there are well known postulates due to Arrow [1, Ch. 3] which hypothesize a systematic relation between wealth and attitudes towards risk.

Let there be S states of the world. Each state is a specification of the wages and the other characteristics in every job. Adopting the expected utility hypothesis the maximization problem assumes the following form:

$$\begin{aligned}
 6. \quad & \max_{t_1, t_2, \dots, t_m} \sum_{s \in S} p_s u(x_s, n_s) \\
 & \text{s.t.} \quad x_s = \sum_{i=1}^m w_{is} t_i + A \\
 & \quad \quad n_s = n_s(t_1, t_2, \dots, t_m) \\
 & \quad \quad 1 = \sum_{i=1}^m t_i, \quad t_i \geq 0
 \end{aligned}$$

To simplify the analysis, we assume that leisure is fixed and that the individual can work in only one job. Specifically, let $t_m = 0$ and $t_i = 0, 1$

for $i = 1, 2 \dots m-1$. Let n_{si} be the value of n when the individual works at job i and state s occurs. Thus each occupation may be viewed as a two dimensional lottery ticket offering a joint distribution of monetary and non-monetary returns. Note the dual role which is now played by the index of non-monetary returns. Given the same wages it provides an ordering over states of the world as well as over occupations.

In dealing with risky occupations or work activities one should be careful to distinguish the monetary and nonmonetary aspects. We shall say that only monetary returns are risky if when the individual works at job i , w_{is} varies with s while n_{is} is independent of the state of the world (i.e. $n_{is} = n_i$). Such may be the case of a prospective lawyer for instance. We shall say that only the nonmonetary returns are risky if w_{is} is independent of the state of the world (i.e. $w_{is} = w_i$) but the function n_{is} is not. Such may be the case of a professional soldier with a guaranteed wage. His utility from the same amount of earnings will depend upon whether he is healthy or injured, a combat hero or an unknown.^{13/} His distinction and level of health depend, of course, on the (unknown) state of the world.

For the sake of simplicity we restrict the analysis to comparisons between a risky occupation and a nonrisky one. Furthermore we deal only with extreme (and unrealistic) situations in which the variance is located at only one type of return, and deal separately with the case of uncertain monetary returns and uncertain nonmonetary ones. We assume that risk aversion is predominant.

Consider, first, the case in which only monetary returns in say job i are uncertain and let there be another job, say j , in which returns (both monetary and nonmonetary) are certain. As before let us define a compensating wage differential q_{ij} , which would make the two jobs equivalent. The appropriate compensation is defined by:

$$7. \quad E \{u(A + \tilde{w}_i, n_i)\} = u(A + w_j + q_{ij}, n_j)$$

(We use ' \sim ' on top of a variable to indicate randomness)

We first examine the effect of an increase in nonhuman wealth on the required compensation. There are now two forces at work. One is the presumed normality of pleasant work activities, the second is decreasing absolute risk aversion. Combining these two aspects we have the following proposition.^{14/}

Proposition 3 If n is a normal good, and if absolute risk aversion for monetary returns is decreasing ($\frac{\partial}{\partial x} (-\frac{u_{xx}}{u_x}) < 0$) then $n_i \geq n_j$ implies that $\frac{\partial q_{ij}}{\partial A} > 0$.

A special case is in which the two occupations are equally pleasant $n_i = n_j$. It is then seen that increase in nonhuman wealth increases the propensity to choose the more risky (in the monetary sense) occupation. Since $n_i = n_j$ also implies that the risky job pays a higher expected wage we get an empirical implication which is in sharp contrast to the results of the previous section. As nonhuman wealth increases the (expected) monetary returns from human capital tend to increase.

The above special case should serve as a sufficient warning against the merging of variability in return with other undesirable attributes. While there is similarity in that both command a compensating wage differential, there is a difference in the direction of the income effect. It is well known for instance that the government and educational institutions pay lower salaries (for the same level of schooling) than private industry. If one interprets this difference mainly as a (negative) compensation for the presumably more pleasant academic life, then one would expect that wealthy individuals would be more likely to accept jobs in universities or in the government and to forego the monetary advantage

associated with private industry. (see Freeman [7, p. 4]). On the other hand it is also known that private industry is more risky in its monetary returns (see Weiss [22]). If one interprets the observed higher mean earning in private industry mainly as compensation for risk, then one would predict that the relatively wealthy be more likely to take on jobs in private industry. Clearly, taking into account both possibilities leads to the conclusion that the effect of family wealth on such choices is not easily predictable.

The notion that more wealthy individuals are, other things being equal, more inclined to prefer risky work activities is, at first glance, in variance with casual experience. Is it not the case, for instance, that more wealthy individuals are less inclined to become professional soldiers, policemen, firemen, mine workers, etc. than poor individuals with comparable ability and skills? Here is where our distinction between monetary and nonmonetary risks comes in. If risk is concentrated in the nonmonetary aspects of a job then under fairly plausible conditions increase in nonhuman wealth will diminish the propensity to choose it.

Consider, then, a case, in which only the nonmonetary returns of job i are uncertain. While, as before, the monetary and nonmonetary returns of the alternative job j are certain.

Let us define q_{ij} along the same lines as before. Let n_i^* be the certainty equivalent level of nonmonetary returns in job i . That is,

$$8. \quad E \{u(A + w_i, \tilde{n}_i)\} = u(A + w_i, n_i^*) .$$

We shall say that job i is (locally) more pleasant than j if $n_i^* > n_j$. It is now possible to prove the following proposition. 15/

Proposition 4 If n is a normal good and if the aversion to nonmonetary risks is nondecreasing with A (i.e. $\frac{\partial}{\partial x} \left(-\frac{u_{nn}}{u_n} \right) \geq 0$) then $n_i^* < n_j$ implies $\frac{\partial q_{ij}}{\partial A} < 0$.

In other words, wealthier individuals will require a lower wage compensation in order to switch to the less risky and more pleasant job.

As seen proposition 4 depends on the nature of risk dependence (see Keeny [8]). The assumption made is that increase in monetary wealth reduces the propensity to take nonmonetary bets of a given size. For instance a wealthy individual with higher consumption potential will be more averse to uncertainty of future health, the reason being, essentially, that more is put at stake. In some cases, of course, risk independence is more reasonable. Teaching for instance involves uncertain nonmonetary returns in terms of respect of students and the like but the variance in the utility of income in teaching is not likely to depend upon the level of income. Note that the direction of risk dependence, i.e., the sign of $\frac{\partial}{\partial x} \left(-\frac{u_{nn}}{u_n} \right)$ is invariant under the choice of index for nonmonetary returns.^{16/}

The apparent puzzle is thus resolved upon noting two different meanings of "riskiness." In common usage risk is most frequently associated with the danger of injury, rather than with earning variability. As we have just seen such occupations are likely to be inferior goods. Casual evidence seems to be consistent with this result.^{17/}

The analysis may be extended to cover the effects of changes in human capital. Let the monetary returns of some job, say i , be uncertain, and compare it with another job, say j , with certain returns. Suppose again that changes in human capital are equated with a uniform equi-proportional increase in earning capacity in all occupations and all states of the world. The effects of such an increase depend on the behavior of the partial degree of risk aversion (see Menezes and Hanson [14] and Diamond and Stiglitz [6]). If we accept the second

postulate of Arrow [1, Ch. 3] namely increasing relative risk aversion then partial risk aversion will also increase. If the two occupations are equally pleasant an then/increase in human capital will induce a shift towards the unrisky occupation. If the two occupations are not equally pleasant then it is necessary to combine attitudes towards risk with attitudes towards monetary and nonmonetary returns. The following proposition can be derived.^{18/}

Proposition 5. If the partial degree of risk aversion towards monetary returns is increasing $(\frac{\partial}{\partial x} (-\frac{w_u}{u} \frac{xx}{x})) > 0$ for $x = w + A$) and if the income effect is dominant for choices under certainty, then $n_i \leq n_j$ implies $\frac{\partial q_{ij}}{\partial H} < 0$. That is if the unrisky occupation is also more pleasant individuals with high earning capacity will be more inclined to choose it.

Notice that for the special case $n_i = n_j$ there is a contrast between the effect of human and nonhuman capital. While inherited family wealth increases the propensity to choose the risky (and on the average high paying) occupation, native abilities or acquired human wealth diminishes it. This reflects the built-in assumption that increase in human capital increases the variance of earnings while increase in A does not.

An interesting empirical question is whether individuals do in fact obey the two Arrow postulates. Decreasing absolute risk aversion and increasing relative risk aversion are after all empirical hypotheses which may be falsified. In the case of portfolio choice casual observation and empirical evidence are consistent with the above postulates. In the case of occupational choice it is difficult to eliminate the nonmonetary effects which as we have seen influence the nature of the testable implications of the two hypothesis. Casual evidence is therefore not so closely at hand.^{19/} Some attention should also be given to interdependences of individual utilities in the context of risk bearing. While

each person in isolation may be risk averse, the desire to prove oneself as a superior individual may lead to a behavior which would appear to imply risk preference.

Multiple Job Holdings and Divisible Careers

The analysis so far assumed that during the period under discussion the individual specializes in one job. For most purposes this is a reasonable assumption. The cause for specialization lies in the accumulation of specific work experience which imposes high (and increasing with age) costs on occupational mobility (see Weiss [23]). However, both in the short run, and in a lifetime context individuals may combine work activities. A nurse may divide a period between day shifts and night shifts, a sailor may divide a lifetime between work on sea and some other occupation on the shore; similar cases would include professional pilots, athletes or soldiers. Finally a physician may divide his life between salaried and independent employment.

At the price of some gross oversimplifications^{20/} such career and job patterns may be analyzed within a one-period model. Suppose that only two jobs are considered, and that the amount of leisure is fixed. We may define job 1 as being more pleasant than 2 if $t_1 = t_2$ implies that $\frac{\partial n}{\partial t_1} > \frac{\partial n}{\partial t_2}$, that is, if, when time is equally divided between the two jobs, then a transfer of a unit of time from job 2 to 1 will increase utility. Given the same demand conditions it follows from this definition that in market equilibrium $w_1 < w_2$.

The comparative static analysis may now be carried out in terms of t_1 and t_2 the proportions of the period spent at jobs 1 and 2 respectively. The results are essentially the same as in the previous sections and will not be repeated here.^{21/} There is however one new aspect of the analysis which is of a considerable empirical importance which I wish to point out.

Due to a negative income effect the short run supply of labor into unpleasant work activities is likely to be wage inelastic and in extreme cases even backward bending. An increase in the pay for night shifts for, say, nurses who are free to choose the desired combination of day and night shifts may encourage them to increase the share of day shifts. To take another example, it has been noted that despite very substantial rates of returns for maritime schooling, the number of applicants is low and decreasing.^{22/} Furthermore wage hikes tend to shorten the proportion of life spent at sea. In such circumstances employers may find it cheaper to invest in improved working conditions instead of wage hikes. In the case of sailors, for instance, money is spent in an attempt to facilitate the joining of wife and children to shorten the duration of trips, and to lengthen the periods on shore.

Conclusions

The analysis of this paper suggests that unpleasant and pleasant jobs may be classified according to two related criteria: (1) Higher wage is paid (in equilibrium) for unpleasant work (2) The supply elasticity with respect to wealth is negative for unpleasant jobs. More generally it is suggested that it is possible to identify a fairly stable pattern of income (wealth) elasticities for occupations. The estimation of these elasticities should prove useful for prediction purposes.

FOOTNOTES

1. That increase in wealth is likely to induce a shift towards pleasant low-paying work activities had been noted by Reder [17], Rapping [18], Freeman [7] and Rosen [16]. Analysis of the income effect on the choice of career under uncertainty is contained in King [9] and in Diamond and Stiglitz [6]. None of the above references, however, attempt to combine attitudes towards nonmonetary advantages with attitudes towards risk.
2. See Lucas [13], Ch. 4,6.
3. In terms of Lancaster's [10, pp. 18-19] framework we assume universality but not objectivity.
4. To simplify the notation and without loss of generality we assume, unless otherwise specified, that $t_i = 1$ and $t_j = 0$ for $i \neq j$ if the individual works in job i .
5. One may consider alternative definitions of q_{ij} . For instance:

$$4' \quad u(A + w_i, n_i) = u(A + w_i + q_{ij}, n_j)$$

Clearly such alternations have no effect in the results. The definition in the text is preferred since it makes explicit the fact that the individual takes wages as data.

6. Suppose that at the original situation the level of utility is given by

$$u(A^0 + w_i, n_i) = u(A^0 + w_j + q_{ij}^0, n_j) = u^0$$

Define $n(x)$ as the solution of $u(x, n) = u^0$. By the assumption of normality:

$$\frac{d}{dx} u_x(x, n(x)) = u_{xx} - u_{nx} \frac{u_x}{u_n} < 0 .$$

Also by assumption $n_i > n_j$ and thus $w_i < w_j + q_{ij}^0$.

It follows that:

$$\frac{\partial q_{ij}}{\partial A} = \frac{u_x(A^0 + w_i, n(A^0 + w_i)) - u_x(A^0 + w_j + q_{ij}^0, n(A^0 + w_j + q_{ij}^0))}{u_x(A^0 + w_j + q_{ij}^0, n(A^0 + w_j + q_{ij}^0))} > 0$$

The proof can be established geometrically in an (n, x) space, noting that due to normality the vertical distance between successive indifference curves is increasing with x .

7. Let the original utility function be given by $u(x, n)$ and the transformed one by $v(x, \bar{n})$. By assumption $\bar{n} = h(n)$ with $h'(n) > 0$. Since $u(\cdot)$ is unique up to a positive monotone transformation we must have

$$v(x, h(n)) \equiv F[u(x, n)] \text{ with } F'(u) > 0.$$

$$\text{Thus } v_{\bar{n}} = F'(u) u_n \frac{1}{h'(n)}$$

$$\text{and } v_x = F'(u) u_x$$

$$\text{It follows that } \frac{\partial}{\partial x} \left(\frac{v_{\bar{n}}}{v_x} \right) = \frac{1}{h'(n)} \frac{\partial}{\partial x} \left(\frac{u_n}{u_x} \right).$$

8. Let $u(A + Hw_i^0, n_i) = u(A + Hw_j^0 + q_{ij}, n_j)$ where w_i^0 denote wages of an individual with a standard unit of skill ($H = 1$). The measure of human capital is H . Solving for the effect of change in H we obtain

$$\begin{aligned} \frac{\partial q_{ij}}{\partial H} &= \frac{w_i^0 u_x(A + Hw_i^0, n_i) - w_j^0 u_x(A + Hw_j^0 + q_{ij}, n_j)}{u_x(A + Hw_j^0 + q_{ij}, n_j)} \\ &= w_i^0 \frac{\partial q_{ij}}{\partial A} + w_i^0 - w_j^0. \end{aligned}$$

Assuming $n_i > n_j$ then under normality the income effect $w_i^0 \frac{\partial q_{ij}}{\partial A}$ is positive. But the substitution effect $w_i^0 - w_j^0$ is negative.

9. To simplify the proof assume that $u(x,n)$ is quasiconcave and that $n'_i(t_i) < 0$, $n''_i(t_i) < 0$ for all i . By the familiar envelope

relation the sign of $\frac{\partial q_{ij}}{\partial A}$ depends just as in the fixed leisure case on the difference in the marginal utility of consumption in the two jobs.

(We assume that an interior solution is attained with $0 < t_i, t_j < 1$).

Under the assumed normality of n it is sufficient to show that

$n_i(t) > n_j(t)$ implies $n_i(t_i) > n_j(t_j)$ and $x_i < x_j$ where (t_i, x_i) is optimal with respect to (A, w_i) and (t_j, x_j) is optimal with respect to $(A, w_j + q_{ij})$.

Recall that $n_i(t) > n_j(t)$ implies that $w_i < w_j + q_{ij}$. Suppose $x_i > x_j$. It follows that $t_i > t_j$ and $n_i(t_i) < n_j(t_j)$. Consider the first order conditions for optimum at each occupation:

$$w_i = - \frac{u_n(x_i, n_i) n'_i(t_i)}{u_x(x_i, n_i)}$$

$$w_j + q_{ij} = - \frac{u_n(x_j, n_j) n'_j(t_j)}{u_x(x_j, n_j)}$$

Under the hypothesis that $x_i > x_j$ and $n_i < n_j$ $\frac{u_n}{u_x}$ is larger in job i and therefore $n'_i(t_i) > n'_j(t_j)$. But this is impossible under the assumptions that $n_i = n_j$ implies $n'_i(t_i) < n'_j(t_j)$ (normality) and $n''_i(t_i) < 0$. This contradiction established the proof.

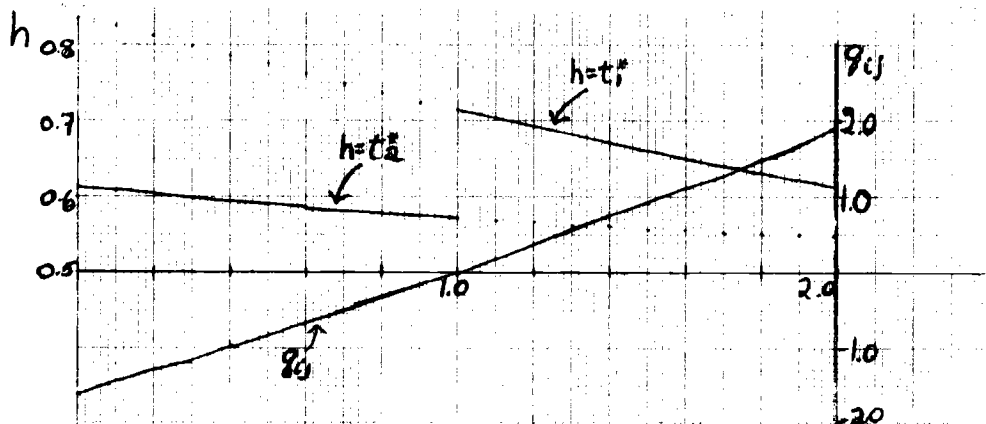
10. The following example may be instructive.

Let $u(x,n) = xn$.

Suppose that in the absence of any restriction $n = -\frac{1}{2} \sum_{i=1}^{m-1} t_i^2 + (\sum_{i=1}^{m-1} a_i t_i) / (1-t_m)$ so that when the individual can work in only one job

$$n_i = a_i - 1/2 t_i^2, \quad n_i' = -t_i < 0 \quad \text{and} \quad n_i'' = -1 < 0.$$

By definition job i is more pleasant than j if $a_i > a_j$. Note that in this example pleasant work activities are normal, $a_i > a_j$ and $n_i(t_i) = n_j(t_j)$ imply that $t_i > t_j$ and thus $n_i'(t_i) < n_j'(t_j)$. For a suitable choice of the parameters it can be shown that upon switching to the pleasant work activity the individual is going to work more hours. For instance, let $a_1 = \frac{103}{98}$, $a_2 = \frac{55}{98}$, $w_1 = \frac{5}{2}$ and $w_2 = 8$. It is easy to verify that at $A = 1$ the individual is indifferent between the two jobs. The optimal levels of t_1 and t_2 are then $\frac{5}{7}$ and $\frac{4}{7}$ respectively. At lower levels of wealth the individual attains a higher level of utility at job 2, and the reverse is true for levels of wealth above 1. The specific solutions for q_{ij} and t_i^*, t_j^* as functions of A are given in the graph below



11. Secular increase in the variance of real wages across occupations and industries is reported by Becker [4, p. 54n] and Lewis [11, Table 29-3]. These results are consistent with our hypothesis. There are, however, alternative explanations. See, for instance, Becker [4, pp. 52-54]. Note also, that if the pleasant jobs require high skills and thus pay

more, our hypothesis implies a reduction in the variance in real wages. This was noted by Reder [17, p. 267]. It is thus clear that an appropriate test of the hypothesis requires that the level of skill is held constant. The 1950, 1960, 1970 U.S. Census data on earnings by schooling and occupation (occupational characteristics) provide some illustrative examples. For instance, plumbers', and brick masons' median annual earnings exceed that of an average participant with a comparable median years of schoolings. Over the period 1950-1970 these differences tend to increase in real terms. In the case of brick-masons the increase in relative pay is associated with decrease in employment indicating a supply shift. In the case of plumbers there is some increase in employment.

12. It is worth noting that in both the over-time and cross-section discussion the effect of the distribution of income on the supply and demand for labor in the various occupations should be incorporated. It is argued by Robinson [19] and Stigler [21, p. 6] that a more equal distribution of income will, ceteris paribus, reduce both the supply and demand for domestic servants.
13. A similar distinction is a familiar one in the literature on the economics of health. See Arrow [2]. Note, however, that in the framework of occupational choice health becomes a partially controlled variable. In this case 'health dependance' does not imply 'state dependance'.
14. The proof follows in the lines suggested by Pratt [16]. Using condition (7) in the text we obtain

$$\frac{\partial q_{ij}}{\partial A} = \frac{E\{u_x(A+\tilde{w}_i, n_i)\} - u_x(A+w_j+q_{ij}, n_j)}{u_x(A+w_j+q_{ij}, n_j)}$$

Let us define a certainty equivalence wage w_i^* such that

$$u(A+w_i^*, n_i) = E\{u(A+\tilde{w}_i, n_i)\}$$

By assumption $n_i > n_j$ and it follows from (7) that $w_i^* < w_j + q_{ij}$.

Furthermore, under normality we have

$$u_x(A+w_i^*, n_i) > u_x(A+w_j+q_{ij}, n_j)$$

It is therefore sufficient to show that

$$E \{u_x(A+\tilde{w}_i, n_i)\} > u_x(A+w_i^*, n_i).$$

Define $v(x) = u(x, n_i)$ and $t = v(A+w_i)$,

so that $A+w_i = v^{-1}(t)$

and $A+w_i^* = v^{-1}[E\{t\}]$.

Due to the assumption of decreasing absolute risk aversion $v'[v^{-1}(t)]$

is a convex function of t . It follows that

$$E \{u_x(A+\tilde{w}_i, n_i) - u_x(A+w_i^*, n_i)\} = E \{v'[v^{-1}(t)]\} - v'[v^{-1}(E\{t\})] > 0.$$

15. As before we define q_{ij} by

$$E \{u(A+w_i, \tilde{n}_i)\} = u(A+w_j+q_{ij}, n_j)$$

where n_i is now random and all other variables are known with certainty. We thus have

$$\frac{dq_{ij}}{dA} = \frac{E \{u_x(A+w_i, \tilde{n}_i)\} - u_x(A+w_j+q_{ij}, n_j)}{u_x(A+w_j+q_{ij}, n_j)}$$

using the definition of n_i^* in (8), and the assumptions that $n_i^* < n_j$,

and that n is normal we obtain

$$u_x(A+w_i, n_i^*) - u_x(A+w_j+q_{ij}, n_j) < 0.$$

It is therefore sufficient to show that

$$u_x(A+w_i, n_i^*) \geq E \{u_x(A+w_i, \tilde{n}_i)\}.$$

Let $t = u(A+w_i, n_i) = v(n_i)$

so that $n_i = v^{-1}(t)$. Also by definition $n_i^* = v^{-1}[E\{t\}]$.

Therefore

$$\begin{aligned} & u_x(A+w_i, n_i^*) - E\{u_x(A+w_i, \tilde{n})\} \\ &= u_x(A+w_i, v^{-1}[E\{\tilde{t}\}]) - E\{u_x(A+w_i, v^{-1}(\tilde{t}))\} \geq 0 \\ &\text{if } u_x(A+w_i, v^{-1}(t)) \text{ is a concave function of } t. \end{aligned}$$

That is if
$$\frac{\partial}{\partial n} \left(\frac{u_{xn}}{u_n} \right) \leq 0$$

Note finally that
$$\frac{\partial}{\partial n} \left(\frac{u_{xn}}{u_n} \right) = \frac{\partial}{\partial x} \left(\frac{u_{nn}}{u_n} \right)$$

so that the relevant conditions is nondecreasing risk aversion for nonmonetary risk as nonhuman wealth increases. i.e., $\frac{\partial}{\partial x} - \left(\frac{u_{nn}}{u_n} \right) \geq 0$.

16. Let $u(x, n)$ be the original utility function and let $v(x, \bar{n})$ be the transformed one where $\bar{n} = h(n)$ with $h'(n) > 0$. Under the expected utility hypothesis $u(x, n)$ is unique up to a linear transforms so that $v(x, h(n)) \equiv F[u(x, n)]$ with $F'(u) > 0$ and $F''(u) = 0$.

We thus have

$$F'(u)u_n = v_{\bar{n}}h'(n)$$

and

$$F'(u)u_{nn} = v_{\bar{n}\bar{n}} [h'(n)]^2 + v_{\bar{n}}h''(n)$$

Dividing the second equation by the first one we get

$$\frac{u_{nn}}{u_n} = \frac{v_{\bar{n}\bar{n}}}{v_{\bar{n}}} h'(n) + \frac{h''(n)}{h'(n)}$$

The second term on the R.H.S. is independent of x . It follows that

$$\text{sign } \frac{\partial}{\partial x} \left(\frac{u_{nn}}{u_n} \right) = \text{sign } \frac{\partial}{\partial x} \left(\frac{V_{nn}}{V_n} \right)$$

17. Again the 1950, 1960, 1970 U.S. Census data on earnings by occupation and level of schooling provides some illustrative examples. Firemen's, Policemen's and Blaster's and powdermen's median annual earnings exceed that of the average participant with a comparable median years of schooling. Over the period 1950-70 these differences have increased, in real terms, considerably. It is worth noting that firemen and policemen report a higher than average number of hours per year. If one adjust to this, perhaps nominal, difference then policemen and firemen are paid less than the average employee. The trend of increase in relative pay is, however, unaffected by this adjustment. Again one must bear in mind the increase in employment which occurred in these occupations.

18. Let q_{ij} be defined by the following equality

$$E\{u(A+H\tilde{w}_i^0, n_i)\} = u(A+Hw_j^0+q_{ij}, n_j)$$

where w_i^0 , which is random, and w_j^0 denote the earning capacity of an individual with a standard level of skill ($H = 1$) and H is an index of human capital. We thus have

$$\frac{\partial q_{ij}}{\partial H} = \frac{E\{\tilde{w}_i^0 u_x(A+H\tilde{w}_i^0, n_i)\} - w_j^0 u_x(A+Hw_j^0+q_{ij}, n_j)}{u_x(A+Hw_j^0+q_{ij}, n_j)}$$

Define a certainty equivalence wage w_i^* by

$$E\{u(A + H\tilde{w}_i^0, n_i)\} = u(A + Hw_i^*, n_i).$$

By assumption $n_i < n_j$. We also assume a dominant income effect for proportional wage changes under certainty, it follows that

$$w_i^* u_x (A+Hw_i^*, n_i) < w_j^* u_x (A+Hw_j^* + q_{ij}, n_j)$$

It is therefore sufficient to show that

$$E \{ \tilde{w}_i^* u_x (A+H\tilde{w}_i^*, n_i) \} < w_i^* u_x (A+Hw_i^*, n_i)$$

$$\text{Let } t = u(A+Hw_i^*, n_i) = v(A+Hw_i^*)$$

$$\text{so that } A + Hw_i^* = v^{-1}(t)$$

$$\text{and } A + H\tilde{w}_i^* = v^{-1} [E(\tilde{t})]$$

Then

$$E \{ \tilde{w}_i^* u_x (A+H\tilde{w}_i^*, n_i) \} - w_i^* u_x (A+Hw_i^*, n_i) =$$

$$\frac{1}{H} [E\{(v^{-1}(t) - A)v'[v^{-1}(t)]\} - (v^{-1}(E\{t\}) - A)v'[v^{-1}(E\{t\})]] < 0$$

if $(v^{-1}(t)-A) v'[v^{-1}(t)]$ is concave in t .

By taking the derivative with respect to t it is immediately seen that concavity is assured if the function $v^{-1}(t) \frac{v''}{v'}$ and $-\frac{v''}{v'}$ are decreasing. (See Meneses and Hansan [14]).

19. A first systematic test was attempted by King [9] who reports a significant positive correlation between family income and the propensity to choose occupations with high earnings variability. However, King's study ignores the "noise" which is introduced by nonmonetary returns.
20. In particular we ignore issues associated with the ordering in time of the various phases of an individual career. Clearly in a world with a positive interest and learning by doing the ordering in time "matters" (see Weiss [23]).
21. We shall sketch the proof^{*} for the analogues of propositions 1 and 3.

Consider first the case of certainty. We assume that job 1 is more pleasant and that $w_2 > w_1$.

The individual's maximization problem is of the

$$\max_{t_1} V(t_1) = u[A + w_2 + (w_1 - w_2)t_1, n(t_1, 1 - t_1)]$$

At an interior optimum $V'(t_1^*) = 0$ and $V''(t_1^*) < 0$. We wish to show that

$$\frac{\partial t_1^*}{\partial A} > 0. \text{ It is sufficient to show that } \frac{\partial V'}{\partial A} = u_{xx}(w_1 - w_2)$$

$$+ u_{xn} \left(\frac{\partial n}{\partial t_1} - \frac{\partial n}{\partial t_2} \right) > 0. \text{ Substituting from the first order condition}$$

we get, due to normality, that

$$u_{xx}(w_1 - w_2) + u_{nx} \left(\frac{\partial n}{\partial t_1} - \frac{\partial n}{\partial t_2} \right) = (w_1 - w_2) \left(u_{xx} - \frac{u_x}{u_n} u_{nx} \right) > 0$$

Consider next, the case in which w_1 is random. We assume that at the optimum t_1 is locally more pleasant, that is $\frac{\partial n}{\partial t_1} > \frac{\partial n}{\partial t_2}$.

$\frac{\partial V'}{\partial A}$ is now given by $E \{ u_{xx} (w_1 - w_2) + u_{nx} \left(\frac{\partial n}{\partial t_1} - \frac{\partial n}{\partial t_2} \right) \}$

Due to normality $u_{nx} > \frac{u_n}{u_x} u_{xx}$

Thus $\frac{\partial V'}{\partial A} > E \left\{ \frac{u_{xx}}{u_x} [u_x (w_1 - w_2) + u_n \left(\frac{\partial n}{\partial t_1} - \frac{\partial n}{\partial t_2} \right)] \right\}$

Furthermore, the term in the square brackets on the R.H.S. is first negative and then positive. Using the first order condition and the fact that $\frac{u_{xx}}{u_x}$ is monotone increasing (due to the assumption of decreasing absolute risk aversion) the R.H.S. is seen to be positive.

22. A study on the rates of return for investment in maritime schooling in Israel [15] estimates the private rate of return at about 25 per cent. The study by Rapping [18] on the earnings of seamen in the U.S. indicates a trend of an increase in their relative pay.

REFERENCES

1. K. J. Arrow. Essays in the Theory of Risk Bearing, North Holland Amsterdam, 1970.
2. _____ . Optimal Insurance and Generalized Deductions, A Rand Corporation Working Paper, 1973.
3. W. J. Baumol. "Macro-economics of Unbalanced Growth," American Economic Review, vol. 57 (June 1967) pp. 415-426.
4. G. S. Becker. Human Capital, New York, N. B. E. R., 1964.
5. W. G. Bowen "Economic Aspects of Education" Industrial Relations Section, Princeton University 1964.
6. P. A. Diamond and J. E. Stiglitz. Increases in Risk and in Risk Aversion, Forthcoming, Journal of Economic Theory. 1974.
7. R. Freeman. The Market for College Trained Manpower, Harvard University Press, Cambridge, Mass. 1972.
8. R. L. Keeny. "Risk Independence and Multiattributed Utility Function," Econometrica, Vol. 41 (January 1973), pp. 27-34.
9. A. G. King "Occupational Choice Risk Aversion and Wealth," An unpublished manuscript, University of Texas at Austin, 1972.
10. K. Lancaster. Consumer Demand, Columbia University Press, New York. 1971.
11. H. G. Lewis. Unionism and Relative Wages in the United States. Chicago The University of Chicago Press, 1963.
12. _____ . "Hours of Work and Hours of Leisure", Industrial Relations Research Association, Proceedings of the Ninth Meeting (December 1956) pp. 196-206.
13. R. E. Lucas "Working Conditions Wage Rates and Human Capital: A Hedonic Study." An unpublished M. I. T. dissertation. October 1972.
14. C.F. Meneses and D.L. Hansan. "On the Theory of Risk Aversion," International Economic Review, Vol. 11 (October 1970), pp. 481-487.
15. A Michaeli "The Profitability of Investment in the Training of Merchant Marine Officers." An unpublished manuscript, Technion, Haifa. 1972 (Hebrew)
16. J.W. Pratt. "Risk Aversion in the Small and in the Large," Econometrica, Vol. 32, pp. 122-136, (January-April 1964).
17. M. W. Reder "Wage Differentials Theory and Measurement," Aspects of Labor Economics, New York, N. B. E. R. 1962, pp. 257-311.

18. L. A. Rapping "The impact of Atlantic Gulf Unionism on the Relative Earnings of Unlicensed Merchant Seamen" Industrial and Labor Relations Review, Vol. 17, No. 1, pp. 75-95, (October 1963)
19. Joan Robinson. "Macro-economics of Balanced Growth: A Belated Comment," American Economic Review, Vol. 59 (September 1969), pp. 632.
20. S. Rosen. "A Theory of Hedonistic Prices," A discussion paper No. 72-8. University of Rochester, 1972.
21. G. J. Stigler. "Domestic Servants in the U.S. 1900-1940" occasional paper No. 25, April 1946. National Bureau of Economic Research.
22. Y. Weiss, "The Risk Element in Occupational and Educational Choices," Journal of Political Economy, Vol. 80 (Nov-Dec. 1972) pp. 1203-1213.
23. Y. Weiss. Learning by Doing and Occupational Specialization," Journal of Economic Theory, Vol. 3 (June 1971) pp. 189-198.