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Categories of Time Use for Forensic Economics

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I. Introduction

There is an old saying that "Time is money." The meaning of this saying is that time can be sold if you have a valuable service to provide, such that wasting time is wasting the opportunity to make money. Time, as such, is the ultimate scarce resource in life. It is the scarcity of time that gives it value. None of us has as much of it as we would like, though perhaps none of us would really like to have an infinite amount of time available. However, time is not really equivalent to money in several very important senses. Of greatest importance to forensic economists, not all time is equal in value—unlike money, which has constant purchasing power, at least within short time frames.

The reasons why all time is not of equal value are based on three factors: energy, scheduling constraints and investment in human capital. (1) When an individual has high energy, time is more valuable than time when an individual is tired and has less energy (Ireland, 1982). (2) Time when an individual is under no specific scheduling constraints may be more valuable than time that is subject to precise scheduling constraints (Caragonne, 1997). If a forensic economist arrives at an attorney's office 15 minutes before an appointment, that extra 15 minutes might or might not have as much value as 15 minutes on a Sunday afternoon with no scheduling pressure (Mason and Fabritius, 1997). (3) Time spent improving one's own human capital can increase the value of time in the future relative to time in the present (Becker, 1993).

Another general difference between time and money is that time must be spent to maintain the value of time. One of the most important uses of time is for sleep. An individual who sleeps eight hours a night spends one-third of his or her life sleeping. Time spent sleeping is needed to maintain the energy and health that makes waking time more valuable. Likewise, time spent on exercise and other health-producing activities such as seeing physicians and dentists and even on relaxation activities may be necessary to maintain the value of other time spent on labor-market activities, non-market services, human capital investments, or true leisure activities. One can think of such uses of time as maintenance activities necessary to maintain the optimum value of time during an individual's lifetime.

The "whole-time" concept in forensic economics deals with the valuation of lost time due to a tortious action. This concept is generally relevant in personal

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injury cases, but may also be relevant in "pure" survival action states.¹ "Whole-time" issues are not relevant in wrongful death actions except to the extent that an individual's use of time would have resulted in benefits to survivors of the decedent.² This paper addresses issues relating to the categories of time that forensic economists should consider in applying the "whole-time" concept to loss assessments. Separate sections are devoted to (1) time spent on maintenance of human capital, (2) time spent in the labor market, (3) time spent in the production of non-market goods and services, (4) time spent in human capital investment, and (5) time spent in true leisure. The final section of the paper deals with issues of forensic valuation regarding these categories of time use. However, before proceeding, it is important to discuss how this paper will deal with travel, waiting time and breaks and with tax issues affecting the choice between labor market and non-labor market uses of time.

A. Travel, waiting time and break issues

All general uses of time are likely to require either travel time, waiting time or specified break time. Time spent going to a physician will include travel time to and from the physician's office and waiting time after arrival. Time spent in the labor market will involve travel to and from work as well as time spent during work breaks and lunch. Time spent in human capital investment may require travel and time waiting for classes to start. Even time spent in true leisure may require travel to and from a leisure activity and perhaps waiting time at the location of the leisure activity. Such time uses up part of the time an individual has available, both directly and in terms of the ability of an individual to use time in the most preferred manner.

This paper will assume that travel time, waiting time, and break time are part of time allocated to the general activity for which travel, waiting or breaks took place. There are two ways in which this can be misleading. (1) Travel, in particular, may have joint purposes. Travel to see a physician may also place an individual in close proximity to a desirable leisure activity following the appointment with a physician and so forth. (2) The length of required travel may be directly a function of how individuals choose to spend time. This is par-

¹Survival actions allow estates of individuals to recover for damages, which if an individual were still alive, that individual could maintain a legal action to recover. Many states have survival actions that apply only from the moment of an injury to the moment of the individual's death. This essentially means that a legal action is treated as if it was a personal injury action for the period from the injury to the individual's death, but then becomes a wrongful death action thereafter. In a wrongful death action, whatever may be lost by the decedent becomes irrelevant and the standard of loss becomes loss to survivors, not the decedent. The value of time lost by the decedent thus becomes relevant only to the extent that it leads to losses by relevant survivors. However, in "pure" survival action states, the right of recovery for the decedent's losses extends for the life expectancy of the decedent before the injury that produced death. That standard would include the "whole lifetime" of the decedent in a manner that corresponds exactly with personal injury action (Ireland, Horner and Rodgers, 1999).

²There are many uses of a decedent's time that would have benefited survivors that are often not considered by forensic economists. The value of time a decedent would have spent in guidance, counsel, comfort, and care for survivors is generally recoverable as lost services under most wrongful death acts. This issue has been explored by Ireland (1998), Olson (1998), Rodgers (1998) and Timari (1999).

ticularly important with respect to time spent in the labor market. If an individual chooses a housing location that requires one hour each way to and from work in preference to another housing location that requires only 15 minutes each way, the 1½ hours per day difference represents an expenditure of 1½ hours a day to obtain the amenities of the more distant housing location.

This has the implication that the true hourly compensation for two workers each receiving the same hourly wage at the same job in the same location may be different. Suppose, for example, two workers work side-by-side at a five day per week, eight hours per day job, starting at 8 a.m. and ending at 5:00 p.m., with a one-hour break for lunch, and are being paid \$10.00 per hour. Both workers are actually spending nine hours per day in or around the job location, but one worker is spending 10 hours per week in travel to and from the job while the other worker is spending only 2.5 hours per week in travel to and from the job. The first worker is receiving a total wage compensation of \$400 per week for committing a total of 55 hours, including 40 paid hours, 5 lunch break hours and 10 travel hours. The true hourly rate of compensation is \$400 divided by 55 hours = \$7.27 per hour. The second worker is receiving the same total wage compensation of \$400 per week, but for committing only a total of 47.5 hours, 40 paid hours, 5 lunch break hours and 2.5 travel hours. That worker's actual hourly compensation is \$400 divided by 47.5 hours = \$8.42 per hour.

This, of course, is quite consistent with the fact that a worker would be likely to accept employment closer to home at a lower wage rate than employment further from home. However, it may also be reflective of different valuations by the two workers of the potential amenities of living in the closer or more distant locations. The current paper makes no attempt to resolve potential differences between these perspectives, but does treat all time committed to the labor market as time committed to the employment for which compensation is paid.

B. Tax issues involved with time valuation

When workers make time allocations between labor market uses of time and all non-labor market uses of time, there are important tax consequences. Individuals pay taxes on labor market earnings, but are not required to pay taxes on the values they receive from non-labor market uses of time. As will be noted below, human capital investments that are made specifically to increase future labor market compensation constitute an exception. But the value of household production and the value of leisure benefits are not taxed, now or in the future. As such, an individual allocating time between labor market and non-labor market uses of time will take into account applicable tax rates on labor market compensation. In terms of the choices individuals make in time allocation, it is the after-tax value of labor market compensation that matters. This can raise difficulties in developing meaningful measures of non-market time in legal venues in which taxes are not taken into account, given that taxes

usually have an impact on the division between labor market uses of time and all other uses of time.³

II. Personal Maintenance Uses of Time

Any individual has 168 hours per week of time for a period equal to that individual's life expectancy. Some of that time must necessarily be spent on various aspects of personal maintenance. This will include time spent on sleep, personal hygiene, exercise, visits to doctors, dentists, etc. to maintain higher performance abilities with respect to future time. If an individual sleeps eight hours per night and spends two awake hours each day on other maintenance activities, 70 of the 168 hours of each week will be spent on various aspects of self-maintenance. While the amount of time required for such maintenance activities will vary by individual, required personal maintenance time takes up a large part of all time an individual has available.

From an individual's standpoint, basic life-maintenance activities, discretionary-health activities may or may not have value in and of themselves. Their value derives from the activities they make possible through better health and more energy. This does not mean, however, that other types of benefits cannot occur during the same time period. A runner with a radio and earphones is spending time on discretionary-health activities, but is reducing the costs of doing so by getting enjoyment from music while engaging in the exertion necessary to produce the desired health and energy effects. Similarly, hearing music in the background may reduce the unpleasantness of hearing one's teeth being drilled on in a dentist's chair.

In terms of a forensic measurement of "whole-time" losses, however, there is no reliable way to determine the utility value of such time uses. As a general rule, it is probably best to treat such time uses as having no dollar value in and of themselves. However, as Caragonne (1997) has argued, a personal injury may have the effect of increasing significantly maintenance uses of time. Standard maintenance activities such as bathing, dressing, and using toilet facilities may require much more maintenance time than before an injury. This implies a loss of discretionary time that can be valued as damages resulting from an injury.

As a convention for the remainder of this paper, personal maintenance uses of time are subtracted from total time available to determine time that

³The impact of taxes on the allocation of time in the labor market is subject to both income effects and substitution effects. The income effect of income taxes is always negative, such that higher income taxes tend to induce individuals to work longer hours to achieve target levels of income. The substitution effect that non-labor market uses of time are made less expensive with higher taxes always works to reduce the number of hours worked. If negative income effects are stronger than positive substitution effects, the result can be a backward bending supply curve for labor (Browning and Browning, 1994). Thus, for any given individual, a higher tax rate can result in that individual providing more, less or the same number of hours of labor. This phenomenon also applies to human capital investments through a wealth effect. Higher future income resulting from human capital investments in the present will be taxed at increasing marginal tax rates. The wealth effect would mean that individuals must invest even more in human capital to achieve the same target levels of future wealth, but also that the value of an hour spent in developing human capital is reduced. Here again, for any given individual, higher tax rates could result in more, less or the same number of hours being invested in human capital.

the individual can allocate among other uses of time. At the margin, individuals can and do make choices about the amount of time they spend on personal maintenance, but that issue will be ignored for the remainder of this paper. Time not used for personal maintenance will be referred to as "discretionary time." Thus, if an individual spends 70 hours on sleeping and other aspects of personal maintenance, the individual has 98 hours per week of discretionary time.

III. Labor Market Time Uses

If individuals are employed in the labor market, they are selling part of their discretionary time. They are usually also committing themselves to specific schedules of time uses. Some occupations give individuals considerable discretion about when the time sold by the employed person is to be provided, but most are based on the provision of time under circumstances more to the convenience of the employer than the employee. Thus, in accepting employment, most individuals are selling specific amounts of time per week, but are also selling an agreement to provide that time during specific periods specified by the employer. Employment relationships also imply giving up degrees of control over unpaid time.

If a worker is expected to be at work and is paid for eight hours per day with a one-hour unpaid lunch period the worker is giving up significant degrees of control over unpaid transportation time to and from work and over the lunch hour. As discussed in the introductory section of this paper, compensation for labor market time includes both paid time and unpaid time that is required to provide labor services on the specified schedule of an employer. In the previous example, two workers who are both being paid \$10 per hour for 40 hours of labor services between 8:00 a.m. and 5:00 p.m. during a work week from Monday through Friday may earn different true per-hour wages. In that example, both workers had one unpaid hour off for lunch. One worker, with 10 hours per week of travel time to and from work, was earning \$7.27 per hour, while the other, with 2.5 hours per week of travel time to and from work, was earning \$8.42 per hour.

Another issue with respect to labor market uses of time involves the utility of work activity. Many discussions of labor activity implicitly assume that wages plus job-related fringe benefits pay are the only benefit an individual receives from labor-market work activity. However, many individuals very much enjoy work activity, meaning that they derive positive utility from such time uses that is a benefit in excess of what can be measured by wages and the value of job-related fringe benefits. There is no reliable way to place a market (or monetary) value on these utility-based benefits that derive from enjoyment of work activity. The difficulty of measuring the utility or disutility derived from work activity is a very important challenge for the future of the "whole-time" concept. To the extent that a worker enjoys labor activity more than post-job uses of time, a worker is not fully compensated if his lost wages and lost job-related fringe benefits are fully compensated in financial terms. The converse of this, however, is that a worker who hated his job and is now having his wages replaced without having to perform the job is being overcompensated.

true leisure and other categories of time use. In the military, time spent on true leisure is typically called "R and R," referring to rest and relaxation. It is clearly understood that individuals need to allocate time to "R and R" as a part of maintaining an ability to provide high quality labor-market participation. Some sporting activities such as golf can provide true leisure, exercise, and social involvement that may enhance human capital and even direct labor-market benefits all at the same time. Likewise, when a parent takes a child out on a recreational outing, the child may still receive very important guidance and counsel from the parent. However, even time spent completely alone on long walks may have exercise and mental relaxation value with respect to future uses of time of all forms. For these reasons, true leisure may be a much smaller category of time use than is commonly realized.

VII. Forensic Valuation Issues

From the standpoint of forensic economic expertise, divisions of time use into categories are useful to the extent that it facilitates damage analysis. This raises the following issues: (1) Which categories of time use are relevant to damage standards in litigation? (2) To what extent can losses in various legally relevant categories be measured? (3) What is the best way to measure those losses? and (4) What errors should be avoided? These questions will be considered in turn.

A. Damage Standards

Damages standards for tort litigation govern what types of time use forensic economists can consider and from what standpoints valuation must be made. In litigation under a wrongful death statute, for example, there is no right of recovery for the lost value of true leisure by a decedent. Wrongful death standards, with some certain exceptions that do not relate to time use, are concerned with losses of survivors, not losses of the decedent. As a result, the value of any enjoyment a decedent has lost because of death is not relevant to damages a forensic economist would calculate. Loss of non-market services of a decedent, on the other hand, are recoverable, but must be measured from the standpoint of surviving claimants. In a personal injury litigation, loss of the value of true leisure may be a recoverable category, to the extent that it can be measured. Loss of non-market services can also be recovered, but the loss must be measured in terms of losses to the injured person (unless family members are joined into the legal action). Survival actions add levels of complexity that go beyond the scope of this paper, but are generally based on standards more like personal injury losses than wrongful death losses (Ireland, et al., 1998). Thus, the first important valuation issue confronting a forensic economic expert is to determine the standpoint from which damages must be calculated. Only time uses consistent with that standpoint are relevant.

B. Possibility of Measurement

The second issue is whether it is possible to measure a particular category of loss under the damage standards relevant to the legal action. In a personal

injury action, both loss of the value of true leisure and loss of non-market production may be recoverable categories. However, the difficulties of measurement are enormous. If a person has been permanently injured, that person has probably suffered a significant loss in the value of his or her true leisure time. The person probably cannot engage in some activities that previously generated a great deal of enjoyment. However, there may be no loss of leisure time and there may even be a gain in the amount of available leisure time. If the worker has been totally disabled from labor-market employment, the worker will have lost the utility previously enjoyed in work activity, but will have a substantial increase in available time. Since there is no reliable way to measure enjoyment per hour, the loss of enjoyment per hour cannot be measured. An exception to this problem exists if the worker, because of an injury, must spend increased amounts of time on personal maintenance. In those cases, the additional time needed to handle routine personal maintenance functions can sometimes be determined. If so, valuation can take place.

Likewise, in personal injury circumstances, a disabling injury will usually mean that there are some services around the home that an individual is no longer capable of providing, while others still can be provided. Some forensic economic experts calculate losses based on estimates of the amount of time spent on activities before an injury. For example, it might be projected that an individual spent 25 hours per week providing non-market goods and services before an injury, but can no longer perform the activities that comprised 10 of those hours. The loss is then calculated as the value of 10 hours of lost non-market goods and services. This, however, is incorrect. Unless the individual has increased personal maintenance time requirements, no time has been lost to the injured person. What has been lost is the opportunity to spend 10 hours performing the activities the person previously preferred to perform during those 10 hours. Value has been lost, but it is not the whole value of 10 hours worth of time. It is the value of the difference between the activities that can no longer be performed and the value of the activities that the injured person is now performing in their place. It can be extremely difficult to measure that difference. Attempting to do so would carry a forensic economic expert into areas that may be regarded as highly speculative.

C. Measurement Methods

Generally, forensic economists value time spent producing non-market services by either opportunity-cost or replacement-cost methodologies. Ireland and Ward (1991) provide a detailed description of two different versions of each approach as applied to household production, but the essential differences are reasonably straightforward. An opportunity-cost approach measures the value of lost time to claimants in the action on the basis of the market value of time to the injured person or decedent. A replacement-cost approach measures the cost to the claimant of replacing the benefits that were lost. Both methods are legitimate tools of economic experts and forensic economic experts regularly use both valuation methods for some of the categories of time loss being considered. Money-earnings loss is almost universally measured in terms of the lost opportunity to continue working in the labor market, though lost job-re-

lated fringe benefits can be measured in terms of either opportunity-cost losses or replacement-cost losses. If an individual was earning a salary of \$40,000 per year, it is conventional to measure the lost opportunity to work at \$40,000 per year without worrying about any issues that might be involved with a calculation of the cost of replacing that job. However, the value of a lost medical benefit might be calculated in terms of what it would cost the worker to replace that medical benefit or in terms of how much that individual would have been willing to pay to retain that benefit. The first approach would be a replacement-cost approach, while the second would be an opportunity-cost approach.

In the context of non-market production of household and family services, the replacement-cost approach projects the lost value as the value of replacing the services that have been lost, while the opportunity cost approach projects the lost value as the value of time that the family was willing to sacrifice in order to produce those services. From the standpoint of a whole-time approach, opportunity-cost would be the method most closely tied to time categories. The value of lost non-market services would be projected at the after-tax hourly pay rate of the injured person or decedent. With a replacement-cost approach, the time spent by the injured person or decedent on non-market production is not important. The issue is the dollar cost-of-replacement provision.

If lost leisure is being evaluated, an economic expert is largely limited to an opportunity-cost approach. The value of leisure can only be measured directly as the value of the opportunity cost of foregone earnings represented by leisure time uses. However, James L. Plummer has written an interesting paper suggesting a replacement-cost approach based on calculating the cost of replacing preferred leisure (consumption) activities with next best substitute consumption activities (1995). Such an approach, however, only results in viable measurements if substitute consumption activities are more expensive than the leisure activities lost because of the injury.

The lost value of time spent in human capital investment probably can be captured best in lost future earnings projections. If at the time of injury an individual was taking classes toward some future degree or if he would have been likely to be promoted to a higher position after a number of years of experience, that increase is likely to have been projected into the anticipated lost labor-market earnings stream. It would therefore not need to be calculated as a separate element of loss.

D. Error avoidance issues

Using either a replacement-cost or an opportunity-cost approach without caution can result in serious error. Problems with the replacement-cost method are explained in detail in Ireland and Ward (1991), but there are also important possible sources of error with the opportunity-cost method. A brain surgeon who makes \$1,000 per hour doing surgery, but who cuts his own lawn is not providing \$1,000 per hour in opportunity-cost equivalent lawn cutting services. He may have reached his maximum capacity for brain surgery and thus have only a very low marginal cost of time for subsequent uses of time, or his lawn cutting activity may be a form of personal maintenance time use, both in terms of mental relaxation and physical exercise.

Any use of the opportunity-cost concept must consider what are the true purposes of non-market service activity and what are the true opportunity costs of providing the services. One must determine whether the activity is true service production, a form of true leisure, a form of self-maintenance, or some mix of the three. One must also consider what are the true opportunities that are being sacrificed to produce the time expenditure on non-market services. If a worker has no opportunity to provide more highly valued labor services in the labor market, the true opportunity cost of time might be quite low.

VIII. Conclusion

Time use is a more complex topic than is often realized. A standard division of time uses into labor and leisure is not sufficient to allow a complete analysis of the values of the true components of time. "True leisure" is more productive of utility than is commonly realized, but many parts of "apparent leisure" are really components of personal maintenance uses of time or are periods during which an individual is actually providing important family services. As economists proceed in the development of the "whole-time" concept, a great deal of caution should be exercised.

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