Earning Capacity and Economic Theory

Gary R. Skoog
Department of Economics
DePaul University
Chicago, IL 60604
and
Legal Econometrics, Inc.
Glenview, IL 60025-2006
Tel: 847-729-6154
Fax: 847-729-6158
Email: gskoog@umich.edu

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I. Introduction

The paper by Stephen Horner and Frank Slesnick which appeared 16 years ago and is the winner of the first Ward-Piette Prize in forensic economics, is certainly seminal. The strength of that and the current paper is the set of extended guidelines, most of which provide useful suggestions for forensic economists. The current re-issue and elaboration appears to backtrack slightly on their clear earlier idea that earning capacity is maximized expected earnings: the choice of the current title – "Latent Earning Capacity: When Earning Capacity is Not Expected Earnings" suggests alternatives. The question needing an answer in each case is therefore whether, in current parlance, latent capacity is zero. It appears that, in most cases, the authors will continue to hold to this belief, and require strong evidence before admitting positive latent capacity.

This paper is an invited reaction to both the original and the current Horner-Slesnick papers. They lamented that their earlier paper was intended as a starting point, and that it had not generated much reaction. Despite agreeing with much of their wise counsel, I provide an alternative definition of earning capacity, which I argue does as well or better than theirs when judged by their ten guidelines. The new definition reflects generally accepted economic theory, by which I mean utility or satisfaction maximization ("SEC" for short). I show by examples where the 1999 and 2015 definition of earning capacity, Horner-Slesnick earning capacity (abbreviated here as "HSEC,") is consistent with, and where it is different from SEC. Despite the difference in definitions, those practitioners who have been adhering to HSEC will need to change little in their methodology in practice; rather, they may continue with most of what they were doing, but now will have a firmer economic foundation.

In the words of the current Horner-Slesnick paper, should their new 2015 concept of "latent capacity" be assumed to be zero? I come to the same conclusion as the current paper – the answer is generally "no." There are a variety of reasons for this conclusion. Some are quite close to the ideas in present Horner-Slesnick paper, but other reasons are very different, although familiar to economists. Despite any differences, this paper will argue that the standard in forensic economic practice should continue to involve the notion of maximization and, where available, reliance on past data, both hallmarks of good economics generally and consistent with the message for practice of earlier Horner-Slesnick paper.

Another topic which this paper addresses, but which was implicit in the Horner-Slesnick paper, is compensation. I read the HSEC papers to say that the proper measure of compensation resulting from an injury is the difference between their measure of earning capacity before and their measure after the injury. By one of their guidelines, this should be consistently measured; this may mean that if latent capacity is claimed to exist in either pre-injury or post-injury state, it should be looked for or included in the other state as well. I will offer computations corresponding to their HSEC notion of earning capacity, to a common approximation (CA, below) used in forensic economics (FE, below) to the SEC proposed here, and to an ideal measure (CV, below) borrowed from standard economics; all are developed in sections V-VIII.

II. General Notions Horner-Slesnick (1999)

The key HSEC definition is that earnings capacity is the expected earnings of a person who maximizes his expectation over actual earnings streams (HS 1999, p. 16). Factors governing the actual earnings streams include the person's abilities, the opportunities available, and the exercise of preferences over that set of opportunities. Left unsaid is what randomness the expectation is taken over, but the authors clearly have in mind notions such as the randomness of future lifetime and future health, together implying future time in the labor force. Their theory is meant to be applied both to the earnings stream that could or perhaps would have been realized, but for the tort, and to the earnings stream available after the tort.

The HS papers are conceptual and not mathematical. There is much nuance in them, which constitutes both strength and weakness. There are tensions in them, as there must be from the topic itself, since it comes both from an uneasy alliance between the court system and economics. Indeed, the presence of the authors' 2015 paper 16 years after the original is testament to these tensions.

Some examples about possible latent capacity will, I suspect, remain very difficult for forensic economists to treat definitively. The authors suggest that, for the injured plaintiff who was attorney, but who has chosen to stay at home caring for pre-school age children, we should use opportunity cost earnings as an attorney. But words like "voluntary," "non-binding" and "temporary" accompany the example, so that we might need to assess how much human capital as an attorney has declined in any particular application. They warn against assuming "maximum possible earnings" but do not elaborate with examples. It may be that the "expectation" has been omitted. Often there is too much speculation involved - we have all read reports without proper evidentiary bases, words that they use. But below we will see situations where economists would say that HSEC would allow or require an earnings capacity which most FE's would not wish to testify to in court.

A major strength of the HS papers is their introduction of maximization into the discussion, because, despite its being a central principle of mainstream economics, it is so seldom used in forensic economics. My references cite, in addition to HSEC, but a few papers. One is a 1995 paper in the *JFE* by Malcolm R. Burns and David J. Faurot employing what I use below, a CES utility function, to household services. A recent theoretical paper by Scott Gilbert incorporates utility over goods and leisure, as here, in a multi-period framework. Utility theory also appeared explicitly in our literature, in a hedonic damages paper by William E Becker and Richard A. Stout. There was an early appeal to incorporating utility more into FE to increase damages in wrongful death cases, by Eli Schwartz and Bob Thornton, back in 1989. Finally, George A. Schieren had a

1998 paper embodying some utility functions, within a law and economics context concerning optimal deterrence.

Many of my reports reference the 1999 paper, by pointing out that earning capacity has a qualitative dimension - how much a career pays (called here a "rate" dimension)- and a quantitative dimension - how long a career is likely to last. Losses can appear in either or both dimensions. Also, the paper is useful when a vocational expert presents a group of jobs paying different hourly rates - choosing among the better paying jobs is implied by optimizing behavior, although these jobs must also realistically be available.

III. General Notions in Horner-Slesnick (2015)

Latent capacity is the new concept. Its dictionary definition includes considerations such as being present and capable of emerging, or developing, but not now visible, obvious, active, or symptomatic. In statistics, latent variables or hidden variables are not directly observed, but are rather inferred from other observed variables. Latent capacity is defined here as the difference between earning capacity and chosen expected earnings. Since earning capacity is the maximization of expected earnings over choices, and I will make a trivial regularity assumption which guarantees that the maximizing career or job exists, latent capacity is the difference between the expected earnings in the maximizing career and the expected earnings in the career undertaken. The questions become, how and where if at all does this occur?

If the courts award is based on earning capacity, and the person has not maximized, then latent capacity appears to be similar to another concept well known to economists: economic rent. The latter is an amount received in excess of the supply price at which it would be willingly offered. A person working for less than they could earn if they maximized is leaving an economic rent unclaimed or permitting it to be captured by another.

We know a bit about economic rents. They tend to get competed out of existence by becoming reflected in the price of their owner. Land supply is close to price inelastic, and land rents are demand determined. Labor supply - think of entertainers and pro athletes - have earned amounts far in excess of what they would have worked for - and did work for - in their leaner and meaner days.

One person's rent is another person's normal cost. That prime corner where the Starbuck's pay a large monthly rent is reflected in the costs of a cup of Starbuck's coffee. For this reason, economists are generally skeptical towards economic rents having a long half-life. I think that FE's should adopt this skepticism about long-lasting latent capacity.

A strong point of the HS 1999 paper was the assumption or "rebuttable presumption" that rents are 0, or in present terms, that latent capacity may be taken to be 0 by FE's in most instances. In different words, earning capacity is well approximated by the expectation of earnings in the selected job, except in exceptional cases, several of which are usefully noted.

IV. "Reasonably Expected to Occur"

I have adopted the position in my reports over the years that, if forensic economists are accepting the guidance of law about earning capacity, we ought to read the legal documents - cases, law and jury instructions - with an eye to what they are saying economically as they discuss earning capacity. In Illinois, the jury instructions and many cases typically follow the phrase "earning capacity" with the words "reasonably expected to occur." I have challenged others for evidence where this interpretation is not the case, and I have collected very few examples over the years. In fact, we see other close substitutes for these words, such as "reasonable probability" in Texas. As Jim Ciecka and I wrote in our state of Illinois *JFE* Illinois paper, the courts speak of earning capacity in the context of examples such as: 1. a person still has earning capacity even if they were unemployed on the accident date; one should not assume zero future earnings over a career; 2. the person who was a recent college graduate, with no significant earnings as a student, may have a substantial loss, and the FE should use the career earnings in careers indicated by the person college major.

HS (1999) cite "reasonable certainty" in *Courtney v. Allied Filter Engineering*, Inc. 181 Ill. App. 3d 222, 129 Ill. Dec. 902, 536, N.E. 2d 952,959 (1989), an Illinois case and Fitzpatrick v. United States, 754 F. Supp. 1023,1038 (1991), a federal case, and *Walker v. Bankston*, 571 So. 2d 690,697 (La. Ct. App. 1990).

However, there is some tension here as well. HS (1999) also cite *Hobgood v. Aucoin*, 574 So. 2d 344 (La. 1991) where the Louisiana Supreme Court stated, "damages may be assessed for the deprivation of what the injured plaintiff could have earned despite the fact that he may never have seen fit to take advantage of that capacity." My reading of these words is that the court did not say how such damages would be calculated, and in particular that such damages should be calculated in the same way that we would employ to assess losses associated with a person with a well established earnings record. There may be an "option value" to earnings unlikely to be exercised, and there may be "psychic costs" associated with changing occupations which could be compensated. Economists might estimate the "option value," although exercise conditions would be very difficult to evaluate. There is no developed theory for individual specific "psychic costs," although the theory of equalizing differences familiar to labor economists (hedonic prices and hedonic wages, both words properly used - cf. "hedonic damages") might provide market adjustments.

Examples of such jury instructions involving earning capacity are:

Illinois Pattern Instruction (IPI) 30.07: "The value of earnings lost and the present cash value of the earnings reasonably certain to be lost in the future" This notion is referred to as "capacity to earn" in the Comment.

Nevada "Plaintiff's loss of earnings or earning capacity which you believe the plaintiff reasonably certain to experience in the future as a result of the accident, discounted to present value.

Texas "Loss of earning capacity that, in reasonable probability, plaintiff will sustain in the future."

Additional comments on the HS 2015 paper begin in Section XI.

V. Satisfaction Earning Capacity (SEC) - Earning Capacity Implied By Economic Theory -Compared With HSEC, an Instance of Becker's "Full Income:" Theory

Satisfaction earning capacity, abbreviated SEC, is defined as the expected earnings of a person who *maximizes expected utility* in the situation contemplated. Quite simply, consumers are assumed to obey the axioms of economic theory.

We compare and contrast SEC with HSEC - as the expected earnings of a person who *maximizes expected earnings* - in several models.

Consider the following textbook model of deterministic and one period earning capacity. One may make this multi-period by applying it to each period of past and future worklife expectancy. Alternatively, this model can be gussied up to become multi-period and dynamic by introducing stochastic shocks and inter-temporal budget constraints. Optimization becomes more complicated - Euler equations replace derivatives.

The representative agent's preferences are represented by a utility function $U(Y_i, L_i, i)$ where $i = 1, \cdots, n$ indicate possible jobs or careers, and Y_i is the income and the sum of earnings from a possible job or career i paying wage rate w_i plus any non-wage income, and L_i denotes the hours of leisure which would be consumed in job i if it were selected. Let NW denote the non-wage income, i.e. income available whether one chose to work or not. H_i indicates the hours of labor weekly which would be supplied if occupation i were chosen. Constraints in the problem are:

$Y_i = w_i H_i + NW$	income is wage income plus non-wage income
$T = L_i + H_i$	there are T hours per week for leisure (non-work) and work; for example, if one needs to sleep and spend 9 hours per day on personal maintenance, take 63 hours from the 168 hours per week and use $T = 105$. This is a capacity constraint.
$0 \le L_i \le T$, $0 \le H_i \le T$	One can choose not to work at all, so that $H_i = 0, L_i = T$, or one can always work, so $L_i = 0, H_i = T$, or one may choose any allocation in between.

As written, the third component of the utility function indicates that there may be intrinsic utility associated with each of the *n* occupations. If one does not care about such intrinsic occupation characteristics - the glamour, status, physicality, odors, timing of hours and the like (their compensating differentials) - then one has $U(Y_i, L_i, i) = U(Y_i, L_i)$, i.e. there is no such job preference. Another special case occurs if there is job separability in the utility function (better, in the preference map), so that $U(Y_i, L_i, i)$ may be expressed as $u(i)(U(Y_i, L_i))$ where $u(i)$ without loss of generality may be taken to be increasing in *i*, and $U(Y_i, L_i)$ is one function which applies to all jobs *i*. This imposes strong testable hypotheses, yields an elegant solution, but may not be met in practice.

Since there is no randomness, maximization of expected utility trivially becomes maximization of utility. If a principle, HSEC or SEC, is to work generally, it had better work in this, the simplest special case. In this paper, the traditional situation without intrinsic job utility will receive most emphasis.

Economics, specifically the theory of consumer choice, implies that this agent will maximize utility subject to the constraints. Multiplying the second constraint by w_i and adding non-wage income gives income as $NW + Tw_i - w_i L_i = NW + w_i H_i = Y_i$. Substituting into the utility function gives $U(Y_i, L_i, i) = U(NW + Tw_i - w_i L_i, L_i, i)$. The ***economic problem*** now is to maximize overall utility, i.e. $\max_{1 \le i \le n} \left\{ \max_{0 \le L_i \le T} U(NW + Tw_i - w_i L_i, L_i, i) \right\}$. The maximization in brackets is the standard labor-leisure problem, and the overall maximization over jobs just involves counting and comparing, as posed here with a finite number of jobs. For each job i, there are three economic parameters, w_i, NW, T plus any parameters characterizing the utility function.

Consider the innermost maximization for fixed *i*, within the brackets, $\max_{0 \le L_i \le T} U(NW + Tw_i - w_i L_i, L_i, i)$. We use the notation $L_i(w_i, NW, T)$ and $H_i(w_i, NW, T)$ to denote the optimizing values of leisure hours and labor hours supplied at these parameter values for job *i*. The function $w_i H_i(w_i, NW, T)$ gives SEC, *i.e.* the wage income earned at the optimal choice for each job *i*, defined as a function of the underlying constraints. This is the definition of SEC or satisfaction maximizing earning capacity. Finally, the optimized value of total income is $Y_i(w_i, NW, T) = w_i L_i(w_i, NW, T) + NW$.

The indirect utility function, conditional on i being chosen, is $U(w_i, NW, T, i) = U(NW + Tw_i - w_i L_i(w_i, NW), L_i(w_i, NW), T, i)$. We may call this the first stage maximization. The first order conditions associated with this optimum will be the general (Kuhn-Tucker) first order conditions familiar to labor economists: if the reservation wage, defined as the absolute value of the marginal rate of substitution (MRS) of income for labor at no hours supplied (known as the reservation wage), exceeds the market wage, no hours are supplied; otherwise either an interior solution exists, or there is a corner solution where all hours T are supplied. The latter solution maximizes (expected) income, and so represents HSEC.

Now let c be the career or job chosen, i.e. the one which maximizes $U(w_i, NW, T, i)$ over the alternatives $1 \le i \le n$. We call this the second stage maximization. The associated wage is w_c, the hours of labor supplied are $H_c(w_c, NW, T)$, the wage income is $Y_c = w_c H_c(w_c, NW, T) = SEC(w_c, NW, T)$, total income is $Y(w_c, NW, T) = w_c H_c(w_c, NW, T) + NW$, leisure consumed is $L_c(w_c, NW, T)$ and utility is $U(Y(w_c, NW, T), L(w_c, NW, T), c)$.

This formulation permits, via the third argument in the utility function, "taste" in jobs.

This is, trivially, a present value (only one period, no discounting) of expected earnings (equal actual earnings, since there is no randomness).

The HSEC definition in this situation is, as always, the expected earnings of a person who maximizes his expectation over actual earnings streams. To maximize one's earnings, one must spend all T hours working, earning Tw_i. Recall that T is defined so that it is feasible to devote all hours to work. Thus, the HSEC definition involves maximizing earned income first given job *i* and then over jobs *i*. Over job *i* incomes are $Y_i = w(T - L_i) + NW$ so maximization is at $L_i = 0$, and income is $w_i T + NW$, of which earned income is Tw_i. In the overall maximization, $\max_{1 \le i \le n} \{Tw_i\} = T \max_{1 \le i \le n} \{w_i\}$, which occurs at the highest paying job, and whose value equals the income that would be earned by selling all of one's feasible time (105 hours per week) at the best wage. Thus HSEC in this leading economic model is well known to economists as Gary Becker's (1965) "full income[1]," Tw_c, charging oneself the market wage for all of one's time, the about which Becker wrote (bolding added):

> This suggests dropping the approach based on explicitly considering separate goods and time constraints and substituting one in which the total resource constraint necessarily equalled **the maximum money income achievable, which will be simply called "full income."** This income could in general be obtained by devoting all the time and other resources of a household to earning income, with no regard for consumption. Of course, all the time would not usually be spent "at" a job: sleep, food, even leisure are required for efficiency, and some time (and other resources) would have to be spent on these activities in order to maximize money income. The amount spent would, however, be determined solely by the effect on income and not by any effect on utility.

I suspect that Horner and Slesnick may be uncomfortable with this construction since for each job *i*, their definition entails assigning all feasible hours to the labor market. In

[1] Jim Rodgers' 2001 paper on the "whole-time concept" also quoted Becker, and in that same issue out Tw appears in a paper by Krueger, Ward and Albrecht.

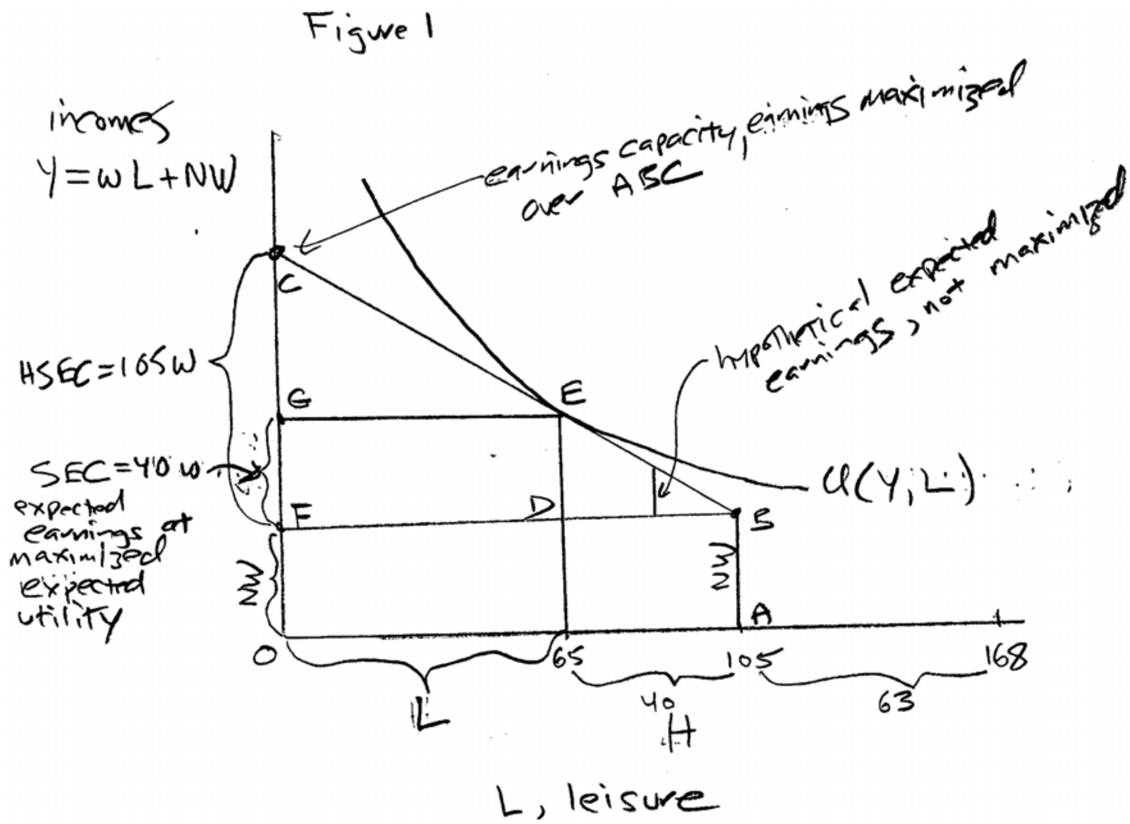
considering historically measured earnings, few people consume no leisure. I suspect that they would not be unhappy with the job selection implied by taking their definition literally, however, since it implies that the highest wage be employed in the definition of earning capacity. Perhaps they would modify their definition to something like $\max_{1 \le i \le n} \{ \bar{H} w_i \} = \bar{H} \max_{1 \le i \le n} \{ w_i \}$ where $\bar{H}$ is a "traditional" number of hours per week worked, in the past by the plaintiff, or generally. Such a modification (the "common approximation" discussed below) would get them to an earning capacity number that would be more "reasonable" in this model, and comport closely with historical earnings.

Since the two definitions involve the maximization of different functions, they will generally lead to different measures of earning capacity. In a few cases they will coalesce; in that case, HSEC proponents will benefit from this paper's formulation, as it ties their definition to generally accepted economic theory.

The rebuttable presumption that economic agents have optimized satisfaction (not expected or realized earnings) in the past provides strong justification for identifying the historical and measured incomes with SEC. Again, we observe very few instances of people maximizing their historical incomes by having sold all available leisure. Regarding future or post-trial income, again it is unlikely that a plaintiff will maximize that expected income (i.e. minimize leisure). A common approximation (CA) regarding "given injury" projections is to use a post-trial wage in mitigation (often suggested by a vocational expert) accompanied by the same number of hours for the future as was observed in the past, perhaps a 40 hour week. This approach will surely be far closer to observed quantities than HSEC's income maximization/leisure minimization. However, we will show in addition that SEC permits the FE to estimate a more precise hours response, in particular what the exact SEC value under maximization would be, for various leading one parameter families of utility functions (linear, Leontief, and Cobb-Douglas) and, more generally (depending on data), for the two parameter constant elasticity of substitution (CES) family, which contains as these single parameter families as special cases. We will observe that one parameterization (the Cobb-Douglas) in fact justifies the CA. Moreover, this line of inquiry permits the calculation of another measure of compensation - the ideal, or compensating variation (CV) measure. It is the lowest amount of wealth transfer such that, with optimization at the lower post-injury wage, the plaintiff would be able to achieve the pre-injury utility level. Additionally, we compute and compare CV compensation with various benchmark compensations such as HSEC, SEC and CA compensation levels under the various utility specifications.

VI. SEC and HSEC: Graphic Illustrations

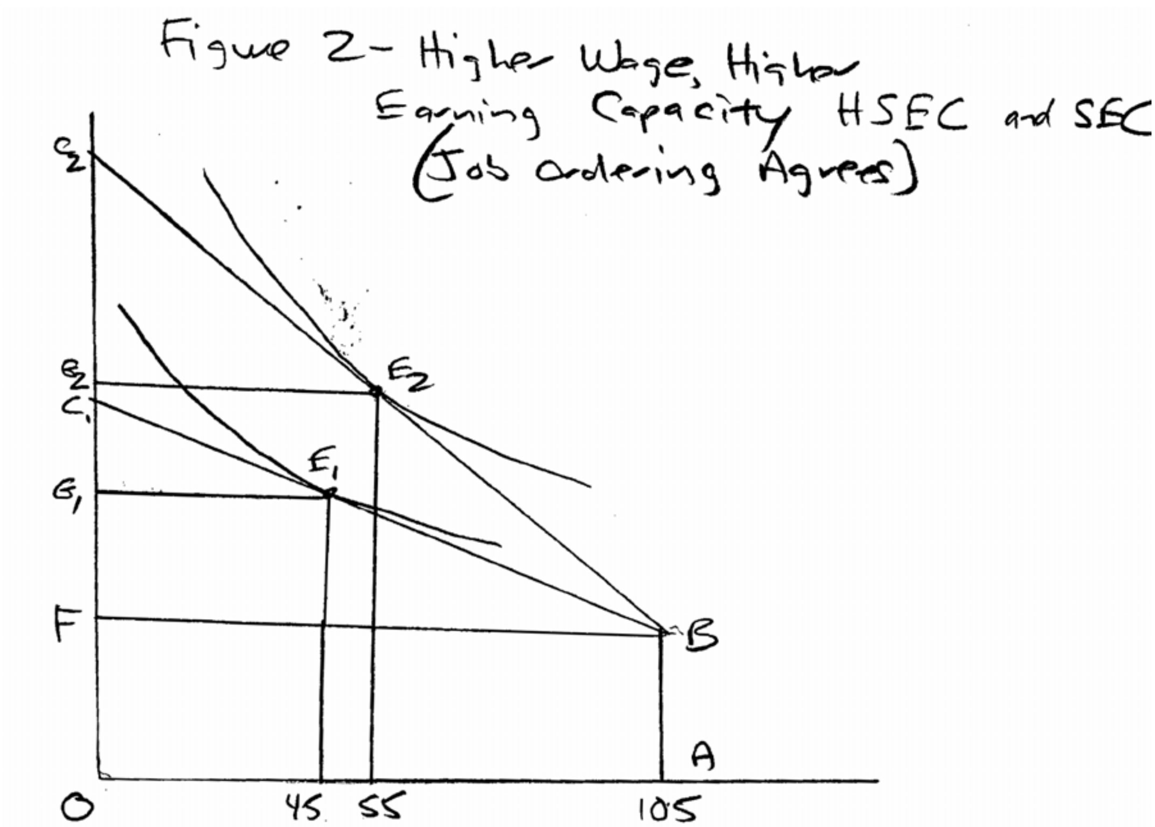
We start with Figure 1, which simply depicts the HSEC and SEC definitions. The y-axis is total income (showing the Hicksian composite commodity of consumer theory) and the x-axis depicts L, hours of leisure. There are 168 such hours in a week, of which, for illustration and definiteness, we take 63 to be required for sleep and personal maintenance. Total remaining feasible hours, *T* generally and here 105, at point A, can be allocated to work, H (measured leftward from 105) or leisure, L (measured rightward from the origin). Preferences are indicated by a typical indifference curve, $U(Y, L)$, which is drawn through the points which maximize satisfaction in this problem. The amount $NW = AB$ of non-wage income is available whether labor is supplied or not. Labor can be supplied at wage w given by the negative of the slope of line BC. If all 105 hours of potential leisure are supplied as labor, wage income, equal to expected income here because there is no randomness, is $105w = FC$, and total income is $105w + \text{NW} = OF + FC = OC$. Evidently $105w = CF$ is HSEC, since it maximizes (expected) earned income. On the other hand, $40w = DE$ is the SEC, since it maximizes satisfaction.



For a person with these preferences, ED would be observed earnings. Only if the indifference curves were very flat throughout would point C be the optimizing leisure-income bundle, and so would be observed, as a corner solution.
Clearly $HSEC = 105w >> 40w = SEC$. Empirical grounds - we see few people working so many hours - would suggest that SEC is much more consistent with the data.

There are a number of variants of Figure 1. One involves the wage line's slope increasing to 1.5w after 40 hours per week (corresponding to time and a half per collective bargaining agreements or covered jobs under the Fair Labor Standards Act). Another would entail the budget line becoming horizontal at EG, if no work above 40 hours were physically possible. If a job only offered 40 hours of work at *w*, but other jobs paying the minimum wage were available as moonlighting jobs at the lower wages, another kinked budget line emerges. The same qualitative conclusion would result - observed wage earnings would generally *not* be on the y-axis, where earnings are maximized, but at lower levels in the interior of the diagram.

Let us introduce a second job, in Figure 2. We now have maximization over jobs as well as the labor leisure choice in our earning capacity model.



We record the following results:

1. (SEC Results) For the lower paying job, the earned income associated with satisfaction maximization is FG_1, while FG_2 is the earned income associated with the higher paying job. Since the optimizing choice at the latter, E_2 is preferred to the optimizing choice at the former, E_1, the associated earnings measured by the SEC which requires utility maximization is FG_2.

2. (HSEC Results) For the lower paying job, the earned income associated with income maximization is OC_1, while OC_2 is the earned income associated with the higher paying job. Since $OC_1 < OC_2$ the HSEC is OC_2, as in Figure 1.

3. Both definitions will rank the jobs the same, but for different reasons. For HSEC, the higher wage will always cut the y-axis at the highest point, and maximize income. For SEC, the higher wage will always induce the highest budget set, and so for any economic preferences (more preferred to less) the higher the wage, the higher the satisfaction level of the associated job.

4. Less work is performed at the higher wage (the income effect dominates the substitution effect) but this is not necessarily the case. More earned income takes place at the higher wage, but again this is not necessarily the case - the income effect could be so strong as to result in less income earned at the higher wage. In this case, the SEC measure could decrease with *w*, the wage rate, although this would be unlikely. For the HSEC measure this negative relationship with *w* can never occur.

If we interpret the slope of BC_2 in Figure 2 as referring to the highest wage among the pre-injury jobs, and BC_1 referring to the highest wage among the post injury jobs (lower paying then the best pre-injury job), then the pecuniary damages under SEC and HSEC may be compared, since they are, respectively, the lengths $G_1G_2 = FG_2 - FG_1$ and $C_1C_2 = OC_2 - OC_1$ .The damages difference, $C_1C_2 - G_1G_2$ is modest, while the differences between the underlying earning capacity differences, G_2C_2 and G_1C_1 look much larger.

Nevertheless, neither damages measure is ideal. Figure 3 on the next page shows the ideal measure, CV_1 defined as the amount of compensation needed to restore the plaintiff to the pre-injury utility level. This will be recognized as Hicks' compensating variation value theory or from welfare economics. The original (pre-accident) budget line, with slope $-w_2$ is ACC_2 with equilibrium at E_2. The new (after accident) budget line, with slope $-w_1$ is ACC_1 with equilibrium at E_1. Earned income is DE_2 and $HE_1 = DJ$ before and after injury. $SEC_{compensation} = JE_2 - JD = JK + KW_1 + W_1E_2$. The indifference curves through the two equilibria discussed so far are indicated. Now the line AC , representing non-wage income, is vertically extended to CV_1, the dashed line. V_1 is chosen so that the line V_1W_1, also with slope $-w_1$ and so parallel to CC_1 is also tangent to the original and higher indifference curve at E_3. Evidently if CV_1 is added to non-wage income AC and the subject maximizes utility, the equilibrium will be at E_3, supplying the same satisfaction as the original point E_1. It is assumed that the injury does not affect labor-leisure preferences; this would unlikely be the case with catastrophic personal injuries.

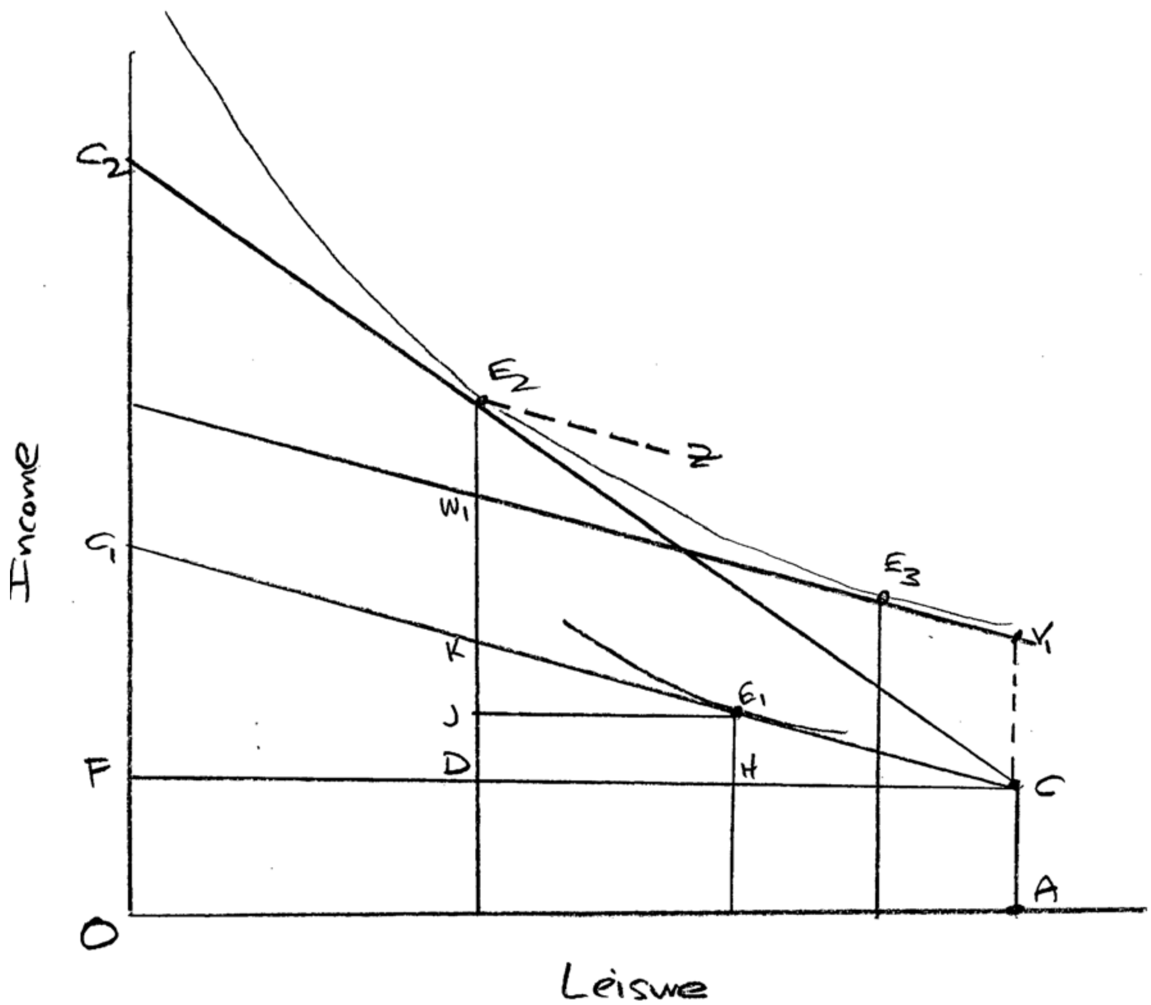
A common strategy in forensic economics is to assume that the economic loss would be given by $DE_2 - DK = KE_2 = KW_1 + W_1E_2$, which is the wage difference times the hours worked before the accident. Notice that this overstates damages by W_1E_2 when compared to the ideal, compensating variation. The $SEC_{compensation}$ overstates the ideal compensation by more: $JK_1 + W_1E_2$ and the *HSEC* overstatement would be more still.

Finally, the line E_2Z is drawn through original equilibrium E_2 at the slope $-w_1$. It depicts the budget line when the amount KE_2 is added to the income that the subject would have if he worked the original number of hours CD at w_1. He can purchase his original income-leisure bundle, and sell more or less labor at the lower price. Evidently he will with to sell less labor, moving rightward and downward, and attaining more and more utility in the process. This is another illustration of the overcompensation of the traditional compensation - it makes the subject better off then before the accident.

Against ideal compensation, $CV_1 = KW_1$, the pecuniary loss calculations we make in forensic economics, and those with which courts are familiar, are at best second best.

Figure 3

Illustrating CV, Ideal or Compensating Variation, and the Overstatements of HSEC, SEC and CA (Conventional Approximation) Measures



VII. SEC and HSEC: Constant Elasticity of Substitution (CES), Cobb-Douglas, Linear and Leontief Results

VIIa. CES

We proceed from graphic presentations to some analytic results before returning to more graphs.

Let $U(Y,L)=\left[Y^{-\rho}+\alpha L^{-\rho}\right]^{-\frac{1}{\rho}}, \alpha \geq 0, -1 \leq \rho \leq \infty$. This is a constant elasticity of substitution (CES), two parameter specification of utility[2]. It is common to define $\sigma = \frac{1}{\rho+1}$ as the elasticity of substitution, with the interpretation that it represents the percentage change in the optimal $\frac{Y}{L}$ ratio induced by a one percent change in the wage ratio. It is useful to note the following identifications where the parameter ρ is pushed to its limits of -1 through 0 (where the utility function is must be defined by continuity) to ∞:

$\rho=-1$	$\sigma=\infty$	*Linear*	$U(Y,L)=Y+\alpha L$
$\rho=0$	$\sigma=1$	*Cobb – Douglas*	$U(Y,L)=YL^{\alpha}$
$\rho=\infty$	$\sigma=0$	*Leontief*	$U(Y,L)=\min\{Y,\alpha L\}$

The two constraints are:

(1) $Y=wH+NW$, wages times Hours plus non-wage income gives total income, Y
(2) $T=L+H$, hours of leisure, L plus hours worked, H, equal total time available, above illustrated at 105

We need an expression for $\frac{dY}{dL}=-\frac{\frac{\partial U}{\partial L}}{\frac{\partial U}{\partial Y}}=-\frac{U_L}{U_Y}=MRS(Y,L)$, the slope of an indifference curve. $U_L=\left(-\frac{1}{\rho}\right)\left[Y^{-\rho}+\alpha L^{-\rho}\right]^{-\frac{1}{\rho}-1}\left(\alpha(-\rho)L^{-\rho-1}\right)=\alpha L^{-\rho-1}\left[Y^{-\rho}+\alpha L^{-\rho}\right]^{-\frac{1}{\rho}-1}$ and

$U_Y=\left(-\frac{1}{\rho}\right)\left[Y^{-\rho}+\alpha L^{-\rho}\right]^{-\frac{1}{\rho}-1}\left((-\rho)Y^{-\rho-1}\right)=Y^{-\rho-1}\left[Y^{-\rho}+\alpha L^{-\rho}\right]^{-\frac{1}{\rho}-1}$, so that

[2] Notice that if $\rho=-1$, $U(Y,L)=Y+\alpha L$, linear utility. However the cases $\rho=0$ and $\rho=-\infty$ require a limiting argument to be applied to the utility function to yield the claimed forms.

$$\frac{dY}{dL} = MRS(Y,L) = -\frac{\alpha L^{-\rho-1}\left[Y^{-\rho}+\alpha L^{-\rho}\right]^{-\frac{1}{\rho}-1}}{Y^{-\rho-1}\left[Y^{-\rho}+\alpha L^{-\rho}\right]^{-\frac{1}{\rho}-1}} = -\alpha\left(\frac{Y}{L}\right)^{\rho+1}.$$

The condition for supplying no labor *i.e.* no leisure is sold, so that $Y = NW, L = T$, is a corner solution, $MRS(NW,T) = -\alpha\left(\frac{NW}{T}\right)^{\rho+1} = -reservation \quad wage < -w$. This is usually expressed as the statement that the reservation wage $\alpha\left(\frac{NW}{T}\right)^{\rho+1}$ exceeds the market wage *w*.

The other corner solution, and the one under which HSEC would be consistent with utility maximization in this model, would entail all leisure being sold. The mathematical condition is $MRS(NW+wT,L) = -\alpha\left(\frac{NW+wT}{L}\right)^{\rho+1} > -w$ at $L = 0$. For $\rho > -1$, the MRS is not even defined at $L = 0$; indeed, indifference curves' slopes approach $-\infty$ as $L \downarrow 0$, so there would never be a corner solution at $L = 0$. To see this, set $L = \varepsilon$, a small positive number, in the MRS, yielding $-\alpha\left(\frac{NW+w(T-\varepsilon)}{\varepsilon}\right)^{\rho+1}$, which approaches $-\infty$ for $\rho > -1$. On the other hand, when $\rho = -1$, $U(Y,L) = Y + \alpha L$, so that $MRS(Y,L) = -\frac{U_L}{U_Y} = -\frac{\alpha}{1}$.

If $-\alpha > -w$ or $\alpha < w$, the labor supply with linear utility has a corner solution: a unit of leisure adds α to utility but, if sold earns $w > \alpha$, it and all units should be sold for income. This is one case where HSEC is consistent with utility maximization: L matters, but not enough to choose any.

Before proceeding to a general analysis of CES utility, there are two additional cases where HSEC is consistent with consumer theory. If $\alpha = 0$, leisure L doesn't matter at all, and the CES formula becomes $U(Y,L) = Y$. Maximizing utility and maximizing income are the same thing. Finally, there is the case of lexicographic preferences, where the preference map cannot be represented by a utility function. Here the preferences are as follows: a bundle (Y_1, L_1) is preferred to a different bundle (Y_2, L_2) if $Y_1 > Y_2$ regardless of L_1 and L_2; however if $Y_1 = Y_2$, then the bundle with more L is preferred. In these three cases - linear utility with $\alpha < w$, $\alpha = 0$ and lexicographic preferences, the HSEC's income maximization is consistent with utility maximization, and of course in agreement with SEC.

Returning to the general CES case, assuming $\alpha\left(\frac{NW}{T}\right)^{\rho+1} \geq w$, then the solution of the consumer's optimization problem is given by the following equations in Y and L:

(3) $\alpha\left(\frac{Y}{L}\right)^{\rho+1} = w$

(4) $Y = w(T-L) + NW$

Re-write (3) as $Y = L\left(\frac{w}{\alpha}\right)^{\frac{1}{\rho+1}}$ and substitute into (4) to get $L\left(\frac{w}{\alpha}\right)^{\frac{1}{\rho+1}} = w(T-L) + NW$ .So $L\left\{\left(\frac{w}{\alpha}\right)^{\frac{1}{\rho+1}} + w\right\} = wT + NW =$ full income, and we have

$L(w, NW; T, \alpha, \rho) = \dfrac{wT + NW}{\left\{\left(\frac{w}{\alpha}\right)^{\frac{1}{\rho+1}} + w\right\}}$, where we explicitly (and pedantically) note the dependence on the parameters w and NW, the constraint T and parameters of the utility function α and ρ. Since $H = T - L$, we have

$$H(w, NW; T, \alpha, \rho) = T - \frac{wT + NW}{\left\{\left(\frac{w}{\alpha}\right)^{\frac{1}{\rho+1}} + w\right\}} = \frac{T\left\{\left(\frac{w}{\alpha}\right)^{\frac{1}{\rho+1}} + w\right\} - wT - NW}{\left\{\left(\frac{w}{\alpha}\right)^{\frac{1}{\rho+1}} + w\right\}} = \frac{T\left(\frac{w}{\alpha}\right)^{\frac{1}{\rho+1}} - NW}{\left\{\left(\frac{w}{\alpha}\right)^{\frac{1}{\rho+1}} + w\right\}}$$

Then SEC or earned income also depends on variables w and NW, the constraint T and the parameters of the utility function α and ρ. We record this as

$$SEC(w, NW; T, \alpha, \rho) = wH(w, NW; T, \alpha, \rho) = \frac{w\left\{T\left(\frac{w}{\alpha}\right)^{\frac{1}{\rho+1}} - NW\right\}}{\left\{\left(\frac{w}{\alpha}\right)^{\frac{1}{\rho+1}} + w\right\}}$$

and finally total income is

$$Y(w,NW;T,\alpha,\rho) = wH + NW = \frac{w\left\{T\left(\frac{w}{\alpha}\right)^{\frac{1}{\rho+1}} - NW\right\}}{\left\{\left(\frac{w}{\alpha}\right)^{\frac{1}{\rho+1}} + w\right\}} + \frac{NW\left\{\left(\frac{w}{\alpha}\right)^{\frac{1}{\rho+1}} + w\right\}}{\left\{\left(\frac{w}{\alpha}\right)^{\frac{1}{\rho+1}} + w\right\}} = \frac{\left(\frac{w}{\alpha}\right)^{\frac{1}{\rho+1}}\left\{wT + NW\right\}}{\left\{\left(\frac{w}{\alpha}\right)^{\frac{1}{\rho+1}} + w\right\}}$$

.

From the expressions for Y and L, notice that $Y = \left(\frac{w}{\alpha}\right)^{\frac{1}{\rho+1}} L$, so that

$\log\left(\frac{Y}{L}\right) = \frac{1}{1+\rho}\log w - \frac{1}{1+\rho}\log\alpha$, from which $\frac{d\log\left(\frac{Y}{L}\right)}{d\log w} = \frac{1}{1+\rho} = \sigma$, justifying the CES name.

Finally, the indirect utility function, recording the utility achieved as a function of the constraints, is

$$U(w,NW;T,\alpha,\rho) = \left(\left(\frac{\left(\frac{w}{\alpha}\right)^{\frac{1}{\rho+1}}\left\{wT + NW\right\}}{\left\{\left(\frac{w}{\alpha}\right)^{\frac{1}{\rho+1}} + w\right\}}\right)^{-\rho} + \left(\frac{\alpha\left\{wT + NW\right\}}{\left\{\left(\frac{w}{\alpha}\right)^{\frac{1}{\rho+1}} + w\right\}}\right)^{-\rho}\right)^{-\frac{1}{\rho}}$$

$$= \left(\frac{\left\{wT + NW\right\}}{\left\{\left(\frac{w}{\alpha}\right)^{\frac{1}{\rho+1}} + w\right\}}\right)\left(\left(\frac{w}{\alpha}\right)^{\frac{-\rho}{\rho+1}} + \alpha^{-\rho}\right)^{-\frac{1}{\rho}}$$

From its definition, *CV*, when added to non-wage income *NW* at the post-accident lower wage w_1 results in the pre-accident utility experienced at w_2. We thus must solve for *CV*:

$$\left(\frac{\{w_1T+NW+CV\}}{\left\{\left(\frac{w_1}{\alpha}\right)^{\frac{1}{\rho+1}}+w_1\right\}}\right)\left(\left(\frac{w_1}{\alpha}\right)^{\frac{-\rho}{\rho+1}}+\alpha^{-\rho}\right)^{-\frac{1}{\rho}}=\left(\frac{\{w_2T+NW\}}{\left\{\left(\frac{w_2}{\alpha}\right)^{\frac{1}{\rho+1}}+w_2\right\}}\right)\left(\left(\frac{w_2}{\alpha}\right)^{\frac{-\rho}{\rho+1}}+\alpha^{-\rho}\right)^{-\frac{1}{\rho}}$$

Multiplication leads to

$$\{w_1T+NW+CV\}=\{w_2T+NW\}\frac{\left\{\left(\frac{w_1}{\alpha}\right)^{\frac{1}{\rho+1}}+w_1\right\}}{\left\{\left(\frac{w_2}{\alpha}\right)^{\frac{1}{\rho+1}}+w_2\right\}}\left(\frac{\left(\left(\frac{w_2}{\alpha}\right)^{\frac{-\rho}{\rho+1}}+\alpha^{-\rho}\right)}{\left(\left(\frac{w_1}{\alpha}\right)^{\frac{-\rho}{\rho+1}}+\alpha^{-\rho}\right)}\right)^{-\frac{1}{\rho}}$$

, so that

$$CV(w_1,w_2,NW;T,\alpha,\rho)=\{w_2T+NW\}\frac{\left\{\left(\frac{w_1}{\alpha}\right)^{\frac{1}{\rho+1}}+w_1\right\}}{\left\{\left(\frac{w_2}{\alpha}\right)^{\frac{1}{\rho+1}}+w_2\right\}}\left(\frac{\left(\left(\frac{w_2}{\alpha}\right)^{\frac{-\rho}{\rho+1}}+\alpha^{-\rho}\right)}{\left(\left(\frac{w_1}{\alpha}\right)^{\frac{-\rho}{\rho+1}}+\alpha^{-\rho}\right)}\right)^{-\frac{1}{\rho}}-\{w_1T+NW\}$$

For $\rho=0$ (Cobb-Douglas) and $\rho=-1$ (Linear) the expression is undefined while the $\rho=\infty$ (Linear) case appears to have a limit; in any event, we work these three special cases up in the continuation of this section. The expression is closed form and may be programmed easily.

If plaintiff's hours are observed at two different wages, say one before and one after the accident, and the post accident wages reflect optimization (and not gaming the lawsuit), we would have, from the equation for H, two equations and two unknowns, permitting us to solve for both α and ρ. Such a calibration would permit the computation of all of the previous reduced form equations, discussed above.

VIIb. Cobb-Douglas, $\rho=0,\sigma=1$

In the more usual cases, where only hours before the accident may be calculated or estimated, we would not be able to compute calibrate the two parameters of a CES function. We could assume that $\rho=0$, i.e. that the preferences were Cobb-Douglas. The first order conditions for this case follow from simply setting $\rho = 0$ to the general CES result, but since the utility function itself does not follow with $\rho = 0$, it is best to start from scratch.

We are maximizing $U(Y,L) = YL^{\alpha}$ subject to $Y = wH + NW = w(T - L) + NW$.

$\frac{dY}{dL} = MRS(Y,L) = -\alpha\left(\frac{Y}{L}\right) = -w$ or $Y = \frac{wL}{\alpha}$ is the first order condition as long as $w \geq \alpha\frac{NW}{T}$ or else we have a corner solution at $L = T, H = 0, Y = NW, U = T^{\alpha}NW$.

Eliminating Y in the constraint results in $\frac{wL}{\alpha} = w(T - L) + NW$ or

$Lw(1 + \frac{1}{\alpha}) = wT + NW$,so

$$L(w, NW; T, \alpha) = \frac{\alpha(wT + NW)}{w(1+\alpha)}$$

$$H(w, NW; T, \alpha) = T - L = \frac{Tw(1+\alpha)}{w(1+\alpha)} - \frac{\alpha(wT + NW)}{w(1+\alpha)} = \frac{Tw - \alpha NW}{w(1+\alpha)}$$

$$SEC(w, NW; T, \alpha) = wH = \frac{Tw - \alpha NW}{(1+\alpha)}$$

$$Y(w, NW; T, \alpha) = wH + NW = \frac{Tw - \alpha NW}{(1+\alpha)} + \frac{NW(1+\alpha)}{(1+\alpha)} = \frac{Tw + NW}{(1+\alpha)}$$

$$U(w, NW; T, \alpha) = \frac{Tw + NW}{(1+\alpha)}\left(\frac{\alpha(wT + NW)}{w(1+\alpha)}\right)^{\alpha} = \frac{\left(Tw + NW\right)^{1+\alpha}\alpha^{\alpha}}{w^{\alpha}(1+\alpha)^{1+\alpha}}$$

We observe or can estimate the pre-injury hours H_2, the pre-injury wage, w_2, and the pre-injury non-wage income, NW , if any. From the hours equation we have

(5) $H_2 = \frac{105w_2 - \alpha NW}{w_2(1+\alpha)}$, so $\alpha(NW + H_2w_2) = 105w_2 - H_2w_2$ or

$$\alpha = \frac{105w_2 - H_2w_2}{NW + H_2w_2} = \frac{L_2w_2}{Y_2}.$$

This represents a calibration of the utility function as a simple function of observables, the ratio of the value of leisure consumed, evaluated at its opportunity cost, to income. For example, if $NW = 0$, $H_2 = 40$, so $L_2 = 65$, and $w_2 = 20$, $\alpha = \frac{65(20)}{40(20)} = 1.625$.

We next turn to compensation measures as differences in earning capacity. Let the before injury and after wage rates be w_2 and w_1, with $w_2 \geq w_1$.

As always, $HSEC(w_1, w_2, T, \alpha) = T(w_2 - w_1)$.

The SEC measures of earning capacity are, respectively
$SEC(w_2, NW; T, \alpha) = \frac{Tw_2 - \alpha NW}{(1+\alpha)}$ and
$SEC(w_1, NW; T, \alpha) = \frac{Tw_1 - \alpha NW}{(1+\alpha)}$, so that the natural measure of compensation based on loss of earning capacity becomes

$$SEC_{compensation}(w_1, w_2, NW, T, \alpha) = \frac{Tw_2 - \alpha NW}{(1+\alpha)} - \frac{Tw_1 - \alpha NW}{(1+\alpha)} = \frac{T(w_2 - w_1)}{(1+\alpha)} = \frac{HSEC(w_1, w_2)}{(1+\alpha)}$$

In the example above, we need to add a value for w_1, which we will take at 8. Then
$HSEC(w_1, w_2, T, \alpha) = 105(20 - 8) = 1260$, and
$SEC_{compensation}(w_1, w_2, NW, T, \alpha) = \frac{HSEC(w_1, w_2, T, \alpha)}{(1+\alpha)} = \frac{1260}{2.625} = 480$; this form expresses the idea of a "contraction factor" of $\frac{1}{1+\alpha} = .38$ being applied to $HSEC(w_1, w_2, T, \alpha)$.

Note that when $NW = 0$ as in this example, $H(w, NW; T, \alpha) = \frac{T}{(1+\alpha)}$, *i.e.* the hours chosen to be worked depend on tastes, α, but are independent of the wage. Thus the same *H* hours will be worked at the post-accident wage as well. This provides a justification for the *CA* or common approximation often employed in forensic economics of setting post injury hours equal to pre-injury hours. This *ad hoc* assumption is implied by optimization, for Cobb-Douglas preferences, without non-wage income, and so will be approximately true also for low, non-wage incomes. We record this result as:
$$SEC_{compensation}(w_1, w_2, 0, T, \alpha) = \frac{T(w_2 - w_1)}{(1+\alpha)} = H_2(w_2 - w_1) \equiv CA.$$

Now while awarding this amount may be consistent with legal precedent and FE tradition, we know that adding CA to the post-injury wealth, now $0 + H_2(w_2 - w_1)$ will put the plaintiff on his pre-injury optimal indifference curve and offer him the possibility of working at a wage w_1 which is less than the marginal rate of substitution which in turn equals w_2. Consequently given this transfer, the plaintiff will work fewer hours, enjoy more leisure, attain a higher indifference curve, and so be over-compensated (Figure 3). The ideal compensation (known as compensating variation in price theory) is the quantity, CV, which when added to initial wealth NW, will at wages w_1 lead to the same utility level as was experienced initially with wealth NW and wages w_2. In other words, as with the general CES case, we must solve

$$U(w_2, NW; T, \alpha) = \frac{\left(Tw_2 + NW\right)^{1+\alpha} \alpha^{\alpha}}{w_2^{\alpha}(1+\alpha)^{1+\alpha}} = \frac{\left(Tw_1 + NW + CV\right)^{1+\alpha} \alpha^{\alpha}}{w_1^{\alpha}(1+\alpha)^{1+\alpha}} = U(w_1, NW + CV; T, \alpha)$$

Canceling results in $\frac{\left(Tw_2 + NW\right)^{1+\alpha}}{w_2^{\alpha}} = \frac{\left(Tw_1 + NW + CV\right)^{1+\alpha}}{w_1^{\alpha}}$, equivalently

$\frac{w_1^{\alpha}\left(Tw_2 + NW\right)^{1+\alpha}}{w_2^{\alpha}} = \left(Tw_1 + NW + CV\right)^{1+\alpha}$. Provided that positive labor is supplied at w_1,

this becomes $CV_{Cobb-Douglas}(w_1, w_2, NW; T, \alpha) = \left(\frac{w_1}{w_2}\right)^{\frac{\alpha}{1+\alpha}} \left(Tw_2 + NW\right) - \left(Tw_1 + NW\right)$.

Notice that if $NW = 0$, we have $CV_{Cobb-Douglas} = \left(\frac{w_1}{w_2}\right)^{\frac{\alpha}{1+\alpha}} Tw_2 - Tw_1$, so $CV < CA$, as reasoned above. The expression for excess compensation granted by CA generally is

$$excess = \left(Tw_2 - Tw_1\right) - \left\{\left(\frac{w_1}{w_2}\right)^{\frac{\alpha}{1+\alpha}} \left(Tw_2 + NW\right) - \left(Tw_1 + NW\right)\right\} = \left\{1 - \left(\frac{w_1}{w_2}\right)^{\frac{\alpha}{1+\alpha}}\right\}\left(Tw_2 - NW\right)$$

This latter expression is guaranteed to be positive by the assumption that labor is supplied at w_2.

VIIc. Linear Utility, $\rho = -1, \sigma = \infty$

Here $U = Y + \alpha L$ so with $Y = wH + NW = w(T - L) + NW$ the function to be maximized is simply $U = w(T - L) + NW + \alpha L = (\alpha - w)L + wT + NW$. If $\alpha = w$, any choice of L on the budget line produces equivalent utility. If $\alpha > w$, an hour of leisure is worth more than what is brings if sold in the market, so setting $L = T$ is optimal, realizing utility of $U = w(T - T) + NW + \alpha T = \alpha T + NW$. Otherwise $\alpha < w$, so that an hour of leisure is worth less than the proceeds from selling it. All hours of leisure should then be sold, yielding $L = 0$, $Y = wT + NW$ and $U = wT + NW$. This may be summarized by:

if $\alpha > w$	if $\alpha < w$	if $\alpha = w$
$L = T$	$L = 0$	any $L \subset [0, T]$
$H = 0$	$H = T$	any $H \subset [T, 0]$
$Y = NW$	$Y = wT + NW$	$Y = wT + NW = \alpha T + NW$
$U = \alpha T + NW$	$U = wT + NW$	$U = wT + NW = \alpha T + NW$

Selling all available leisure, $HSEC(w,T) = wT$ regardless of α, while

$$SEC(w, NW; T, \alpha) = \left\langle \begin{array}{ll} 0, & \alpha > w \\ [0, wT = \alpha T], & w = \alpha \\ wT, & \alpha < w \end{array} \right.$$

Consequently when $\alpha \leq w$, $HSEC(w,T) = SEC(w, NW; T, \alpha)$, and HSEC would be observed when $\alpha < w$.

Regarding compensation, again let the before-injury and after-injury wage rates be w_2 and w_1 with $w_2 \geq w_1$, as usual. Then $HSEC_{compensation}(w_1, w_2, T) = (w_2 - w_1)T$ while $SEC_{compensation}(w_1, w_2, NW; T, \alpha)$, defined as $SEC(w_2, NW; T, \alpha) - SEC(w_1, NW; T, \alpha)$, will vary, depending on the case. (I have ignored equalities in the cases, since they give rise to indeterminacies, as shown above):

Case 1 $w_1 < \alpha < w_2$ $SEC(w_1, NW; T, \alpha) = 0$ and $SEC(w_2, NW; T, \alpha) = w_2 T$ so

$SEC_{compensation}(w_1, w_2, NW; T, \alpha) = w_2 T$ versus

$HSEC_{compensation}(w_1, w_2, T) = (w_2 - w_1)T$

Case 2 $\alpha < w_1 < w_2$ $SEC(w_1, NW; T, \alpha) = w_1 T$ and $SEC(w_2, NW; T, \alpha) = w_2 T$ so

$SEC_{compensation}(w_1, w_2, NW; T, \alpha) = (w_2 - w_1)T = HSEC_{compensation}(w_1, w_2)$

Case 3 $w_1 < w_2 < \alpha$ $SEC(w_1, NW; T, \alpha) = 0$ and $SEC(w_2, NW; T, \alpha) = 0$ so

$SEC_{compensation}(w_1, w_2, NW; T, \alpha) = 0$ versus

$HSEC_{compensation}(w_1, w_2, T) = (w_2 - w_1)T$

Clearly depending on the tastes for work, either measure may exceed the other, or there may be agreement:

Case 1 $w_1 < \alpha < w_2$ $SEC_{compensation}(w_1, w_2, NW; T, \alpha)$ exceeds $HSEC_{compensation}$ by $w_1 T$

Case 2 $\alpha < w_1 < w_2$ $SEC_{compensation}(w_1, w_2, NW; T, \alpha) = HSEC_{compensation}(w_1, w_2)$

Case 3 $w_1 < w_2 < \alpha$ $HSEC_{compensation}$ exceeds $SEC_{compensation}(w_1, w_2, NW; T, \alpha)$ by $(w_2 - w_1)T$

Optimal compensation will vary with the case as well. Let the loss in utility from the lower wage be indicated by $\Delta U = U(w_2, NW; T, \alpha) - U(w_1, NW; T, \alpha)$. Next, note that NW enters the indirect utility function additively, so that recording the fall in utility ΔU gives the amount of compensating income. The results are:

Case 1 $w_1 < \alpha < w_2$ $\quad \Delta U = w_2 T + NW - \alpha T + NW = (w_2 - \alpha)T$, ideal compensation
Case 2 $\alpha < w_1 < w_2$ $\quad \Delta U = w_2 T + NW - w_1 T + NW = (w_2 - w_1)T$, ideal compensation
Case 3 $w_1 < w_2 < \alpha$ $\quad \Delta U = \alpha T + NW - (\alpha T + NW) = 0$, ideal compensation

Using $CV_{Linear}(w_1, w_2, NW; T, \alpha)$ to denote this ideal or compensating variation, and recalling that compensating variation refers to the minimal compensation needed to compensate, we have:

$CV_{Linear}(w_1, w_2, NW; T, \alpha) = (w_2 - \alpha)T$ in Case 1, when $w_1 < \alpha \le w_2$

$CV_{Linear}(w_1, w_2, NW; T, \alpha) = (w_2 - w_1)T$ in Case 2, when $\alpha < w_1 < w_2$

$CV_{Linear}(w_1, w_2, NW; T, \alpha) = 0$ in Case 3, when $w_1 < w_2 < \alpha$

In Case 1, where one would have worked before the injury ($\alpha < w_2$), or been indifferent between working and not working ($\alpha = w_2$) but would not work after the injury, SEC compensation of $w_2 T$ exceeds the ideal of $(w_2 - \alpha)T$ by αT and SEC exceeds HSEC by even more, $(w_2 - w_1)T$. On the other hand, HSEC exceeds the ideal compensation by $(w_2 - w_1)T - (w_2 - \alpha)T = (\alpha - w_1)T$. Notice that non-corner solutions can emerge when the only when $\alpha = w_2$, and in this case, $CV_{Linear} = 0$, a case arising in our comparison below.

In Case 2, where one elects to work all of the time, the SHEC and SEC measures are the same, and the compensation measures are both ideal.

In Case 3, where one would elect to do no work either both before and after the injury, HSEC would provide compensation based on the assumption that all time would have been worked, and so would greatly over-compensate, while the SEC compensations before and after injury would both be 0, as would their difference, so that SEC compensation achieves the CV ideal, which is 0. It is hard to argue with the economics: the person's preferred alternative was not disturbed by the accident, so there is no loss, unless something not accounted for were to change. This is a statement about willful choices - the before accident wage wasn't good enough to induce work. It should take strong evidence to overcome the presumption of no loss, such as that the person was a student or temporarily disabled or temporarily out of the labor force at the time of the accident.

The main interest in linear utility is that it provides a special case rationalizing HSEC; in that special case, SEC does so as well.

VIId. Leontief Utility, $\rho = \infty, \sigma = 0$

The other polar case is $U(Y,L) = \min\{Y, \alpha L\}$. Clearly $Y = \alpha L$ is a necessary condition for utility maximization, provided that the line αL does not intersect the vertical line at $L = T$ before $Y = NW$, i.e. we must not have $\alpha T < NW$. The calculations below make this assumption, and so assume $\alpha T \geq NW$. If this condition fails, utility is maximized at $L = T$, and $U(Y,L) = \alpha T = \min\{Y, \alpha L\} = \min\{ND, \alpha L\} < NW$, so that $NW - \alpha T$ of income produces no utility. This is a corner solution.

Inserting $Y = \alpha L$ into the budget constraint $Y = wH + NW = w(T - L) + NW$ yields $\alpha L = w(T - L) + NW$, so that $(\alpha + w)L = wT + NW$. Collecting results,

$$L(w, NW; T, \alpha) = \frac{wT + NW}{\alpha + w}$$

$$H(w, NW; T, \alpha) = T - L(w, NW; T, \alpha) = \frac{\alpha T + wT}{\alpha + w} - \frac{wT + NW}{\alpha + w} = \frac{\alpha T - NW}{\alpha + w}$$

$$SEC(w, NW; T, \alpha) = wH = \frac{w(\alpha T - NW)}{\alpha + w}$$

$$Y(w, NW; T, \alpha) = wH + NW = \frac{w(\alpha T - NW)}{\alpha + w} + \frac{\alpha NW + wNW}{\alpha + w} = \frac{\alpha(wT + NW)}{\alpha + w}$$

$$U(w, NW; T, \alpha) = Y = \frac{\alpha(wT + NW)}{\alpha + w}$$

$$HSEC_{compensation}(w_1, w_2, T) = (w_2 - w_1)T$$

$$SEC_{compensation}(w_1, w_2, T, \alpha) = \frac{w_2(\alpha T - NW)}{\alpha + w_2} - \frac{w_1(\alpha T - NW)}{\alpha + w_1} =$$

$$\frac{w_2(\alpha + w_1)(\alpha T - NW) - w_1(\alpha + w_2)(\alpha T - NW)}{(\alpha + w_2)(\alpha + w_1)} = \frac{\alpha(w_2 - w_1)(\alpha T - NW)}{(\alpha + w_2)(\alpha + w_1)}$$

When $NW = 0$,

$$SEC_{compensation}(w_1, w_2, T, \alpha) = \left(\frac{\alpha}{\alpha + w_2}\right)\left(\frac{\alpha}{\alpha + w_1}\right)(w_2 - w_1)T = \left(\frac{\alpha}{\alpha + w_2}\right)\left(\frac{\alpha}{\alpha + w_1}\right)HSEC \,.$$

Ideal or compensating variation solves

$U(w_2, NW; T, \alpha) = Y = \dfrac{\alpha(w_2T + NW)}{\alpha + w_2} = \dfrac{\alpha(w_1T + NW + CV)}{\alpha + w_1} = U(w_1, NW; T, \alpha)$, entailing

$$CV_{Leontief}(w_1, w_2, NW, T, \alpha) = \frac{(w_2 - w_1)(\alpha T - NW)}{\alpha + w_2} \,.$$

When $NW = 0$, $CV_{Leontief} = \dfrac{\alpha}{\alpha + w_2}(w_2 - w_1)T = \dfrac{\alpha}{\alpha + w_2}HSEC$, so $CV_{Leontief} < HSEC$.

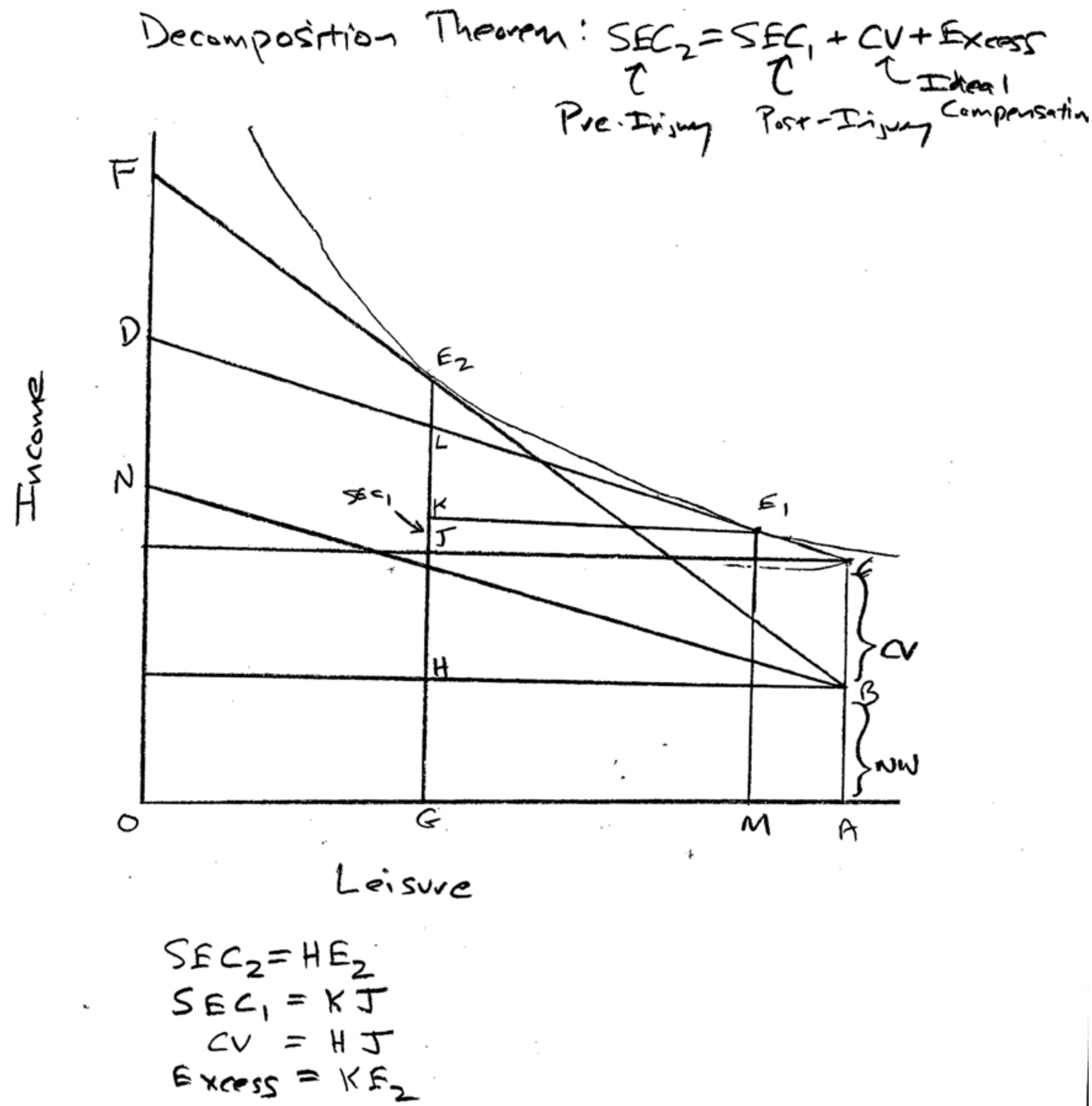
Finally, again with $NW = 0$, $SEC_{compensation} = \left(\dfrac{\alpha}{\alpha + w_1}\right)CV_{Leontief}$, so

$SEC_{compensation} < CV_{Leontief}$

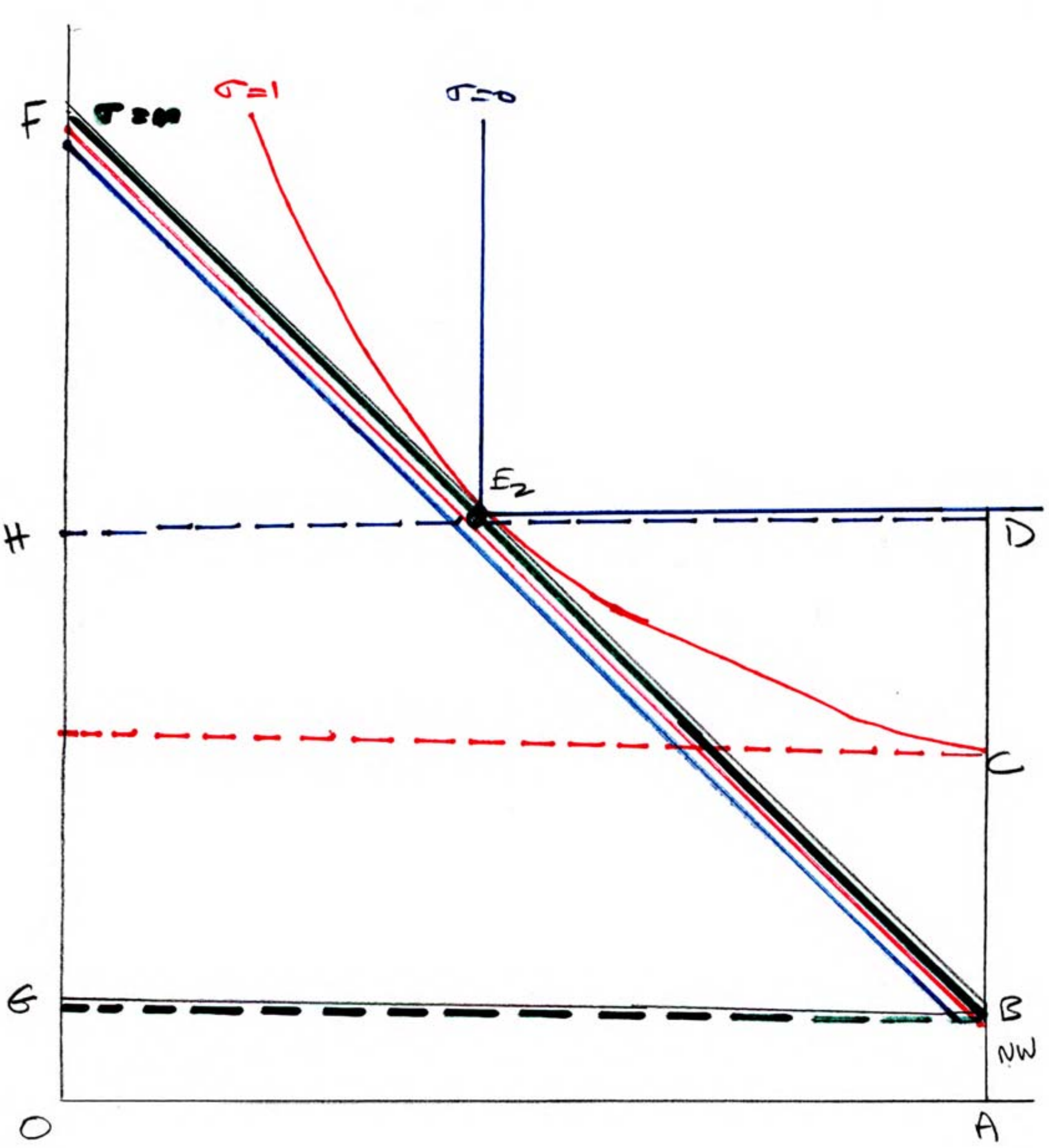
One may ask whether there is some other definition of earning capacity, call it IEC (for ideal earning capacity) with the property IEC_2 gives the present value of the pre-injury earnings stream, IEC_1 gives the present value of the post-injury earnings stream, and $IEC_2 - IEC_1 = CV$. I leave that as a research problem, but I am doubtful. A leading candidate would start with $IEC_2 = SEC_2$, but the development here indicates that equating IEC_1 with $SEC(w_1, NW, T)$ does not work. Further, we know that the earned income when awarded the ideal compensation is $SEC(w_1, NW + CV, T) = w_1H(w_1, NW + CV, T)$ and that total income with ideal compensation is $Y_1 = w_1H(w_1, NW + CV, T) + NW + CV$. However, none of these candidates work. In fact, the diagram which gives rise to the construction of CV implies a decomposition of SEC_2 into 3 pieces, all in general positive (although each piece may vanish in special cases). Two of the pieces are what we desire, the first being $SEC(w_1, NW + CV, T) = w_1H(w_1, NW + CV, T) = SEC_1$ which is chosen to be earned in mitigation, and the second being *CV*. It is the presence of the third piece, called here *the excess*, which constitutes an impossibility theorem for SEC to have the desired decomposition into just the two desired pieces as $SEC_2 = SEC_1 + CV$. Further, the *excess* constituters a part of pre-injury earning capacity which would *never* need to be awarded as compensation for lost pre-injury capacity, and it increases with the severity of the injury (the amount w_1 is lowered). We record this as:

Decomposition Theorem: $SEC_2 = SEC_1 + CV + Excess$

The next diagram shows the decomposition graphically.



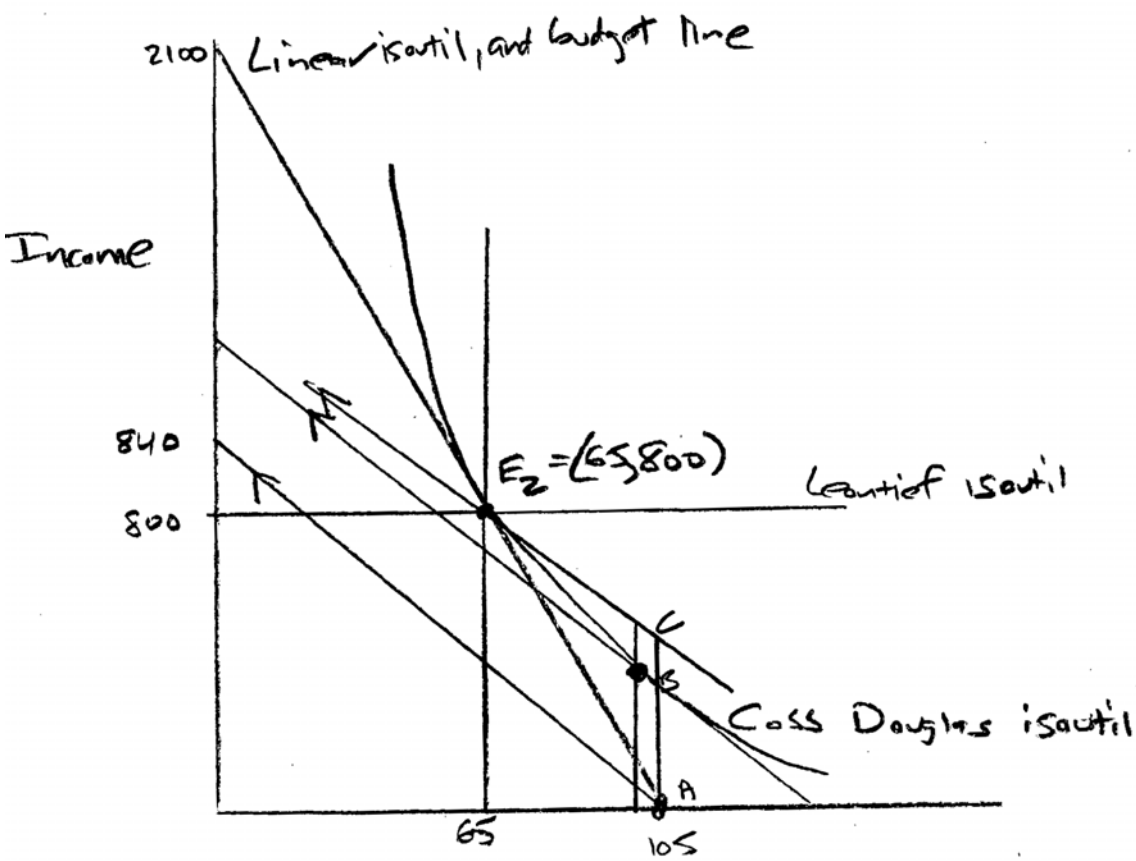
The next diagram shows special cases of the Decomposition Theorem, specifically, when $w_1 = 0$, $SEC_1 = 0$, so $SEC_2 = CV + Excess$. Because $SEC_2 = BD$ is the same for all 3 indifference curves, and CV varies from 0 (for the Linear, green preferences) to BC (for the Cobb-Douglas, red preferences), to BD (for the blue, Leontief preferences), the $Excess$ does the reverse.



VIII. Example - The Higher the Elasticity of Substitution the Lower the Compensation Variation

An economically interesting example illustrating the sensitivity of earning capacity and compensation to the preference map may be constructed by placing in the same income-leisure diagram the indifference curves corresponding to the extreme values of the elasticity of substitution and comparing the meaningful economic outcomes. The value of α as a descriptor of preferences is not meaningful across the utility functions - only the indifference curves matter. However, prices are comparable across the 3 examples. We continue the Cobb-Douglas example illustrated above, where the wages were $w_2 = 20, w_1 = 8, T = 105$ and $NW = 0$. Note that the α value for Leontief utility will be $\frac{800}{65}$ in order for it to go through the equilibrium point $Y = 40 * 20 = 800$ and $L = 105 - 40 = 65$. For the linear utility function to pass through the equilibrium point, we need $\alpha = 20$ so that the isoutil coincides with the budget line; otherwise we have a corner solution. The Cobb-Douglas value of α was $\frac{8}{5}$. Here we compute the CV's under each of the three utility functions, using the formulae derived above, to illustrate the claim in the section header. Figure 4 depicts the situation geometrically.

Figure 4
The Lower σ, The More Compensating Variation Required



$\rho = -1$	$\sigma = \infty$	*Linear*	$CV = 0$
$\rho = 0$	$\sigma = 1$	*Cobb – Douglas*	$CV = AB = 390.1$
$\rho = \infty$	$\sigma = 0$	*Leontief*	$CV = AC = 480$

For the linear case, at the lower wage of 8, supplying no work puts the subject on the original indifference curve, so $CV_{Linear} = 0$ - no compensation is needed. Intuitively the infinite elasticity of substitution says that leisure can be perfectly substituted for income.

The Cobb-Douglas formula above is

$$CV_{Cobb-Douglas} = \left(\frac{w_1}{w_2}\right)^{\frac{\alpha}{1+\alpha}} Tw_2 - Tw_1 = \left(\frac{8}{20}\right)^{\frac{.625}{1.625}} (105)(20) - (105)(8) = 350.9$$

The Leontief formula above is

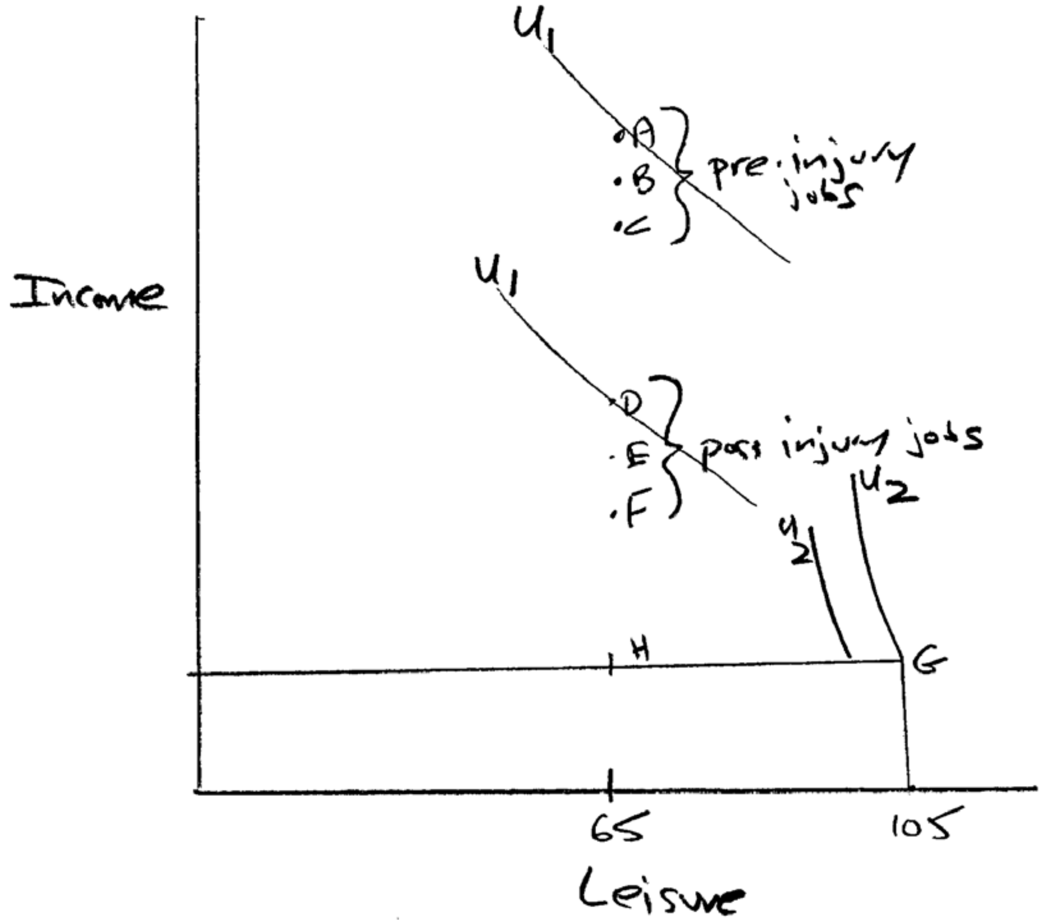
$$CV_{Leontief}(w_1, w_2, NW, T, \alpha) = \frac{(w_2 - w_1)(\alpha T - NW)}{\alpha + w_2} = \frac{(20-8)(\frac{160}{13})(105)}{\frac{160}{13} + 20} = 480$$

As asserted, the less the substitution elasticity, the more the compensating variation needed.

IX. Discrete Income-Leisure Examples, Some Consistent With HSEC

If the number of jobs is discrete and each job offers an expected income along with a fixed number of hours, so that individuals do not face the kind of linear choice set depicted in previous sections. The HSEC definition may again be consistent with utility maximization, or not. A best case scenario appears in Figure 5, where the pre-accident and post accident clusters of jobs are shown.

Figure 5



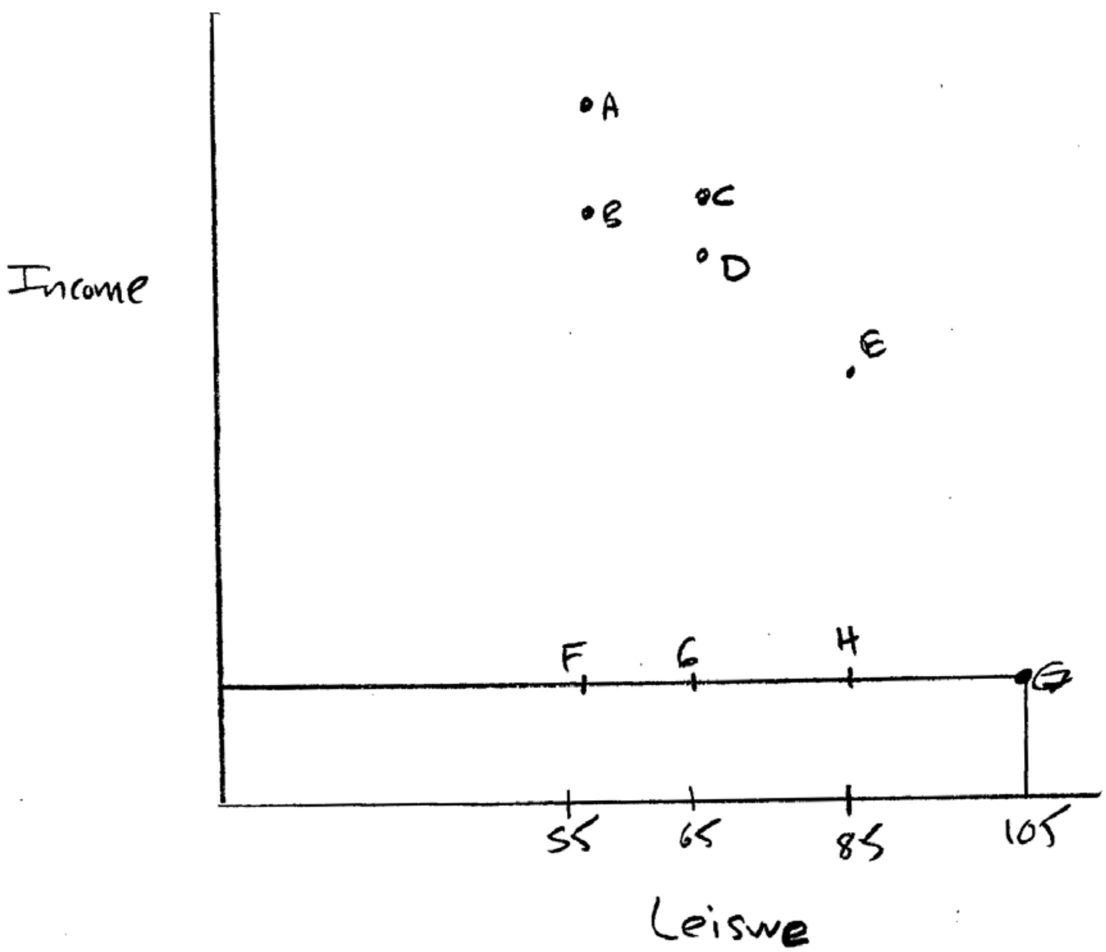
Here the 6 jobs are represented by points. Their hours and incomes may be read off the chart. All require 40 hours of work per week, no more, no less. They pay the amounts HA, HB, etc. There is non-wage income shown, *e.g.* 105G.

The HSEC income maximizing jobs are A pre-injury and D post-injury. Clearly A dominates B and C, while D dominates E and F. If the preferences are as depicted in U_1, these will be the SEC jobs as well, and the two concepts, HSEC and SEC, will merge in this example. If preferences are as depicted in U_2, the person will choose not to work, and the SEC will be 0, where utility maximization takes place.

This illustration makes clear that the fundamental insight of HSEC is that of dominance or a partial ordering over choices. Let jobs $J_i(H), 1 \le i \le n$ be under consideration, and assume that all require the same number of hours of work, H. If $J_1(H)$ has the highest expected salary, then J_1 dominates all the rest, so that its salary would constitute HSEC. When different jobs require different but fixed numbers of hours, $J_i(H_i)$ then one should order the jobs by their hours and use the dominance notion to select the best paying job from each group having the same number of hours. The upper envelope set then provides an income-hours tradeoff, over which the preference function will select the utility maximizing job, as in Figure 6.

Here A, C and E form the set of jobs which are not strictly dominated by another job. HSEC would be A, the highest paying. However, reasonable preferences might maximize utility at any of the jobs A, C or E; G, no work, could even be chosen. We need preferences to determine the SEC, as always.

Figure 6



X. SEC and HSEC In a Model Where Income Is Random

The paper so far has focused on the situation where one factor other than income, or expected income, leisure, is important to economic agents. Eliminating the value of leisure, by adjusting α in the utility functions presented, was a strategy for making HSEC consistent with SEC and dependent on income alone, as were corner solutions, limits on hours and lexicographic preferences.

There is another factor different from leisure which is generally understood to result in persons not simply maximizing expected income: variance in income, or, more generally, other aspects of the distribution of income. There is reference to actual earnings as "a series of outcomes of a complex stochastic process" at p. 14 of the 1999 paper. Dating from von Neumann and Morgenstern, positing preferences over underlying random events satisfying regularity conditions, there exists a utility function over the events representing those preferences, with the property that maximizing its expected utility produces the choice which maximizes the underlying preferences. Notice that this result says that the *expected utility* of the process, and not the *expected value* of the choices, is that which is maximized.

Early theorists including Harry Markowitz and James Tobin developed a portfolio theory using the mean and the variance of the underlying random variable, Y (here, for income); expected utility is a function of these two parameters. As McLaren (2009) shows, there are two situations where the von Neumann and Morgenstern expected utility function $E(U(Y))$ will depend on only the first two moments μ_Y and σ_Y^2 of Y. The problem now is that we wish to chose among a set of Y 's to maximize earning capacity.

The first case is where the utility function is quadratic, i.e. for a typical random variable Y, $U(Y) = \alpha Y - \frac{\beta}{2}Y^2$. Then for regardless of the distribution of the random variable Y, $E(U(Y)) = \alpha\mu_Y - \frac{\beta}{2}\left(\mu_Y^2 + \sigma_Y^2\right)$, which is a function of the underlying mean and variance alone, being quadratic in the mean and linear in the variance. Expected utility thus depends on both of the first two moments, so maximizing it over jobs requires consideration of both the mean income and the variance of each job. Maximizing $\alpha\mu_Y$ in the last equation, or μ_Y generally, per SHEC, will *not* generally be consistent with expected utility maximization.

A second situation occurs where the random variable Y is normally distributed. Since a normal variable is characterized by its mean and variance, $E(U(Y))$ must therefore be a function of μ_Y and σ_Y^2 for any well-behaved utility function $U(Y)$. At this level of generality, we don't know the form of the function $E(U(Y))$'s dependence on μ_Y and σ_Y^2. Whatever specific form it takes, we know $\frac{\partial E(U(Y))}{\partial \mu_Y} > 0$ and $\frac{\partial E(U(Y))}{\partial \sigma_Y^2} < 0$ from properties of $U(Y)$. Now from the theory of finance, the market will give an efficient frontier locus offering higher μ_Y in exchange for tolerating higher σ_Y^2. However, if the utility function is $U(Y) = -e^{-\eta Y}$, a negative exponential, and if Y is normal, then, since $\log(U(Y))$ is normal, McLaren shows that $E(U(Y)) = -e^{-\eta[\mu_Y - \frac{1}{2}\eta\sigma_Y^2]}$, so that maximizing $E(U(Y))$ is equivalent to maximizing another explicit function of the mean and the variance given by $[\mu_Y - \frac{1}{2}\eta\sigma_Y^2]$.

In both of these cases, and another shown by McLaren, expected utility maximization requires more than maximizing expected income, the original HS definition, which is retained in Appendix 1: The Revised Guidelines, #1, Definition.

XI. SEC and the HSEC 2015 Guidelines

The guidelines, both the 1999 and 2015 versions, are generally reasonable and helpful, with the exceptions of #7, Probability and #8, Minimum Capacity, as discussed below. In fact, this section will compare the two definitions and argue that SEC outperforms HSEC on the new Guidelines.

1. Definition. Both involve maximization, but SEC's maximization is over what generally accepted theory holds economic agents maximize over - expected utility. Both envisage a "stream of earnings" but only SEC proposes a model, which, while static, may be interpreted as repeated over future periods. Advantage: SEC.

2. Consistency. This requirement holds that pre-injury and post-injury capacity should be evaluated with the same measuring techniques. Users of either SEC or HSEC may satisfy this requirement. In fact, applying #5 below, it is likely that past History will be given rebuttable presumption status, which most economists would say entails assuming that maximization of utility occurred in the past. If so, then Consistency nudges the adoption of maximization in the future, i.e., SEC. Advantage: SEC.

3. Functional Capacity. Jobs for which a person does not have a functional capacity should not be considered. This is obviously true, and for SEC it is understood to be embedded in the choice set over which satisfaction maximization takes place. For the less formally developed HSEC, its explicit statement is understandable. Advantage: Neither.

4. Vocational Capacity. Jobs for which a person has no vocational capacity have no effect on earning capacity. The remarks on functional capacity apply here. Advantage: Neither.

5. History and Maximization. The first sentence indicates that it is a rebuttable presumption that the definition is true. This applies to either definition. But the application that it applied to past earnings, as pointed out in #2, cuts in favor of SEC in two circumstances: a. when the evidence shows that some leisure was consumed, so that past income was not maximized; and b. when the assumption of utility maximization of economic theory is given due consideration. Advantage: SEC

6. Higher Earnings Are Preferred. If modified by *ceteris paribus,* this applies equally to both. But as a general proposition, this is a restatement of the difference between SEC and HSEC. Advantage: Neither.

7. Probability. This section discusses probabilities of jobs being taken, which might apply to those without any labor force history and to those needing to switch jobs, post accident. But "the probability of realization" is not elaborated upon. The *Dictionary of Occupational Titles,* published in 1938 and abandoned in the 1990's, had over 12,500 occupations. Its replacement, Occupational Information Network (O*NET) has about 974 categories. It seems clear that most plaintiffs will qualify vocationally for many of these jobs, both pre-accident and post-accident. I know of no vocational expert who has ever separated the totality of jobs into zero probability and positive probability groups, with the zero probability jobs being those for which functional or vocational capacity was zero. Assuming this were done, before probabilities of locating a job could be contemplated, one would need to know about the incomes and hours requirements of these positions and the tastes for them, if any, by the plaintiff. Only then might information about the demand for the individual's services be considered, and a search problem specified, from which probabilities for individual jobs, summing to one, could be constructed. This is an incredibly complex task, and I have never seen it as fully articulated as this, let alone ever implemented. Perhaps vocational experts could produce an approximate ("heuristic") solution by combining the better paying positions, the individual's aptitudes and tastes, and a measure of the relevant labor market.

The HS discussion continues, with the requirement that the set of jobs considered must have an aggregate probability of more than 50%. Unfortunately, there will be many such sets, and there will be a different HSEC and SEC for each set. Perhaps the 50% set should be ordered with probabilities being taken top to bottom. This would make it unique, and the "smallest" such set, like a minimal confidence interval.

There is also discussion of a "probability of realization." Assume that a vocational expert lists 10 feasible positions in his "heuristic" report, in which the jobs included are a combination of the better paying and the more readily available. There are still economics considerations. The "probability of realization" of any particular job increases with the length of time one is willing to search, and with whether the job search is hierarchical (one job at a time) or simultaneous. The ten probabilities will not add to one, because they do not refer to mutually exclusive events.

There may be other difficulties. Does the application of Consistency require that the post-injury job search mimic the pre-injury job search? If so, this may present a problem rather than a reasoned solution - what if the pre-injury job search were unusually short, reflecting good luck? Or unusually long, reflecting bad luck or harder times? The post-injury search also may need to reflect legal considerations of mitigation, and so be different from pre-injury search, which had no such restrictions.

Advantage: Neither

8. Minimum Capacity: "Every unimpaired person is capable of earning at the minimum wage rate on a full-time, year round basis."

The statement does not reference the minimum wage that it contemplates. Since the minimum wage fluctuates over time, over states and over cities at a point in time, there is some range for which HS implicitly assume that there will be no employment effects. (I ignore the case where the minimum wage is set at an absurdly low level, such a $1.00 per hour, and so is non-binding for most or almost everyone, who could be employed at $1.00 per hour.) It seems evident that there is no role for the minimum wage if it were not binding; and to be binding, it must be high enough that some people cannot find jobs satisfying it.

We are about to see more evidence if the federal minimum wages increases from $7.25 per hour to around $10.00 (perhaps not in the next two years), and in those states which have recently voted to increase their minimum wage. I do believe in the empirical work of Neumark and Wascher.[3] Their book, *Minimum Wages* published in October, 2008 by the MIT Press has won critical review by labor economists Dan Hammermesh, John Burkhauser and Charles Brown. They find that minimum wages reduce employment opportunities for less-skilled workers and reduce their earnings. If the policy goal is to reduce poverty; there are other more efficient ways to achieve this objective. Increasing the minimum wage has further adverse longer-term effects on wages and earnings, by reducing the acquisition of human capital.

In addition to losing employment by a large increase in the minimum wage, HS's full-time employment claim for many citizens will be shown to be incorrect if the employer mandate of Obamacare is not rescinded. When employers have an incentive to cut their workers' hours to under 30 per week, to avoid having to greatly increase their cost of health insurance, many workers will lose their full-time employment status, if not their jobs.

The guideline then gives ground, and becomes more like a call for some justification in assuming that the subject cannot find a minimum wage job. It is a tautology that, if one finds a covered job, it must pay the minimum wage, and it is also true that most people could find a minimum wage job if they looked and showed up for work. Perhaps the current incentives which cause many not to look for work, such as Food Stamps or SNAP (*Supplemental Nutrition Assistance Program*),Temporary Assistance (a cash benefit either paid to an applicant or to a vendor to pay for specific household needs), Medicaid, HEAP (Home Energy Assistance Program, which provides energy assistance to low income households through payments to those households' fuel and/or utility suppliers), the easing of requirements for disability determination and extended unemployment will lower the supply of workers at the minimum wage. It is also true that most people cannot find a job paying over $200,000 per year, but we don't have a similar guideline.

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[3] David Neumark a professor of economics at the University of California, Irvine and research associate at the National Bureau of Economic Research, a senior fellow at the Public Policy Institute of California, and a research fellow at the Institute for the Study of Labor. William L. Wascher is a senior associate director in the Division of Research and Statistics at the Federal Reserve Board.

Advantage: Neither

9. Age-Earnings Cycle. The guideline suggests that earnings follow such a cycle. Earnings that follow a quadratic function of experience was claimed by Finis Welch to be the strongest empirical result in all of economics. Except for assessments of young persons, I do not see this built in to the majority of reports that I review. In any event, neither SEC nor HSEC make any claims on this topic. Advantage: Neither

10. Worklife Expectancy (WLE). The guideline is that "A person presumably would have normal worklife expectancy." I agree with the statement, and observe that worklife expectancy as measured incorporates both events that people cannot control (their mortality, their poor health, their becoming too disabled to participate) and events that they can control (taking time off and retiring). Consequently worklife expectancy reflects optimizing behavior, and so is consistent with SEC. If people were truly maximizing lifetime incomes, I would think that the HSEC definition would entail people working until they die, and therefore would *not* endorse WLE. Advantage: SEC

XII. An Altogether Different Appeal to Capacity

We sometimes see an injured plaintiff with a primary source of earnings, from wages earned from others, say, and a secondary source of earnings, say a farm or a consulting side business. Further, assume that the secondary source produces losses on the income tax returns. The injury causes an alteration in the primary earnings source, resulting in a lower paying job post accident, and the secondary source disappears altogether. We calculate the losses in the primary employment as we usually would. What do we say about the secondary source, in which the previous loss has now been eliminated? If we include the elimination of the losses of the secondary job in our calculations, the defense in effect gets a credit.

Some economists would ignore the secondary job altogether. Their argument might be that the plaintiff had the "capacity" to shut down the losses before the accident, did not do so, and so on "capacity" grounds the "losses" should be ignored. Alternatively, the "losses" did have an economic purpose - reducing income taxes - and that purpose has now been lost. Others would reason that the income tax returns, which presumably contained an element of fraud, should be taken at face value - one should not be able to tell one story to the government and another story to the court.

XIII. Conclusion

HS 2015 indicates that the authors were expecting more controversy to have arisen from the guidelines presented in their original paper. This paper offers, in SEC, hopefully not controversy, but what HS call a "stronger conceptual framework." The focus here is not so much on the original or revised guidelines, but rather to the basic earning capacity definition.

The notion of maximization over only expected income in HSEC has been shown to need to be broadened, to incorporate other choice elements, such as leisure, risk and perhaps intrinsic job preference. Replacing it with SEC retains the HSEC message that, other things equal, more expected income is preferred to less (Guideline #6). However SEC does more: by embracing generally accepted economic theory, it represents an upgrade. Additionally, most economists, in cases where the plaintiff has a significant work history, will accept that work history as evidence of pre-injury capacity, as Guideline #5, History and Maximization, suggests. Thus the application of the Consistency Guideline #2 forces the adoption of optimization posited by SEC in quantifying post-trial earning capacity.

HSEC is explicit about earning capacity pre-injury and post injury, but does not state that economic damage should be measured by subtracting the two earning capacities that it identifies. I do so here, as I believe this to be a fair reading of their paper. I then calculated damages by the analogous subtraction for SEC. I then examined the implications of these definitions, for earning capacity and for damages, in the context of the CES family of consumer preferences, with leading examples being linear, Cobb-Douglas and Leontief. I showed how to calibrate these models from data. This permitted explicit formulae for the earning capacities and hence for damages under both HSEC and SEC, which were provided. Finally, given preferences and their calibration, I then calculated the absolute standard of ideal or compensating damages, called CV, and compared the two HSEC and SEC based damages measures to the ideal CV measures.

Although we have seen that SEC produces CV in a few cases, in most cases it does not, nor does the usual CA measure often used in FE, for which formulae were also provided.

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