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ABSTRACT

Higher Tax and Less Work: An Optimal Response to Relative Income Concern*

There is much evidence that relative income concern reduces subjective wellbeing and raises labour supply – 'keeping up with the Joneses' (KUJ), while increasing use of social media and growing inequality encourage comparison. Models with one or two agent –types generally miss the policy relevant dimension of labour force participation, so we include a distribution of wages with intensive and extensive margins of labour supply, both of which are increased by comparison. The optimal tax response increases with comparison, but, surprisingly, dominates the comparison effect and reduces individual labour supply, thus reversing KUJ, and maintains constant employment, independent of comparison.

JEL Classification: H240, D630

Keywords: income comparison, maxi-min, inequality, unemployment

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1. *Introduction*

Veblen (1899) pointed out over a century ago that the wealthy often engage in conspicuous consumption. As technology and productivity have advanced to a level unimaginable at his time, conspicuous consumption has become widespread under the influence of advertising and social media. Meanwhile average subjective wellbeing or happiness has remained largely constant in the west, and even declined in the US, while real per capita GDP has increased significantly over the last half century (Easterlin, 1974, 1995, 2013; Kaiser and Vendrik, 2018). One reason is rapidly rising income inequality, with most economic growth benefitting just a small minority, particularly in the US and UK, while social mobility has been declining (Stiglitz, 2012; Piketty, 2014; Atkinson, 2015).

Burkhauser et al. (2016) found the income share of the top 1% to be closely and negatively correlated with happiness in a large international panel with many individual controls. While comparison and positional concern for relative income and status have always been important for wellbeing, as noted by classical economists from Adam Smith onwards, comparison is now enhanced by increasingly effective digital communication. Increasing screen time on social and other media has been associated with subsequently rising rates of depression, anxiety and suicidal tendencies, particularly among teenagers in the US and elsewhere (Twenge et al., 2018; Spitzer, 2017; Mujcic and Oswald, 2018). There is considerable direct evidence that concern for relative income generates negative externalities and raises labour supply, or 'keeping up with the Joneses' (KUJ) (Bowles and Park, 2005; Bracha et al., 2015; Clark et al., 2008; Goerke and Pannenberg, 2013; Pérez-Asenjo, 2011).

More indirect evidence for KUJ comes from the fact that decades of post-war rising productivity have not led to major declines in working time in most advanced economies, in stark contrast to Keynes's (1930) famous prediction of a 15 hour work week. However, due to fixed costs of employment, employers also have a strong interest in maintaining long hours for full-time employees, though many would prefer shorter hours. Since workers are also competing for relative income and status through promotion, or just to retain their jobs during downturns in the face of growing employer market power, KUJ also facilitates exploitation through long hours, including extensive unpaid overtime ('more than 5 million people put in an average of 7.5 hours a week in unpaid overtime during 2018' in the UK), in Pareto inferior Nash equilibrium for workers (Sellers, 2019; Stiglitz, 2019).

As self-employment and non-standard employment relations (including zero hour contracts) have proliferated in recent years, working time regulation has become less effective, and Clark (2015) reports that 'Many measures of job satisfaction have been trending downward in OECD countries.' This situation is exacerbated in the US and UK by generally declining union power and stagnant real wages. Real hourly wages for most male workers in the US have not increased for nearly 50 years, and for most employees since 2008 in the UK.

By contrast, the more egalitarian Nordic economies have maintained strong institutions of collective bargaining, and substantially reduced work time compared to the long-hours culture of the most unequal US and UK. High marginal tax rates encourage the better Nordic work-life balance, and allow comprehensive welfare support for the poorest, resulting in less poverty and among the highest life satisfaction, job satisfaction and happiness levels (Krugman, 2018; Kallis et al., 2013).

Pioneering discussions of comparison by Duesenberry (1949), Leibenstein (1950), Runciman (1966), Boskin and Sheshinski (1978), Layard (1980), Oswald (1983), and Frank (1985) were long neglected, but following McBride (2001), extensive survey evidence for the negative effects of comparison on subjective well-being, life satisfaction or happiness has since emerged and been reviewed by Clark et al. (2008), and Layard et al. (2010)[1].

There is also a large theoretical literature on the impact of status, KUJ and corresponding policy. In an influential model, Ljungqvist and Uhlig (2000) obtain an optimal consumption tax equal to the rate of negative externality. Unfortunately this elegant result relies on the fact that identical consumers choose the same consumption level, so there is no relative income effect in equilibrium. Dupor and Liu (2003) refine the definition of KUJ as a higher marginal utility of consumption relative to leisure, different from envy defined as a lower utility, due to comparison with higher aggregate consumption. They argue that only the latter requires an optimal tax increase to correct over-consumption. However, in some circumstances both these effects may be present simultaneously, as in our model below. In a stochastic model with a KUJ utility function and imperfect competition, Guo (2005) finds the optimal labour cost to be constant. His model also assumes a representative agent and his optimal tax cannot apply to the case with heterogeneous consumers. Similarly, with a representative consumer, Mujcic and Frijters (2015) show the optimal tax should increase with conspicuous consumption.

With two types of consumers, Aronsson and Johansson-Stenman (2008) obtain a higher optimal marginal tax under relative consumption concerns, while they (2013) find opposite effects under relative leisure concerns. Again assuming two types of consumers, they further extend the higher tax result to international comparison (2015) and a paternalist government which does not respect consumers' concerns for relative income (2018). In an interesting alternative approach following Ireland (1994), Koenig and Lausen (2018) show that with two

[1] More recent empirical contributions include Ferrer-i-Carbonell (2005), Senik (2009), Dohmen et al. (2011), Card et al. (2012), FitzRoy et al. (2014), Mujcic and Frijters (2015), FitzRoy and Nolan (2016), Mujcic and Oswald (2018), FitzRoy and Nolan (2018).

types of individuals and consumption goods, one of which is positional, both public supply of the non-positional good (such as education or health care), as well as taxation of the positional good are generally required for efficient policy.

The assumption of a representative consumer limits the relevance of optimal taxes. Income inequality is crucial for relative income effects. While assuming two types of consumers can partially correct this omission, the tax policy remains more illustrative than directly relevant. In optimal tax models with a general income distribution, Kanbur and Tuomala (2013) and Tuomala (2016) obtain both higher progressivity and marginal taxes due to concerns for relative income. Their numerical simulations assume maxi-min and utilitarian objectives. In a model similar to the one used here, the simulation by FitzRoy and Nolan (2016) finds that relativity implies much higher linear taxes under a utilitarian objective, but makes little difference to maxi-min taxes. Slack and Ulph (2017) also find linear tax rising with income comparison and provide simulation results.

In this paper, we develop a simple model with extensive and intensive margins of labour supply, and comparison with widely used average income as reference group. Tax revenue funds a universal basic income (BI). We have two surprising results: optimal (maxi-min or utilitarian) employment does not depend on the strength of comparison, and the optimal linear tax increases with stronger comparison to actually reverse the KUJ effect – individual labour supply *declines*, the unemployed suffer least, and inequalitydeclines.

These theoretical results seem to be new, and have some policy relevance. Higher income tax, combined with shorter work time may be welfare improving for a new reason, in addition to traditional arguments for increasing leisure with productivity, in an increasingly interconnected world of digital communication and comparison. A common critique of BI is that it may reduce individual labour supply at the intensive margin, but with comparison and KUJ this is actually a beneficial effect. A limitation of our and similar models is that growing employer market power may help to maintain excessive working time, so that labour market regulation and stronger employee representation are also required.

The model is set out in section 2 below, followed by derivation of equilibrium conditions in section 3. The main optimal tax results and policies are obtained in section 4, and conclusions are summarised in section 5.

2. *A simple model of comparison*

We assume an economy with a unit population and a continuous distribution of wages $w \in [0, b]$. Wages close to zero may appear to be unrealistic, but should be interpreted as nominal wages net of costs of working, such as transport or the cost of childcare during worktime. The distribution function is denoted by $F(w)$, and the density function $f(w)$. The wage is identical with productivity. Individual labour supply is $x \geq 0$. Utility is quasi-linear in leisure. Comparison is with mean income, higher than median income, due to the positively skewed distribution of income in all economies. It is commonly assumed in the literature, and implies realistic upward comparison for most. However (downward) comparison has a much smaller relative affect for high earners, so this may be a reasonable approximation to capture the general positional externality. As the distribution becomes more skewed, the median declines relative to the mean and comparison becomes more important.

An individual with wage w and labour supply x earns wx, and receives after-tax earnings $(1 - t)wx$ given a flat tax rate t. Additionally, everyone receives a basic income B, financed by the flat tax. Though unrealistic this is a widely used, simplifying assumption. Let y be total income or output, which is also equal to average income given a unit population. Concern for relative income equivalently reduces everyone's effective income by βy, where β (> 0) represents the strength of comparison. A non-working[2] individual has no earned income, and his effective income is $B - \beta y$. When $B - \beta y \geq 0$, the utilities for the employed and non-working, V and U are:

$$V = \frac{1+\varepsilon}{\varepsilon}[(1-t)wx + B - \beta y]^{\frac{\varepsilon}{1+\varepsilon}} - x \tag{1}$$

$$U = \frac{1+\varepsilon}{\varepsilon}(B - \beta y)^{\frac{\varepsilon}{1+\varepsilon}} \tag{2}$$

If $B - \beta y < 0$, we define $U = 0$. We will show later that this will not happen given a reasonable tax policy. Here, t is the government choice variable, $wx(1-t) + B$ is net income of the employed, and ε (> 0) is elasticity of labour supply with respect to the net wage, i.e., $(1 - t)w$. The total earnings impose a negative externality on everyone, $-\beta y$. We consider the case of $\beta < 1$, and particularly focus on the effect of an increase in β. From (1) we find the first-order condition of utility maximization for a worker with wage w, i.e., $\frac{dV}{dx} = 0$:

$$(1 - t)^{1+\varepsilon}w^{1+\varepsilon} = (1 - t)wx + B - \beta y \tag{3}$$

From (3) we can solve for optimal individual labour supply as:

$$x = (1 - t)^{\varepsilon}w^{\varepsilon} - \frac{B - \beta y}{(1-t)w} \tag{4}$$

Given $B - \beta y > 0$, the labour supply always increases with w. It obviously decreases with t if $B - \beta y$ is fixed, while $B - \beta y$ in fact will change too. An individual will choose to work if his utility V in (1) is higher than U in (2). We define the *marginal* wage m from (4)

[2] These individuals may be voluntarily unemployed, or out of the labour force and working in the home, so we use both terms. Involuntary, random unemployment could be included but would not provide additional insight.

as the highest wage with which an individual chooses zero labour supply (non-employment), i.e. $x = 0$. By definition a marginal wage earner is indifferent between work and non-employment. So we have

$$(1 - t)^{1+\varepsilon} m^{1+\varepsilon} = B - \beta y \tag{5}$$

Anyone with wage lower than m will choose non-employment, perhaps doing unpaid work at home and supported by the basic income. The total non-employment rate is $F(m)$, and total employment is $E(m) = 1 - F(m)$.Subtracting (5) from (3) we find earnings for worker with $w \geq m$ as:

$$wx = (1 - t)^{\varepsilon}(w^{1+\varepsilon} - m^{1+\varepsilon}) \tag{6}$$

Let $G(m) \equiv \int_m^b w^{1+\varepsilon} f(w) dw$. Integrating (6) over all $w \geq m$, yields total output $y = \int_m^b wxf(w)dw$. Recall that $E(m) = 1 - F(m)$. Then we have:

$$y = (1 - t)^{\varepsilon}[G(m) - m^{1+\varepsilon} E(m)] \tag{7}$$

Given marginal wage m, total output falls with t. However, as t changes, m will be affected as we can see through (5). To evaluate the impact of t on m, we need to specify basic income B, which is financed by tax revenue, i.e., $B = ty \geq 0$. Then (5) and (7) contain three variables, β, t and m, consistent with optimal labour supply. β is a parameter, t is the choice variable and m is determined by β and t. Given this system with a tax financed basic income, we will show that concern for relative income will raise labour supply and reduce everyone's utility, and examine how a tax policy should respond to income comparison.

3. *Equilibrium with income comparison*

We first obtain the maximized utility of the employed and non-employed. Substituting (3) into (1), we get $V = (1 + \varepsilon)(1 - t)^{\varepsilon}w^{\varepsilon} - x$. Solving for x from (6) and substituting it here, we

find the maximum V. Similarly, substituting (5) into (2), we get U. Hence the utility of employed and non-employed in equilibrium are:

$$V = (1-t)^{\varepsilon}\left(\frac{w^{\varepsilon}}{\varepsilon} + \frac{m^{1+\varepsilon}}{w}\right) \tag{8}$$

$$U = \frac{1+\varepsilon}{\varepsilon}(1 - t)^{\varepsilon}m^{\varepsilon} \tag{9}$$

The maximized utility of an employee, V, always increases with his wage w. By (8) and (9), marginal wage earners, with $w = m$, have the same utility as that of the non-employed, U. It will be useful to define $h(m)$, a function of m as follows:

$$h(m) = \frac{G(m) - m^{1+\varepsilon}E(m)}{G(m) + m^{1+\varepsilon}E(m)} \tag{10}$$

Obviously $h(m) < 1$. As $m^{1+\varepsilon}E(m) < G(m)$, we have $h(m) > 0$ for any m. Substituting $B = ty$ and (7) into (5), we obtain $(1 - t)m^{1+\varepsilon} = (t - \beta)[G(m) - m^{1+\varepsilon}E(m)]$. As $t - \beta = 1 - \beta - (1 - t)$, we get $(1 - t)[G(m) + m^{1+\varepsilon} F(m)] = (1 - \beta)[G(m) - m^{1+\varepsilon}E(m)]$. So we obtain a simple relation between t, β and m as follows:

$$1 - t = (1 - \beta)h(m) \tag{11}$$

Thus m is an implicit function of the policy variable t and comparison strength β. When $t = \beta$, we see from (11) that $h(m) = 1$. From (10) we see that $h(m) = 1$ if and only if $m = 0$. Hence setting tax rate $t = \beta$ will lead to full employment (zero non-employment). On the other hand when t approaches 1, $h(m)$ must be close to 0 for any $\beta < 1$. From (10) we see that $h(m) = 0$ if and only if $m^{1+\varepsilon} E(m) = G(m)$, which implies $m = b$. Hence setting $t = 1$ will lead to zero employment and output as expected.

Moreover, from (11) we can evaluate how the equilibrium marginal wage m is affected by tax t given comparison β, and how m is affected by comparison β given tax t. We will show that $h(m)$ monotonically falls with m. Then the implicit function m has the following dependence on t or β, when the other variable is fixed.

Proposition 1: *Given any* β, $\frac{\partial m}{\partial t} > 0$*; given any* t, $\frac{\partial m}{\partial \beta} < 0$.

Proof: We differentiate $h(m)$ in (10). As $G'(m) = -m^{1+\varepsilon} f(m) = -m^{1+\varepsilon} F'(m)$, the numerator of $h'(m)$ is $-(1-\varepsilon) m^{\varepsilon} G(m)$. So $h'(m) < 0$ for any m. Given β, we differentiate both sides of (11) with respect to t, so $(1-\beta) h'(m) \frac{\partial m}{\partial t} = -1$ and $\frac{\partial m}{\partial t} > 0$. Similarly, given t, we differentiate (11) with respect to β: $-h(m) + (1-\beta) h'(m) \frac{\partial m}{\partial \beta} = 0$. Hence $\frac{\partial m}{\partial \beta} = h(m)/(1-\beta)h'(m) < 0$.

V and U in (8) and (9) can be written implicitly as functions of β and t. Given β, we can choose t to maximize a social welfare function, usually as weighted average of V and U. Before we consider any optimal tax policy, we first show that we should have $t > \beta$. In the earlier literature with a representative consumer, e.g., Ljungqvist and Uhlig (2000), the optimal tax rate is equal to β. This no longer holds here when we assume a general income distribution. Since we have $\frac{\partial m}{\partial t} > 0$ given any β, a higher tax always implies less employment. Moreover, from (6) we see that higher t and m also imply less earnings for every worker. Thus total output y must be lower, i.e., we have $\frac{\partial y}{\partial t} < 0$. As $B - \beta y = (t - \beta)y$, its derivative respect to t is $y + (t - \beta)\frac{\partial y}{\partial t} > 0$ if $t \leq \beta$. From (2) we see $U = 0$ if $t \leq \beta$. Similarly, differentiating (1) with respect to t, we see the derivative is positive if

$y - wx + (t - \beta)\frac{\partial y}{\partial t} > 0$, which holds if $y > wx$ and $t \leq \beta$. Hence, a tax increase benefits an employee if his earnings are less than average earnings. Moreover, the median income is usually lower than the mean. Our utility V in (1) exhibits decreasing marginal utility. So, utilitarian welfare must rise with t when $t \leq \beta$. This conclusion also applies to any social welfare function which assigns more weight to lower income earners than higher ones. Therefore, we obtain:

***Proposition* 2**: *A reasonable social welfare function requires $t > \beta$.*

Given this result, we will only consider the case of $t > \beta$, and our utility function for the unemployed in (2) is valid and $U > 0$ for all cases considered. Note that β measures the negative externality that a unit increase in total income imposes on everyone. When $t = \beta$, it is similar to a Pigouvian tax, which is equal to the negative externality in the economy. Our result suggests that this tax rate is not sufficient because there is also a need for income redistribution, which is absent given a representative agent. Proposition 2 also implies a potential need to adjust tax policy when income comparison becomes stronger.

Before we examine such tax adjustment, we look at the impact of β given t. From (6) we can write a worker's labour supply $x = (1 - t)^{\varepsilon}(w^{\varepsilon} - \frac{m^{1+\varepsilon}}{w})$. Since $\frac{\partial m}{\partial \beta} < 0$, the impact of income comparison on labour supply given t is $\frac{\partial x}{\partial \beta} = -(1 - t)^{\varepsilon}(1 + \varepsilon)\frac{m^{\varepsilon}}{w}\frac{\partial m}{\partial \beta} > 0$. Its value is inversely related to wage rate w.

***Proposition* 3 – KUJ**: *Given any fixed tax, income comparison raises individual labour supply, and the effect is inversely proportional to the wage.*

Intuitively, those affected most by income comparison are likely the poorest, which is made precise in proposition 3. From (8) and (9), we see both employed and unemployed are worse off with lower m due to higher $\beta > 0$. Furthermore, we obtain from (8) the impact on an employee, $\frac{\partial V}{\partial m} = (1 + \varepsilon)(1 - t)^{\varepsilon}\frac{m^{\varepsilon}}{w}$, which falls with w; and from (9) we find the impact on the non-employed, $\frac{\partial U}{\partial m} = (1 + \varepsilon)(1 - t)^{\varepsilon}m^{\varepsilon-1}$. Given t, since $\frac{\partial V}{\partial m} < \frac{\partial U}{\partial m}$ for any $w > m$, the unemployed are affected most and the highest earners least. Summarising:

***Proposition* 4**: *Given any fixed tax, income comparison reduces everyone's utility, with the non-employed affected the most*.

Our result is consistent with the earlier literature with a general income distribution, e.g. FitzRoy and Nolan (2016), but differs from Ulph (2014) who shows if everyone compares his income only with those with the same wage or qualification, a low paid worker will end up being worse off than an unemployed individual. The lowest wellbeing of the unemployed is more consistent with empirical findings and indicates that income comparison does not only impose a negative externality affecting everyone, but also worsens inequality by inflicting the greatest loss on the poorest.

Hence a tax response is needed to offset the externality and reduce inequality. As we have shown, the tax rate equal to the externality β is a minimum requirement, but not sufficient. An optimal tax will depend on the social welfare function, especially the relative weight assigned to the poor and the rich. Finding this tax is more difficult than it is in a normal situation with a negative externality or inequality alone, since the strength of income comparison β is more difficult to measure than a normal externality such as pollution.

4. *Tax response*

We have seen that income comparison leads to KUJ and harms the unemployed most. One natural response to KUJ is *maxi-min policy*, to maximize the utility of the worst-off, the unemployed, or equivalently, the lowest paid employed who share the same utility as the unemployed. Kanbur and Tuomala (2013) and FitzRoy and Nolan (2016) both consider maxi-min and utilitarian welfare functions and compare the corresponding optimal tax policy. We will also consider maxi-min tax first.

From (8) and (9), we see that utility of the non-employed, U, monotonically increases with $m(1-t) = (1-\beta)mh(m)$. Given any $\beta < 1$, this function is zero when $m = 0$ or b, and positive in between. To simplify we assume strict concavity of $mh(m)$. Then for any β, to maximize U is equivalent to maximizing $mh(m)$. By strict concavity, there must be a unique m^* to maximise U. Surprisingly, this m^* does not depend on β, as $1-\beta$ is a multiplicative term. The optimal maxi-min tax should ensure that the marginal wage equals m^* and itself must be equal to $t^* = 1-(1-\beta)h(m^*)$ as indicated by (11). When comparison becomes stronger or β rises, t^* thus increases, but $h(m^*)$ remains the same, giving:

Proposition* 5**: *The maxi-min tax t^* generates a marginal wage, m^*, and unemployment rate, $F(m^*)$, which are* ***independent *of β, though t^* increases with β.*

If government raises tax to maintain employment and the marginal wage when comparison becomes stronger, this will only affect everyone's utility through the tax increase, and in the same proportion. Hence higher wage earners will lose more than lower ones, with the unemployed suffering the least, consistent with the social objective to help the poorest in the maxi-min case.

However, the maxi-min policy is problematic because it ignores the welfare of the employed. Since the employed forms a majority in every society, this will reduce utilitarian welfare and political feasibility. Moreover, as we will show below, it is marginally Pareto inefficient. When we choose $m = m^*$ by raising tax, it hurts every employee and does not benefit the unemployed significantly at the margin. This implies that starting from $m = m^*$, lowering tax marginally would be weakly Pareto-improving.

Proposition 6: *Given any β and $m = m^*$, a marginal tax reduction will benefit all the employed without hurting the non-employed.*

Proof: From (8) we have $\frac{dV}{dt} = \frac{\partial V}{\partial t} + \frac{\partial V}{\partial m}\frac{\partial m}{\partial t} < 0$ if and only if

$$(1 - t)(1 + \varepsilon)m^{\varepsilon}\frac{\partial m}{\partial t} < w^{1+\varepsilon} + \varepsilon m^{1+\varepsilon} \tag{12}$$

Differentiating (11), $1 - t = (1 - \beta)h(m)$, gives $(1 - \beta)\, h'(m)\frac{\partial m}{\partial t} = -1$, and substituting for $1 - \beta$ in (11), and then for $1 - t$ in the LHS of (12), yields $-(1 + \varepsilon)m^{\varepsilon}h(m)/\, h'(m)$. When $m = m^*$, the first-order condition $h(m^*) + m^*h'(m^*) = 0$ implies $-h(m^*)/\, h'(m^*) = m^*$. So $\frac{dU}{dt} = 0$, and U does not fall with a marginal reduction in t. But for $w > m^*$, $(1 + \varepsilon)m^{*1+\varepsilon} < w^{1+\varepsilon} + \varepsilon m^{*1+\varepsilon}$, so $\frac{dV}{dt} < 0$. Hence a small tax *reduction* is weakly Pareto-improving at $m = m^*$.

Thus, it seems reasonable to lower tax and reduce m below m^*. Clearly, how much we should lower m depends on our social welfare function. As strict maxi-min policy is Pareto inefficient, and is unlikely to benefit a majority, we consider a more acceptable objective, to maximize a weighted average utility of the whole population.

This social objective should exclude the case of setting $m > m^*$. If $m > m^*$, a tax reduction will lower m towards the maxi-min m^*, and thus benefit the unemployed. Meanwhile the tax reduction leads to higher net earnings $(1 - t)wx$, both directly and via increased labour supply. So, everyone will be better off from the tax reduction, and we must have a Pareto improvement. Hence setting $m > m^*$ must be Pareto inefficient, and an optimal tax policy to maximize a weighted average utility must lead to $m < m^*$.

The optimal tax t and marginal wage m will depend on the relative weights given to the poor and the rich. We assign a weight $s(w)$ to an individual with wage w in the social welfare function. The weight for every unemployed person is denoted by $s(m)$. The total welfare weight should sum to one, i.e., $s(m)F(m) + \int_m^b f(w)s(w)dw = 1$. Without loss of generality we assume that $s(w)$ is non-increasing in w, so the poor have no less weight than the rich. We multiply (8) and (9) by $s(w)$ and $s(m)$ respectively, substitute $1 - t$ by (11) and integrate them. Then our weighted average social welfare of the whole population is:

$$SW = [(1-\beta)h(m)]^{\varepsilon}\left[\frac{1+\varepsilon}{\varepsilon} m^{\varepsilon} s(m)F(m) + \int_m^b \left(\frac{w^{\varepsilon}}{\varepsilon} + \frac{m^{1+\varepsilon}}{w}\right) f(w)s(w)dw\right] \quad (13)$$

We see that β is again separable from the rest of the function, which only depends on m. There is at least one m maximizing (13) independent of β. For simplicity we assume (13) is again strictly concave in m, so there is a unique maximising $\bar{m}$. For any m, when $s(w) = 0$ for all $w > m$, then from the 'sum to one' property of the weighting function, we have $s(m)F(m) = 1$, so (13) reduces to maxi-min and $\bar{m} = m^*$. Otherwise $\bar{m} < m^*$, which implies less unemployment. While the optimal marginal wage, $\bar{m}$, is independent of β, the corresponding optimal tax, $\bar{t} = 1 - (1-\beta)h(\bar{m})$ from (11), depends on β.

***Proposition* 7**: *To maximize a weighted average utility, the optimal tax should maintain a constant marginal wage* $\bar{m}$ ($< m^*$)*, again independent of* β.

The optimal $\bar{m}$ depends on the weighting function $s(w)$, and it is not obvious what precise form this function should take. However, the policy maker could target a 'typical' or representative wage earner somewhere in the 'middle' of the distribution, and maximize his utility. Since $\bar{m} < m^*$, we know the unemployed would be better off if m increases from $\bar{m}$. Substituting (11) into (8), we have $V = (1-\beta)^{\varepsilon}h(m)^{\varepsilon}(\frac{w^{\varepsilon}}{\varepsilon}+\frac{m^{1+\varepsilon}}{w})$. Its derivative with respect to m is $(1-\beta)^{\varepsilon}h(m)^{\varepsilon-1}[\varepsilon(\frac{w^{\varepsilon}}{\varepsilon}+\frac{m^{1+\varepsilon}}{w})\ h'(m)+(1+\varepsilon)h(m)\frac{m^{\varepsilon}}{w}]$. It is always decreasing in w since $h'(m) < 0$ from Proposition 1. Since $\bar{m}$ maximizes the weighted average utility, the utility of low wage earners must be increasing at $\bar{m}$, and that of high wage earners must be decreasing. By continuity, there must be wage earners whose utility is stationary, i.e., being maximized. We denote their wage by $\bar{w}$, which must satisfy the first-order condition $(\bar{w}^{1+\varepsilon}+\varepsilon\bar{m}^{1+\varepsilon})h'(\bar{m})+(1+\varepsilon)h(\bar{m})\bar{m}^{\varepsilon}=0$, and is thus determined by $\bar{m}$. If we give lower weight for higher earners, (13) is closer to maxi-min, $\bar{m}$ is closer to m^*. This also implies a lower $\bar{w}$, closer to m^*. In the extreme case, zero weight for all employed implies $\bar{w}=m^*$ and maxi-min tax t^*.

As $\bar{m}$ is independent of β, so is $\bar{w}$. Then, since maximization of our weighted average utility is always identical to maximizing the utility of workers with corresponding wage $\bar{w}$, it may be more practical just to choose such a typical wage initially, instead of a complicated social welfare function for the whole population. This then represents a more transparent, centrist political agenda to benefit a typical "working family".

***Proposition* 8**: *Maximising any weighted average welfare function is equivalent to maximising the utility of some representative worker, and maintaining employment, independent of income comparison.*

As long as we keep employment constant when comparison strengthens, our tax policy maximizes a weighted average utility. The level of employment reflects our social preference. Higher employment implies less 'weight' and lower welfare for low-wage earners and the unemployed. On the other hand, allowing employment to vary with income comparison is inconsistent with maximizing a social welfare function.

Targeting a particular worker can help us to adjust the tax policy without precise knowledge about β or other parameters. When $m = \bar{m}$, workers with wage $\bar{w}$ are indifferent to marginal tax changes. Anyone with a lower wage prefers a tax rise and everyone above prefers a tax cut. When β increases without a tax response, $\bar{m}$ will decline and workers with wage $\bar{w}$ will prefer a tax rise. This should be a signal for a tax adjustment.

While a higher β raises individual labour supply with tax held constant, our optimal tax response to keep $m = \bar{m}$ can reverse this impact. From (6) we see that when β rises, and $\bar{t}$ increases in response to maintain optimal $\bar{m}$, every worker's labour supply will fall, with the same elasticity ε. The tax effect dominates that of stronger comparison.

Proposition* 9 - *reversing KUJ: *With a tax policy to maximize a weighted average utility, stronger comparison reduces individual labour supply.*

Finally we evaluate the net effect on everyone's utility, given our tax response. From the first-order condition above, we know that $\frac{dV}{dt} > 0$ for any $w < \bar{w}$, also $\frac{dU}{dt} > 0$. So the tax response must benefit everyone with a wage below $\bar{w}$. The lower wage is, the more benefit one receives. However, the overall impact of a higher β is still negative for everyone. Furthermore, from (8) and (9), we see that with a fixed m and a higher t, everyone's utility falls in the same proportion, implying a smaller loss for those with lower utility. Thus, under the tax policy stronger comparison actually leads to a lower inequality.

***Proposition* 10**: *With a tax policy to maintain constant employment, everyone is still worse off when comparison becomes stronger, but the non-employed suffer least.*

This policy essentially redistributes income in response to stronger comparison to reduce inequality. Its justification lies in the fact that inequality would increase otherwise.

While the tax rise reduces total output, the loss is compensated by a higher level of weighted average utility, as a reasonable social welfare function.

5. *Conclusions*

Full time working hours have not declined for a long time in the UK and US, in spite of growing productivity, at least partly due to increased employer market power and declining union bargaining power. However comparison or relative income concern is likely to be another factor, encouraged by social media and rising inequality, which increases labour supply at the intensive margin – KUJ. Our simple model also includes an extensive margin**,** and we find that the optimal tax response to stronger income comparison maintains constant employment, though the tax itself rises with comparison. The higher optimal tax then dominates the KUJ effect and *reduces* individual labour supply. Tax revenues are refunded as an equal per capita basic income.

Market imperfections imply that stronger regulation to reduce employer power are also needed, as well as employee participation in management and more effective union bargaining power to curb widespread abuses such as unpaid overtime. Our simple, competitive model suggests that even without these imperfections, higher income tax can reverse KUJ and raise welfare, without reducing labour market participation and employment at the extensive margin, and thus might still have benefits in conjunction with a basic income to redistribute revenue, and other measures such as reducing employer market power in a practical context. Information requirements for an 'optimal' tax are prohibitive, so the main qualitative conclusion seems to be that reduced working time under a basic income and higher tax have an additional benefit that has not been captured in previous models. Clearly, further research is needed to see how this policy holds up in a more general setting.

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