PRELIMINARY DRAFT (Date of Draft: October 26, 1999)

The Whole Time Concept in the Context of a Becker Utility Function

by

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Prepared for presentation at the NAFE Session

"The Whole Time Concept in Forensic Economics"

Southern Economics Association

New Orleans, Louisiana

November 21, 1999

"When a person is injured or killed as a result of an accident, the overall losses are composed of both tangible, pecuniary components and intangible, nonpecuniary components....The fact that serious injuries and death entail more than just tangible, pecuniary losses is universally recognized by economists who assess economic damages in both personal injury and wrongful death/survival actions. For a seriously injured person, these intangible, nonpecuniary losses may include pain and suffering, anxiety and mental depression, a loss of the ability to pursue enjoyable activities and a shift of time use toward greater personal maintenance and medical care activities, effectively stealing away the person's time. Family members of the injured person may experience a loss of society and comfort hitherto normally received from their interaction with the injured family member, and children of an injured parent may experience a loss of guidance and tutelage. Nonpecuniary, intangible losses in death cases may include the same types of elements as those mentioned for personal injury cases, with the exceptions that (a) losses experienced by the decedent presumably end with death and (b) in a death case, the loss to the decedent obviously includes the loss of life itself." (Ireland, et al., 1998, p. 62)

"...the crux of personal injury is the value of time. Time is perhaps the most

> important basic resource possessed by individuals and households. An individual's market income is usually at least a partial product of the sale of his own time on the market, and his pleasures at least partially the product of the use of his time in pleasurable activity. The victim of personal injury suffers loss though the reallocation or extinction of time: extinction to the extent that death ensues immediately or through shortened life expectancy; reallocation to the extent that the incident forces the injured to employ his time in a manner he would not have chosen in the absence of the injury.
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> The present personal injury damage structure explicitly considers the value of time in the context of lost earnings or lost earning capacity. There the plaintiff is compensated because his time has been or will be employed in a less remunerative manner. The crux of the analysis which follows is that *all* personal injury damages can be analyzed profitably in the same terms as those accepted for earning capacity and that the present damage structure may have disregarded or at least misperceived a large part of the value of the time loss." (Komesar, 1974, as reprinted in Manne, 1975, pp. 320-21)

I. Introduction: Setting the Context for the "Whole Time" Concept

As revealed by these opening quotations, very often the elements of damages computed by an economist in regard to a serious personal injury or death represent an incomplete assessment of the overall damages. The typical economic appraisal includes an estimate of lost money earnings, the value of employer-provided fringe benefits and the value of a subset of lost household services. In serious personal injury cases, the economist may also calculate the cost of a life care plan describing the future medical care and other needs of the plaintiff. In death cases, the economist in most states of the U.S. is required to compute and make a deduction for the decedent's personal consumption.

The incompleteness of the damage elements ordinarily computed by the economic damage expert has been a source of uneasiness and dissatisfaction. Economic experts know that the losses are greater than what is represented by the elements they customarily compute. Juries and judges would like more help and guidance with the less quantifiable elements of damages not traditionally and typically measured by economic experts. Plaintiff's attorneys would presumably like to have more of the total damages in the "economic" category that can be testified to by economic experts. To the extent that overall awards could be made more predictable, defense attorneys and potential tortfeasors would also presumably favor such quantification by economic experts. Can the concept of economic damages be broadened to include what have been traditionally viewed as noneconomic damages? In other words, can elements hitherto regarded as

belonging to "general" damages somehow be included in the "specials"?

Hedonic damage advocates have answered this question with a resounding "Yes." However, the hedonic damage approach has been controversial and has had a mixed reception in the courts.[1] Hence, there has been a desire to find other avenues and methodologies by which a larger portion of the overall damages in personal injury and death cases could be brought under the "economic damage umbrella."

A key issue that must be confronted in any effort to expand the domain of economic damages involves the question of what exactly is the distinguishing difference between economic, pecuniary, tangible damages, on the one hand, and noneconomic, nonpecuniary, intangible damages, on the other. One very traditional distinction long used by the courts is based on a division of time into work and leisure activities. Loss of the capacity to engage in work, primarily in the place of labor market employment and to a lessor extent in traditional housework at home, is considered an economic loss and is appraised by the economic expert, whereas loss of the ability to enjoy leisure is intangible and does not get appraised as an economic loss.[2]

An alternative distinction is based on whether there are reasonable market equivalents for the goods and services that are lost. For example, guidance and counsel provided by a parent to a child could be treated as a pecuniary element of damages because such services can be purchased in the market. However, love and affection provided to the child by the parent would be considered a nonpecuniary element of damages because love and affection cannot be purchased for money.

There are a number of examples in the literature where economists have proffered methods of converting what have been traditionally regarded as nonpecuniary losses into pecuniary losses capable of being included in the elements of economic damages incorporated in an economic appraisal. Each of these efforts uses some type of market valuation approach to value nonmarket time that is lost or that must be redirected to other uses because of a personal injury or death. In some, a method is suggested to value "unconventional" types of household services, such as "society and comfort." In others, a method is suggested to value leisure time. Tinari (Ireland and Depperschmidt (1999), Reading 19) argues that the concept of household services should be broadened to include (1) companionship services and (2) advice, guidance and counsel services. Hours spent in these activities are valued by reference to the median wages in advice-related

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[1]For treatments of these issues, see Ireland, et al., 1998, pp. 62-76, and Ireland and Ward (1996).

[2]This distinction is emphasized by Komesar (1974), as reprinted in Manne (1975).

occupations and companion-related occupations. Suggested guidelines for hours spent in these activities are also provided. Olson and Rodgers (Ireland and Depperschmidt (1999), Reading 21) propose a method of valuing lost emotional services by resort to the market wages of occupations providing such services. This paper also poses a number of questions and research issues arising in such a valuation effort. A paper by James Plummer (Ireland and Ward (1996), Reading 29), argues that if an individual is prevented from engaging in previously enjoyable leisure activities, the market cost of suitable replacement leisure activities should be included in tort awards. In the paper by Kurt Krueger, John Ward and Gary Albrecht (Ireland and Ward (1996), Reading 11), the authors use what is known as the "whole time" approach to compute the number of pre-injury leisure hours and place a pecuniary value on leisure time at a wage rate equal to the pre-injury market wage. The size of the loss due to the injury is based on the additional testimony of other medical and psychological experts regarding the injured party's loss of ability to enjoy leisure.

The remainder of this paper examines the theory of time allocation proposed by Becker (1965) and offers some remarks about how this theory might be extended to the analysis of the impact of personal injury and death and to assist in a more complete computation of losses in such cases.

II. The Becker Model of Time Allocation

In 1965, Gary Becker published an influential paper that sought to expand the traditional theory of consumer behavior to take more explicit account of the allocation of time. The traditional theory postulates that consumer units (i.e., individuals or households) maximize utility functions of the form:

$$(1) \quad U = U(y_1, y_2, \ldots, y_n)$$

subject to the resource constraint:

$$(2) \quad \sum_j p_i y_i = I = W + V$$

where the y_i are goods purchased on the market, the p_i are the prices of the goods, I is money income, W is earnings and V is all other income not derived from selling labor services in the market, such as income from interest, dividends, rent, retirement pensions, and welfare, unemployment and disability payments. Becker's point of departure is the systematic incorporation of non-working time. He postulates that consumers use time and goods to produce the commodities that ultimately produce utility. Thus, each household has production functions for commodities, which are specified as:

(3) $Z_i = f_i(x_i, T_i; R)$

where the Z_i are the commodities that ultimately produce utility, x_i is a vector of market goods, T_i is a vector of time inputs used to produce the *i*th commodity, and R is a vector of "environmental" variables such as age, education, ability, climate in which the household resides, etc.[3] Becker assumes that households combine goods and time to produce commodities rather than simply assuming that the amount of time used in an activity is a direction function of the amount of goods consumed.[4] When capital goods such as vacuum cleaners are used, x refers to the services yielded by such goods. Becker notes that "...T_i is a vector because, e.g., hours used during the day or on weekdays may need to be distinguished from hours used at night or on week-ends. Each dimension of T_i refers to a different aspect of time." (p. 495)

In Becker's theory, households maximize a utility function:

$U = U(Z_1, \ldots, Z_m) \mathbin{/} U(f_1, \ldots, f_m) \mathbin{/} U(x_1, \ldots, x_m; T_1, \ldots, T_m; R)$

subject to the budget constraint:

(4) $g(Z_1, \ldots, Z_m) = Z$

where g is an expenditure function of Z_i and Z is the bound on resources. Becker states "...the main goal of the analysis is to find measures of g and Z which facilitate the development of empirical applications. The most direct approach is to assume that the utility function in equation (4) is maximized subject to separate constraints on the expenditure on market goods and time, and to the production functions in equation (3)." (p. 496). He writes the goods constraint as:

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[3]The vector of environmental variables, R, did not appear explicitly in the production function in Becker (1965), but was introduced in Becker's theory text (1971), Lecture 10, pp. 45-50.

[4]One advantage of the production function approach is that it becomes possible to model the effects of a change in the cost of goods relative to time, which would suggest that households would substitute away from the input which rises in relative cost. Another advantage is that changes which modify the production function via changes in the variables in the R vector, such as attaining more knowledge through education, or, more relevant to this paper, experiencing an injury that limits one's ability to engage in various activities, can be modeled for the impact on household production or productive capacity.

(5) $\sum p_i x_i = I = V + T_w \bar{w}$

where p_i is a vector giving the unit prices of the x_i, T_w is a vector giving the hours spent at work and $\bar{w}$ is a vector giving the earnings per unit of T_w. The time constraints are written as:

(6) $\sum T_i = T_c = T - T_w$

T_c is a vector giving the total time spent at consumption and T is a vector giving the total time available.

Becker then writes the production functions in the form:

(8) $T_i / t_i Z_i$
$x_i / b_i Z_i$

where t_i is a vector giving the total time spent at consumption per unit of Z_i and b_i is a similar vector for market goods. Becker then notes that the constraints expressed in (6), (7) and (8) are interrelated and can be reduced to one basic constraint: (6) is not independent of (7) because time can be converted into goods by using less time at consumption and more at work. If T_w is solved for in (7) and this expression is substituted into (6), one obtains:

(9) $\sum p_i x_i + \sum T_i \bar{w} = V + T \bar{w}$

If the values in (8) are then substituted for the x_i and the T_i in (9), one obtains (10):

(10) $\sum (p_i b_i + t_i \bar{w}) Z_i = V + T \bar{w}$

with

(11a) $B_i = p_i b_i + t_i \bar{w}$
(11b) $S' = V + T \bar{w}$

The interpretation of (10) and (11) is that B_i is the full price of a unit of Z_i, including both the price of goods and the price of the time used to produce a unit of Z_i. Hence, every commodity consumed has a resource cost in terms of both time cost and goods cost, just as the cost of developing human capital through education has a money cost for tuition and

an opportunity cost in terms of foregone earnings that could have been earned by working in the labor market rather than spending time attending school.

If the assumption is made that $\overline{w}$ is constant, independent of the Z_i, then S' can be interpreted as the money income that could be achieved if all time is devoted to market work. Under this assumption, Becker notes that "This achievable income is 'spent' on the commodities Z_i either directly through expenditures on goods, $p_i\ b_i\ Z_i$, or indirectly through the forgoing of income, $t_i\ \overline{w}\ Z_i$, i.e., by using time at consumption rather than at work. As long as $\overline{w}$ were constant, and if there were constant returns in producing Z_i so that b_i and t_i were fixed for given $\overline{w}$ and p_i, the equilibrium condition resulting from maximizing (4) subject to (10) takes a very simple form:

(12) $U_i = \partial U/\partial Z_i = \lambda B_i \qquad i = 1, \ldots, m$

where λ is the marginal utility of income. If $\overline{w}$ were not constant the resource constraint is equation (10) would not have any particularly useful interpretation: $S' = V + T\overline{w}$ would overstate the money income achievable as long as marginal wage rates were below average ones. Moreover, the equilibrium conditions would become more complicated than (12) because marginal prices would have to replace average prices." (p. 497)

Because S' cannot be interpreted as the maximum money earnings achievable unless $\overline{w}$ is constant, which is a "special and unlikely case," Becker argues that the approach based on separate goods and time constraints should be dropped in favor of one that uses a total resource constraint which by definition equals the maximum income achievable, which he denotes as "full income," S. This income is defined as the amount that could be earned by devoting all resources of a household to earning income, with no regard for consumption, but with the minimum amount of time devoted to sleep, food and perhaps also leisure in the amounts required to maintain efficiency so that money income can be maximized.[5] Becker relates this minimal consumption and time allocation to that which might be accorded a slave who was given time off work only in so far as this time off was made up for by the gain in productivity from getting food and rest, or to the behavior of free persons in poor environments who have to maximize money income just to survive.

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[5]Consuming only the amount of time and goods minimally sufficient to maintain efficiency calls to mind the notion of "maintenance consumption" described in some court decisions. Maintenance consumption is often defined as the amount of money that would have been necessary to keep the decedent in such a condition of health and well-being that earning power could be maintained. See Rodgers and Thornton (1999). In Becker's concept of full income, however, it is made explicit that maintenance consumption would include minimum quantities of time as well as money.

For richer economies, households will not seek to maximize income but rather will sacrifice money income for additional utility. These households may work fewer hours than necessary to maximize income, take jobs that pay less per hour but that provide nonpecuniary benefits, eat more than is necessary to maintain earning power, etc. Full income, S, is defined by Becker through the equation:

(13) $L(Z_1, \ldots, Z_m) = S - I(Z_1, \ldots, Z_m)$

where L is the total earnings forgone or "lost" because of the desire to maximize utility rather than income. If S = I, L = 0 and income is maximized. L and I are functions of the Z_i because how much is earned or foregone depends on the consumption set chosen.

Now make the simplifying assumptions are that 1) $\overline{\mathbf{w}}$ is constant (meaning there is no overtime pay at premium rates nor lower-wage moonlighting jobs that must be taken if the worker wants to work more hours) and 2) the Z_i are produced with constant returns to scale, so that the t_i and b_i in (8) do not vary with the quantity of Z_i produced for given values of $\overline{\mathbf{w}}$ and p_i. Under these assumptions, the price of each Z_i is defined by (11a), and first-order conditions for maximizing utility are given by (12). One major novelty of Becker's theory is that a change in the wage rate changes the cost of all commodities, with Z_i that are more time-intensive experiencing a larger change in cost than those which are less time-intensive. Another major implication is that the effects of many "environmental" variables can be understood and modeled through the effects on household production functions.[6]

III. Using the Becker Model to Examine the Impact of Personal Injury

Having reviewed the Becker model, its implications for the analysis of the personal injury are explored. For purposes of brevity, death cases are not considered except for a

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[6]Originally, it was even claimed that the effect of changes in wages and in these environmental variables could be analyzed independently of tastes. However, Pollack and Wachter (1975) showed that this "independence" exists only under the special assumptions of constant returns to scale and no joint production. Without these two conditions the B_i depend on the amounts of Z_i that a household chooses to produce, and price differences between households depend on tastes as well as on constraints. It is unlikely that the requirement of "no joint production" will be met in practice. When time is an input, jointness will be pervasive because production activities are often a *direct* source of utility (e.g., a person may enjoy gardening for its own sake). Only if households are indifferent about time uses will there be no joint production.

brief mention in one of the subsections.

An injury may reduce the wage rate that the individual can earn and also the ability to produce the commodities that yield utility–which presumably include those commodities needed for "maintenance," like sleep, those related to traditional areas of "household production," such as home-cooked meals and a clean house, and "leisure activities," such a golf games and family picnics. If the Becker model is to contribute to an assessment of the "whole time" approach, it must be able to help with the two main questions that the whole time approach purports to answer: (1) the kinds of time loss that should be valued and (2) the dollar value that should be placed on each kind of time.

In the Becker model, the t_i and b_i coefficients, as well as the average wage rate, $\overline{\mathbf{w}}$, depend on the vector of environmental variables, R, which certainly would include the mental and physical abilities of each person in the household. An injury that reduces a particular member's abilities has a diverse set of effects in the model through the effects on the coefficients and on the wage rate. The following is a list of possible effects of an injury, expressed in terms of the variables of the model:

1. A serious injury is likely to reduce the person's productivity and therefore $\overline{\mathbf{w}}$ which reduces full income, S. There may also be a reduction in the amount of time devoted to market work, T_w, which means that the money income available to purchase goods would decline, if this reduction is not offset by increases in non-wage income, V.

2. In the unlikely event that the injury has no effect on the t_i and b_i coefficients, the decline in $\overline{\mathbf{w}}$ would cause a shift in the relative prices of the Z_i. Commodities that were produced with time-intensive methods would experience a decline in relative prices, whereas commodities that are goods-intensive would experience a rise in relative prices. This relative price shift would lead the household to shift its production toward time-intensive commodities and away from goods-intensive commodities. In addition, the household would be given the incentive to look for more time-intensive ways to produce each and every commodity.[7] This general substitution would be further stimulated if the reduction in $\overline{\mathbf{w}}$ is also accompanied by a reduction in money income, $\overline{\mathbf{w}}\, T_w + V$. Such a reduction will occur if money earnings decline and this decline is not offset by a rise in non-wage income, V (for example, disability insurance payments). If there is a decline in money income to spend on goods, the household is forced to use less goods in household

[7]It is useful to envision the household as having at its disposal several ways to produce each of the Z_i, as in activity analysis, with some requiring a lot of time and few goods and others requiring little time and many goods. The method chosen would then depend on the relative prices of goods and time.

production. Finally, there would also be what might be called a "full income" effect. The loss of full income caused by the reduction in $\overline{\mathbf{w}}$ would lead the household to want to cut back more severely on the production and consumption of commodities that were more "full income" elastic, cut back less severely on those commodities that were less "full income" inelastic, and actually increase production and consumption of any inferior commodities with negative "full income" elasticities.

3. Even if the b_i coefficients are unaffected, in general, an injury is likely to increase the amount of time that the household must use to produce at least some and perhaps all commodities. In other words, the values the t_i, the input coefficients showing the amount time needed to produce one unit of the various commodities, would be likely to increase. This increase in the time requirements represents a type of technological change in which, instead of "progress," wherein fewer inputs are required for given outputs, there is "regress," with more inputs being required for given amounts of output. This increase in time requirements may not be proportionately the same for all commodities, but if it is and if each t_i rises by the same percentage that $\overline{\mathbf{w}}$ falls, then the relative price changes described in 2. above would not occur. The reduction in the opportunity cost of time due to the fall in $\overline{\mathbf{w}}$ would be offset by the increase in the amount of time required to produce each unit of each commodity. One can easily imagine circumstances in which a reduction in time devoted to market work is totally absorbed in home production but with no increase in output because of the injury-induced technological "regress."

4. Matters could, of course, be more complicated because the b_i coefficients could be affected as well. One can imagine brain injuries that could reduce a person's overall mental abilities to such an extent that the person would need to increase both goods and time inputs in order to obtain the same output of commodities.

5. To amply the point in 4., it is likely that not all commodity production, i.e., not all the t_i and b_i coefficients for each commodity, would be affected by a given injury in the same way. Post-injury, some of the production activities might be impossible for the injured person to perform, meaning that the time input coefficients for particular kinds of time in producing some commodities would have infinitely large values. In this event, to continue production of these kinds of commodities would require that the household shift the production tasks from the injured household member to other household members, or else have these production tasks performed by outsiders. If outsiders are persons living in separate households (relatives, friends, or neighbors), that kind of assistance would effectively increase the household's full income by adding to the household's time constraint. If outsiders were persons hired to provide services, that would show up as an increase in the household's allocation of money income to market goods and services, the x_i.

6. Becker spends considerable time on the topic of "productive consumption," noting that

the cost of time varies between commodities and at different periods of time. He notes that the cost of time is often less on week-ends and in the evening because firms are closed then. (This is not as likely to be true in 1999 as in 1965.) The cost of time also varies among commodities depending on the relative contribution of different commodities to productive effort. He notes that sleep, food and even "play" fall under this heading and that the cost of time spent producing such commodities is presumably less because the production and consumption of such commodities indirectly contribute to earnings. We might refer to these as maintenance commodities, and note that Becker sets aside enough time to produce the amounts of sleep, food and "leisure" to allow earnings to be maximized. This maintenance amount of time could be denoted as T_M. Then with constant hourly wages, the full-income constraint could be written as:

$$\textbf{(14)} \quad \sum (p_i b_i + t_i \bar{w}) Z_i = V + (T - T_M)\bar{w} = S$$

where $T-T_M$ is discretionary time, i.e., total time less maintenance time.

7. The application of the Becker model to a personal injury context exposes the need to develop a model of household production that shows how a given household allocates the time of its members.[8] Such a model would show this time allocation in both the pre-accident situation and then predict how the allocation would change, given the injury sustained by one of the family members. While such a model cannot be developed in this paper, it would be worthwhile to attempt such an effort in future research. A few additional remarks can be made about this research agenda. We know that not all households are alike. Some are one-person households; some are two-person households with both spouses engaged in full-time labor market work, and with a division of household production that is different from households in which one spouse works in the labor market and the other stays at home. Some households have children and some do not. Some are single-parent households. In death cases, the number of household members is reduced by one, with consequences for the household's full income that depend on the pre-injury and post-injury allocation of time among the members.

8. The Becker model was designed to provide an enriched characterization of the constraints facing a household, thereby reducing the need to explain differences in behavior by needing to attribute such differences to different tastes. However, one of the likely results of a personal injury that is serious and life-changing is that the person may undergo a shift in tastes as a result of the injury. Such changes are recognized in the

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[8]Becker has worked on this general topic as well, most notably in his *A Treatise on the Family* (1981).

theory of choice under uncertainty, wherein a person may be assigned different utility functions in the pre-injury and post-injury "states of the world."[9] Preference function changes have not been studied in depth by economists but occur, presumably, as a result of the experience of pain and suffering, altered capacities in engage in life activities and as a means of coping with the effects of the injuries. While the Becker model can be used as a framework for assessing the full-income impact of a personal injury, the full-income impact should not be interpreted as encompassing the entire welfare-reducing impact of the injury. A full assessment of such an impact, in the opinion of this writer, is beyond the expertise of economists and, perhaps, beyond the expertise of any other experts or combination of experts.

IV. Damage Computation

The Kruger/Ward/Albrecht (KWA) paper describing the "whole time" approach makes the reasonable suggestion in "Figure One–The Full-Income Model" that the value of a personal injury damages in the Becker model should be based on the goal of restoring the full income of the household to its pre-injury level. We know this because the KWA diagrammatic representation of full compensation is an amount which places the household back on the same full-income budget line as prior to the injury. To look at this in terms of Becker's time allocation model, let the pre-injury level of full income be denoted by S^B (superscript B for "before") and the post-injury level of full income be denoted by S^A (superscript A for "after"). The damage to be compensated is therefore:

$$\textbf{(15)} \quad D = S^B - S^A$$

The compensation required by (15) can be expressed in terms of equation (14) as

$$\textbf{(16)} \quad D = V + (T - {}^BT_M)\overline{w}^B - V - (T - {}^AT_M)\overline{w}^A = (T - {}^BT_M)\overline{w}^B - (T - {}^AT_M)\overline{w}^A$$

where B superscripts refer to values before the injury and A superscripts refer to values after the injury.

Assume that the time period is a week. Also assume that non-wage income, V, is unaffected by the injury.[10] Equation (16) says that the loss of full-income is the difference

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[9]See, for example, Steven Shavell (1987), Chs. 8-10.

[10]V could be reduced if the household uses financial assets in order to maintain living standards in the face of diminished labor market earnings. Non-wage income could

between the value of discretionary time before and after the injury. Now consider the loss of full income in various situations.

An Increase in Maintenance Time. Suppose the injury leaves the hourly wage and the t_i and b_i coefficients unchanged but increases the amount of maintenance time, meaning that ${}^{A}T_M > {}^{B}T_M$. The loss of full income would therefore be equal to the loss of discretionary time multiplied by $\overline{\mathbf{W}}$. For example, if 63 hours of personal maintenance time had been required before the injury and 83 hours are required after the injury, and if the wage is $15.00 per hour, the loss of full income would be 20 hours x $15.00 = $300.00 per week.

Note that in this situation, where maintenance time increases, the individual will probably choose to work less in the labor market than before. Consider the situation after the injury but prior to compensation. The loss of 20 hours of discretionary time will mean that, with no adjustment in labor market hours worked, the individual will have to reduce production of commodities such that 20 hours are saved. But this reduction in production with leave some money income unspent and thereby provide an opportunity to increase utility by reallocating time from market work to commodity production. When the individual receives compensation in the amount of $300.00 per week, the incentive to use more time in commodity production, rather than in labor market work, will be reinforced.

A Decrease in the Hourly Wage Rate. Now suppose that the hourly wage is reduced by the injury but that maintenance time and the t_i and b_i coefficients remain unchanged. In this case the amount of discretionary time remains unchanged. If the injured worker is free to work in the labor market for as much or as little as he or she chooses before the injury and after the injury, it is reasonable to presume that the value of the individual's time, at the margin, is equal to the before-injury wage, $\overline{\mathbf{W}}^{\mathbf{B}}$, before the injury, and that the value of the individual's time after the injury is equal to the after-injury wage, $\overline{\mathbf{W}}^{\mathbf{A}}$. Hence, the loss of full-income is given by change the wage rate multiplied by the amount of discretionary time. To use the values in the example above, if the individual uses 63 hours of maintenance time per week, the amount of discretionary time is 105 hours per week. If the wage rate drops from $15.00 to $5.00, the reduction in full income is 105 x $10.00 = $1,050.00 per week.

The reduction in the wage rate will cause changes in the relative price of

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be increased if the injury triggers the payment of short-term or long-term disability, worker's compensation, welfare payments, transfers from relatives and friends, etc. The receipt by the household of a settlement or jury award as a result of litigation will, of course, increase V.

commodities, leading to an increase in the relative price of goods-intensive commodities and a fall the relative price of time-intensive commodities. This change will encourage a shift in household production and consumption toward time-intensive commodities. In addition, for any given commodity, the household will seek out and employ more time-intensive methods of production. These incentives direct the household toward more home production hours and less labor market work hours. Moreover, once compensation is paid, the incentive to reduce labor market hours is reinforced.

A Decrease in the Hourly Wage and an Increase in Maintenance Time and in the Input Coefficients. The most realistic scenario for serious personal injuries is a scenario wherein the hourly wage capable of being earned in the market decreases and both maintenance time and input coefficients increase. In this scenario, (16) does not give the full decrease in full income as a result of the injury. To do that, it is necessary to have an expression for "real" full income that takes the change in the commodity prices, the B_i, into account. With an increase in the t_i and b_i coefficients, the prices of all commodities produced and consumed by the household increase and this increase is an independent source of reduction in full income, separate from and in addition to the reduction in the hourly wage rate and the increase in maintenance time. For example, suppose maintenance time grows by 20 hours per week and the market wage rate falls from $15.00 per hour to $5.00 per hour. Using (16) the loss of full income is 105 x $15.00 - 85 x $5.00 = $1,150. However, this is not the total loss. Allowance also has to made for the fact that the commodity prices are higher and a given amount of full income will not "buy" as much as before. If the t_i and b_i coefficients all proportionately rise by, say, 20%, the decline in real full income is $1,150.00 x 1.2 = $1,380.00.

Comparison and Contrast to the KWA Analysis. One difference between the analysis of the full-income loss in this paper and the KWA analysis is that I have not resorted to the reliance on other experts to compute the reduction in the injured person's ability to enjoy "leisure" (i.e., non-market-working, non-maintenance time). In Becker's model, full income and changes therein can be computed without resort to an assessment of how much of a change there is in the injured person's ability to enjoy leisure.[11] It seems to me that the change in full income can be computed without the aid of other expert opinion concerning the matter of lost enjoyment.

A second difference is that the KWA use the pre-accident wage rate to value discretionary, non-labor-market-working time. But given the accident-caused reduction in

[11]I am not arguing that the opinion of other experts is not needed to determine the increase in maintenance time, the increase in the input coefficients and the reduction in the hourly wage rate caused by the injury.

wages, the injured person will surely behave as if the incremental value of time is the post-injury wage rate that can be earned in the market.

Suggestions for Future Research. The Becker time allocation model seems to have some rich possibilities for the conceptualization of personal injury losses that is broader than the traditional approach to the assessment of such losses. As noted above, there are many issues that need to be addressed. In particular, the lack of a model in this paper for how time is allocated among household members needs to be addressed. Additional work needs to address the issues that arise if it cannot be assumed that the injured person is satisfied with the amount of time worked given the wage rate, and there needs to be further refinements for situations where the wage rate is subject to overtime provisions and/or lower for moonlighting jobs. Additional work also needs to be done in assessing how the economist could work with other experts in determining the values of the variables needed to assess full income losses. In part, some this work is probably already underway and the need is to reinterpret existing work in terms of the Becker model's terminology. In part, there is no doubt much that remains to be done and discovered about the usefulness of the Becker approach in allowing a greater fraction of the losses in personal injury and death cases to be brought within the economic damage umbrella.

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