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On the social opportunity cost of unemployment

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ABSTRACT
The handling of unemployment is a central issue in cost–benefit analysis. Typically, the shadow price of employing an unemployed is derived by considering a marginal change in the employment constraint faced by an unemployed or rather an underemployed. In contrast, in this paper, we consider the discrete shift from unemployment to (full) employment. The result provides guidance how to estimate the social cost of recruiting otherwise unemployed to a project. It is shown that the social cost is overestimated by using the private reservation wage. The common practice of adding different cost items is shown to be flawed.

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Policy Highlights

- The reservation wage overestimates the social cost of unemployment.
- Simply adding different private costs of unemployment causes a bias.
- Adding socio-economic gains to reservation wages may cause double-counting.

1. Introduction

Unemployment is a curse hitting almost every country in the world. Therefore, the handling of unemployment should be a central issue in cost–benefit analysis. There are at least two different aspects of the issue. The first relates to the definition of the opportunity cost of an employee that is recruited from the pool of unemployed. The second aspect relates to the fact that an economy could experience different macroeconomic disequilibrium regimes, for example, classic unemployment, where unemployment is due to too high wages, or Keynesian unemployment, where unemployment is due to sticky wages and deficient demand for goods.[1]

In this paper, we focus on the first aspect. Those previous formal economic analysis we are aware of use a marginal approach. That is, they consider utility maximization subject to the conventional budget constraint plus a constraint on the number of working hours. Marginally varying this number gives the impact on utility of working an extra hour. Thus, previous studies focus on what could be labelled underemployment; refer to, for example, Lesourne (1975), Johansson (1982), Drèze and Stern (1987), Florio (2014), and

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Johansson and Kriström (2016). The same holds true for the extensive review articles by Haveman and Weimer (2015) and Masur and Posner (2012).

However, few, if any, unemployed faces this kind of marginal choice. Rather, there is a discrete shift from (full-time or part-time) unemployment to employment. The purpose of this paper is to generalize the existing marginal measures to cover such more realistic discrete shifts. This generalization is not only of academic interest but is useful in applied research. Basing an empirical evaluation, such as a cost–benefit analysis, on a basically irrelevant marginal concept results in a flawed outcome. No economist would ignore consumer surplus changes in a goods market, claiming that only marginal changes matter. Likewise, discrete producer surplus changes in labor market should be accounted for.

The current paper derives an expression for the private reservation wage in the presence of unemployment benefits as well as other incomes or debts. To our knowledge, a novel result is that the reservation wage is affected also by other monetary phenomena than unemployment benefits. This reservation wage is contrasted to the social opportunity cost to be used in a cost–benefit analysis. The true opportunity cost simply reflects the "pain" of displacing valued leisure time. This is the relevant economic concept. In contrast, authors like Haveman and Weimer (2015, p. 123) interpret the reservation wage as the marginal opportunity cost of time. We show that this is incorrect, in general. In addition, and as hinted at above, the value of a discrete change in working time cannot fully be reflected by a marginal (opportunity cost) concept, as is done in major review articles of the costs of unemployment.

Although the focus is on the choice between a full-time work and unemployment, we further generalize the analysis to cover "'intermediate'" cases, for example, switches from part-time to full-time work or from unemployment to part-time work.

Unemployment might be associated with socio-economic costs that are not covered by a conventional economic analysis. Therefore, we go on to augment the concept of the social opportunity cost of unemployment to reflect the impact on health, life expectancy, and human capital. We demonstrate that the common practice of adding different cost concepts (time, unemployment benefits, the monetary value of health changes, and so on) is flawed. Such an approach does not respect individuals' budget constraints, in general. The correct approach is provided, delivering still another novel result. Obviously, also this result has significance for applied work.

There is a need for research on the social cost of unemployment. As Masur and Posner (Masur and Posner 2012, 623) conclude in their review article on unemployment: " … contrary to conventional wisdom in the cost–benefit literature, unemployment costs are significant and cannot be ignored as rounding errors." This paper contributes to these research efforts.

The remainder of the paper is structured as follows. First, we present the tools needed in the analysis. Then, these tools are used to derive the basic measure of the opportunity cost of unemployment. Then, we move on to introduce some socio-economic costs of unemployment and show how to account for them in a correct way, and then we conclude.

2. The cornerstones

Let us begin by considering the indirect utility function of a fully employed individual:

$$v = v(p, w \cdot (1-t), m), \tag{1}$$

where p is a vector of goods prices, w is the wage rate, t is a proportional tax on labor income, and m is a lump-sum item, included to illustrate that also non-wage incomes/ debts affect the reservation wage. Complications/generalizations such as externalities, market power, goods taxes, and so on, are ignored. In the present context, they just complicate notation without adding insight.

To simplify the exposition, we introduce a hypothetical employment constraint that just "bites." Thus, we add a constraint $L^s = L$, where a superscript s denotes supply of labor, to the utility maximization problem, but set the constraint such that it (virtually) corresponds to the utility maximizing supply of labor. Then, the indirect utility function can be written as follows:

$$V = V(p, m + (1-t) \cdot w \cdot L, T - L), \tag{2}$$

where T denotes the time endowment, and L labor supply (or employment).

To verify the equivalence of the two utility functions, differentiate Equation (2) with respect to w:

$$\frac{\partial V}{\partial w} = V_m \cdot [(1-t) \cdot L + (1-t) \cdot w \frac{\partial L}{\partial w}] - V_\ell \cdot \frac{\partial L}{\partial w}] = V_m \cdot (1-t) \cdot L, \tag{3}$$

where V_m denotes the marginal utility of lump-sum income, and V_ℓ denotes the marginal utility of leisure time. At an interior maximum, it holds that $(1-t) \cdot w = V_\ell / V_m$. Hence, because the employment constraint just bites, Equation (3) "verifies" the Envelope Theorem.

Consider next the indirect utility attained if unemployed. This corresponds to a situation where $L = 0$ in Equation (2). Thus,

$$V = V(p, m + m^B, T), \tag{4}$$

where m^B denote (after-tax) unemployment benefits.

The question arises how to calculate the social cost of employing the unemployed. As a first step, let us calculate the economic gain of having a job (working L hours). We define it as the sum of money that equalizes utility between the two states of the world under consideration:

$$V(p, m + (1-t) \cdot w \cdot L - CV, T - L) = V(p, m + m^B, T), \tag{5}$$

where CV (the compensating variation) denotes the amount of money that makes the individual indifferent between working and being unemployed.[2]

A part of CV is the difference in disposable income between the two states of the world and is defined as follows:

$$CV^m = \Delta m^d = (1-t) \cdot w \cdot L - m^B, \tag{6}$$

where CV^m denotes the net gain in disposable income when switching from unemployment to a job.

The second part of CV in Equation (5) relates to leisure time. Holding disposable income constant at $m + m^B$, the loss of leisure time is valued as follows:

$$V(p, m + m^B - CV^L, T - L) = V(p, m + m^B, T), \tag{7}$$

where $CV^L < 0$ denotes the minimal compensation needed in order to voluntarily give up $T - L$ hours of leisure time. CV^L depends on the magnitude of $m + m^B$ unless the marginal utility of income is constant (as is the case when preferences are quasi-linear, i.e., additive and linear in lump-sum income).[3]

Note that the compensation CV^L corresponds to an area to the left of the Hicksian demand curve for leisure time:

$$-CV^L = -\int_T^L \frac{V_\ell^C(.)}{V_m^C(.)} d\ell, \tag{8}$$

where $V_\ell^C(.)$ denotes the Hicksian marginal utility of leisure time, $V_m^C(.)$ denotes the Hicksian marginal utility of income, used to convert units of utility to monetary units, a superscript C indicates that the level of utility is held constant at the level defined by Equation (5), and l denotes leisure time.

To facilitate the interpretation of the measure in Equation (8), consider preferences that are linear in one good and separable in leisure, i.e., generating a particular form of a quasi-linear utility function. Suppose the leisure-subutility function is $\ln(T - L) = \ln(\ell)$. Because V_m is a constant for a quasi-linear function it can be normalized to unity, and Equation (8) simplifies to:

$$-CV^L = \int_{T-L}^{T} \frac{1}{\ell} d\ell = \ln(T) - \ln(T - L). \tag{9}$$

Thus, $-CV^L$ is simply the value of having T hours of leisure less the value of the number of leisure-hours experienced while being a full-time employee. Given the considered quasi-linear utility function, $L = T - 1/w^d$, i.e., $\ell = 1/w^d$, where w^d denotes the after-tax wage rate. This case is depicted in Figure 1 for $T = 24$ and $t = 3/10$. Integrating the demand curve for leisure between $w^d = 1/24$ and (say) $w^d = 1/12$ yields an income-compensated consumer surplus gain equal to $-CV^L = \ln(2)$. This corresponds to the area to the left of the demand curve in Figure 1 between w^d about 0.04 to w^d about 0.08.

Alternatively, calculate the area *under* the (Hicksian) inverse supply curve $w^d = 1/(T - L)$ between $L = 0$ and $L = 12$ to obtain $-CV^L = \ln(2)$. The curve is depicted in Figure 2. We integrate under the curve because the aim is to calculate the *cost* of giving up valued leisure time. By the way, the rule of half, see, for example, de Rus (2010, 29–30) can be used to provide quite accurate approximations of the considered areas in the figures.[4]

Returning to Equation (7), the income argument in the left-hand side of the equation provides a definition of the reservation wage. We have simply deducted $CV = CV^m + CV^l$ from disposable income of an employed worker to make her as well off as if unemployed. Thus:

$$w^R = m + m^B - CV^L. \tag{10}$$

We term w^R the reservation wage although it is a reservation income, i.e., an income making the individual indifferent between the two states of the world. The higher the

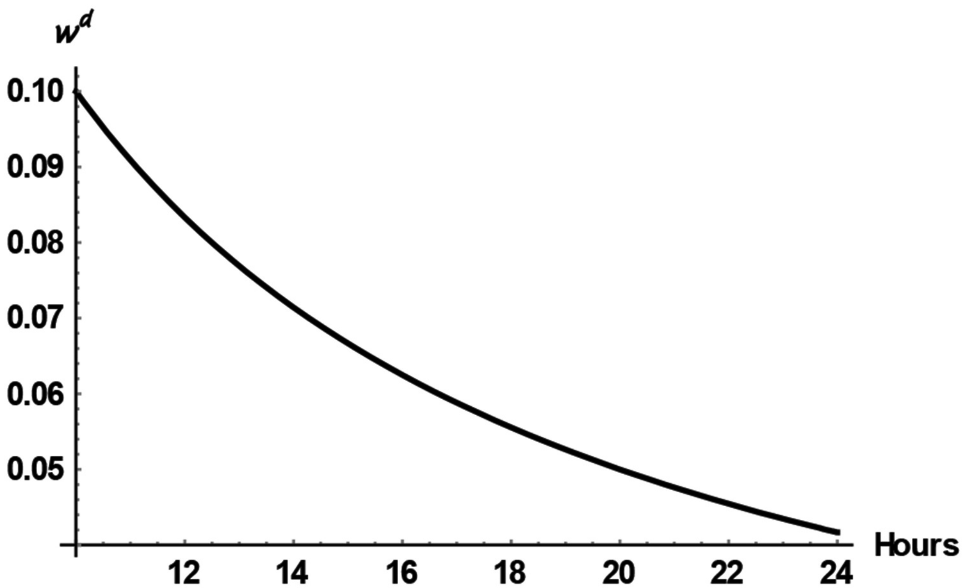

Figure 1. Demand for leisure time.

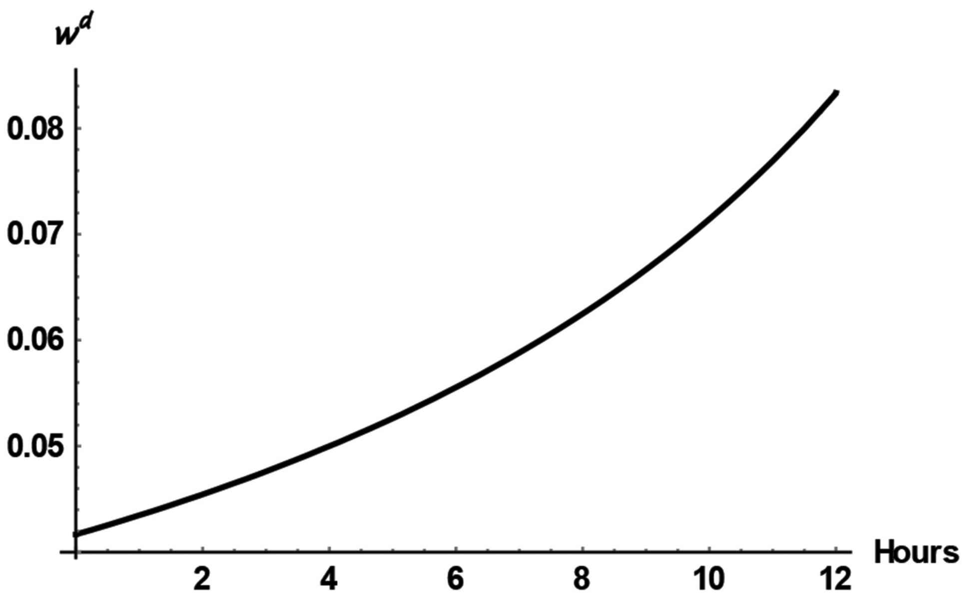

Figure 2. Labor supply.

unemployment benefits (and other incomes), the higher is the reservation wage. In addition, the more valued leisure time is, the higher is the reservation wage. This makes perfect sense.

Alternatively, we may define a wage rate that equalizes utility in the two states of the world. It easily verified that the following holds:

$$CV = (1 - t) \cdot (w - w^{\rho}) \cdot L, \tag{11}$$

where w^{ρ} is the wage rate making an employed individual as well off as if unemployed; to see this more clearly, replace CV in Equation (5) by the right-hand side expression in Equation (11). However, because CV, as previously defined, is the most straightforward concept in defining the social opportunity cost, we do not elaborate further. Instead, we turn to our main results.

3. The main results

Our main contribution is a result on how to value unemployment in cost–benefit analysis (CBA). To this end, it is useful to begin by considering the limitations of possible approaches. In particular, is the reservation wage a relevant concept also for CBA? To shed some light on this issue, let us divide society into three categories. The first category contains the formerly unemployed who by being employed gains CV. The second is labelled "the government". It receives $t \cdot w \cdot L$ in tax revenue from the formerly unemployed but also saves unemployment benefits equal to m^B. The third category is employers. Suppose that the formerly unemployed produces a value equal to $p\Delta x$, for simplicity leaving all relative prices approximately constant. If all markets, except the labor market, are competitive the change in profits is equal to $\Delta\pi = p\Delta x - w \cdot L$.

Setting aside distributional issues, all groups are attributed the same weight. Thus, summing across categories, we find:

$$\begin{aligned}\Delta S = \; & [(1 - t) \cdot w \cdot L - m^B + CV^L] + [t \cdot w \cdot L + m^B] + [p\Delta x - w \cdot L] = \\ & p\Delta x + CV^L.\end{aligned} \tag{12}$$

In the middle equality, the outcome for each of the three categories is shown within square brackets. Using Equation (6), the terms within the first set of square brackets reduce to $CV^m + CV^L$, i.e., to CV. The second pair of square brackets capture the impact on the government. It gains from the extra wage taxes paid by the newly employed. Therefore, the tax paid by the formerly unemployed and the tax received by the government sum to zero in Equation (12). A loss of unemployment benefits is a cost to the individual entering a job, but the government saves the same amount. The third pair of square brackets capture the change in profit income.

What remains after transfers are eliminated is simply the value of the new goods produced less the social cost of providing these goods. The cost equals the value of displaced leisure time; see Equation (9). Thus, from a societal point of view, the reservation wage w^R in Equation (10), and hence CV, overstates the social cost, i.e., – CV^L in Equation (12), of recruiting an unemployed. In the present context, unemployment benefits are simply transfers from a societal point of view. As seen from Equation (10), also other lump-sum incomes/debts will affect the lowest total income the individual is willing to accept. Such lump-sum items, wherever they originate, add to the unemployed laborer's demands.

Next, let us consider four additional issues that are relevant in the present context: unemployment insurance, social security fees, part-time unemployment, and heterogenous labor. First, in the case of fair unemployment insurance, the individual pays a premium in each state of the world. The expected present value of premiums just balances the expected present value of unemployment benefits. Therefore, the premium is deducted from the reservation wage in Equation (10) but will not affect CV^m because the premium is paid in both states of the world. In Equation (12) it seems reasonable to take an intertemporal perspective. Reduced unemployment means that the cost of the insurance decreases. Given fair insurance, saved expected present value premium payments will just balance the cost m^B in the individual's account while m^B vanishes from the government's account. Thus, ΔS remains unaffected.

Second, if social security fees paid by firms are considered as pure taxes, they will obviously sum to zero in Equation (12). Alternatively, they may be considered as covering, say, future pensions. If so, they represent a part of the individual's wage package and are added to the wage rate w. Hence, summing across the individual and firms in Equation (12) social security fees will leave ΔS unchanged.[5] Thirdly, our approach is easily extended to cover a shift from underemployment – part-time unemployment – to full employment. The right-hand side utility function in Equation (5) is replaced by a function reflecting the mix of incomes, wage income and unemployment benefits, and the constraint on employment.[6] Finally, a complication, pointed out by Boardman et al. (2018) and others, arises because of individual heterogeneity: in any market, there will be a distribution of reservation wages and there is no guarantee that the hired workers will be those with the lowest reservation wages. In an ex ante policy evaluation, one could possibly address this complication by evaluating the proposal at the highest and lowest social opportunity costs, respectively, if estimates are available.

It should be added that if the considered individual had been fully employed elsewhere in the economy, no leisure time is displaced. Hence, each of the first two expressions in square brackets in Equation (12) equals zero. However, when production elsewhere is displaced, we must add $p\Delta x^A - w.L^A$, where $-L^A = L$ and $\Delta x^A < 0$, because under full employment and fixed labor supply, labor is simply reshuffled from one sector of the economy to another. Thus, the benefit $p\Delta x$ in Equation (12) is compared to the opportunity cost $p\Delta x^A$. We compare the value of the goods and services the individual produces with the (maximal) value she could have produced elsewhere in the economy.

This completes our analysis of the conventional approaches to shadow-pricing of unemployment. In the next section, we look at various ways of thinking about the social cost of unemployment in more comprehensive models. We derive a welfare measure that includes impacts on health, life expectancy, and human capital if shifting from being unemployed to being employed.

4. Augmenting the concept of the social cost

Thus far, we have focused on the leisure cost of switching from unemployment to a full-time job. However, as indicated in the Introduction, there may be other aspects of human well-being that are affected by the shift. Consider the following utility function:

$$V = V(p, m + (1 - t) \cdot w \cdot L, T - L, q^1, \pi^1, h^1), \tag{13}$$

where q refers to quality-adjusted life years, QALYs, π refers to remaining life expectancy, h refers to human capital, and a superscript 1 refers to being employed. The same parameters, but indexed 0, are added to the utility function in Equation (4). All these parameters (and possibly others) could be affected by shifting from or to an employment. QALYs are calculated by estimating the years of life remaining for a person and weighting each year with a quality-of-life score on a 0 to 1 scale.[7] Surveys are often used to estimate QALYs. For example, Norström et al. (2019) find that unemployment causes a significant and negative impact on QALY scores. In addition to affecting physical and mental well-being, as captured by q in the utility function, unemployment might also affect life expectancy. The maintained hypothesis is that unemployment tends to shorten remaining life expectancy π.

From the theory of endogenous growth, see, for Romer (1986, 1990), and Aronsson, Johansson, and Löfgren (1997), it follows that unemployment could have a negative long-run impact on human capital. Much of this capital is built and maintained while employed. In particular, there might be a positive externality through the impact on firms' production functions that occurs over and above the effects covered by the individual's utility function; refer to Aronsson, Johansson, and Löfgren (1997, 73–94) for details.

Thus, a more complete measure of the social opportunity cost of recruiting an unemployed would change the final expression in Equation (12) to read:

$$\Delta S^{*} = p\Delta x + CV^{L} + CV^{q,\pi,h}, \tag{14}$$

where $CV^{q,\pi,h}$ captures the willingness-to-pay for the combined impact on health, life expectancy, and human capital if shifting from being unemployed to being employed (conditional on CV^L, as explained below).

The existing literature seems to suggest that one can simply add the different effects in Equation (14), i.e., value changes in L, q, π, and h separately. But this is like summing a person's willingness-to-pay (WTP) for a Volvo plus her WTP for a Jaguar plus her WTP for a Ford. As the number of cars goes to infinity so does the total WTP for cars. A correct approach values the WTP for a car, *conditional* on what has already been paid for other cars (or asks the person of her total WTP for cars). This latter approach respects the person's budget constraint. Refer to, for example, Johansson and Kriström (2016, 97–103) for details on this issue. This implies that there is no unique value of CV^L. In general, its magnitude depends on where in the valuation chain it is evaluated, as is obvious from the car-example; in Equation (14) time is assumed to be the first effect to be valued, while $CV^{q,\pi,h}$ is evaluated conditional on CV^L.[8] This is a further insight generated by the approach used in this paper.

Equation (14) suggests that the social opportunity cost of recruiting an unemployed is lower than the value of lost leisure time. While $CV^L < 0$, we expect that $CV^{q,\pi,h}$ is strictly positive because shifting to a job should have a non-negative impact on q, π and h, and a strictly positive impact on at least one of these parameters. As mentioned above, if human capital is affected, there is typically an externality through the impact of human capital on production possibilities. Such an externality augments $CV^{q,\pi,h}$ through its impact on the benefit term $p\Delta x$ in Equation (14).

5. Concluding remarks

We consider how to value the discrete shift from unemployment to (full) employment as well as the one from part-time unemployment to employment. Our main result provides guidance how to estimate the social cost of recruiting otherwise unemployed to a project in a cost–benefit analysis. We have also shown that the social cost is overestimated by using the private reservation wage as a shadow price in a cost–benefit analysis. Furthermore, unemployment is widely agreed to be detrimental to an individual in more ways than one. Health risks, deterioration of human capital and many other items have been identified in the literature. Our approach shows that the common practice of adding these items is flawed. The sum of such values have little or no economic meaning, if they are not summed conditionally; the total value of two items is the conditional sum of the first and the second value, where the second item is valued conditional on having paid for the first item. Otherwise, the budget constraint is violated.

In closing, let us relate our results to the survey techniques frequently used to estimate reservation wages. Often, unemployed are asked simple survey questions about their ′lowest acceptable wages′. For example, the influential study by Krueger and Mueller (2016, 149) is based on the following question: "Suppose someone offered you a job today. What is the lowest wage or salary you would accept (before deductions) for the type of work you are looking for?" What items a respondent includes in such a self-reported reservation wage seems unclear. It could be just the value of time, but she could also include other items, such as impact on health and human capital. As Equation (14) demonstrates, all factors affected by a shift from unemployment to a job must be accounted for (jointly or in the sequential way described below Equation (14)).

The approach advocated in this paper also eliminates the risk of double-counting, where respondents include the value of, say, health changes in their answers to the question about their lowest acceptable wage, and (unwitting) researchers add separate estimates of this health impact, thereby in addition violating the unemployed person's budget constraint (as Equation (14) demonstrates). In applying survey methods, it is also necessary to collect information on any unemployment benefits, denoted m^B in this paper, and non-wage incomes/debts, denoted m. This is necessary because their sum must be deducted from the reservation wage to arrive at the social opportunity cost of unemployment. Thus, the paper provides some important lessons also for those using surveys to estimate the social cost of unemployment.

Notes

1. The reader is referred to Cuddington, Johansson, and Löfgren (1984) and Johansson (1982) for early contributions to both aspects. For an excellent review of all the issues involved as well as a historical résumé the reader is referred to Chapter 5 in Florio (2014).
2. The individual would be willing to pay more than CV if she could adjust her working time as income is reduced. However, here we focus on fixed work schedules.
3. For example, $V = v^p(p) + v^L(T - L) + (1 - t)\, w\, L + m + \delta\, m^B$, where $\delta = 1$ if unemployed ($L = 0$), 0 otherwise.
4. $-CV^L \approx (1/2)(\ell^0 + \ell^1)\Delta w \approx (1/2)(w^0 + w^1)\Delta L \approx 0.72.$ ($CV^L = \ln(2) \approx 0.69$.)
5. An open question is whether an unemployed laborer's decisions are affected by this kind of postponed income, assuming perfect capital markets; compare the lump-sum item m.

6. Drawing on equation (3.34) and Appendix 3.8.2 in Johansson and Kriström (2016), the right-hand side of (5) is replaced by $V(p, m + m^{BP} + (1 - t) \cdot w \cdot L^P, T - L^P)$, where a superscript P refers to "part-time". The individual makes a gain in after-tax wage income, but a loss of unemployment benefits and leisure time. However, summing as in Equation (12), it is easily verified that the social opportunity cost is represented by the value of displaced leisure time, but here from part-time to full-time employment.
7. Pliskin, Shepard, and Weinstein (1980) is the pivotal reference to the concept of a QALY.
8. Thus, also the WTP for a change in, say, q depends on where in the valuation chain it is evaluated. However, the order of integration does not affect the total sum (equal to the sum of the two compensating variations in Equation (14)). If there is no substitutability between q, π, and h (Leontief technology), it does not make sense to value ceteris paribus changes in one factor; they must be varied jointly to produce utility. In the rather special case of quasi-linear preferences, one can sum in the way suggested by the car example, as should be obvious from the function in endnote 3.

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