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How and Why the Incomes of Others Can Shape the Supply of Overtime Work

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> Relative success, tested by an invidious pecuniary comparison with other men, becomes the conventional end of action. The currently accepted legitimate end of effort becomes the achievement of a [less un] favourable comparison with other men [... .]
>
> Thorstein Veblen [1899]. *The Theory of the Leisure Class.*
> [Quoted from the edition: Reprints of Economic Classics,
> New York: Augustus M. Kelley, 1965, p. 33.]

1. Introduction

In a great many occupations, pay is for working a given number of hours per day or per week; work beyond that is considered, and referred to, as overtime work. In a great many circumstances, employers who are in need of more work time prefer to have the extra work provided by existing workers rather than by new hires. This preference naturally raises the twin questions of what motivates workers to work overtime, and how workers can be motivated to work longer hours. The apparent long-term tendency of workers in some economies (for example, in the United States [Hamermesh 1999]) increasingly to shy away from working overtime lends impetus to these questions.

We investigate the repercussions when an individual compares his income with the incomes of others, for the allocation of the individual's time between work and leisure. The desire to emulate the consumption standards of others who are better off is a natural consequence when an individual compares himself

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with others. The *pecuniary emulation* – the foundation of Thorstein Veblen's 1899 theory of consumption – suggests a way in which an individual's choice of work hours is influenced by the perceived consumption standards of others. Since the consumption of goods is more visible than the consumption of leisure, people compare levels of consumption rather than of leisure. Therefore, income which determines the level of consumption may be the focus for emulation.[1] The relative income hypothesis, formulated and tested by Duesenberry [1949], posits an asymmetry in the comparisons of income which affect the individual's behavior: the individual looks upward when making comparisons. Hence, the comparisons that affect the allocation of the individual's time between work and leisure are those with individuals whose incomes are higher than his own [cf. Stutzer 2004; Bowles and Park 2005].

The sociological-psychological concepts of relative deprivation (*RD*) and reference groups are ideally-suited tools to the specification of an invidious comparison. An individual senses the unpleasant emotion of *RD* when he lacks a desired good, and when he perceives that others in his reference group possess that good [Runciman 1966]. Given the income distribution of the individual's reference group, *RD* is the sum of the deprivations caused by every income unit that the individual does not possess [Yitzhaki 1979].

We inquire how an individual reacts to an increase in his *RD* by optimally changing his work time. In section 2 we present a standard neoclassical model of overtime work and leisure [cf. Killingsworth 1983]. In section 3 we expand the model by incorporating a measure of *RD*. The extended model is based on a utility function that includes a measure of *RD* as an argument. Incorporation of *RD* in the utility function raises the marginal cost of an hour of leisure (reduces the marginal value of an hour of leisure) and thereby impacts on the optimal allocation of time between work and leisure. The extended model enables us to address the question of whether individuals increase or reduce their working hours when their "social reference income" rises. Holding the wage rate per hour constant, we show that an increase in an individual's *RD* induces the individual to work longer hours.

The paper that comes closest to ours is a paper by Bowles and Park [2005], henceforth B&P. The B&P paper, which is aimed at investigating the relationship between greater income inequality and longer work hours, draws on a micro-economic model that explains how the desire to emulate the rich affects the individual's duration of hours of work. While the basic tenet of our model is similar to that of B&P, the specifications of the procedure of income comparisons that affects the individual's behavior are considerably different. Specifically, our modeling differs from the modeling of B&P in three main respects. First, instead of the ad hoc term "effective consumption," which B&P define as the individual's own consumption level minus a constant times the level of consumption of "some higher income reference group," we use the well-founded term of relative

[1] We comment further on this perspective in the Conclusions section.

deprivation (*RD*) and a utility function that includes as an argument a measure of *RD*. This formulation enables us to consider the individual's preference for (the dismay that he is subjected to upon) invidious comparisons, as distinct from his preferences for leisure and for consumption. While the concept of "effective consumption" does address the unpleasantness of invidious comparisons, our model captures the essence of non-cogitative *pecuniary emulation*, and it does so by means of two assumptions: the marginal disutility from *RD* increases in *RD*, which is a natural assumption for a "bad;" the marginal disutility from *RD* is not influenced by a change in leisure, which is an assumption that embodies the notion that the individual emulates the consumption standards of the richer individuals rather than their leisure. This notion is not encompassed in the model of B&P, however. Second, our measure of *RD* is based on the income distribution of the population at large, whereas in the model of B&P the individual emulates only the consumption standards of richer individuals who belong to the next higher up homogenous income class. This is a restrictive assumption. The more integrated a society, the less appealing the notion that the individual's reference group is merely the adjacent income group. Hence, our measure of *RD* is better-suited for encompassing income comparisons of an individual who belongs to a (classless, modern) society in which the display of consumption is widely visible. In a way, the model of B&P is a special case of our general formulation in that whereas in the model of B&P, individuals attach a positive weight to those who have the next higher level of income, a zero weight to all those whose income are higher still, in our model individuals put equal weights on all those who have higher incomes. Since in the model of B&P the individual emulates the consumption level of the next higher up income class, the individual's behavior is not conditioned by the number of the individuals who belong to this (higher income) reference group. In our model, however, the individual's dismay arises not only from the *level* of income of the richer individuals, but also from their *number*. Hence, the model of B&P misses out the proportion of those who earn more than the individual and consequently, in their analysis, the individual's income rank in the population is immaterial for the individual's choice of work hours, which we contend is an oversight.[2] Third, in the model of B&P, the individual's entire income is the wage rate per hour times the number of hours of work. We, however, consider two types of income: basic income (which does not depend on the number of hours of work), and income earned during hours of overtime work.[3] This distinction matters considerably since by decomposing the incomes as we do we are capable of predicting the individual's response to an exogenous change in the incomes of

[2] We contend that there is a difference between the dismay that arises from comparing 10 with 20, where 10's rank is second and, following our definition of *RD* below, his *RD* = 5, and the dismay that arises from comparing 10 with (20,20), where 10's rank is third and his *RD* = $6^{2}/_{3}$.

[3] Since individuals ordinarily obtain incomes independently of the duration of their work (salaries, pensions, social transfers, capital profits), our model better reflects real life than the model of B&P.

others. That is, the increase in the individual's *RD*, following an increase in the mean income of those people earning more than the individual or an increase in the proportion of the individuals who earn more than the individual, is elicited from exogenous changes in the basic incomes of other individuals. In the model of B&P, because of the Slutsky effect, the impact of an exogenous change in the wage rate per hour of the higher income reference group on the consumption standard of that group is unpredictable. Then, since the individual emulates the consumption standard of the higher income reference group, it is unclear how the increase in the individual's "desire to emulate the rich" (the decrease in the individual's "effective consumption," holding the individual's own consumption constant) can arise in the model of B&P.

2. The optimal choice of overtime hours of work: a benchmark neoclassical model

We consider a simple setting in which an individual spends his entire income on consumption. We use the following notations:

y – the entire income of the individual;
y_0 – the part of the individual's income which does not depend on the number of hours of overtime work (this income can possibly include non-labor income), henceforth basic income;
w – the wage rate per hour of overtime work;
H – the number of hours of overtime work;
L – the number of leisure hours;
T – the total time available to the individual for allocation between leisure and overtime work.

Hence, the entire income of the individual is given by

$$y = y_0 + wH. \tag{1}$$

Let the individual's utility function, which reflects the individual's preferences for consumption (which in turn is facilitated by his entire income), and leisure, be[4]

$$V = V(L, y), \tag{2}$$

$$V_L > 0,\ V_y > 0,\ V_{LL} \leqslant 0,\ V_{yy} < 0,\ V_{Ly} \gtrless 0. \tag{3}$$

We analyze the allocation of time between the individual's hours of overtime work and leisure, noting that w, y_0, and T are exogenous. The individual's maximization problem is

$$\max V = V(L, y),\ \text{subject to}\ y = y_0 + w(T - L), \tag{4}$$

[4] We use the notations $V_L = \frac{\partial V}{\partial L}, V_{yy} = \frac{\partial^2 V}{\partial y^2}, V_{Ly} = \frac{\partial^2 V}{\partial L\, \partial y}$, and so on. We assume that the first-order, second-order, and the cross partial derivative in (3) are continuous.

where, to ensure an interior solution, we posit that

$$\frac{V_L(T, y_0)}{V_y(T, y_0)} \leqslant w \leqslant \frac{V_L(0, y_0 + wT)}{V_y(0, y_0 + wT)}.$$

The first-order condition for a maximum is

$$\left.\frac{dV(L, y)}{dL}\right|_{y = y_0 + w(T-L)} = 0 \Leftrightarrow V_L(L^*, y^*) = wV_y(L^*, y^*), \tag{5}$$

where L^* is the individual's optimal leisure time, $H^* = T - L^*$ is the individual's optimal hours of overtime work, and y^* is the individual's resultant optimal income.[5]

The analysis based on the benchmark neoclassical model of labor supply implies that an increase in the individual's hours of overtime work can be induced in one of two manners: a decrease in y_0, and an increase in w.

Claim 1: A decrease in basic income increases overtime work.

Proof. The proof is in the Appendix.

Claim 2: If the substitution effect is stronger than the income effect, an increase in the wage rate per hour of overtime work increases overtime work.

Proof. The proof is in the Appendix.

Thus, the effective arsenal of tools aimed at inducing (extra) overtime work which is available to an employer is quite limited: since lowering the basic income of an employee is not practical,[6] raising the wage rate per hour of overtime work is the only effective means, assuming that the substitution effect dominates the income effect. We next show that this tool kit is expanded when employees care not only about income and leisure but also about relative deprivation.

3. The optimal choice of overtime hours of work: an extended model incorporating relative deprivation considerations

The concept of *RD* can be used to incorporate invidious comparisons into the analysis of an individual's economic choices. Let the individual's reference group be given. A difficult question in social-psychological research is which set of individuals constitutes the individual's reference group. As noted by Clark et al. [2008], only few studies ask individuals about their reference group rather than imposing one. The received literature appears to suggest that those with whom an individual is in regular and close contact constitute the individual's reference group. Co-workers thus constitute a natural reference group.

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[5] The assumptions in (3) guarantee that the second-order condition for a maximum holds.

[6] Teulings and Hartog [1998] present evidence that wage cuts are virtually never observed within organizations in Europe, and Bewley [1999] presents evidence that wages are downwardly rigid even during a recession.

Let the cumulative distribution of income in the individual's reference group be given by $F(x)$. Hence, $1 - F(x)$ is the proportion of those in the individual's reference group whose incomes are higher than his own. Let the *RD* of an individual whose income is y, $RD(y)$, be measured by

$$RD(y) = \int_{y}^{\infty} [1 - F(x)]dx.$$

That is, *RD* is the sum of the deprivations from every unit of income that the individual does not possess. Let the individual's utility function be redefined as

$$U = U(L, y, RD), \tag{6}$$

where

$$\begin{gathered}\text{(a) } U_L > 0,\ \text{(b) } U_y > 0,\ \text{(c) } U_{LL} \leqslant 0,\ \text{(d) } U_{yy} \leqslant 0,\ \text{(e) } U_{Ly} \geqslant 0, \\ \text{(f) } U_{RD} < 0,\ \text{(g) } U_{RDRD} < 0,\ \text{(h) } U_{RDL} = 0,\ \text{(i) } U_{RDy} \geqslant 0\end{gathered} \tag{7}$$

and where the first-order, second-order, and cross partial derivatives in (7) are continuous. Assumptions (a)–(e) are as per the benchmark neoclassical model and require no further comment. Assumption (f) captures the unpleasantness of *RD*; assumption (g) means that the marginal dismay evoked by *RD* is increasing in *RD*, which is natural for a "bad." Assumption (h) means that a change in leisure does not affect the marginal disutility from *RD*. This assumption follows from the very essence of the dismay caused by *RD*: the impact of an increase in *RD* cannot be influenced by a change in leisure since *RD* is premised on income comparisons (in other words, a given increase in *RD* evokes equal disutility, independently of the individual's level of leisure). The rationale for assumption (i) is that when income is increasing, a *given* increase in *RD* affects the individual's utility less and less. Having a higher income renders an individual less susceptible to a *given* increase in *RD* for which the individual's higher income serves as a better cushion.

Let us now reconsider the optimal choice of hours of overtime work, noting that the wage rate per hour of overtime work (w), the basic income of the individual (y_0), the total time available to the individual for allocation between leisure and overtime work (T), and the cumulative distribution of income in the individual's reference group (F), are exogenous. The individual's maximization problem is

$$\max U = U[L, y, RD(y)],\ \text{subject to } y = y_0 + w(T - L), \tag{8}$$

where, to ensure an interior solution, we posit that

$$\left.\frac{U_L}{U_y - U_{RD}[1 - F(y)]}\right|_{[T,\, y_0,\, RD(y_0)]} \leqslant w \leqslant \left.\frac{U_L}{U_y - U_{RD}[1 - F(y)]}\right|_{[0,\, y_0 + wT,\, RD(y_0 + wT)]}.$$ [7]

[7] A corner solution to (8), $H^{**} = 0$, arises when the wage rate per hour of overtime work is lower than the reservation wage, viz. when $w < \left.\frac{U_L}{U_y - U_{RD}[1 - F(y)]}\right|_{[T,\, y_0,\, RD(y_0)]}$.

The first-order condition for a maximum is[8]

$$\left.\frac{dU[L, y, RD(y)]}{dL}\right|_{y = y_0 + w(T-L)} = 0$$
$$\Leftrightarrow U_L = wU_y - wU_{RD}[1 - F(y)]\Big|_{[L^{**}, y^{**}, RD(y^{**})]}, \tag{9}$$

where L^{**} is the individual's optimal leisure time, $H^{**} = T - L^{**}$ is the individual's optimal hours of overtime work, and y^{**} is the resultant optimal income.[9]

Proposition 1. When the individual's utility is affected by *RD*, the individual's optimal duration of overtime work time is longer than when the individual's utility is not affected by *RD*.[10]

Proof. Let the first utility function be $U(L, y, RD)$. From (9) the choice of hours of overtime work, $H^{**} = T - L^{**}$, in the case of the first utility function is yielded by $U_L = wU_y - wU_{RD}[1 - F(y)]\big|_{[L^{**}, y^{**}, RD(y^{**})]}$. Consider the second utility function $V(L, y)$, where $V_y(L, y) = U_y[L, y, RD(y) = 0]$ and, recalling assumption (h), $V_L(L, y) = U_L(L, y) = U_L[L, y, RD(y)]$.[11] From (5) the choice of hours of overtime work in the case of the second utility function is $V_L = wV_y\big|_{(L^*, y^*)}$. From assumption (i) we have that $V_y(L, y) = U_y[L, y, RD(y) = 0] \leqslant U_y[L, y, RD(y)]$. Then, recalling assumption (h), (9), and assumption (f) we obtain that $V_L(L^{**}, y^{**}) = U_L(L^{**}, y^{**}) = U_L[L^{**}, y^{**}, RD(y^{**})] > wU_y[L^{**}, y^{**}, RD(y^{**})] \geqslant wV_y(L^{**}, y^{**})$, and as a result $V_L > wV_y\big|_{(L^{**}, y^{**})}$. Since the three right-hand side assumptions of (3) are fulfilled, we conclude that $L^* > L^{**}$, and that $H^* < H^{**}$, where $H^* = T - L^*$ is the optimal choice of hours of work in the case of the second utility function.[12] □

Proposition 2. Holding the wage rate per hour of overtime work constant, an increase in *RD* induces longer optimal hours of overtime work.[13]

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[8] The details of the derivation of (9) are in the Appendix.

[9] The assumptions in (7) guarantee that the second-order condition for a maximum holds; the proof is in the Appendix.

[10] Consider the case of a corner solution in which the individual does not work overtime. Then, if the individual's utility is affected by *RD*, the individual's optimal duration of work time is not shorter than when the individual's utility is not affected by *RD*.

[11] From assumption (h), $U_{RDL} = 0$, we have that $U_L[L, y, RD(y)] = \dfrac{\partial U[L, y, RD(y)]}{\partial L} = U_L(L, y)$. Hence U_L is a function of only two arguments, L and y.

[12] Since $U_{RD}[T, y_0, RD(y_0)] < 0$, $V_L(T, y_0) = U_L(T, y_0) = U_L[T, y_0, RD(y_0)]$, and $V_y(T, y_0) = U_y[T, y_0, RD(y_0) = 0] \leqslant U_y[T, y_0, RD(y_0)]$, the reservation wage in the case of the first utility function is lower than the reservation wage in the case of the second utility function. Notice that if we were to incorporate corner solutions into the analysis, we would conclude that $H^* \leqslant H^{**}$.

[13] The inclusion of corner solutions in the analysis does not interfere with Proposition 2. By assumptions (f)–(i), an increase in the individual's *RD* induces a decrease in the individual's reservation wage, and we conclude that an increase in *RD* induces longer optimal hours of work or that it does not affect the optimal duration of work.

Proof. Consider the following: $RD(y) = [1 - F(y)] \cdot E(x - y \,|\, x > y)$.[14] Then, an increase in the mean income of those people earning more than the individual or an increase in the proportion of those who earn more than the individual increases the individual's *RD*. We analyze first the response to an increase in mean excess income, and then the response to an increase in the proportion of those whose incomes are higher.

Responding to an increase in mean excess income

The change in the individual's optimal income caused by a marginal increase in the individual's *RD* brought about by an increase in the incomes of those who earn more than the individual, is given by[15]

$$\left.\frac{dy^{**}}{dRD}\right|_{F(y^{**})=const} = \frac{w\{U_{RDy} - U_{RDRD}[1 - F(y)]\} - U_{RDL}}{2U_{Ly} - \frac{1}{w}U_{LL} - wU_{yy} + \left(wU_{RDy} - U_{RDL}\right)[1 - F(y)] - wU_{RD}f(y)}\Bigg|_{[L^{**}, y^{**}, RD(y^{**})]}. \tag{10}$$

By assumptions (c)–(i), $\left.\frac{dy^{**}}{dRD}\right|_{F(y^{**})=const} > 0$. Thus, an increase in mean excess income in the individual's reference group "invites" a higher optimal income, and hence, the individual will work for longer hours. □

Responding to an increase in the proportion of higher-income individuals

Consider an increase in the proportion of those in the individual's reference group whose incomes are higher than y^{**}. Such an increase implies a transformation of the income distribution, $F \rightarrow F'$: $F'(y^{**}) < F(y^{**})$. A re-write of equation (9) as $U_L - wU_y = -wU_{RD}[1 - F(y)]\big|_{[L^{**}, y^{**}, RD(y^{**})]}$ enables us to analyze the individual's reaction to an increase in *RD* caused by this transformation as follows:[16]

1) From the re-write of (9) and from assumptions (f)–(i), we have that $-wU_{RD}[1 - F'(y)]\big|_{(L^{**}, y^{**}, RD[F'(y^{**})])} > -wU_{RD}[1 - F(y)]\big|_{(L^{**}, y^{**}, RD[F(y^{**})])}$ and that $U_L - wU_y\big|_{(L^{**}, y^{**}, RD[F'(y^{**})])} \leqslant U_L - wU_y\big|_{(L^{**}, y^{**}, RD[F(y^{**})])}$. Hence we conclude that $U_L - wU_y < -wU_{RD}[1 - F'(y)]\big|_{(L^{**}, y^{**}, RD[F'(y^{**})])}$.

[14] A succinct proof of this transformation is provided in Stark [2006].

[15] We define $f(y) = \frac{dF(y)}{dy} > 0$, where $f(y)$ is the density function. The derivation of (10) is in the Appendix.

[16] We use the notations $RD[F(y)] = \int_y^{\infty} [1 - F(x)]dx$, and $RD[F'(y)] = \int_y^{\infty} [1 - F'(x)]dx$.

2) From the re-write of (9) the optimal choice of work hours for the transformed exogenous F' is obtained by

$$U_L - wU_y = -wU_{RD}[1 - F'(y)]\big|_{(L^{**} - \Delta H,\, y^{**} + w\Delta H,\, RD[F'(y^{**} + w\Delta H)])},$$

where ΔH is the change in the optimal duration of work.

3) We show by contradiction that $\Delta H > 0$. Let us assume that $\Delta H \leqslant 0$. Then, from assumptions (c)–(i), we have that

$$U_L - wU_y\big|_{(L^{**} - \Delta H,\, y^{**} + w\Delta H,\, RD[F'(y^{**} + w\Delta H)])} \leqslant U_L - wU_y\big|_{(L^{**}, y^{**}, RD[F'(y^{**})])}$$

and

$$-wU_{RD}[1 - F'(y)]\big|_{(L^{**}, y^{**},\, RD[F'(y^{**})])} < -wU_{RD}[1 - F'(y)]\big|_{(L^{**} - \Delta H,\, y^{**} + w\Delta H,\, RD[F'(y^{**} + w\Delta H)])}.$$

Drawing on point 1., we conclude that

$U_L - wU_y < -wU_{RD}[1 - F'(y)]\big|_{(L^{**} - \Delta H,\, y^{**} + w\Delta H,\, RD[F'(y^{**} + w\Delta H)])}$. Hence we have that $\Delta H > 0$.

We conclude that a transformation of the income distribution, $F \rightarrow F'$: $F'(y^{**}) < F(y^{**})$, induces longer optimal hours of overtime work. □

In summary, incorporation of *RD* in a standard model of labor supply of overtime work implies that an increase in the individual's *RD* induces a longer optimal duration of overtime work.

4. Conclusions

How to increase the "marginal incentives" of workers to supply hours of work beyond the standard work day, work week, or work month is of paramount interest to employers who, while requiring extra work input, are shy of recruiting additional workers when fresh hirings are highly costly.

We have shown how income comparisons influence individuals' optimal allocation of time between work and leisure. An analysis based on the embedding of relative deprivation in a neoclassical model of labor supply reveals that, holding the wage rate per hour unchanged, an increase in an individual's relative deprivation increases his overtime work. This response suggests that an employer could elicit more work effort without incurring the cost of a higher wage rate; when relative deprivation matters, and when the workplace consists of distinct reference groups, a mere reshuffle of these groups could increase the supply of overtime work: if two groups of workers, each consisting of two workers whose basic incomes are (2,2) and (3,3), and each constituting the reference group of the group members, are reshuffled into two new reference groups (2,3) and (2,3), more overtime work will be supplied.

Indeed, the "engineering" by employers of the reference group is an interesting research topic. For example, the span or scope of the reference group

could also be affected by varying the degree of income (wage) confidentiality.[17] The variance across societies in the supply of overtime work could then be attributed both to a measure of wage inequality and to a measure of wage transparency.

Three concluding comments are in order. First, our modeling framework is essentially a partial equilibrium framework in the sense that only one individual is analyzed, and this individual takes the incomes of other individuals as given. When the reaction of other individuals who may respond to the behavior of a given individual is considered, the work supply question becomes more difficult to handle. Put differently, in the present analysis the income of everybody else is taken as exogenous, and we only consider how an individual chooses his labor supply. In a general equilibrium model, the distribution of income is determined by each individual's work-leisure choice. If everybody cares about relative deprivation, it may be possible to find a rat race equilibrium in which everybody just struggles to keep up with the Joneses in terms of income level, creating a multiplier effect or the possibility of multiple equilibria. We are attending to this issue in our ongoing research. Second, while we have earmarked for close study the supply of overtime work, our analytical framework can be adjusted to the study of a more general work-leisure choice problem. Third, in the present paper we explicitly assume that relative deprivation does not depend on comparisons of leisure. In general, relative deprivation may not depend only on comparisons of incomes or levels of consumption. For example, an individual's reference group may include not only his co-workers but also his social networks. And the individual may compare his leisure time to that of people working in different industries and jobs. In such a case, the effects of relative deprivation on overtime work decisions will become more ambiguous.

Appendix

Proof of Claim 1

From (5), we know that the individual's optimal duration of overtime work, H^*, is given by $V_L(T - H^*, y_0 + wH^*) = wV_y(T - H^*, y_0 + wH^*)$. Holding w and T constant, we have that $\frac{dH^*}{dy_0} = -\frac{wV_{yy} - V_{Ly}}{w(V_{yy}w - V_{Ly}) - (V_{Ly}w - V_{LL})}$.

The assumptions in (3) guarantee that $\frac{dH^*}{dy_0} < 0$. □

[17] Whole Foods Market, one of the most successful chains of supermarkets in the US, goes out of its way to disclose to the company's entire workforce what everyone in the company is being paid. This transparency, combined with a capping of executives' salaries and bonuses to a modest multiple of the average worker's pay, effectively transforms the entire company into every worker's reference group.

Proof of Claim 2

Under the four right-hand side assumptions of (3), a change in the wage rate per hour of overtime work entails a substitution effect (reflecting the fact that the opportunity cost of leisure has changed) and an income effect (the individual's real income has changed). The condition for an increase in the hours of overtime work in response to the increase in the wage rate per hour of overtime work follows from the Slutsky equation $V_y > -H^*(wV_{yy} - V_{Ly})|_{(L^*, y^*)}$; the substitution effect has to be stronger than the income effect (if the income effect dominates, a decrease in the wage rate per hour of overtime work will induce longer overtime work).[18] □

Derivation of (9)

We have that $y = y_0 + w(T - L)$ and that $U = U[L, y, RD(y)]$. Noting that $F(x)$ is the cumulative distribution of income in the individual's reference group, $RD(y)$ is defined as $RD(y) = \int_y^\infty [1 - F(x)]dx$ (recall section 3). Since $\frac{\partial RD}{\partial y} = \frac{\partial}{\partial y}\left(\int_y^\infty [1 - F(x)]dx\right) = -[1 - F(y)]$, the first-order condition for the maximization of (8) is yielded by

$$\frac{dU}{dL} = U_L + U_y\frac{\partial y}{\partial L} + U_{RD}\frac{\partial RD}{\partial L} = U_L + U_y(-w) + U_{RD}\frac{\partial RD}{\partial y}\frac{\partial y}{\partial L}$$
$$= U_L - wU_y - U_{RD}[1 - F(y)](-w) = U_L - wU_y + wU_{RD}[1 - F(y)]$$
$$= 0 \Leftrightarrow U_L = wU_y - wU_{RD}[1 - F(y)].$$

We conclude that the individual's optimal duration of overtime work, $H^{**} = T - L^{**}$, is given by

$$U_L = wU_y - wU_{RD}[1 - F(y)] \mid_{[L^{**}, y^{**}, RD(y^{**})]},$$

where L^{**} is the individual's optimal leisure time, and y^{**} is the resultant optimal income. □

Derivation of the second-order condition for a maximum of (8)

$$\frac{d^2U}{dL^2} = U_{LL} + U_{yL}\frac{\partial y}{\partial L} + U_{RDL}\frac{\partial RD}{\partial L} - w\left(U_{Ly} + U_{yy}\frac{\partial y}{\partial L} + U_{RDy}\frac{\partial RD}{\partial L}\right)$$
$$- wf(y)\frac{\partial y}{\partial L}U_{RD} + w[1 - F(y)]\left(U_{LRD} + U_{yRD}\frac{\partial y}{\partial L} + U_{RDRD}\frac{\partial RD}{\partial L}\right)$$

[18] The Slutsky equation measures the change in the optimal duration of work induced by a marginal increase in the wage rate per hour of work. The equation incorporates two terms: the substitution effect (positive) and the income effect (negative).

$$= U_{LL} - wU_{Ly} + wU_{RDL}[1 - F(y)] - w(U_{Ly} - wU_{yy} + wU_{RDy}[1 - F(y)])$$
$$+ w^2 U_{RD} f(y) + w[1 - F(y)](U_{RDL} - wU_{RDy} + wU_{RDRD}[1 - F(y)])$$
$$= U_{LL} + w^2 U_{yy} + w^2 U_{RDRD}[1 - F(y)]^2 - 2wU_{Ly} + 2wU_{RDL}[1 - F(y)]$$
$$- 2w^2 U_{RDy}[1 - F(y)] + w^2 U_{RD} f(y),$$

where, recalling footnote 15, $f(y)$ is the density function $f(y) = \frac{\partial F(y)}{\partial y} > 0$. Recalling assumptions (c)–(i),[19] we have that $\frac{d^2U}{dL^2} < 0$. □

Derivation of (10)

We derive $\frac{dy^{**}}{dRD}$ assuming that $F(x)$ is constant for $x \in (y^{**} - \varepsilon, y^{**} + \varepsilon)$, where $\varepsilon > 0$. That is, $\left.\frac{dy^{**}}{dRD}\right|_{F(y^{**}) = const}$ is the change in optimal (resultant) income induced by a marginal increase in RD which is the result of an increase in the mean excess income in the individual's reference group.

We define a function

$$G[L^{**}, y^{**}, RD(y^{**})] = U_L - wU_y + wU_{RD}[1 - F(y)]\big|_{[L^{**}, y^{**}, RD(y^{**})]}.$$

From (9) we have that $G[L^{**}, y^{**}, RD(y^{**})] = 0$ for all optimal incomes, and that $dG[L^{**}, y^{**}, RD(y^{**})] = 0$. Hence, the impact of a marginal increase in RD on optimal income is given by

$$dU_L = d\{wU_y - wU_{RD}[1 - F(y)]\}\Big|_{[L^{**}, y^{**}, RD(y^{**})]}. \qquad \text{(A1)}$$

Since from (1) and $H = T - L$ $\frac{dL}{dy} = -\frac{1}{w}$, the left-hand side of (A1) is yielded by

$$U_{LL}dL + U_{yL}dy + U_{RDL}dRD = \left(U_{Ly} - \frac{1}{w}U_{LL}\right)dy + U_{RDL}dRD\Big|_{[L^{**}, y^{**}, RD(y^{**})]}.$$

Then, noting that $f(y) = \frac{\partial F(y)}{\partial y}$, we derive the right-hand side of (A1):

$$w(U_{Ly}dL + U_{yy}dy + U_{RDy}dRD) - w[1 - F(y)](U_{LRD}dL + U_{yRD}dy + U_{RDRD}dRD)$$
$$+ wU_{RD}\frac{\partial F(y)}{\partial y}dy = \{-U_{Ly} + wU_{yy} + U_{RDL}[1 - F(y)] - wU_{RDy}[1 - F(y)]$$
$$+ wU_{RD}f(y)\}dy + w\{U_{RDy} - U_{RDRD}[1 - F(y)]\}dRD\Big|_{[L^{**}, y^{**}, RD(y^{**})]}.$$

[19] From the Young's Theorem we have that $U_{Ly} = U_{yL}$, $U_{RDL} = U_{LRD}$, and $U_{RDy} = U_{yRD}$.

Since

$$dU_L = d\{wU_y - wU_{RD}[1 - F(y)]\}\Big|_{[L^{**}, y^{**}, RD(y^{**})]}$$
$$\Leftrightarrow \Big\{U_{Ly} - \frac{1}{w}U_{LL} + U_{Ly} - wU_{yy} - U_{RDL}[1 - F(y)]$$
$$+ wU_{RDy}[1 - F(y)] - wU_{RD}f(y)\Big\}dy$$
$$= \{wU_{RDy} - wU_{RDRD}[1 - F(y)] - U_{RDL}\}dRD\Big|_{[L^{**}, y^{**}, RD(y^{**})]},$$

we obtain that

$$\frac{dy^{**}}{dRD}\Big|_{F(y^{**}) = const}$$
$$= \frac{w\{U_{RDy} - U_{RDRD}[1 - F(y)]\} - U_{RDL}}{2U_{Ly} - \frac{1}{w}U_{LL} - wU_{yy} + (wU_{RDy} - U_{RDL})[1 - F(y)] - wU_{RD}f(y)}\Bigg|_{[L^{**}, y^{**}, RD(y^{**})]}.$$

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HOW AND WHY THE INCOMES OF OTHERS CAN SHAPE THE SUPPLY OF OVERTIME WORK

Abstract

This paper shows how the allocation of an individual's time between overtime work and leisure is affected by comparisons with the incomes of others. It is shown that when the individual's utility function incorporates a measure of relative deprivation, the individual's optimal duration of overtime work is longer for any positive level of relative deprivation. Given the wage rate per hour, the individual reacts to an increase in his relative deprivation by increasing his overtime work.

Keywords: Labor supply; Overtime work; Income comparisons; Relative deprivation
JEL classification: A14; D01; J01; J22; J31

JAK I DLACZEGO DOCHODY INNYCH MOGĄ KSZTAŁTOWAĆ PODAŻ PRACY W NADGODZINACH

Streszczenie

Artykuł przedstawia w jaki sposób na alokację czasu pomiędzy pracę w nadgodzinach a czas wolny wpływa porównywanie przez pracownika jego dochodu z dochodami innych osób. Autorzy wykazują, że uwzględnienie w funkcji użyteczności pracownika niezerowej (dochodowej) relatywnej deprywacji wydłuża optymalny czas pracy w nadgodzinach. Przy stałej stawce płacy za godzinę, wzrost poziomu relatywnej deprywacji pracownika powoduje, że jego czas pracy w nadgodzinach rośnie.

Słowa kluczowe: Podaż pracy; Praca w nadgodzinach; Porównania dochodów; Relatywna deprywacja

КАК И ПОЧЕМУ ЧУЖИЕ ДОХОДЫ МОГУТ ВЛИЯТЬ НА ПРЕДЛОЖЕНИЕ ТРУДА В СВЕРХУРОЧНОЕ ВРЕМЯ

Резюме

В статье рассматривается вопрос, каким образом на распределение времени между работой в сверхурочные и свободные часы влияет сопоставление работником своего дохода с доходами других лиц. Авторы доказывают, что учёт в функции полезности работника ненулевой (касающейся дохода) относительной депривации удлиняет оптимальное время работы в сверхурочное время. При постоянной ставке зарплаты за час, рост уровня относительной депривации работника приводит к тому, что время его работы в сверхурочное время растёт.

Ключевые слова: Предложение труда; Работа в сверхурочное время; Сопоставление доходов; Относительная депривация