The United States Approach to Computing Economic Damages Due to Personal Injury and Wrongful Death

Kurt V. Krueger and Gary R. Albrecht

June 10, 2009

Abstract

Tort damage law in the United States allows the claimant to recover economic damages incurred due to injury when the injury causes reduced individual productivity. Economic damages are a function of the difference between the pre- and post-injury values of obtainable economic output. Although the state jurisdictions in the U.S. have variations in their compensable economic damages, there are core economic methods used in all jurisdictions to determine tort economic damages. This chapter presents the generally accepted economic theories and methodologies which form the "U.S. approach" to computing economic damages.

Kurt V. Krueger, Ph.D.

Kurt V. Krueger, Ph.D. is an economist at John Ward Economics located in Prairie Village, Kansas. He specializes in forensic economics and economic demography. He is the Managing Editor of the *Journal of Forensic Economics* and he is a past Vice President for the National Association of Forensic Economics. He has published in *Medical Care*, *Journal of Forensic Economics*, *Journal of Legal Economics*, *Litigation Economics Digest*, *Litigation Economics Review*, and *The Earnings Analyst* in addition to authoring economic research reports, book chapters, and one book on catastrophic injury damages. He holds a Doctorate degree in Economics from the University of Missouri-Kansas City.

Gary R. Albrecht, Ph.D.

Gary R. Albrecht, Ph.D. is an economist at Albrecht Economics located in Winston-Salem. He specializes in economic forecasting and forensic economics. He has been an Assistant and Adjunct Associate Professor at Wake Forest University and he was the Director of Econometric Modeling at the University of Kansas. He is a past Vice President for the National Association of Forensic Economics. He has published in the *Journal of Forensic Economics*, *Journal of Legal Economics*, *Trial Briefs*, and *The Earnings Analyst* in addition to authoring economic research reports and book chapters. He holds a Doctorate degree in Economics from Indiana University.

1 INTRODUCTION

This chapter examines the legal and scientific approaches taken in the United States for computing economic damages due to personal injury and wrongful death. The U.S. law of tort damages conforms to a general economic valuation of reduced or lost productivity due to injury under the goal of assigning tort damages optimally so that harm in the society is minimized. Today, "economic damages" are defined term in every U.S. jurisdiction, and the field of forensic economics has produced a body of literature concerned with accurately measuring them.

This chapter is a general overview of the economic damages topic designed for readers without thorough exposure to the measurement of economic damages under U.S. tort law. For readers interested in further research, an appendix presents a bibliography organized under the major subject areas in the chapter. The chapter begins by examining the social objectives of tort damages in the U.S. It is noted that state jurisdictional law can influence some of the calculations without changing the core economic methods of determining tort damages. The commonly accepted components of U.S. tort economic damages are then listed. This listing is followed by the generally accepted economic theories and methodologies which form the "U.S. approach" to computing economic damages. The chapter shows typical analytical steps followed in determining economic damages in the U.S. Ending the chapter is a sample personal injury case to which the U.S. approach and calculation methods are applied.

2. THE SOCIAL OBJECTIVES OF U.S. TORT DAMAGES COMPUTATION

Under U.S. civil law, the remedy offered to the victim of a tort is money paid by the tortfeasor to compensate for the damages caused. Regardless of jurisdiction, the U.S. relies upon the reasoning of judges or juries (the trier of the facts) to ascertain the amount of money under a universal "make-whole" principle that intends to make the tort victim as well off as if the injury had not occurred. Tort damages are assigned to three categories: general, special, and punitive.

General and special damages are to restore the plaintiff to his or her former state (to make whole) while punitive damages are intended to punish a defendant who acted with malice in committing the tort. General damages are defined as those that flow as the natural, necessary, logical, and anticipated consequences of a wrongful act. For example, the consequence of legitimate personal injury must be pain, suffering, and/or the loss of the enjoyment of life, so those elements of loss are assigned to general damages. General damages are also described as any component of the loss of life or lifestyle which cannot be measured in monetary terms. Special damages, on the other hand, are those that result from the defendant's act by reason of the unique circumstances of the case. Special damages require some proof of causation resulting from the tort. When an injury forces a plaintiff to miss work, that plaintiff's loss of earnings is a special damage because not every personal injury causes a loss of earnings. All economic damages in the U.S. are special damages, and general damages have been come to be referred to as simply "non-economic damages."

To decide damages, the U.S. law encourages all forms of evidence to be presented to the trier of the facts. Whenever scientific or specialized knowledge could assist in the understanding of evidence, the U.S. courts allow expert witnesses to give their opinions regarding the issues to be ultimately decided by the trier of the facts. The court or judge qualifies the expert's testimony by way of the witness' education, training, and experience and his or her utilization of generally accepted theories and methods within his or her field. The trier of the facts is not bound by any expert testimony and may accord such testimony as little or as much weight as deemed appropriate. Since forensic economists have knowledge of the scientific methodologies that are generally accepted for accurately measuring pecuniary damages, they are utilized as expert witnesses by plaintiffs and defendants. In the U.S., forensic economists most often testify on

behalf of the plaintiff as every U.S. jurisdiction places upon the plaintiff a burden-of-proof as to the best evidence of his or her damages claims. A forensic economist for the defense provides advice and/or serves as a testifying expert witness to rebut the plaintiff's expert's analysis or to calculate damages utilizing evidence offered by the defendant.

All economic damages must be expressed as a lump sum, and any loss that would have likely occurred after the date of judgment is subject to a present value calculation. Hence, the economic study of interest rates and price inflation has shaped the methodology of complying with the legal present value requirement—again a legal subject calling for expert economic testimony. The U.S. Supreme Court recognizes that prediction of the future is affected by various probabilities and resulting jury speculations but "(t)hat juries in tort cases must routinely engage in such difficult predictions (compounded further by discounting for present value) is the price paid by the common-law approach for the finality of a one-time lump-sum judgment."[1] A goal of rigorous economic analysis in U.S. litigation is to work to minimize the error made in predictions about the future, and the U.S. approach works to provide neutral, accurate methods of computing tort economic damages.

The study of "make-whole" considerations is embedded into economics with such concepts as externalities and compensating and equivalent variations related to changes in utility and prices. The prospect of opining "make-whole" calculations is engaging to an economist versed in economic value-of-life theories, methods, and empirical research. The findings of value-of-life research based upon indirect measurement of the prices people pay in order to reduce the chance of incurring injury could be relevant to general and special tort damages; and the costs avoided or the profits obtained by a firm under a malicious creation of public harm could be relevant to punitive damages. Despite what "make-whole" information might be produced using

such value-of-life theories and measurements, general economic analysis within the U.S. is limited to quantifying the directly measurable market values of the special damages claims of the loss of earnings and/or earning capacity, the ability to perform services, future medical expenses, and the loss of financial support due to wrongful death. The justification for the reduced emphasis on economic value-of-life empirical evidence reverts to (a) the consensus within the U.S. case law that any witness is no more expert than are jurors regarding the personal value-of-life; (b) the fact that, while economists using revealed preferences can rank an individual's economic enjoyment-of-life positions, there are no dollar-based data available to quantify the differences between an individual's enjoyment rankings; and, (c) empirical value of life or profit motivation abstractions obtained from the behavior of populations are not reliable indicators for evidence of damages in an individual case.

A well-established principle in the U.S. law of damages is that the wrongdoer is generally not entitled to have the damages for which he or she is liable reduced by proving that the plaintiff has received or will receive compensation for the loss from a collateral source. This collateral source rule flows directly from the law and the economic goal of minimizing harm by making tortfeasors responsible for all of the harm they create. While tort reform movements across U.S. jurisdictions have chipped away at the collateral source rule (and injected related issues such as the role of income taxes on lost earnings claims), jurisdictional laws have not overridden the basic economic elements of the U.S. approach; they have only added some required adjustments to them. For example, a jurisdiction might offset economic damages by the receipt of disability insurance benefits or the required payment of income taxes. The admissibility of those two considerations does not eliminate the need of a calculation of the loss of earnings or earning capacity before those deductions. Some jurisdictions also have rules regarding the method of the

present value calculation, which again does not detract from its requirement in the U.S. approach.

3. ORIGINS OF GENERAL AND SPECIAL TORT DAMAGES

Legal theory addresses tort damages with economic questions such as "who pays the cost" and "for what to compensate the victim?" The U.S. Supreme Court in *Carey v. Piphus* wrote that the law provides to us a legal right to engage in our own meaningful life activities and tort liability provides to us a broad range of damages to compensate us "fairly for injuries caused by the violation of (our) legal rights."[2] Related to the question "for what to compensate?," state and federal damage items for consideration by the trier of the facts in personal injury and wrongful death include the loss of earnings, earning capacity, services, future medical costs, and financial support, as well as life activities related to the loss of affection, aid, assistance, attention, care, comfort, companionship, consortium, disability, disfigurement, domestic duties, education, enjoyment of life, guidance, inconvenience, nurture, pain, protection, services, suffering, among other items. While a plaintiff is legally entitled to such broad areas of compensable damages, the law gives little guidance on how the trier of fact should make the damages valuation. Each jurisdiction requires that the compensable items of damages must be considered in light of such economic-related productivity characteristics such as the plaintiff's ability, age, character, expectation of life, habits, health, industry, intelligence, mental and physical capacity (before and after injury) with the probable increase or diminution of that ability with the lapse of time, occupation, work record, and in wrongful death cases, the care and attention the deceased may have been expected to give his family. The U.S. Supreme Court in *Sea-land Services, Inc. v. Gaudet* stated that tort compensation rests on "the good sense and deliberate judgment" of the trier of fact and "as in all damages awards for tortious injury, insistence on mathematical precision would be illusory and the judge or juror must be allowed a fair latitude to make

reasonable approximations guided by judgment and practical experience."[3] The above statement does not diminish the value of the U.S. approach with its economic focus; it simply points out that the deliberation of damages must also include other matters such as the "character" of the plaintiff which are unable to be captured by mathematics and statistics.

The U.S. approach to computing tort damages is grounded in microeconomic theories that model the personal creation of utility or enjoyment of life through the consumption of leisure and goods. Since everyone labors to acquire goods, injury through the loss of personal productivity, (1) lowers the enjoyment of life attainable during leisure hours and (2) lowers the ability to obtain money income during work hours in order to purchase goods.[4] These results are demonstrated by Krueger, Albrecht, and Ward in "the whole-time concept" of tort damages.[5] The whole-time model begins with the maximization of the enjoyment of life subject to personal budget constraints relating the value of time at leisure and the prices of market goods. When an injury causes a decrease in personal productivity, the budget constraint contracts to lower values reducing the possibility for enjoyment of life. By comparing pre- and post-injury earning capacity, the whole-time concept allows the computation of the market dollar-based amount necessary to push the post-injury budget constraint out to its pre-injury level. However, that amount of damage compensation would still not necessarily restore the pre-injury utility or enjoyment of life. The reason is that even with additional income, the impact of the injury on productivity persists, thereby diminishing alternative leisure and consumption choices.

Since all legitimate torts are subject to general damages for the loss of enjoyment of life, the beginning values of special tort damages are the market prices of goods now unobtainable due to decreased (or eliminated) work productivity caused by the injury (or death). The loss of obtainable goods such as food, shelter, transportation, and medical care using the pre-injury

expected amount of time the tort victim would have spent in the labor market is measured as the difference in pre- and post-injury earning capacity.[6] When the "goods" desired result from hours of non-market labor provided by a person for his or her own or family's consumption, such as a clean house or child care, those losses are measurable using the market price to replace the output from that non-market work. The economist can state to the trier of the facts that the U.S. approach to dollar-measurable values of special damages allows the injured person to restore the same possible set of consumption goods available to him before the injury; however, having the ability to purchase those lost goods with the money damages does not necessarily make the plaintiff whole when considering that the loss of physical productivity persists post-injury to hamper the ability to enjoy life with the consumption of those pre-injury selected goods.

Can economists say anything more about economic damages? Freidman[7] (1982) has asked "How much money would it take to compensate a blinded man?" In an attempt to restore enjoyment to the blind man through his remaining senses, the trier of the facts could attempt to decide how many gourmet meals, nice fitting clothes, or concert performances it would take to compensate for the blinding. Economists are unable to embark on such compensatory routes for two reasons. First, economists do not have methods for determining required compensating bundles of goods or for knowing how many of those goods would be necessary to reach a compensating value of pre-injury enjoyment of life. Secondly, economists discourage such expeditions recognizing that under the law of diminishing returns eventually such goods have little value and it would socially inefficient to satiate the tort victim with them. Instead of focusing only on how to compensate for the loss of enjoyment of life with money, general legal and economic thought endorses providing special damages that work towards restoring the pre-injury productivity of the plaintiff. Medical experts opine on the cost of medical, psychological,

and supportive care, as well as medicines and equipment which would increase the post-injury productive capabilities of the plaintiff to work or to enjoy leisure. These special damages offset some general damages, however. For example, if the plaintiff requires a wheelchair and special transportation in order to interact with the community, the costs of those items offset to some degree the general damages for the loss of enjoyment of life from not being able to interact with the community. The present value of such future life care costs (where lifetime costs in today's dollars are specified by medical evidence) is often an integral part of the special tort damages evaluated by an economist expert witness, and methods to calculate those present values are included in the U.S. approach.

4. THEORETICAL AND METHODOLOGICAL COMPONENTS OF THE U.S. APPROACH

The U.S. approach to computing tort damages is generally limited to the damage categories of the loss of earnings and/or earning capacity, services, future medical expenses, and the loss of financial support. These damages originate from the reduction in personal productivity due to injury (or its elimination due to death). This section presents the generally accepted economic theories and methods[8] which have defined the terms and procedures used to compute economic damages in the U.S. This material demonstrates that determining portions of tort damage compensation is an exercise clearly rooted in economics. The section also serves as a reference guide to the generally accepted methods taken to compute tort economic damages.

4.1. Loss of Earning Capacity and Earnings

4.1.1. Economic and Legal Definitions of Earning Capacity and Earnings

At the heart of the U.S. approach to determining economic tort damages is the concept of earning capacity. From an economist's view, an individual's *earning capacity* is equal to the amount of money he or she could reasonably expect to earn working at a job that fully utilizes

his or her abilities. An individual's *expected earnings* are the money amounts it is anticipated that he or she will actually earn working at a job. The extent to which the person utilizes his or her abilities in the labor market over the course of their working life determines his or her *lifetime expected earnings*.

In U.S. case law, the phrase "earning capacity" was first associated with the potential market worth of property. When property was destroyed or held in dispute, damages were assigned according to the property's potential market worth or earning capacity. Relevant to personal injury, an early appearance of the term "earning capacity" was in a 1901 U.S. Supreme Court opinion (*Texas & Pacific Railway v. Humble* (181 U.S. 57, 1901)) where the court allowed a married woman to make a claim for her own loss of earning capacity due to injury. At issue was an Arkansas' court's instruction that

> If you should find for the plaintiff, in assessing her damages you will take into consideration her age and earning capacity before and after the injury was received, as shown by the proofs, her physical condition before the injury, and her physical condition after the injury, and the nature and character of the injury she received, whether it be permanent or temporary in its nature, and find for her such sum as will fairly and reasonably compensate her therefor, including therein fair and reasonable compensation for any physical and personal pain and suffering she may have undergone as the result thereof.

The case illuminates the simultaneity of economic and non-economic damages. First, the court instructs the trier of the facts to consider the economic damages associated with the impact of the reduced "physical condition" or productivity caused by the injury and then to consider the non-economic damages compensating for pain and suffering.

While every state has since commented on earning capacity as a component of tort damages, a clear, early economic statement of the term was provided by the Supreme Court of Missouri in *Wolfe v. Kansas City* (334 Mo. 796, Mo. 1934):

> Capacity to labor (physically or mentally) includes the capacity to earn money, and more. Our law is that recovery may be had for an impairment of the capacity to labor, although there may be in fact no actual loss of earnings, and to be deprived of the power to work is a source of injury, independent of the pecuniary benefits that such labor may confer. …
>
> There is a distinction between the power or capacity to work and earn money and loss of time or money that one probably will lose in the future on account of physical or mental disability. Loss of time, or what one may reasonably be expected to earn in the future, comes under the head of the amount of loss of time or earnings, or the fruits or gains from the power or capability to work and earn money. …
>
> Compensation for incapacity to labor or work is not founded on the theory that such incapacity is merely a matter of discomfort, inconvenience or annoyance, as was said in some of the earlier cases and, for that reason, compensation as a part of the general injuries received. Inability to work is something more than a discomfort, inconvenience and annoyance. The mere inability to move about or to use a movable member of the body is a discomfort, inconvenience or annoyance. Therefore, inability to play or engage in any active diversion comes under the same head. While inability to work, mentally or physically, is a discomfort, inconvenience and annoyance, unless such inability is compensated upon the theory that it results in more than a limitation of the power or disposition to move around as one does in play, it is entirely logical to say that it is merely a discomfort, inconvenience and annoyance. However, there is quite a difference in one's loss as a result of inability to work and inability to play. The main difference between work and play is that, in the former, the activity is engaged in order to exist or live and in the latter the activity is entered into merely as a pastime. Therefore, any activity engaged in, other than play, is work or the exacting of a living from one's surroundings or environment. This, of course, includes the earning of money, which is merely a medium of exchange for work where one works for another. So the inability to work or labor, physically or mentally, is something more than discomfort, inconvenience or annoyance. It is that plus the inability to, wholly or partially earn a living, either by working for others at a wage or salary (money) or for one's self. Viewing it from this standpoint, the inability to earn money is included in the inability to work.

The above passages from the *Wolfe* case correspond with the economic theories presented in this chapter. The inability of a person to achieve his or her earning capacity is an inability to productively exist or live while an inability to enjoy leisure is a discomfort, inconvenience, or annoyance that is compensated by general or non-economic damages. The inability to work includes the inability to work for others at a wage or work for one's self by laboring to exist or live. Therefore, earning capacity is something that exists in every human being (young/old,

disabled/able-bodied, unemployed/employed/retired) and when an injury impacts the ability to labor (i.e., individual productivity), an economic tort damage exists coinciding with that harm. The U.S. approach captures these economic damages with models of the loss of earnings and/or earning capacity, lost ability to perform service work, future medical expenses, and the loss of financial support.

4.1.2. Theory of the Determination of Earning Capacity

Economic theory holds that a plaintiff's earning capacity at a point in time (for example, at an injury or death date) is determined by employers who know the current abilities of the plaintiff. The generally accepted economic theory of earning capacity has its origin in the economic literature with the wage rate[9] conditions of a profit-maximizing firm (or organization) in economic equilibrium. It is generally accepted that when a firm maximizes profits and is in equilibrium, an employee of the firm receives a wage rate, w, which is equal to the marginal revenue product of his or her labor input, MRP_L. After dissecting MRP_L, the wage-rate-determining equation becomes $w = MR \times MP_L$, which states that the wage rate is equal to the multiplicative product of marginal revenue and the marginal product of the individual's labor, which is in turn determined by the innate abilities and the human capital of the individual worker. From the marginal revenue part of the wage rate determining equation, since the worker has no control over market prices, the wage rate that he or she receives is influenced by factors exogenous to the quality or kind of work supplied by the worker.

4.1.3. Growth in Earning Capacity

Not only must the forensic economist in the U.S. forecast earning capacity at a point in time in a plaintiff's working life, it is also necessary to forecast future changes in earning capacity by age or expected employment tenure. The wage rate determining equation shows that through marginal revenue wages will change when prices change (inflation) and when an economist

includes changes in the price level as one of the reasons for wage rate changes, he or she is said to be studying "nominal rates" of wage rate growth. When an economist does not include changes in price levels as one of the reasons for wage rate (therefore focusing on the marginal product part of the wage rate determining equation), he or she is said to be studying "real rates" of wage rate growth.

According to economic theory, the changes in an individual's marginal product of labor or productivity over time are a function of changes in innate abilities, human capital, and technological conditions. Innate abilities refer to the individual's natural mental and physical capacities that are subject to changes with age. Loss of innate ability may create negative marginal productivity growth, causing earning capacity to decline (the decline can be gradual with advancing age or immediate with the onset of a disability). Human capital, in contrast to innate abilities, refers to skills and positions acquired by individuals throughout life. The generally accepted human capital model argues that the behavior of earnings over time depends on the human capital possessed by the individual. As human capital increases, productivity, and hence earning capacity, increases. Human capital research shows that growth in human capital is greatest at younger ages and then diminishes over a worker's lifetime. To address human capital's impact on earning capacity, economists empirically analyze life-cycle earnings patterns that coincide with the theoretical models of human capital. Technological change can also result in changes in the individual's marginal product and thus changes in his or her wage rate (or earning capacity). Economists usually measure the impact on technology on wages as a part of the real growth in wages observed in secular wage trends over time.

4.1.4. Exercising Earning Capacity to Produce Earnings

The possession of an earning capacity provides an ability to achieve earnings in the labor market, and the extent to which a person utilizes his or her abilities in the labor market over the

course of working life determines his or her lifetime expected earnings. The theory of labor supply is used to understand reasons for attachment to the labor force. The conventional labor supply model begins with a consumer dividing a fixed amount of allocable time, *T*, into hours worked in the labor market, *h*, and hours spent at consumption, *l*. Ignoring savings, the consumer with characteristics *A* possesses a utility function defined by the consumption of commodities, *x*, and hours of work, *h*, as $U = U(x, h; A, \varepsilon)$ where ε stands for the consumer's tastes, availability for home production, or whatever essential item that the consumer balances between work in the labor market and consumption. Income from market work depends upon hours of work *h* and, in the simplest case, the fixed wage rate *w* (or earning capacity) per unit of work. If *p* is the fixed per unit price of the bundle of commodities *x*, and if *y* is income independent of the labor supply decision, then the consumer's budget constraint is $px = wh + y$. The consumer is assumed to choose $x > 0$ and $h \geq 0$ that maximizes utility subject to the budget constraint. At the utility maximization point, when the market's valuation of the consumer's time, *w*, exceeds the consumer's implicit value of his or her time when $h = 0$ (w^*, the reservation wage), then the consumer will participate in the labor force and supply a positive number of hours *h* of market work. Conversely, if at the margin the consumer places a greater value on an extra unit of his consumption time than does the market on his or her work time ($w^* > w$), then the consumer will not supply labor to the labor market. Earning capacity is a key component in determining lifetime labor supply. When earning capacity declines rapidly at advanced age due to declines in innate ability and/or in the value of human capital, the reservation wage quickly eclipses earning capacity and retirement occurs.

4.1.5. Lifetime Expected Earning Capacity and Expected Earnings

We have seen that generally accepted economic theory supplies the framework to evaluate an individual's lifetime expected earning capacity through his or her marginal product by age and an individual's lifetime expected earnings through his or her demand for consumption. The economic situation of a plaintiff at a point in his or her lifetime, which we call an economic "state," is caused by the various factors discussed that are specific to the plaintiff (innate ability, human capital, and choice of leisure versus work) and by other factors that are relevant to all persons in the economy (price levels and technology). Generally accepted economic theory includes components that anticipate transition or movement from one economic state to another over the course of a lifetime. For example, the decrease in innate ability with age (physical deterioration) decreases the individual's marginal product capability leading to a decrease in his or her earning capacity, which in turn influences his or her demand for consumption. Consumption demand controls how much labor he or she supplies to the market, which ultimately determines his or her earnings level.

In order to estimate future multi-year earning capacity and expected earnings, in the U.S. approach economists use econometric models formed from generally accepted economic theories. Using a variety of empirical data to properly account for the variability in lifetime earnings and earning capacity, the economist describes the relationships that produce earning capacity and earnings by presenting statistics. Going back to the human capital example, economists are interested in measuring the effects of human capital on lifetime earnings. In order to describe the relationship statistically, the economist obtains observations of the earnings of similar persons with respect to age or tenure in an occupation, called the "sample." The human capital model sets forth the hypothesis of the mathematical form expected in the relationship of earnings to age or tenure. From the sample, using statistical methods, the

economist tests whether the mathematical form of human capital theory is observed within the sample. The economist presents an estimate of earnings resulting from the statistical relationship of age or tenure to earnings and then tests whether that relationship is reliably described by using deviations (or error rates) between the earnings in the sample and the predicted life-cycle earnings pattern. Therefore, economists use econometrics to obtain quantitative values of the relationships posited in the parameters of an economic theory and test those values for reliability as operators of economic theory.

Individuals have certain identifying characteristics (current abilities and their records of earnings and human capital attainment) and the economy possesses certain current and historical characteristics (inflation, unemployment, and the progress of technology) that together affect earning capacity. Likewise, persons of comparable characteristics over various ages (a cross-section of the current population) present a relevant sample from which to draw information regarding transitions or movements in economic states over a lifetime. In order to present reliable economic information to the trier of fact regarding the expected present value of multi-year earnings losses, the economist uses econometric methods to apply all of the relevant determinants of earning capacity and earnings to appropriate relevant samples of population data within the economy. While the detail in sampling and statistical estimation is subject to debate and variation among economists, conformity to the firm economic theories of earning capacity and expected earnings is required in all statistical studies. For example, a valid projection of earning capacity will include both human capital and innate ability analysis. An economist cannot project earning capacity based on human capital attainment over a lifetime without also considering the expected effects of the reduction in innate ability.

4.1.6. Estimating Growth and Other Economic Parameters

In order to implement any economic loss model involving projections, it is necessary to forecast variables that are exogenous to the model. Some variables are assumed to be static and their future value is based upon current cohort values. For example, survival probabilities for a cohort group are usually assumed to be static, and forecasts are based upon recent observations of survival from the cohort group. Other variables fluctuate to an extent that a method of forecasting that takes into account a series of values over time is required. For example, the unemployment rate for a particular cohort group may change from year to year to such an extent that using the most recent observation to forecast future amounts is not an appropriate forecasting method. In economics, forecasting methods range from complex econometric models to simple univariate time-series forecasts, also referred to as extrapolation. In this section, we briefly discuss various methods of forecasting variables with the focus on simple extrapolation methods as best suited for implementing the U.S. approach.

A goal of the U.S. approach is to present reliable economic estimates formed from existing economic and demographic information. Traditionally, complex economic forecasting models are designed for simulation exercises in order to provide information for the evaluation of government policy or near-term expectations of general macroeconomic variable values such as economic growth and inflation. Complex econometric modeling may reveal, for example, that an increased life expectancy affects individuals' decisions with regard to the accumulation of human capital and labor force participation. While the forecasts of the U.S. Centers for Disease Control point to increased life expectancy, the general U.S. approach is not designed to account for the effect that increased life expectancy may have on human capital acquisition and labor force participation in the future; they rely upon the past and present cohort situation to develop the forecast without changes in the cohort segment. For example, economic data show what the

labor force participation rate of 45-year-old males with a high school education is and has been. It is beyond the forensic economist's purview to be forced to forecast changes in the labor force participation rate due to increased life expectancy. Changes over time in the cohort population's disability rates, unemployment rates, wage growth rates, medical cost growth rates, participation rates and other variables that may be used to forecast earnings would each cause the actual value of economic loss to be above or below the model's estimate. Since *ex post* measurements of actual economic losses are immeasurable, an objective is to build the U.S. approach in which the immeasurable errors would tend to offset each other.

Often the economic loss forecast period embedded into the U.S. approach is long—a forty-year forecast of an individual's earnings is not uncommon. The forecast period for wage and medical price growth rates is similar in length to demographic forecasts. Complex econometric models are generally quarterly models that forecast about eight future quarters. It is certainly not the consensus in the field of economics that a complex econometric model is capable of a more reliable long-term forecast than less complex extrapolative methods. Rather, absent an expectation of substantial structural shifts, a method "that simply extrapolates from previous outcomes may be more successful. If the economy stays on track, such extrapolative forecasts are generally accurate" (Hendray et al., 2001, p. 8). In conclusion, the goal of the U.S. approach is to present reliable economic conclusions formed from existing economic and demographic information. As such, simple averages of relevant past economic information, or extrapolations, form the basis of the forecasts made by the U.S. approach. Since the trier of the facts should be made aware of qualitative information regarding the tort victim, the nature of any economic forecast and its potential variations should be information that the trier of the facts considers when evaluating the usefulness of the forensic economic evidence of damages presented.

4.2. Loss of Non-Market Work or Services

4.2.1. Economic and Legal Definitions of Services

As previously discussed in this chapter, service losses originate from an individual's loss of non-market productivity due to physical harm created by a tort. A tort victim has experienced service losses when physical injury has reduced the victim's productivity in performing labor-related activities in order to exist or to live a certain lifestyle. A Missouri appellate court in the case *Larose v. Washington University* (154 S.W.3d 365, (Mo. App. 2004)) pointed out the inseparability of impaired ability to perform services with the loss of earning capacity as follows:

> Defendant also claims that the award of damages for Gail's loss of ability included as future economic damage, and such damages should have been classified as noneconomic damage under Richard's loss of consortium claim instead. We disagree. As discussed above, the court in *Collier* discussed a wife's ability to recover damages for her loss of ability to perform household services. 366 S.W.2d at 500. In its discussion, the court noted that "[a]ny physical inability of a housewife to perform domestic duties must necessarily mean a physical inability to work and labor." Id. at 499. Additionally, the court acknowledged that such impairment is a compensable item of damage to the wife, and not to her husband. Id. at 500. As previously stated, the loss of ability to work has been defined as an economic damage under section 538.205. Thus, the loss of ability to perform household services, or loss of ability to work, was properly included as an economic damage, recoverable by Gail.

Such association of impairment in ability to perform services and loss of earning capacity is recognized across state and federal jurisdictions in the U.S.

The motivation to work is to acquire consumption goods—labor market work produces money income to purchase goods while service work produces actual goods to consume. For example, when the good to consume is a tidy lawn, a person can work at a job to obtain money to hire the neighbor boy to cut his lawn or the person can cut his lawn himself. Basic economic theory demonstrates that when a person performs service work that has a market price less than that person's earning capacity, in addition to the good produced the person must be receiving compensating utility value. When service activities are personal in nature, such as teaching

one's child to read, the teaching work might have a market price less than one's earning capacity; but the addition of bonding time with one's child is an inducement to perform that activity. While the value of joyful services such as family time are apparent, mundane tasks such as cleaning the house may have additional personal value, such as acquiring exercise, comfort in not having strangers around one's house, deferring income in order to take a vacation or saving to purchase some good, or strong disutility towards labor market work. Because the performance of services clearly involves enjoyment-of-life issues, the generally accepted approach to valuing economic damages associated with reduced productivity in the ability to perform services is to measure the service activity's market replacement cost.

The Kansas Supreme Court addressed the concurrency of services and enjoyment of life during family activities in the case of *Clark v. Southwestern Greyhound Lines* (144 Kan. 344 (Kan., 1936)). The *Clark* case involved the plaintiff's husband bringing an action for loss of services and companionship from his injured wife. The Court wrote:

> The position taken by plaintiff would require courts and juries to distinguish between services and companionship. That is, when a dutiful wife arose in the morning and prepared breakfast for her husband, that would be services, and the husband could not maintain an action for loss of that, but while this happy couple were eating breakfast and the wife had surrendered the morning papers and during a lull in the efforts necessary to induce the children to eat their cereal she laughed at an occasional stale joke or offered a comment on some passing news of the day, that would be companionship, and the husband could maintain an action for loss of that. Then when the time came to go to the office and the wife drove the husband to work in the family car, that would be work that might be performed by a chauffeur and would be called services, and the husband could not maintain an action for loss of it. If, however, on the way down there was gay laughter and happy conversation while this happy couple planned a picnic for the evening, that would be companionship and the husband could maintain an action for the loss of that. It seems that the mere statement of the proposition is a refutation of it. The fact is that the wife owes the duty to observe the little amenities and attentions that tend to keep the matrimonial bark riding at an even keel as much as she does the duty to look after the more material tasks of the household. By way of dicta it may be said that the husband owes the same duty. They are all services as dealt with by

> R. S. 23-205. To hold otherwise would require the installation of a time sheet in every home and devolve upon courts and juries the impossible task of deciding where services left off and companionship began. We are loath to think that the legislature intended to place upon the courts such a task.

While the law at the time of *Clark* was different than today regarding how spouses claim damages, the case points out that enjoyment of life exists with service performance. The fact that enjoyment of life is also obtained with service activity does not eliminate the obtainable damages when physical injury causes reduced capability in performing services.

4.2.2. Determining Service Value

While we often apply feelings or special care to our service activity time, pecuniary service losses are not based on emotional activity. Service losses are valued by their market cost of obtaining productivity or work commensurate with the service tasks once performed by the tort victim at his or her pre-injury productivity level. As noted earlier, economic theory holds that a plaintiff's earning capacity at a point in time (for example, at the date of injury or death) is determined by employers who know the productive abilities of the plaintiff. In order to value a tort victim's loss of services, the pre-injury work effort expended by the tort victim must be determined and then matched to the labor market wage associated with such output. In order to identify an appropriate market replacement cost of normal service work (cooking, cleaning, home maintenance, child care, etc.), the productivity applied to service work is assumed to be low when compared to skilled labor supply in the marketplace. For example, while a homeowner might occasionally nail down a loose board on his house, that task does not require the skills of a carpenter to complete. In order to minimize the anticipated general differential between service productivity level and for-hire labor, services are valued using labor market wage data for the lowest skilled workers whose jobs involve tasks related to service work (e.g., cooks, maids, childcare workers, trade helpers, etc.). Any unique aspects of the tort victim's

ability to perform service activities is presented to the trier of the facts through evidence from persons who know those the talents of the tort victim.

4.2.3. Inventorying Lost Service Time

The most common methods used to inventory lost services are through "direct questions" and "time-diaries". In the direct question approach, a common service activity such as cooking is suggested by the interviewer, and the tort victim forms a recollection and determination of the total weekly time was devoted to cooking before the injury and how much time is now spent cooking after the injury. Claimed lost service time includes such activities as housework, food cooking and clean-up, taking care of pets, maintaining home and vehicles, household financial management, shopping, travel for household activities, and caring for or helping household members. The time-diary approach requires respondents to record in time sequence their usual daily services activities during a week, often splitting the week into weekdays and weekends. From the responses, service related tasks are separated from other time use. Studies that compare time-diary to direct-question data find that direct questions typically produce higher time estimates than time-diary questions, especially for activities that occur frequently. For activities that occur infrequently, direct questions produce lower time estimates, possibly because a longer period of recall is required.

An alternative approach to discovering service losses is for tort victims to rate themselves in terms of efficiency and/or output of service effort before and after the injury. Case-specific medical evidence might also be used to determine or verify the loss of productivity rating. To quantify service losses, survey data regarding hours-of-service performance of people not involved in litigation is applied to the reduced productivity rating supplied by the tort victim or presented as evidence regarding the victim's functional capacities.

The amount of services provided is a function of the situation of the individual at the particular point in time. Some aspects of the individual's situation may change in the future, and the changes may alter the amount of services provided by him or her. For example, the amount of services provided is a function of the existence of children in the household, the age of the children, and the employment status of the individual. Changes in these parameters will likely change the amount of services provided. In order to estimate the multi-year value of services provided, economists utilize models that estimate the changes in the services provided when the situation of the particular individual changes. The models are derived from data showing how services provided change with children aging, with children leaving the household, and with retirement. It is necessary to take these changes into account to accurately estimate the amount of services that would have been provided.

4.2.4. General Economic Parameters of Service Losses

Many variables that are beyond the scope of the economist using the general approach to service losses will affect the value of the services that an individual will supply. A relative wage change in the sectors that provide the household services would affect the estimations in different ways. The hours individuals devote to household activities may change due to relative wage changes between the individual's wages and the wages of those who provide the services. The relative wage change would also likely affect the value of a unit of services provided. As in earning capacity forecasts, the probability of survival and maintained productivity affects the future value of services provided. Again, these variables are assumed to be cohort-determined at the point in time. Furthermore, absent an expected structural shift, simple extrapolations are used by the economist to determine service losses.

4.3. Future Medical Costs

Instead of focusing only on monetary compensation for the loss of enjoyment of life, special damages related to medical items or services can work towards restoring some of the pre-injury productivity of the plaintiff. Medical experts present testimony on the cost of medical, psychological, and supportive care, medicines, and equipment which would increase the post-injury productive capabilities of the plaintiff to work or to enjoy leisure. To a degree, these special damages offset some general damages. For example, a surgery which costs $30,000 might alleviate some pain so the $30,000 medical cost works towards reducing general damages for suffering pain. Economists do not opine on the set of medically-related goods that might work towards restoring the pre-injury productivity of the plaintiff. However, economists do testify as to the present value of such future life care costs (where lifetime costs in today's dollars are specified by medical evidence).

4.4. Loss of Financial Support

4.4.1. Economic and Legal Definitions of Loss of Financial Support

Survivors' claims for the loss of financial support derive from the expected living expenses, gifts, and bequests that would have been provided to them by the decedent but for the wrongful death. The objective of the wrongful death loss computation is to calculate the present value dollar amount that, with investment, will enable the survivors to replace their economic losses incurred due to the wrongful death of their benefactor.

Within U.S. state law, wrongful death damages are usually specified by statute, and they are often referred to as the sum of lost support and lost net accumulations. For example, the Florida wrongful death statute 768.21 (5) (a) calls for damages regarding the

> (l)oss of earnings of the deceased from the date of injury to the date of death, less lost support of survivors excluding contributions in kind, with interest. Loss of the prospective net accumulations of an estate, which might reasonably have been

expected but for the wrongful death, reduced to present money value, may also be recovered.

Lost support can be referred to as the present value of the expected routine payments of living expenses and gifts to the survivor by the decedent, and lost net accumulations represent the present value of what the decedent's estate would have been worth to the survivor at the time of normal death less the value of the estate at the time of death.

4.4.2. Economic Calculation of Loss of Financial Support

The methodology for the economic calculation of the loss of financial support is presented by Krueger and Albrecht (2007) beginning with a person having three assets during the time that he is living: (1) stored wealth, (2) earning capacity, and (3) the monetary value of expected gifts to be provided to him or her before death. During the person's expected lifetime, he might have provided routine annual support to legal heirs, and upon the person's death the legal heirs might have inherited some portion of the person's stored wealth. Wrongful death damages of the loss of financial support are related to the loss of expected annual financial support and inheritance due to a premature death. The calculation of the loss of financial support (including potential net estate accumulations) can be reduced to a calculation of the decedent's expected lifetime earnings less his or her own personal consumption of those earnings. See Krueger and Albrecht (2007) for the mathematics of this method.

4.5. Discounting to Present Value

After a forensic economist estimates an expected multi-period loss according to the U.S. approach, the expected future stream earnings must be reduced to a present-value lump sum. Present-value lump sum payments must comply with two legal requirements: (1) the plaintiff's damages must be paid in full, and (2) the defendant must be equitably treated because the plaintiff will be able to receive a secondary stream of investment income from that portion of the

lump sum that is not needed to compensate for current losses. Generally accepted economic theory anticipates the rewards and risks of investing lump sums that allow for reliable present value calculations. Below we address the generally accepted methods regarding the discounting procedure to account for the time value of money and investment risk.

4.5.1. Discounting Formula

The formula used to calculate the amount required today, the present value, in order to compensate for an amount that would have been received in the future, the future value, is $PV = FV\left[\frac{1}{(1+i)^t}\right]$, where PV = the present value, FV = the future amount to be received in period t, i = the interest rate, per time period, used for discounting, and t = the number of time periods in the future until FV would be received. The term in the brackets is often referred to as the discount factor, and the interest rate, i, is often referred to as the discount rate. If there are several periods in the future where an amount would have been received, the formula is written as $PV = \sum_{t=1}^{n} FV_t\left[\frac{1}{(1+i)^t}\right]$, where FV_t = the future amount to be received in period t. The amount of future value, FV_t, is not necessarily the same amount at every period t. Likewise, it is not necessary that the interest rate, i, be the same for every time period t.

4.5.2. Risk Associated with Receiving the Future Value

One factor that affects the choice of the appropriate discount rate is the known probability (or risk) that is associated with receiving the future amount. The greater the probability that the future amount would have been received, the greater is the present value of the amount. Assume that an amount FV will be received with certainty in one year. Moreover, further assume that the appropriate risk-free discount rate has been determined to be i percent so that the present value is

$PV = FV\left[\frac{1}{(1+i)}\right]$. Now assume that the amount *FV* will be received with the probability of η_{FV} where $0 \leq \eta_{FV} \leq 1$ so that the expected amount received is defined by $E(FV) = FV \times \eta_{FV}$. With the existence of risk, it is not appropriate to calculate the present value of *FV* by using the risk-free discount rate of *i* and amount *FV*. There are two equivalent methods of calculating the present value of *FV* when *FV* will be received with a probability of less than one. The first method uses the discount rate *i* with the expected future value *E*(*FV*), so that the present value is $PV = E(FV)\left[\frac{1}{(1+i)}\right]$. The second method uses a discount rate that incorporates the probability of receiving the amount. The discount rate that incorporates the probability of receiving the amount FV is represented as, i_p, where $i_p = \left[\frac{(1+i)}{\eta_{FV}}\right] - 1$, then $PV = FV\left[\frac{1}{(1+i_p)}\right]$. There are situations when *E*(*FV*) and i_p are each present in the discounting problem. When *E*(*FV*) and i_p are independent of each other and can be separately estimated, it is appropriate to use both of their values in the discounting equation. When using both *E*(*FV*) and i_p in the discounting problem, the economist must articulate their independence and separable estimation; otherwise risk will be doubly-counted in the resulting present value amount and the plaintiff is under-compensated for his or her losses. In summary, if there is risk concerning the receipt of the future amount, the risk must be accounted for or else the plaintiff will be overcompensated. The risk can be accounted for either by adjusting the amount to be received to the expected amount or by adjusting the discount rate to reflect the risk (or both when independent risks exist).

4.5.3. Inflation and the Discount Rate

Amounts to be received in the future may be affected by price inflation. To show how inflation affects the choice of the discount rate, we begin with the explanation of the difference

between a nominal discount rate and a real discount rate. The nominal interest rate is the observable market rate. According to the Fisher[10] equation, the nominal interest rate is a function of the real interest rate and the expected rate of inflation. For discrete growth rates, the function is $i = i_r + f + i_r f$, where i is the nominal interest rate, i_r is the real interest rate, and f is the expected rate of inflation. When discounting a future amount that changes according to the rate of inflation, the future amount can be inflated by the expected rate of inflation and then discounted by i. Conversely, the future amount, absent the expected inflation increase, can be discounted by i_r.

5 AMERICAN TORT DAMAGES MODELS

So far in this chapter, the legal and economic foundations of the U.S. approach have been presented. Using a series of tables, this next section presents the U.S. approach as a set of broad analytical steps that are used in every generally accepted scientific analysis of economic damages in the areas of: loss of lifetime earning capacity (Table 1); loss of lifetime earnings (Table 2); loss of financial support (Table 3); loss of lifetime ability to perform services (Table 4); and the present value of future medical expenses (Table 5). Each of the procedural steps in the tables draws upon the economic methodologies presented in the previous sections of this chapter.

Table 1. U.S. Approach for Estimating Lifetime Expected Earning Capacity

Step 1: Determine the Base Value of Earning Capacity The base value is the beginning year or age value of earning capacity measured by (1) the individual's earnings, wage, and benefits history, or (2) matching the individual's demonstrated levels of innate ability and human capital to empirical labor market data, or (3) deferring to the expertise of a vocational specialist.
Step 2. Forecast Changes in Earning Capacity Due to Individual Changes Apply an age-earnings profile to measure the changes from the base value of earning capacity due to changes in the individual's innate abilities and human capital. The age-earnings profile is calculated by matching characteristics relevant to the individual's innate ability and human capital to a cross-section of age-earnings experiences of similarly situated people as measured by empirical labor market data.
Step 3. Forecast Changes in Earning Capacity Due to Changes in Market Conditions The individual's earning capacity changes (at a minimum) from the base period dollar level with (1) inflation, and (2) increases in labor productivity due to technology. The evaluator either estimates expected future price inflation based on market expectations or ignores growth due to price inflation and discounts earnings capacity to present value using an inflation-free discount rate. The evaluator often estimates productivity by observing secular changes in the real earnings (earnings growth absent expected general price inflation) paid by employers to workers performing specific tasks.
Step 4. Additional Consideration of Benefits Earning capacity is the sum of wages and the value of employer provided benefits. The percentage mix of wages and the value of benefits summing to total compensation can differ after the base period. Also, the economic value of benefits may not be realized at the time they are earned; and the expected rate of change in wages and the value of benefits may differ due to market reasons. As a result of these expectations, the evaluator may sometimes estimate only wages under steps one through three and then estimate the value of employer-provided benefits separately as step four.
Step 5. Possible Consideration of Income Taxes In some situations, an after-tax estimate of earning capacity is required. Annual expected income taxes are estimated in step five based on the earning capacity estimates determined in steps one to three.
Step 6. Hazards Preventing the Individual from Realizing Earning Capacity After the base period, there is a non-zero expectation that an individual would be prevented from obtaining his or her earning capacity due to a variety of involuntary factors including death, the onset of disability that precludes work, and lack of access to employers (e.g., unemployment or discouragement). The evaluator estimates the probability of these hazards to the individual using cross-sectional observations of mortality, morbidity, and labor market experiences of similarly situated persons.
Step 7. Determining the Boundary Age of Reliable Estimation Steps two and six are estimated from cross-sectional observations of persons in similar situations to that of the individual. When making economic calculations, the evaluator must consider the reliability of the application of the information contained within his or her samples of population data to the individual studied. While the detail in sampling and statistical estimation is subject to debate and variation, reasonable conformity to the individual is required for all statistical studies. As such, the evaluator must determine a reasonably conforming final earning capacity age level to apply to his or her estimates of an individual's expected earning capacity in order for the estimates to remain reliable.
Step 8. Discounting to Present Value The completion of steps one to seven produces a multi-period stream of expected, or risk-adjusted, earning capacity. The last step is to reduce that multi-period stream of expected earning capacity to a present-value lump sum. Since risks related to earning capacity are recognized in previous steps, expected lifetime earning capacity is generally discounted to present value using a risk-free rate associated with the currently available yields of United States Treasury securities. However, in some situations there may be justifiable risks not accounted for in steps one to seven that require increasing the discount rate above the risk-free rate. In those cases, the economic rationale of such a rate increase must be grounded in the analysis in steps one to seven. If income taxes are considered as a part of step 5, the present value calculation must also consider any income taxes on investment return.

Table 2. U.S. Approach for Estimating Lifetime Expected Earnings

Step 1: Base Earnings Determination Earnings, consisting of wages and value of employer paid benefits, are the money results of the individual's choice, in some part, to utilize his or her earning capacity in the labor market. The evaluator measures the base value of earnings in a similar manner as the base value of earning capacity shown in Table 1 (Earning Capacity).
Step 2. Forecast Changes in Earnings Due to Individual Changes At each age beyond the base value, assuming the continuance of the individual's base choice to utilize his or her earning capacity in the labor market (see step 6), the age-earnings profile measures the change from the base value of earnings due to changes in the individual's innate abilities and human capital. The age-earnings profile is similar to that as in Step 2 of Table 1 (Earning Capacity).
Step 3. Changes in Earnings Due to Changes in Market Conditions The individual's earnings will change for the same market reasons as in Step 3 of Table 1 (Earning Capacity).
Step 4. Additional Consideration of Benefits Benefits may also be considered in a separate step as in Step 4 of Table 1 (Earning Capacity).
Step 5. Possible Consideration of Income Taxes Income taxes are calculated as in Step 5 of Table 1 (Earning Capacity).
Step 6. Hazards Preventing the Individual from having Earnings After the base period, there is a non-zero expectation that an individual would not have earnings due to a variety of voluntary and involuntary factors including the choice to work, death, the onset of disability that prevents work, and lack of access to employers (e.g., unemployment or discouragement). The evaluator estimates the probability of these hazards to the individual using cross-sectional observations of decision to work, mortality, morbidity, and labor market experiences of similarly situated persons to the individual.
Step 7. Determining the Boundary Age of Reliable Estimation As in Step 7 of the Table 1 (Earning Capacity), the evaluator must determine a reasonably conforming final earnings age level to his or her estimates of an individual's expected earnings in order for the estimates to remain reliable. The boundary age is influenced by the age beyond which cross sectional information from the population has high error rates due to the combined effects of (a) high risks of mortality and morbidity, (b) the small size of the population that works from which to draw earnings experience data, and (c) the large variations in the earnings and labor supply of the elderly.
Step 8. Discounting to Present Value Discounting to present value is accomplished as in Step 8 of Table 1 (Earning Capacity).

Table 3. U.S. Approach for Estimating Loss of Financial Support

Step 1: Determine the Discounted Value of Earnings The evaluator measures the base value of financial support as in the base value of earnings as shown in steps 1 to 8 in Table 2 (Earnings). Not all employment benefits may be available to survivors.
Step 2. Optional—Estimate Retirement Income Derived from Employment In situations where the decedent's retirement income is relevant as a loss to survivors, the evaluator measures the present value of the retirement income received as a benefit of employment in the same manner as he or she would in steps 1 to 8 in Table 2 (Earnings).
Step 3. Subtract from Earnings (and Optionally Retirement Income) the Present Value of the Decedent's Personal Consumption The evaluator measures personal consumption as the amount of money that the decedent would have used for his or her own exclusive benefit had death not occurred. Personal consumption is often either measured as a percentage of the present value of earnings or measured in detail as in steps 1 to 8 from Table 2 (Earnings).

Table 4. U.S. Approach for Estimating Lifetime Services

Step 1: Base Annual Service Value Determination The base value of services is the beginning point for quantifying the lifetime value of services. The evaluator estimates the base value of services by first (1) using the amount of the individual's pre-event service production, or (2) matching the individual's current status to empirical data reflecting the service production of similarly situated individuals. Generally, the amount of production is measured by time units devoted to various tasks. The amount of production is then valued by placing a value on the time units or by estimating the cost of having the tasks performed. The value of time may be obtained by using occupational wage data. For example, the wage rate of a maid may be used to value the time devoted to cleaning.
Step 2. Forecast Changes in Earnings Due to Individual Changes For each age beyond base year, the individual's situation in terms of his or her individual and household situation is forecasted. The evaluator takes into account variables such as the aging of children in the household, the status of the spouse, and the labor force status of the individual in question. The changes in the household make-up and labor force status are matched to characteristics of similarly situated individual using cross-sectional data. The changes in the value of services supplied by the particular individual are generally denominated in the dollar level associated with base value of services provided.
Step 3. Changes in Earnings Due to Changes in Market Conditions The replacement cost of services will change for the same market reasons as in Step 3 of Table 1 (Earning Capacity).
Step 4. Additional Consideration of Benefits The cost of benefits of employing workers to replace service losses may also be considered in a separate step as in Step 4 of Table 1 (Earning Capacity).
Step 5. Hazards Preventing the Individual from Producing Services After the base period, there is a non-zero expectation that an individual would have been prevented from producing services. For example, the onset of reduced productivity with age that would have prevented the production of services or death must be accounted for. The evaluator estimates the probability of these hazards to the individual using cross-sectional observations of mortality and morbidity. The probability is then used to obtain the expected value.
Step 6. Determining the Boundary Age of Reliable Estimation As in Step 7 of Table 1 (Earning Capacity), the evaluator must determine the boundary age to his or her estimates of an individual's expected service performance in order for the estimates to remain reliable. The boundary age is relevant to the same factors as earnings and earning capacity.
Step 7. Discounting to Present Value Discounting to present value is accomplished as in Step 8 of Table 1 (Earning Capacity).

Table 5. U.S. Approach for Estimating the Present Value of Future Medical Costs

Step 1: Timing Medical Costs to the Future Periods When Consumed Future medical costs are generally supplied to the economic evaluator as current dollar amounts per future time period. The economic evaluator first schedules current dollar life care needs to each future period as they are to be consumed.
Step 2. Changes in Current Medical Costs Due to Changes in Market Conditions Medical costs will change from their current cost to each future consumption date for the same market reasons as in Step 3 of Table 1 (Earning Capacity). Instead of wage data, the evaluator studies changes in price data related to the medical need.
Step 3. Mortality Hazard After the base period, there is a non-zero expectation that an individual would not survive in order to consume the life care need. The evaluator estimates the expected cost of future medical needs by applying a mortality hazard calculated from data regarding similarly situated individuals as the injured person.
Step 4. Discounting to Present Value Discounting to present value is accomplished as in Step 8 of Table 1 (Earning Capacity).

6. A SAMPLE PERSONAL INJURY CASE

In this section, a sample personal injury case is presented in order to operate the U.S. approach to estimating personal injury tort damages of lost earning capacity and services. Assume an injured married male, Mr. Smith, age 30, with two children ages 8 and 14. Mr. Smith completed a college degree in the field of business, and he has worked for the past seven years at a medical services corporation. His current job title is Manager of Procurement. His total compensation package is worth $75,000 per year. The injury permanently prevents Mr. Smith from being able to be employed in the competitive labor marketplace. He has also lost some of his ability to perform household work services for his and his family's benefit. Sample chosen parameters for each step of the U.S. approach of lifetime expected earning capacity are shown in Table 6 with the calculations shown in Table 7. Service parameters are contained in Table 8 with the calculations shown in Table 9.

Table 6. Mr. Smith's Parameters for Computing Lifetime Expected Earning Capacity

Step 1: Determine the Base Value of Earning Capacity The base value earning capacity is set to $75,000.
Step 2. Forecast Changes in Earning Capacity Due to Individual Changes An age-earnings profile is calculated based upon the mean earnings of male managers in the U.S. medical care services industry.
Step 3. Forecast Changes in Earning Capacity Due to Changes in Market Conditions Price inflation is ignored at this step and a mid-year 1% growth in earning capacity per year is applied.
Step 4. Additional Consideration of Benefits Since benefits are included in total compensation, they are not separately computed.
Step 5. Possible Consideration of Income Taxes The jurisdiction of the litigation case forbids the introduction of evidence of income taxes.
Step 6. Hazards Preventing the Individual from Realizing Earning Capacity A hazard is computed reflecting involuntary factors including death, the onset of disability that prevents work, and lack of access to employers (e.g., unemployment or discouragement). The data selected to compute the hazard are from males that have completed a 4-year college degree.
Step 7. Determining the Boundary Age of Reliable Estimation The calculation of earning capacity is presented to age 67, the age Mr. Smith would be qualified to receive his full Social Security benefits.
Step 8. Discounting to Present Value A mid-year 2.5% real, inflation-free discount rate is chosen to compute present value.

Table 7. Mr. Smith's Present Value of Lost Earning Capacity

Age	*Step 1* Base earning capacity	*Step 2* Age-earnings profile	*Step 3* Market growth	*Step 6* Mortality	*Step 6* Risk of being unable to work	*Step 8* Present value factor	Present value of expected earning capacity
30	$75,000	1.00000	1.00499	0.99939	0.98513	0.98773	$73,298
31	$75,000	1.04945	1.01504	0.99812	0.96650	0.96364	$74,269
32	$75,000	1.09709	1.02519	0.99683	0.96269	0.94014	$76,104
33	$75,000	1.14291	1.03544	0.99549	0.96312	0.91721	$78,052
34	$75,000	1.18691	1.04579	0.99407	0.96824	0.89483	$80,180
35	$75,000	1.22909	1.05625	0.99255	0.97333	0.87301	$82,120
36	$75,000	1.26946	1.06681	0.99094	0.97523	0.85172	$83,603
37	$75,000	1.30802	1.07748	0.98919	0.97557	0.83094	$84,761
38	$75,000	1.34475	1.08826	0.98729	0.97487	0.81068	$85,639
39	$75,000	1.37967	1.09914	0.98522	0.97195	0.79090	$86,137
40	$75,000	1.41277	1.11013	0.98297	0.96548	0.77161	$86,137
41	$75,000	1.44406	1.12123	0.98055	0.96133	0.75279	$86,171
42	$75,000	1.47353	1.13245	0.97792	0.95978	0.73443	$86,271
43	$75,000	1.50118	1.14377	0.97508	0.95912	0.71652	$86,293
44	$75,000	1.52702	1.15521	0.97198	0.95771	0.69904	$86,092
45	$75,000	1.55104	1.16676	0.96863	0.95478	0.68199	$85,606
46	$75,000	1.57324	1.17843	0.96498	0.95708	0.66536	$85,443
47	$75,000	1.59362	1.19021	0.96105	0.96003	0.64913	$85,199
48	$75,000	1.61219	1.20211	0.95680	0.95796	0.63330	$84,372
49	$75,000	1.62895	1.21413	0.95223	0.95394	0.61785	$83,250
50	$75,000	1.64388	1.22628	0.94728	0.94896	0.60278	$81,923
51	$75,000	1.65700	1.23854	0.94197	0.94504	0.58808	$80,578
52	$75,000	1.66831	1.25092	0.93627	0.94129	0.57374	$79,141
53	$75,000	1.67779	1.26343	0.93022	0.93896	0.55974	$77,727
54	$75,000	1.68546	1.27607	0.92379	0.93293	0.54609	$75,918
55	$75,000	1.69131	1.28883	0.91703	0.92874	0.53277	$74,182
56	$75,000	1.69535	1.30172	0.90987	0.93035	0.51978	$72,825
57	$75,000	1.69757	1.31473	0.90229	0.93229	0.50710	$71,404
58	$75,000	1.69797	1.32788	0.89410	0.93212	0.49473	$69,723
59	$75,000	1.69656	1.34116	0.88523	0.92575	0.48267	$67,500
60	$75,000	1.69333	1.35457	0.87553	0.92402	0.47089	$65,536
61	$75,000	1.68828	1.36812	0.86500	0.93106	0.45941	$64,094
62	$75,000	1.68142	1.38180	0.85352	0.94298	0.44820	$62,860
63	$75,000	1.67274	1.39562	0.84119	0.94601	0.43727	$60,925
64	$75,000	1.66224	1.40957	0.82808	0.94374	0.42661	$58,586
65	$75,000	1.64993	1.42367	0.81419	0.94985	0.41620	$56,705
66	$75,000	1.63580	1.43790	0.79932	0.95600	0.40605	$54,737
							$2,833,359

Table 8. Mr. Smith's Parameters for Computing Lifetime Expected Services

Step 1: Base Annual Service Value Determination A review of Mr. Smith's service performance before and after injury reveals 15 lost weekly hours of services. Replacement costs are estimated, including legally required benefits, to be $13.00 per hour.
Step 2. Forecast Changes in Earnings Due to Individual Changes Based upon empirical data on married males that work full-time with and without children in the home, when the youngest daughter is age 13 to 17, services are increased by 20%; and when the youngest daughter turns 18 years old, service losses are decreased by 25%. At retirement age, service losses are increased by 25%.
Step 3. Changes in Service Costs Due to Changes in Market Conditions Price inflation is ignored at this step and a mid-year 0.7% growth in service cost per year is applied.
Step 4. Additional Consideration of Benefits Ignored since legally required benefits are included in step 1.
Step 5. Hazards Preventing the Individual from Producing Services A combination mortality/morbidity hazard is applied based upon morbidity statistics regarding functional capacity.
Step 6. Determining the Boundary Age of Reliable Estimation While his life expectancy is age 80, service losses for Mr. Smith are computed to age 75.
Step 7. Discounting to Present Value A mid-year 2% real, inflation-free discount rate is chosen to compute present value.

Table 9. Mr. Smith's Present Value of Expected Lost Services

	Steps 1 & 2		*Step 3*	*Step 5*	*Step 7*	
Age at end of year	Weekly service hours	Replacement cost of services	Market growth	Mortality and morbidity	Present value factor	Present value of expected service losses
30	15.00	$13.00	1.00349	0.99857	0.99015	$10,061
31	15.00	$13.00	1.01052	0.99557	0.97073	$9,903
32	15.00	$13.00	1.01759	0.99238	0.95170	$9,745
33	15.00	$13.00	1.02472	0.98896	0.93304	$9,588
34	15.00	$13.00	1.03189	0.98527	0.91474	$9,430
35	18.00	$13.00	1.03911	0.98134	0.89681	$11,128
36	18.00	$13.00	1.04639	0.97712	0.87922	$10,938
37	18.00	$13.00	1.05371	0.97263	0.86198	$10,749
38	18.00	$13.00	1.06109	0.96782	0.84508	$10,560
39	18.00	$13.00	1.06851	0.96271	0.82851	$10,370
40	11.25	$13.00	1.07599	0.95729	0.81227	$6,363
41	11.25	$13.00	1.08352	0.95159	0.79634	$6,244
42	11.25	$13.00	1.09111	0.94556	0.78072	$6,126
43	11.25	$13.00	1.09875	0.93921	0.76542	$6,007
44	11.25	$13.00	1.10644	0.93254	0.75041	$5,888
45	11.25	$13.00	1.11418	0.92554	0.73569	$5,770
46	11.25	$13.00	1.12198	0.91817	0.72127	$5,651
47	11.25	$13.00	1.12984	0.91048	0.70713	$5,532
48	11.25	$13.00	1.13775	0.90244	0.69326	$5,413
49	11.25	$13.00	1.14571	0.89407	0.67967	$5,295
50	11.25	$13.00	1.15373	0.88530	0.66634	$5,176
51	11.25	$13.00	1.16181	0.87618	0.65328	$5,057
52	11.25	$13.00	1.16994	0.86671	0.64047	$4,939
53	11.25	$13.00	1.17813	0.85694	0.62791	$4,821
54	11.25	$13.00	1.18638	0.84681	0.61560	$4,703
55	11.25	$13.00	1.19468	0.83640	0.60353	$4,586
56	11.25	$13.00	1.20304	0.82565	0.59169	$4,470
57	11.25	$13.00	1.21146	0.81453	0.58009	$4,353
58	11.25	$13.00	1.21994	0.80287	0.56872	$4,236
59	11.25	$13.00	1.22848	0.79065	0.55756	$4,119
60	11.25	$13.00	1.23708	0.77776	0.54663	$4,000
61	11.25	$13.00	1.24574	0.76417	0.53591	$3,880
62	11.25	$13.00	1.25446	0.74979	0.52541	$3,758
63	11.25	$13.00	1.26324	0.73477	0.51510	$3,636
64	11.25	$13.00	1.27209	0.71911	0.50500	$3,513
65	11.25	$13.00	1.28099	0.70283	0.49510	$3,390
66	11.25	$13.00	1.28996	0.68571	0.48539	$3,265
67	18.75	$13.00	1.29899	0.66782	0.47588	$5,232
68	18.75	$13.00	1.30808	0.64904	0.46654	$5,021
69	18.75	$13.00	1.31724	0.62942	0.45740	$4,807
70	18.75	$13.00	1.32646	0.60879	0.44843	$4,590
71	18.75	$13.00	1.33574	0.58732	0.43964	$4,372
72	18.75	$13.00	1.34509	0.56486	0.43102	$4,151
73	18.75	$13.00	1.35451	0.54139	0.42256	$3,928
74	18.75	$13.00	1.36399	0.51670	0.41428	$3,701
						$268,464

7. CONCLUSION

This chapter has presented a examination of the scientific approach taken in the United States to compute the economic damages due to the torts of personal injury and wrongful death. The general law on tort damages presented reveals that U.S. tort damages include a damages component which directly corresponds to the economic science of studying the impact of reduced productivity on lifetime-obtainable goods and services. While we have noted a few instances of jurisdictional law which causes economic damages to deviate from a general economic result, those jurisdictional adjustments do not override the core economic compensating mechanisms of the U.S. approach to tort damages. With a strict adherence to appropriate economic compensation, the U.S. approach to tort damages corresponds with efficient tort solutions where harm is minimized when all economic consequences are included in the monies paid by the tortfeasor to his or her victim.

References and Bibliography by Subject Area

LAW AND ECONOMICS RELATED TO TORT DAMAGES

Arlen, Jennifer (1990), "Reconsidering Efficient Tort Rules for Personal Injury: The Case of Single Activity Accidents," 32 *William and Mary Law Review*, 41-103.

Arlen, Jennifer (1992), "Liability Rules for Physical Injury when Injurers as well as Victims Suffer Losses," 8 *Journal of Law, Economics and Organization*, 411-426.

Arrow, Kenneth (1971), "Insurance, Risk, and Resource Allocation," in *Essays in the Theory of Risk-Bearing*, Chicago, IL, Markham.

Arthur, W.B. (1981), "The Economics of Risks to Life," 71 *American Economic Review*, 54-64.

Bishop, William and Sutton, John (1986), "Efficiency and Justice in Tort Damages: The Shortcomings of the Pecuniary Loss Rule," 15 *Journal of Legal Studies*, 347-370.

Brown, John P. (1973), "Toward an Economic Theory of Liability," 2 *Journal of Legal Studies*, 323-350.

Choi, Albert and Sanchirico, Chris W. (2004), "Should Plaintiffs Win What Defendants Lose? Litigation Stakes, Litigation Effort, and the Benefits of Decoupling," 33 *Journal of Legal Studies*, p. 323-354.

Conley, Brian C. (1976), "The Value of Life in the Demand for Safety," 66 *American Economic Review*, 45-65.

Cooter, Robert D. (1982), "Economic Analysis of Punitive Damages," 56 *Southern California Law Review*, 79-101.

Cooter, Robert D. (1989), "Towards a Market in Unmatured Tort Claims," 75 *Virginia Law Review*, 383-412.

Cooter, Robert D. (1989), "Punitive Damages for Deterrence: When and How Much?" 40 *Alabama Law Review*, 1143 ff.

Cooter, Robert D. and Porat, Ariel (2006), "Liability Externalities and Mandatory Choices: Should Doctors Pay Less?" 1 *Journal of Tort Law*, Issue 1, Article 2.

Kaplow, Louis and Shavell, Steven (1996), "Accuracy in the Assessment of Damages," 39 *Journal of Law and Economics*, 191-210.

Karpoff, Jonathan M. and Lott, John R. Jr. (1999), "On the Determinants and Importance of Punitive Damage Awards," 42 *Journal of Law and Economics*, 527-573.

Komesar, Neil K. (1974), "Toward a General Theory of Personal Injury Loss," 3 *Journal of Legal Studies*, 457-486.

Landes, William and Posner, Richard (1980), "Joint and Multiple Torts: An Economic Analysis," 9 *International Review of Law and Economics*, 517-556.

Landes, William and Posner, Richard (1981), "An Economic Theory of Intentional Torts," 1 *International Review of Law and Economics*, 127-154.

Landes, William and Posner, Richard (1984), "Tort Law as a Regulatory Regime for Catastrophic Personal Injuries," 13 *Journal of Legal Studies*, 417-434.

Landes, William M., and Posner, Richard A. (1987), *The Economic Structure of Tort Law*, Cambridge, MA, Harvard University Press.

Polinsky, A. Mitchell and Rubinfeld, Daniel (1996), "Optimal Awards and Penalties When the Probability of Prevailing Varies among Plaintiffs," 27 *RAND Journal of Economics*, 269-280.

Polinsky, A. Mitchell and Shavell, Steven (1994), "Should Liability be Based on the Harm to the Victim or the Gain to the Injurer," 10 *Journal of Law, Economics, and Organization*, 427-437.

Polinsky, A. Mitchell and Shavell, Steven (1998), "Punitive Damages: An Economic Analysis," 111 *Harvard Law Review*, 869-962.

Posner, Richard A. (1972), "A Theory of Negligence," 1 *Journal of Legal Studies*, 29-96.

Posner, Richard A. (2003), *Economic Analysis of Law*, 6th Edition, New York, NY, Aspen Publishers.

Rizzo, Mario (1982), "A Theory of Economic Loss in the Law of Torts," 11 *Journal of Legal Studies*, 281-310.

Schwartz, Gary (1986), "Economic Loss in American Tort Law: The Examples of J Aire and of Products Liability," 23 *San Diego Law Review*, 37-78.

Shavell, Steven (1979), "On Moral Hazard and Insurance," 93 *Quarterly Journal of Economics*, 541-562.

Shavell, Steven (1980), "Strict Liability Versus Negligence," 9 *Journal of Legal Studies*, 463-516.

Shavell, Steven (1987), *Economic Analysis of Accident Law*, Cambridge, MA, Harvard University Press.

Van Wijck, Peter and Winters, Jan Kees (2001), "The Principle of Full Compensation in Tort Law," 11(3) *European Journal of Law and Economics*, 319-332.

GENERAL ECONOMIC METHODS RELEVANT TO FORENSIC ECONOMICS

Akerlof, George A. and J. Yellen (1986). *Efficiency Wage Models of the Labor Market*. Cambridge University Press: Cambridge.

Becker, Gary (1993). *Human Capital, A Theoretical and Empirical Analysis with Special Reference to Education*, 3rd Ed. Chicago: University of Chicago Press.

Benninga, Simon and Aris Protopapadakis (1983). "Real and Nominal Interest Rates under Uncertainty: The Fisher Problem and the Term Structure." *Journal of Political Economy* 91: 856–67.

Ben-Porath, Y. (1967). "The Production of Human Capital and the Life Cycle of Earnings." *Journal of Political Economy* 75:352-65.

Cameron, S., and J. Heckman (1998). "Life Cycle Schooling and Dynamic Selection Bias: Models and Evidence for Five Cohorts of American Males." *Journal of Political Economy* 106(2): 262-333.

Cox, John C., Jonathan E. Ingersoll, and Stephen A. Ross (1985). "An Intertemporal General Equilibrium Model of Asset Prices." *Econometrica* 53: 385-408.

Duesenberry, James (1952). *Income, Saving, and the Theory of Consumer Behavior*. Cambridge, MA: Harvard U. Press.

Dupont, Dominique and Brian Sack (1999). "The Treasury Securities Market: Overview and Recent Developments." *Federal Reserve Bulletin* 85: 785-806.

Evans, Martin D.D. (1998). "Real Rates, Expected Inflation, and Inflation Risk Premia." *Journal of Finance* 53: 187-218.

Fama Eugene F. and Michael R .Gibbons (1982). "Inflation, Real Returns, and Capital Investments." *Journal of Monetary Economics* 9: 297-232.

Fama, E and K. French (1993). "Common Risk Factors in the Returns on Stocks and Bonds." *Journal of Financial Economics* 33: 3-56.

Fama, E. and K. French (1995). "Size and Book-to-Market Factors in Earnings and Returns." *Journal of Finance* 50: 131-155.

Fama, Eugene F. (1975). "Short-Term Interest Rates as Predictors of Inflation." *American Economic Review* 65:269-82.

Fama, Eugene F. (1976). "Inflation, Uncertainty and the Expected Returns on Treasury Bills." *Journal of Political Economy* 84: 427-448.

Fama, Eugene F. (1990). "Term Structure Forecasts of Interest Rates, Inflation, and Real Returns." *Journal of Monetary Economics 25:* 59–76.

Fama, Eugene F. (1996). "Discounting under Uncertainty" *Journal of Business* 69: 415-428.

Feldstein, Martin. 1976. "Inflation, Income Taxes, and the Rate of Interest: A Theoretical Analysis." *American Economic Review* 66: 809-820.

Fishburn, Peter C. and Ariel Rubinstein. (1982). "Time Preference." *Int. Econ. Rev.* 23(2): 677–694.

Fisher, Irving (1930). *The Theory of Interest*. NY: Macmillan.

Fisher, Franklin and Romaine, R. Craig (1990), "Janis Joplin"s Yearbook and the Theory of Damages", *Journal of Accounting, Auditing and Finance,* 145-157.

Freeman, Richard (1979). "The Effect of Demographic Factors on Age-Earnings Profiles." *Journal of Human Resources* 14: 289-318.

Gali, Jordi (1992). "Keeping Up with the Joneses: Consumption Externalities, Portfolio Choice, and Asset Price." *Journal of Money, Credit, and Banking* 26: 1-8.

Harris, M., and B. Holmstrom (1982). "A Theory of Wage Dynamics." *Review of Economic Studie*s, 49: 315-33.

Heckman, J. (1976). "A Life-Cycle Model of Earnings, Learning and Consumption." *Journal of Political Economy*, 84(4): 11-44.

Heckman, J. and S. Polachek (1974). "Empirical Evidence on the Functional Form of the Earnings-Schooling Relationship." *Journal of the American Statistical Association* 69:350-354.

Heckman, J., L. Lochner, and C. Taber (1998). "Explaining Wage Inequality: Explorations with a Dynamic General Equilibrium Model with Heterogeneous Agents." *Review of Economic Dynamic*s, 1(1): 1-52.

Hendray, D. F., and N. R. Ericsson (2001). *Understanding Economic Forecasts*. The MIT Press: Cambridge, MA.

Ireland, Peter N. (1996). "Long-Term Interest Rates and Inflation: A Fisherian Approach." Federal Reserve Bank of Richmond *Economic Quarterly* 82: 21–36.

Keane, M., and K. Wolpin (1997). "The Career Decisions of Young Men." *Journal of Political Economy*, vol. 105(3): 473-522.

Killingsworth, M. (1982). "'Learning by Doing' and 'Investment in Training': Two Rival Models of the Life Cycle." *Review of Economic Studie*s 49: 263-71.

Knight, Frank H. (1921). *Risk, Uncertainty and Profit*. Hougthon Mifflin: Boston.

Labadie, Pamela (1994). "The Term Structure of Interest Rates over the Business Cycle." *Journal of Economic Dynamics and Control* 18: 671-98.

Laibson, David; Andrea Repetto and Jeremy Tobacman (1998). "Self-Control and Saving for Retirement." *Brookings Pap. Econ. Act.* 1: 91-196.

Lazear, E. (1979). "Why is There Mandatory Retirement?" *Journal of Political Economy* 87: 1261-1284.

Lazear, E. (1981). "Agency, Earnings Profiles, Productivity, and Hours Restrictions." *American Economic Review*, 71(3) 606-620.

Medoff, J. and K. Abraham (1981). "Are Those Paid More Really More Productive: The Case of Experience." *Journal of Human Resources* 16:281-302.

Mincer, J. (1974). *Schooling, Experience and Earnings*. New York: Columbia University Press.

Moore, Michael J. and W. Kip Viscusi (1988). "The Quantity-Adjusted Value of Life." *Econ. Inq.* 26(3): 369–388.

Murphy, K. M., and L. Katz (1992). "Changes in Relative Wages, 1963-1987: Supply and Demand Factors." *Quarterly Journal of Economic*s 107: 992.

Neal, D. (1995). "Industry-Specific Human Capital: Evidence from Displaced Workers." *Journal of Labor Economic*s 13(4): 653-77.

Parsons, D. (1974). "The Cost of School Time, Foregone Earnings, and Human Capital Formation." *Journal of Political Economy*, 82:251-266.

Polachek, S., and W. Siebert (1993). *The Economics of Earnings* Cambridge: Cambridge University Press.

Read, Daniel (2001). "Is Time-Discounting Hyperbolic or Subadditive?" *Journal of Risk and Uncertainty* 23: 5–32.

Rosen, S. (1972). "Learning and Experience in the Labor Market." *Journal of Human Resource*s 7(3): 326-42.

Rosen, S. (1979). "Substitution and the Division of Labour." *Economica*, 45:235-250.

Rosen, S. (1981). "The Economics of Superstars." *American Economic Review*, 71:845-858.

Salop, S. (1979). "A Model of the Natural Rate of Unemployment." *American Economic Review* 69: 117-125.

Samuelson, Paul (1937). "A Note on Measurement of Utility." *Rev. Econ. Stud.* 4: 155–61.

Tinbergen, Jan (1939). "Econometric Business Cycle Research." *Rev. Econ. Stud.* 7: 73-90.

Topel, R. (1991). "Specific Capital, Mobility, and Wages: Wages Rise with Job Seniority." *Journal of Political Economy* 99(1): 145-76.

Varian, Hal R. (1978), *Microeconomic Analysis*. New York: W. W. Norton.

Viscusi, W. Kip and Michael J. Moore (1989). "Rates of Time Preference and Valuation of the Duration of Life." *Journal of Public Economics* 38(3): 297– 317.

Weiss, Andrew (1980). "Job Queues and Layoffs in Labor Markets with Flexible Wages." *Journal of Political Economy* 88(3): 526-538.

Weiss, Y. (1986). "The Determination of Life Cycle Earnings." pp. 603-40 in Ashenfelter, O. and R, Layard, Eds. *Handbook of Labor Economics,* Vol. 1. Amsterdam: North-Holland.

Welch, F. (1970). "Education and Production." *Journal of Political Economy* 78:35-59.

Williams, J. (1979). "Uncertainty and the Accumulation of Human Capital over the Life Cycle." *Journal of Busines*s, 52(4): 521–548.

Willis, R. (1986). "Wage Determinants: A Survey and Reinterpretation of Human Capital Earnings Functions." pp. 525-602 in Ashenfelter, O. and R, Layard, Eds. *Handbook of Labor Economics,* Vol. 1. Amsterdam: North-Holland.

Willis, R., and S. Rosen (1979). "Education and Self-Selection." *Journal of Political Economy* 87: 7-36.

Zarkin, G. (1985). "Occupational Choice: An Application to the Market for Public School Teachers." *Quarterly Journal of Economic*s 100: 409-446.

CALCULATION OF ECONOMIC DAMAGES

Albrecht, Gary R. (1997). "Risk and Damage Awards: Short-Term Bonds Vs. Long-Term Bonds, *Journal of Legal Economics*, Vol. 7, No.1, Spring/Summer 1997, pp. 48-54.

Albrecht, Gary R. (1997). "The Need to Use Risk-Free Discount Rates," *Journal of Legal Economics*, Vol. 7, No.1, Spring/Summer 1997, pp. 92-95.

Albrecht, Gary R. and John C. Moorehouse (1989). "On the Derivation and Consistent Use of Growth and Discount Rates for Future Earnings." *Journal of Forensic Economics* 2(3): 95–102.

Anderson, Garry A. and Robert D. Willig (1985). "Economic Theory and the Present Value of Future Lost Earnings: An Integration, Unification, and Simplification of Court Adopted Methodologies", 39 *University of Miami Law Review*, 723-756.

Anderson, Gary A. and Barber, Joel R. (1992). "A Simple Procedure for Computing the Present Value of Non-annual Damages," 6(1) *Journal of Forensic Economics*, 3-6.

Arlen, Jennifer (1985). "An Economic Analysis of Tort Damages for Wrongful Death," 60 *New York University Law Review*, 1113-1136.

Ben-Zion, Barry and Reddall, Ronald G. (1985). "Life Expectancy and Actuarial Present Values:

A Note to Forensic Economists," 7 *Research in Law and Economics*, 160-71.

Brookshire, Michael and Caruthers, Shelly (1995). "Principles of Establishing the Lost Earnings Base," *Litigation Economics Digest*, 1995, 1(1), 45-61.

Brookshire, Michael L. and Ireland, Thomas R. (1994). "Converting from a Present Value Lump Sum to a Future Payment Stream," 7(2) *Journal of Forensic Economics*, 151-7.

Brookshire, Michael L., and Smith, Stan V. (1990). *Economic/Hedonic Damages: The Practice Book for Plaintiff and Defense Attorneys*, Cincinnati: Anderson Publishing Company.

Brown, Ralph J. and Johnson, Dennis A. (1983). "Wrongful Death and Personal Injury: Economics and the Law," 29 *South Dakota Law Review*, 1-23.

Bruce, Christopher J. (1984). "An Efficient Technique for Determining the Compensation of Lost Earnings," 13 *Journal of Legal Studies*, 375-8.

Bruce, Christopher J. (1987). "Measure of Damages for the Wrongful Death of a Child," 66 *Canadian Bar Review*, 344-59.

Cahill, Gerard A. and Goldberg, Gerald F. (1993). "Life Insurance as an Offset to Economic Loss in Wrongful Death Cases: A Note," 6(3) *Journal of Forensic Economics*, 277-279.

Carter, R.A.L. and Palmer, John P. (1991). "Real Rates, Expected Rates, and Damage Awards," 20 *Journal of Legal Studies*, 439-62.

Ciecka, James E. (1994). "A Survey of the Structure and Duration of Time Periods for Lost Earnings Calculations," 4(2) *Journal of Forensic Economics*, 39-50.

Coyne, Thomas Joseph (1982). "Present Value of Future Earnings: A Sensible Alternative to Simplistic Methodologies," 49(1) *Insurance Counsel Journal*, 25-31.

Depperschmidt, Thomas O. (1994). "Unintended Consequences and Perverse Effects in Forensic Economic Award Calculations," 4 *Journal of Legal Economics*, 65-72.

Dulaney, Ronald A. (July 1991). "Estimating Decedents" Consumption Expenditures in Wrongful Death Actions: Some Refinements," 1(2) *Journal Legal of Economics*, 94-98.

Durham, Stephan E. (1993). "The Correct Value of Social Security Contributions in Personal Injury and Wrongful Death Settlements: A Comment," 6(2) *Journal of Forensic Economics*, 151-2.

Fischer, Charles C. (1994). "The Valuation of Household Production: Divorce, Wrongful Injury and Death Litigation," 53 *American Journal of Economics and Sociology*, 187-201.

Fitzgerald, Patrick and Krueger, Kurt V. (2006), "Tort Remedy in the Law Versus Economic Restitution for Personal Injury and Wrongful Death," *The Earnings Analyst*, Volume VIII.

Horner, Stephen and Frank Slesnick (1999). "The Valuation of Earning Capacity: Definition, Measurement, and Evidence," *Journal of Forensic Economics*, 12(1), 13-32

Ireland, Thomas (2007). "Valuing Advice, Counsel and Companionship between Parents and Adult Children," *The Earnings Analyst*, 9, 35-61.

Ireland, Thomas, et al. (1998). *Expert Economic Testimony: Reference Guides for Judges and Attorneys*, Tucson, AZ: Lawyers & Judges Publishing, Co.

Jennings, William P. and Phillips, Michael G. (1989). "Risk as a Discount Rate Determinant in Wrongful Death and Injury Cases," 56(1) *Journal of Risk and Insurance*, 122-127.

Jones, David D. (1990). "Choosing a Discount Rate for Future Losses in Wrongful Death and Injury Cases," 57(1) *Journal of Risk and Insurance*, 137-40.

Kidner, R. and Richards, K. (1974). "Compensation to Dependents of Accident Victims," 84 *Economic Journal*, 130-142.

King, Elizabeth M. and Smith, James P. (1988). *Computing Economic Loss in Cases of Wrongful Death*, Santa Monica, CA, Rand Institute for Civil Justice.

King, Elizabeth M. and Smith, James P. (1988). *Economic Loss and Compensation in Aviation Accidents*, Santa Monica, CA, Rand Institute for Civil Justice.

Knoll, Michael S. (1996). "A Primer on Prejudgment Interest," 75 *Texas Law Review*, 293-374.

Krueger, Kurt V. (2008), "Personal Consumption by Husbands and Wives," *Journal of Forensic Economics*, Volume 20, Number 1, 15-30.

Krueger, Kurt V. (2004), "Tables of Inter-year Labor Force Status of the U.S. Population (1998-2004) Usable in Operating the Markov Model of Worklife Expectancy," *Journal of Forensic Economics*, Volume 17, Number 3, 313-381.

Krueger, Kurt V. and Albrecht, Gary R. (2007), "A Review of the Economic Foundations of Earnings and Discounting Theories Used in Forensic Economics," *The Earnings Analyst*, Volume IX, 1-34.

Krueger, Kurt V. and Albrecht, Gary R. (2008), "The Present Value of Lost Financial Support due to Wrongful Death," *Journal of Legal Economics*, Volume 15, Number 1, 35-42.

Krueger, Kurt V. and Skoog, Gary and James Ciecka (2006), "Worklife in a Markov Model with Full-Time and Part-Time Activity," with Gary Skoog and Jim Ciecka. *Journal of Forensic Economics*, Volume 19, Number 1, 61-82.

Krueger, Kurt V., Ward, John O. and Albrecht, Gary R. (2001). "Introduction to the Whole-time Concept," *Journal of Forensic Economics*, Volume 14, Number 1, 3-8.

Lewis, W. Cris (1992). "The Rationale and Quantitative Evidence for the Personal Consumption Offset in Wrongful Death Actions," 2(2) *Journal of Legal Economics*, 1-18.

Martin, Gerald, *Determining Economic Damages* (2008) Santa Ana, CA: James Publishing Company.

Pacey, Patricia L. (1985). "Measures of Economic Loss in the Wrongful Death of a Child," 14 *Colorado Lawyer*, 392-402.

Piette, Michael J. and Thornton, Janet R. (1994). "Using New Labor Force Participation Rates When Computing Economic Damage and Loss: A Methodological Note," 4(2) *Journal of Legal Economics*, 81-88.

Plummer, James L. (1995). "The Cost of Substitute Consumption Activities: A Better Alternative than Hedonic Damages," 8(2) *Journal of Forensic Economics*, 159-165.

Rogers, Walter B., Fayissa, Bichaka and Balch, B.W. (1991). "Variations in the Economic Estimation of Personal Injury and Wrongful Death Claims," 1(1) *Journal of Legal Economics*, 81-88.

Schieren, George A. (1994). "On Using Minimum-Cost Portfolios to Determine Present Value," 4(1) *Journal of Legal Economics*, 47-59.

Skoog, Gary and James Ciecka (2001). "A Markov (Increment-Decrement) Model of labor Force Activity: Extended Tables of Central Tendency, Variation, and Probability Intervals," *Journal of Legal Economics*, Spring/Summer 2001, 11(1), 23-87.

Skoog, Gary and James Ciecka (2003). "Probability Mass Functions for Years to Final Separation from the Labor Force Induced by the Markov Model," *Journal of Forensic Economics*, Winter 2003, 16(1), 51-86.

Tinari, Frank D. (1998). "Household Services: Toward a More Comprehensive Measure," *Journal of Forensic Economics*, 11(3), 1998, 253-265.

Trout, Robert R. and Foster, Carroll B. (1993). "Estimating a Decedent's Consumption in Wrongful Death Cases," 6(2) *Journal of Forensic Economics*, 135-150.

Ward, John O. and Olson, Gerald W. (1986). "Forensic Economics: The Development and Outlook for the Field," *Journal of Forensic Economics*, Vol. 1, Issue 1.

Yandell, Dirk (1991). "The Value of Lost Future Earnings: Methodology, the Discount Rate, and Economic Theory," 1(3) *Journal Legal Economics*, 54-67.

Yunker, Katherine K. (1994), "Addressing the Real Problems for Law and Economics of Factoring Interest Rates, Earnings Growth and Inflation into Awards for Lost Future Earnings," 56 *University of Pittsburgh Law Review*, 1-106.

ROLE OF INCOME TAXES

Alberts, Robert J., Clauretie, Terrence M. and Jameson, Mel (1994). "Ordinary and Reverse Tax Effect in Personal Injury and Wrongful Death Cases," 7(3) *Journal of Forensic Economics*, 245-66.

Albrecht, Gary R. (1994). "Modeling Taxes in Personal Injury and Wrongful Death Award Calculations," 7(3) *Journal of Forensic Economics*, 239-43.

Bell, Edward B. and Taub, Allan J. (1994). "An Analysis of Alternative Methods of Calculating Tax-Adjusted Awards," 7(3) *Journal of Forensic Economics*, 267-74.

Blackburn, Joseph W. (1989). "Taxation of Personal Injury Damages: Recommendations for Reform," 56 *Tennessee Law Review*, 661-91.

Brady, Dennis, Brookshire, Michael and Cobb, William (1985). "The Development and Solution of a Tax-Adjusted Model for Personal Injury Awards: A Response," 52 *Journal of Risk and Insurance*, 520-21.

Brush, Brian C. and Breeden, Charles H. (1994). "Income Taxes and Economic Damages," 4(2) *Journal of Legal Economics*, 51-63.

Burke, John F. and Rosen, Harvey S. (1983). "Taxes and Compensation for Lost Earnings: A Comment," 12 *Journal of Legal Studies*, 195-200.

Creedy, John (1988). "Taxation and Compensation to Dependents of Accident Victims," 8 *International Review of Law and Economics*, 85-95.

Markowski, Edward P. and Cross, Edward M. (1991). "Determination of Tax-Adjusted Lost Income Awards'" 1(1) *Journal of Legal Economics*, 11-18.

Markowski, Edward P. and Cross, Edward M. (1991). "Determination of Tax-Adjusted Lost Income Awards: Reply," 1(3) *Journal Legal Economics*, 103-104.

Rea, Samuel (1990). "Taxation, the Standard of Care and Damage Awards," 10 *International Review of Law and Economics*, 285-92.

Schieren, George A. (1994). "Taxes and Present Value Awards for Wrongful Death," 7(3) *Journal of Forensic Economics*, 293-304.

NON-ECONOMIC/HEDONIC DAMAGES

Albrecht, Gary R. (1994). "The Application of the Hedonic Damages Concept to Wrongful Death and Personal Injury Litigation," 7(2) *Journal of Forensic Economics*, 143-50.

Ashenfelter, Orley (2006). "Measuring the Value of a Statistical Life: Problems and Prospects," IZA Discussion Paper Series No. 1911.

Bagenstos, Samuel R. and Schlanger, Margo (2007). "Hedonic Damages, Hedonic Adaptation, and Disability," 59 *Vanderbilt Law Review*, 101-53.

Becker, William E. and Stout, Richard A. (1992). "The Utility of Death and Wrongful Death Compensation," 5 *Journal of Forensic Economics*, 197-208.

Berla, Edward P., Brookshire, William and Smith, Stan V. (1990). "Hedonic Damages and Personal Injury: A Conceptual Approach," 3(1) *Journal of Forensic Economics*, 1-8.

Broome, John (1978). "Trying to Value a Life," 9 *Journal of Public Economics*, 91-100.

Buchanan, James M. and Faith, Roger L. (1979). "Trying Again to Value a Life," 12 *Journal of Public Economics*, 245-248.

Fraser, Clive D. (1984). "What Is 'Fair Compensation' for Death or Injury? A Note," 4 *International Review of Law and Economics*, 83-88.

Friedman, David (1982). "What Is 'Fair Compensation' for Death or Injury?" 2 *International Review of Law and Economics*, 81-93.

Gilbert, Roy F. (1994). "The Application of Hedonic Models to Personal Injury Litigation," 4(3) *Journal of Legal Economics*, 13-26.

Havrilesky, Thomas (1993). "The Misapplication of the Hedonic Damages Concept to Wrongful Death and Personal Injury Litigation," 6(2) *Journal of Forensic Economics*, 93-98.

Havrilesky, Thomas (1995). "The Persistent Misapplication of the 'Hedonic Damages' Concept to Wrongful Death and Personal Injury Litigation," 8(1) *Journal of Forensic Economics*, 49-54.

Ireland, Thomas R. (1993). "The Meaning of 'Hedonic Damages' in Tort Litigation," 4(2) *Journal of Forensic Economics*, 99-104.

Ireland, Thomas R. (1995). "The Application of the Hedonic Damages Concept to Wrongful Death and Personal Injury Litigation: A Comment," 8(1) *Journal of Forensic Economics*, 93-94.

Ireland, Thomas R. and Rodgers, James D. (1993). "Hedonic Damages in Wrongful

Death/Survival Actions: Equitable Compensation or Optimal Life Protection?" 3 *Journal of Forensic Economics*, 43 ff.

Ireland, Thomas R. and Ward, John O. Eds. (1998). *The New Hedonics Primer for Economist and Attorneys*, Tucson, AZ: Lawyers and Judges Publishing Co.

Kornhauser, Lewis A. (1990). "The Value of Life," 38 *Cleveland State Law Review*, 209-230.

Miller, Ted R. (1990). "The Plausible Range for the Value of Life - Red Herrings Among the Mackerel," 3(3) *Journal of Forensic Economics*, 17-40.

Mishan, E.J. (1981). "The Value of Trying to Value Life," 15 *Journal of Public Economics*, 133-137.

Smith, Stan V. (1990). "Hedonic Damages in the Courtroom Setting - A Bridge over Troubled Waters," 3 *Journal of Forensic Economics*, 41-49.

Viscusi, W. Kip (1990). "The Value of Life: Has Voodoo Economics Come to the Courts?" 3(1) *Journal of Forensic Economics*, 1-15.

[1] *Metropolitan Stevedore Co. v. Rambo*, 521 U.S. 121, 133 (1997)

[2] 435 U.S. 247, 257 (1978)

[3] 414 U.S. 573 (1974).

[4] The same restrictions upon utility or enjoyment of life can be placed on the surviving victims of wrongful death because they are no longer able to enjoy the goods and services given to them by their decedent.

[5] See Krueger (2001).

[6] Suppose a tort victim loses half of his earning capacity per hour worked and post-injury the victim doubles their pre-injury level of work to restore their income. In these types of situations, the ability to achieve a greater earning capacity existed pre-injury under the post-injury hours worked; therefore, loss is the same as comparing pre- and post-injury earning capacity during the amount of pre-injury work time.

[7] David Freidman, "What is 'Fair Compensation' for Death or Injury?" *International Review of Law and Economics*, 1982 Volume 2, Issue 1, pp. 81-93.

[8] Portions of this and the next section are from Krueger (2006), and they are contained here with permission of *The Earnings Analyst*.

[9] The wage rate in this context is the total unit cost of labor that includes money wages to the worker, fringe benefits, payroll taxes, and unemployment insurance, etc. The mix of money wages and other labor costs within the total unit cost of labor is variable under the theories of wage-rate determination. In most forensic economic wage rate determination problems, economists disaggregate their empirical analysis of money wages and fringe benefits. The "unit" in "total unit cost of labor" is also variable and dependent upon the specification of the profit maximization function. The demand for labor determines the units of earning capacity (e.g., a job giving a certain level of earning capacity might be constrained in the market to eight hours per day for five days per week for 52 weeks per year). Due to market, mental, and physical constraints, a person may possess one or more levels of earning capacity. For example, within the labor market, a person might weekly supply H_1 hours of labor at C_1 level of earning capacity and also provide H_2 hours at C_2 level of earning capacity where $C_1 > C_2$. A typical example is where a person works a strenuous full-time day job for H_1 at C_1 and a light duty part-time night job for H_2 at C_2; it is unlikely that the person could work ($H_1 + H_2$) hours per week at C_1 level of earning capacity due to limiting market, physical, and mental constraints.

[10] See Fama (1976), Hirshliefer (1970), and Varian (1978). Albrecht and Moorhouse (1989) provide a detailed discussion of the distinction between continuous and discrete growth rates.