# Labour supply, relative income and basic income

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*Abstract*

There is evidence that concern for relative income can lead to excessive labour supply, though it is difficult to distinguish this effect from competitive effort to gain promotion and job-security. Unpaid overtime is widespread, and surveys show that many workers would prefer shorter hours even with reduced pay, while many are also underemployed because they cannot find full time jobs.

In a model with a universal basic income (UBI), there is a marginal wage below which workers choose voluntary unemployment. In a general equilibrium version when benefits are funded by taxation, stronger comparison also increases labour supply when the tax is given. However, the maxi-min optimal linear tax and resulting marginal wage do *not* depend on comparison, while increasing importance of comparison under this tax *reduces* labour supply by employed individuals.

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*Introduction*

The importance of comparison and status for happiness or life satisfaction was emphasized by Adam Smith and other classical economists, and developed by Veblen (1899). There is extensive evidence for the role of relative income in the rapidly growing empirical literature on 'happiness economics' (Clark et al., 2008; Goerke and Pannenberg, 2015). The plausible positive effect of comparison on labour supply to 'keep up with the Joneses' is more difficult to identify, since hours and working conditions are usually set by employers in the medium term, while competitive promotion also provides incentives for extra effort. Many low earners are part time and 'underemployed' because they would prefer full time work but are unable to find such jobs, but others choose part time work with a partner in full time employment, and/or family caring responsibilities.

Nevertheless, careful studies have provided evidence that concern for relative income can raise effective labour supply (Bracha et al., 2015; Card et al., 2012; Clark et al., 2008; Goerke and Pannenberg, 2013; Perez, 2006). Furthermore, inequality at the national level reduces well-being and encourages longer working hours (Wilkinson and Pickett, 2009; Bowles and Park, 2005). Top income shares in a large international sample universally depress life satisfaction even after controlling for household relative income (Burkhauser et al., 2016). While reference groups depend on context, approaches based on upward comparison or local area average income predominate in micro-studies (Ferrer-i-Carbonell, 2005) – consistent with Veblen's (1899) concept of motivation to emulate the rich and their 'conspicuous consumption'.

In contrast to the usual assumption, peer comparison appears to indicate future opportunities to younger workers (who are generally the lowest paid), and has a robust *positive* effect on their well-being (FitzRoy et al., 2014). It is also plausible that relative deprivation increases

with the difference between own-income and higher incomes, represented by some average measure, so the relative importance of comparison should decline as own income rises.

*Overwork and Comparison*

While surveys show happiness or life satisfaction always increases with income after controlling for many individual characteristics, a theoretical model by Ulph (2014) shows that low wage workers who compare only with peers earning the same wage (as in Beath and FitzRoy, 2009), and choosing optimal hours close to zero in Nash Equilibrium (NE), are less happy than the voluntarily unemployed, with an unconditional basic income (UBI) for all. NE holds when all choose identical, positive optimal hours for any wage above the reservation wage. However, those with a wage below the reservation wage do not work, receive UBI, but only compare themselves with unemployed peers, and hence do not suffer from 'relative deprivation'.

This model starts from a conventional utility of consumption and leisure, multiplied by a comparison term. Consumption depends on earnings and UBI. Realistically however, low-earning individuals often share income from a working partner in the household, there are minimum wages in all advanced economies, and the lowest earners generally work very few hours at or close to the minimum wage, but may have a partner in full time work. Thus it seems important to include the income effects of shared household income, as we do in the following. An individual wage or productivity can be treated as proxy for education and qualifications, and assortative mating implies that partners' earnings are positively correlated with the own wage. Furthermore, higher wages usually mean more interesting work, a positive externality that is usually neglected in welfare economics, and education may have an independent positive effect on well-being after controlling for income, by improving the quality of both consumption and leisure.

We define the *effective* wage as the market wage or productivity less the pecuniary cost of going to work. This is particularly important for single parents with dependent children; if their market wage is low they may have to pay more for child care than they earn, so in principle the effective wage could be negative. However, we assume zero labour supply from households with zero or negative effective wages and a continuous distribution, denoted $w \in [0,b]$, with distribution $F(w)$, density $f(w)$, and $F(1)=1$. There is a positive mass of individuals at zero who supply no work. Individual contractual labour supply is $x \geq 0$, an increasing function of the wage.

Well-being of the employed is $U(C)+V(x/x_0)-D(x)$ where $U$ is concave increasing as usual, and the cost of work, $D$, is convex increasing. $V$ represents the value of relative income or own effort relative to labour supply by other workers with the same qualification or wage rate. This may reflect status and/or the increased probability of future promotion to a higher pay level resulting from greater current effort. $C = wx(1-t)+B-Y$ is effective consumption with positive labour supply plus basic income, $B$, and a negative effect of comparison income, $Y$. Utility of the unemployed is $U(B-Y)$.

We assume the probability of employment, $P$, is increasing in the wage, reflecting the better employment chances of more qualified workers. There is thus an exogenous probability of involuntary unemployment, $(1-P)$. Expected well-being is thus

1. $$W = P\{U(C)+V-D(x)\}+(1-P)U(B-Y)$$

The first order condition for optimal labour, say $\hat{x}$, is

2. $$w(1-t)U'(\hat{C})+\frac{V'(\hat{x}/x_0)}{x_0}-D'(\hat{x})=0$$

In Nash equilibrium, all workers of the same type choose the same optimal $\hat{x}$, and (2) becomes

3. $$\hat{x}\left\{w(1-t)U'\left(\hat{C}\right)-D'\left(\hat{x}\right)\right\}+V'(1)=0$$

Clearly $\hat{x}$ is a unique function of *w* and other variables, decreasing in *B*, intuitively because basic income reduces marginal utility, or by differentiating (3). Clearly the terms in curly brackets must be negative, instead of zero when there is no value of relativity.

Now let $\hat{C}=w\hat{x}(1-t)+B-Y$, be equilibrium effective consumption with optimal labour supply. We make the usual assumption that labour supply increases with the wage, and also assume that $V(1)>0$ so there is a benefit from employment in addition to extra income, in accordance with extensive empirical evidence. Then for any $B>0$ there is a positive marginal wage, say $m=m(t,B)$ at which workers are indifferent between employment and unemployment, so

4. $$U\left(m(1-t)\hat{x}+B-Y\right)+V(1)-D\left(\hat{x}\right)=U\left(B-Y\right)$$

Now total tax revenue, say $R(t,B)$ is defined as

5. $$R(t,B)=t\int_{m}^{b}P(w)\,w\hat{x}\,dF(w)$$

and the integral is a decreasing function of *B* since *m* increases and labour supply declines with *B*. It follows that for all $t\in[0,1)$ there is a unique basic income $B(t)$ such that $R\left(t,B(t)\right)=B(t)$ so the budget condition that all revenue is distributed as basic income for the unit population is satisfied.

To obtain the behaviour of well-being at the reservation wage, we take the total derivative using the FOC and the Envelope Theorem, so:

$$6. \qquad dW/dw|_{w=m} = P'(m)\left\{U\left(\hat{C}\right)+V-D-U\left(B-Y\right)\right\}+P(m)\left\{U_C.\left((1-t)\hat{x}-Y_w\right)-\frac{V'}{\hat{x}}\right\}$$

The negative effects of comparison and status are likely to be small for low wage workers, so those with wages just above $\hat{m}$ are unlikely to be worse off than the unemployed.

*A general equilibrium model of income comparison and labour supply*

The empirical evidence shows that individual life satisfaction actually always increases with earnings, holding other factors constant. However, people are less satisfied and work longer hours in a more unequal economy with higher average earnings relative to the lowest (Goerke and Pannenberg, 2015; Bowles and Park, 2005), consistent with egalitarian Nordic countries having higher life satisfaction and shorter working time than highly unequal US and UK.

An alternative approach is to consider comparison with a fixed income, such as average income in the economy, which increases relative to the median with growing income inequality in the distribution. Then with a basic income and zero labour supply at the reservation wage, the total derivative above is zero at the reservation wage, which is not informative about the behaviour of utility for higher wages. To proceed we thus choose a simple functional form which also allows a General Equilibrium (GE) analysis with taxes and a government budget, that also turn out to be crucial for labour supply.

We assume utility is quasi-linear in leisure, and comparison is with average income. Since this is empirically higher than median income, it implies upward comparison for most. (There is evidence that downward comparison is relevant for the rich). Labour supply increases with concern for relativity in partial equilibrium; the unemployed suffer from relative deprivation;

most people's happiness declines with inequality of the wage distribution; and happiness is a concave increasing function of income. We show that labour supply in GE depends crucially on the interaction between employment, tax and comparison.

Utility for the employed and unemployed is respectively:

7. $$U_{em}(w) = \frac{\gamma}{\gamma - 1}\left(wx(1-t) + B - \beta y\right)^{\frac{\gamma-1}{\gamma}} - x$$

$$U_{un} = \frac{\gamma}{\gamma - 1}\left(B - \beta y\right)^{\frac{\gamma-1}{\gamma}}$$

Here, $\gamma > 1$, (and $\gamma - 1$ is the elasticity of labour supply in the standard case, when $\beta$ = 0), $t$ is the tax rate on earnings, $wx$ is output with linear technology, equal to earnings, $wx(1-t) + B$ is total net income of the employed, which is consumed, and $y$ is the comparison income, which will be defined in equilibrium as total output or output per capita with our unit population, in (14) below. Empirical evidence suggests that a variety of comparisons may be relevant, dependent on context, but our simple model just represents the idea of income comparison in a tractable form consistent with some stylized facts, albeit with unrealistic voluntary unemployment and UBI. For simplicity we have a unit marginal cost of separable labour supply.

The FOC for (7) now gives labour supply according to

8. $$w^{\gamma}(1-t)^{\gamma} = w\hat{x}(1-t) + B - \beta y$$

As in the previous section workers with less than the reservation *wage*, say *m*, will supply zero effort, and these and all others with lower wages will prefer not to be employed. (With other variables constant in partial equilibrium, a stronger comparison effect increases labour

supply to keep up with the 'average Joneses', but this changes in GE). Thus the reservation or marginal wage *m* from (8) with $\hat{x}=0$ is given by

9. $$m^{\gamma}(1-t)^{\gamma} = B - \beta y$$

The number (or share) of non-employed in the unit population is thus $F(m)$. Then, from (8) and (9), we have wage earnings for worker *w*:

10. $$w\hat{x} = \left(w^{\gamma} - m^{\gamma}\right)(1-t)^{\gamma-1}$$

The utility of the employed follows easily as:

11. $$U_{em} = \left\{\frac{w^{\gamma-1}}{\gamma-1} + \frac{m^{\gamma}}{w}\right\}(1-t)^{\gamma-1}$$

The derivative is

12. $$\frac{\partial U_{em}}{\partial w} = \left\{w^{\gamma-2} - \frac{m^{\gamma}}{w^2}\right\}(1-t)^{\gamma-1}$$

which is zero for $w=m$ and positive for larger *w*. Thus, employed well-being increases with the wage as expected.

Next we introduce the government budget to complete the GE model. All tax receipts are spent on basic income for the unit population, so $ty = B$ and from (9) we have

13. $$(t-\beta)y = m^{\gamma}(1-t)^{\gamma}$$

From (10) we find the value of total output, say $\hat{y}$, with optimal labour supply as

14.
$$\hat{y} = \int_{m}^{1} w\hat{x}dF = \int_{m}^{1} \left(w^{\gamma} - m^{\gamma}\right)(1-t)^{\gamma-1}dF$$
$$= (1-t)^{\gamma-1}\left\{G(m) - m^{\gamma}\left(1-F(m)\right)\right\}$$

with $G = G(m) \equiv \int_{m}^{1} w^{\gamma} f(w)dw$ . Using (13) then gives the 'equilibrium' or budget balancing tax with reservation wage *m* as

15.
$$\hat{t} = \beta + \frac{(1-\beta)m^{\gamma}}{G + m^{\gamma}F}$$

As expected, the equilibrium tax increases with the reservation wage (and unemployment), and also with the importance of comparison, $\beta$. This increase of the tax with $\beta$ thus partially offsets the negative externality imposed by comparison. Since *t* is the actual policy variable we can invert (15) to give the equilibrium reservation wage, and hence unemployment, say $\hat{m} = \hat{m}(t, \beta)$, which is generated by – and increases with – *t* , and declines as $\beta$ rises. Interestingly, as unemployment and *m* tend to zero, the tax tends to $\beta$.

Utility of the unemployed in GE easily follows from (7), (9) and (13) and is zero when *t* equals $\beta$ or 1 (and $m$ ranges from zero to its maximum, *b*):

16.
$$\hat{U}_{un} = \frac{\gamma}{\gamma-1}\left(\left(\hat{t}-\beta\right)\hat{y}\right)^{\frac{\gamma-1}{\gamma}} = \frac{\gamma}{\gamma-1}m^{\gamma-1}\left(1-\hat{t}\right)^{\gamma-1}$$

With any *fixed* tax *t*, the equilibrium reservation wage $\hat{m}$ *decreases* when $\beta$ rises, from (15), so employment increases with stronger comparison. On the intensive margin, we see from (10) that in this case stronger comparison and hence declining $\hat{m}$ also increase individual labour supply. The downside is that, from (11) and (15), the utility of both employed and

unemployed individuals declines as $\beta$ rises and $\hat{m}$ falls when tax is given, as expected since comparison is essentially an externality.

In contrast, if any given *m* and the corresponding equilibrium tax (15) are substituted into (10) we then see that individual labour supply *declines* with stronger comparison, since $\hat{t}$ increases with $\beta$ , so the 'Joneses effect' is reversed by fixing the marginal wage and allowing the equilibrium tax to accommodate stronger comparison.

An interesting special case is as follows. We can write unemployed utility (16) in terms *of m* as depending on:

17. $$m(1-t) = (1-\beta)\left\{m - \frac{m^{1+\gamma}}{G(m) + m^{\gamma} F(m)}\right\}$$

Then if *m** is the optimal marginal wage which maximises (17) and (16), it does *not* depend on comparison, $\beta$, which is multiplicative in (17), and $t* = \hat{t}(\beta, m*)$ is the resulting optimal equilibrium tax from (15) which rises with $\beta$ (equivalently , $m* = \hat{m}(\beta, t*)$). Thus with the maxi-min optimal marginal wage, it follows again that stronger comparison raises the required tax and lowers individual labour supply, so we can conclude:

*A given marginal wage, including the maxi-min optimal value, reverses 'keeping up with the Joneses' by generating a higher tax and lower labour supply with stronger comparison.*

Note also that the macroeconomic association between inequality and work time depends on the wage distribution, with $G(m)$ increasing as the highest earners predominate. Then the equilibrium tax *declines*, from (15), and labour supply increases.

*Majority choice and Basic Income*

A common critique of UBI is that the required tax (rise) would penalise a majority by costing them more than they gain. To investigate, we substitute equilibrium tax (15) into equilibrium

total output from (14) and write the resulting values as $\hat{y}_e = \hat{y}_e(\beta, m) \equiv \hat{y}(m, \hat{t})$, and the corresponding basic income as $\hat{B}_e = \hat{B}_e(\beta, m)$,which equals total tax revenue, so $\hat{t}\hat{y}_e = \hat{B}_e$. With these equilibrium values in the FOC (9), denote optimal labour supply for worker *w* by $\hat{x}_e = \hat{x}_e(\beta, m, w)$. Then the *equilibrium mean earnings-generating wage* , say $\bar{w}_e$ in the unit population, is defined in the obvious way by $\bar{w}_e \hat{x}_e(\beta, m, \bar{w}_e) = \hat{y}_e(\beta, m)$ and it follows that

18. $$\hat{t}(\beta, m)\bar{w}_e \hat{x}_e(\beta, t, \bar{w}_e) = \hat{t}(\beta, m)\hat{y}_e(\beta, m) = \hat{B}_e(\beta, m)$$

Thus at the average wage, basic income equals tax paid, so lower wage workers will enjoy a net benefit, and higher earners lose out. Since the median wage is less than the average with realistically unequal distributions, it follows that the poorest majority benefits from a basic income. Notice that this result follows with our flat tax, the less favourable case for redistribution, while a progressive tax could obviously benefit a majority. Furthermore, it does not depend on our specific function for utility, but holds quite generally.

Finally we obtain a concise value for the equilibrium average wage by substituting from (10), (13) and (15) into (18). As shown below, it increases with *m*, and turns out not to depend on $\beta$:

19. $$\bar{w}_e^{\gamma} = m^{\gamma} F(m) + G(m),$$

though of course, higher $\beta$ does imply a larger equilibrium tax for given *m*. Thus, higher unemployment implies higher average wages and earnings, so the number who would benefit from *UBI* would also rise. Again, with a fixed tax, since the equilibrium reservation wage $\hat{m}$ decreases when $\beta$ rises, then so will the equilibrium wage.

The contrast between majority gains from a universal benefit and the opposite case for categorical benefits is obvious but worth emphasising. As long as the unemployed, or

recipients of any categorical benefit, are in a minority, then a majority will bear the cost of the required tax, with only immaterial or empathetic gains in compensation. This is consistent with low public support for redistribution to the poor, though the decline in such support has probably been driven by demonization of welfare recipients and widespread misperceptions of the problems under neoliberal policies in many countries.

*Conclusions*

While the results here are hardly relevant for a typical economy with mainly involuntary unemployment and no *UBI*, a natural question is whether the introduction of *UBI* (perhaps after pilot studies in Finland, the Netherlands and elsewhere now under way or in preparation) would generate excess~~ive~~ labour supply ~~for~~ by low earners, most of whom are currently part-time employees. Evidence from lottery winners and various local BI trials suggests that very few people stop working altogether, and a modest reduction of hours worked is the usual reaction.

Thus, the reservation wage would probably be much lower than standard minimum wages with a modest *UBI*. Furthermore, low earners would have much greater bargaining power to allow more job search, and for better jobs. Lower aggregate labour supply by low earners could also reduce involuntary unemployment.

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