Relative Income, Redistribution and Well-being

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Abstract

In a model with heterogeneous workers and both intensive and extensive margins of employment, we consider two systems of redistribution: a universal basic income, and a categorical unemployment benefit. Well-being depends on own-consumption relative to average employed workers' consumption, and concern for relativity is a parameter that affects model outcomes. While labour supply incurs positive marginal disutility, we allow negative welfare effects of unemployment. We also compare Rawlsian and utilitarian welfare in general equilibrium under the polar opposite transfer systems, with varying concern for relativity. Basic income Pareto dominates categorical benefits with moderate concern for relativity in both cases.

JEL classifications: H20, D40

Keywords: Relative income, redistribution, basic income, unemployment benefits, happiness, well-being

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1. *Introduction*

Evidence on the importance of relative income in subjective well-being (SWB) has been accumulating rapidly, as summarized in the most comprehensive study to-date by Layard et al (2010), or recent reviews by Clark et al (2008), Frey (2008), and Oswald (2009). Appropriate reference income has a highly significant, negative effect on well-being similar in magnitude to the effect of own income, after controlling for many personal characteristics. The externality involved implies that redistributive taxation is less distortionary than otherwise, and that tax rates should rise with concern for relativity[1]. Following the early study of relative income by Boskin and Sheshinski (1978), subsequent work in this area has also usually neglected the participation decision – whether to work or rely on benefits – which empirical evidence shows to be most responsive to tax and wage incentives (Immervoll et al, 2007).

In contrast, most theoretical studies of redistribution and welfare in a general equilibrium framework neglect the importance of relative income for well-being, and assume a universal lump-sum transfer or basic income for all. This form of transfer has attractive theoretical properties (Atkinson, 1995), but is far removed from practical welfare systems. These invariably try to target the most needy, such as the unemployed or low-wage workers, with categorical benefits that are withdrawn as earnings increase, thus generating often very high effective marginal rates of tax, which can create a ‘poverty trap’ or disincentive to work. Providing an adequate basic income for all, including the majority who are above the poverty level, has generally seemed to require unacceptably high rates of taxation, but recent microeconomic simulations show that a basic income can dominate other welfare systems under realistic assumptions for some countries, including low observed labour supply

[1] These results also help to explain the ‘Easterlin Paradox’ or lack of correlation between long term economic growth and changes in average happiness or SWB in advanced economies, in contrast to the positive, short term relationship and cross-sectional correlation between income and SWB (Easterlin, 1974; Easterlin and Angelescu, 2009; Layard et al, 2010). Subjective well-being is also strongly correlated with many objective indicators of quality of life (Oswald and Wu, 2010).

elasticities for the full time employed, and high participation response (Colombino et al, 2010). In a model focussing mainly on the participation decision, FitzRoy and Jin (2010) find that basic income is generally preferred by a majority to categorical benefits. However these models do not explicitly include concern for relative income, which has not yet been widely incorporated into standard theories of optimal taxation and public economics (Kaplow, 2008)[2].

Here we follow Layard's (1980, 2006) call to systematically incorporate the widely observed concern for relative income into the public economics of taxation and redistribution. We differ from most previous contributions by developing an explicit comparison of the welfare consequences of the two fundamental alternative modes of redistribution – basic income and categorical benefits – in a simple general equilibrium model with heterogeneous workers, including concern for relative income and income effects, and voluntary unemployment. We find a surprising Pareto dominance of the basic income system with even slight concern for relativity, and also that optimal tax *and* unemployment increase with concern for relativity, under both Rawlsian and utilitarian social objectives.

These issues are of vital importance as poverty and unemployment increase in the aftermath of recession. In the existing literature, there is extensive discussion of welfare reform to encourage low wage employment and remove poverty traps, but little acknowledgement of the role of relative income in comparing welfare consequences of differing policy goals and models of redistribution, or the potential of a universal basic income. The widely recognised tendency for economic policy-making to lag behind developments in academic economics serves to add to the urgency of the situation. Layard

[2] Pioneering exceptions include Oswald (1983), and Kanbur and Tuomala (2009), with optimal non-linear taxation. Beath and FitzRoy (2009) consider a related model with categorical benefits, a public good, flat taxes and a narrower reference income, and hence obtain some different results in this case, but this approach is not appropriate for modelling basic income and making the comparisons pursued here. Eaton and Eswaran (2009) include a 'relative consumption externality' from a Veblen good in a model of homogenous households (without redistribution), and a lump-sum tax to fund a public good.

(2005, 2006, 2009), Oswald (2009), Stiglitz et al (2010), and many others have emphasised the need for policy to focus on the goal of happiness or subjective well-being, rather than exclusive concern with average GDP (growth). In so-doing, important issues to consider include relative income, basic income to avoid the ‘poverty trap’, taxation as an instrument to discourage excessive effort, redistribution and social interactions.

For tractability, we restrict attention to linear or flat taxes, which may be a reasonable approximation to optimal taxes. Thus Mankiw et al (2009, p. 2) suggest that “ A flat tax, with a universal lump-sum transfer, could be close to optimal”, although Colombino et al (2010) do find welfare gains from progressive taxes, using empirically-supported low labour supply elasticities for full time employees, in contrast to much previous literature on optimal taxation. The latter generally finds high marginal rates on low earners to be optimal, to ‘phase out’ a universal transfer, followed by lower rates on higher earners to encourage labour supply. The withdrawal of categorical benefits for full-time workers thus appears to approximate at least part of the optimal tax schedule, though there are also important differences (Kaplow, 2008).

The plan of the paper is to develop the benchmark general equilibrium model with a universal basic income in section 2, and corresponding results with categorical unemployment benefits in section 3. Most comparisons between the two systems and dependence on optimally chosen parameters cannot be obtained analytically, so we present the results of extensive numerical simulations of the main relationships (including the plots themselves) in section 4. Conclusions are summarized in a final section 5.

2. *A model with universal basic income*

Assume a continuous distribution of productivity or wages, denoted $w \in [0,1]$, with distribution $F(w)$, density $f(w)$, and $F(1)=1$. (We could allow a positive measure of individuals with zero productivity who are thus essentially disabled or unable to work, but our focus is on voluntary unemployment, or the participation decision). Individual effort or labour supply is *x*, and utility or subjective well-being is quasi-linear in leisure, with constant elasticity of relative consumption, so for the employed and unemployed we have respectively:

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

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

Here, $\gamma > 0, \gamma \neq 1$, (and $\gamma - 1$ is the elasticity of labour supply in the standard case, when *B*=0), *t* is the tax rate on earnings, *B*>0 is *basic income*, an unconditional transfer received by all, *wx* is output with linear technology, equal to earnings, $wx(1-t)+B$ is total net income of the employed, which is consumed, and $\overline{y}$ is the *reference income*, defined simply as *mean net income of all employed households*, below. Finally, $\beta \in [0,1]$ is the *degree of concern for relative income*, with $\beta = 0$ the traditional case when only absolute income is considered. As discussed in the introduction, there is growing evidence for the importance of relative income, but of course our simple model omits many other factors that affect well-being. (Our results suggest that β too close to one is unrealistic, while exceeding one does not make sense theoretically).

The FOC for (1) now gives labour supply, say $\hat{x}$, and after-tax income or consumption, say *Y,* according to

2. $$w\hat{x}(1-t)+B \equiv Y = \frac{w^{\gamma}(1-t)^{\gamma}}{\overline{y}^{\beta(\gamma-1)}}$$

The positive basic income means that households with some positive *marginal wage*, say *m*, will supply zero effort, and these and all other households with lower wages will be voluntarily unemployed. Thus *m* is the effective minimum wage for employment, or strictly, the lower bound, and from (2) it is given by

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

The number (or share) of the unemployed is thus $F(m)$. Now using (2) and (3) we can define mean, net income (or consumption) of the employed as follows:

4. $$\overline{y}\left(1-F\left(m\right)\right)=\int_{m}^{1}(w\hat{x}\left(1-t\right)+B)dF=\int_{m}^{1}\frac{w^{\gamma}\left(1-t\right)^{\gamma}}{\overline{y}^{\beta(\gamma-1)}}dF$$

So we have average income as a function of *m* and *t*:

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

where $G\left(m\right)\equiv\int_{m}^{1}w^{\gamma}f\left(w\right)dw$ and $G'(m)=-m^{\gamma}f(m)$.

Next, the government budget is defined by equating tax revenue with redistributive expenditure on the basic income for the unit population, so we obtain benefits as a function of *m* and *t*, say

6. $$\overline{B}\left(m,t\right)=t\int_{m}^{1}w\hat{x}dF$$

Using (2) yields

7. $$\overline{B}\left(m,t\right)\left(1-tF\left(m\right)\right)=\frac{t\left(1-t\right)^{\gamma}}{\overline{y}^{\beta(\gamma-1)}}G\left(m\right)$$

Next we incorporate the incentive-compatibility condition (3) for the marginal wage. Then it is convenient to consider this minimum employment wage as the policy variable, and derive the equilibrium tax rate, say $\hat{t}(m)$, consistent with a given, incentive compatible choice of minimum wage and the balanced-budget level of basic income by substituting for *B* from (3) to give

8. $$\hat{t}(\gamma, m) = \frac{m^{\gamma}}{m^{\gamma} F(m) + G(m)}$$

It is easy to verify that this is an increasing function of *m*, and a decreasing function of γ, and so could be inverted to give the minimum wage as an implicit function of the tax. It is thus convenient to consider the minimum wage as the government's policy instrument.

Now we can find *general equilibrium mean, net income* (*or consumption*), and *basic income*, defined in the obvious way when the equilibrium tax is substituted into (5) and (7), as functions of the minimum wage. From these two equations we get

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

and from (3),

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

Notice that this has the same form as (3), but now we have substituted the equilibrium tax and average income.

Then we can obtain the *equilibrium individual income, effort* and *utility* of the employed and unemployed respectively as functions of the policy instrument, *m*, and the individual wage, using (8) and (9)

$$\hat{Y}(m, w) = \frac{w^{\gamma}(1-\hat{t})^{\gamma}}{\hat{y}^{\beta(\gamma-1)}},$$

$$\hat{x}(m, w) = \left\{ \frac{w\left(1-\hat{t}\right)}{\hat{y}^{\beta}} \right\}^{\gamma-1} - \frac{\hat{B}}{w\left(1-\hat{t}\right)} = \left\{ w^{\gamma-1} - \frac{m^{\gamma}}{w} \right\} \left\{ \frac{1-\hat{t}}{\hat{y}^{\beta}} \right\}^{\gamma-1}$$

11.

$$\hat{U}_{un}(m) = \frac{\gamma}{\gamma-1}\left\{\frac{\hat{B}}{\hat{y}^{\beta}}\right\}^{\frac{\gamma-1}{\gamma}} , \qquad \hat{U}_{em}(m,w) = \left\{\frac{w^{\gamma-1}}{\gamma-1}+\frac{m^{\gamma}}{w}\right\}\left\{\frac{1-\hat{t}}{\hat{y}^{\beta}}\right\}^{\gamma-1}$$

We summarize the main conclusions from these expressions as

<u>*Proposition* 1</u>:

For given *m*, individual labour supply in general equilibrium increases with the wage (though not necessarily when $\gamma < 1$, a case we do not consider further), as does the well-being of the employed, (which corresponds to empirical findings). For given *m* and *w*, equilibrium mean income and individual effort increase with concern for relativity.

Intuitively, increasing concern means that other individuals' greater effort creates a larger externality, which in turn generates more offsetting effort by raising the marginal return to effort. In the traditional case of zero concern for relative income, we see that benefits first increase and then decline with unemployment or the minimum wage in a standard Laffer curve. If *m* is small, the wage elasticity of labour supply for those in work is approximately $\gamma - 1$, which empirical evidence suggests is small for full-time workers. The general case is too complicated for analytical solution.

3. *Categorical benefits*

A basic income to replace other benefits has not yet been introduced in practice, and redistribution mainly targets the unemployed and the lowest paid workers. We explore this alternative in the simplest way by assuming a fixed transfer for the non-employed, which is lost when any labour is supplied, thus imposing a high marginal tax rate on low wage workers who are just above effective minimum wage, and hence only slightly better off working. While this neglects the complications of 'tapered' withdrawal of transfers as earnings increase, it captures (in a tractable approximation) the basic feature of existing welfare systems, that most of the employed do not receive transfers, and is closer to reality than the universal basic income which is widely used in theoretical models. We thus drop benefits in the utility of the employed in (1) and from the FOCs obtain labour supply, say

12. $$x^{*}=\left\{\frac{w(1-t)}{\bar{y}^{\beta}}\right\}^{\gamma-1}$$

Note that this yields the same after-tax earnings, $wx^{*}(1-t)$, as with basic income in (2), for a given reference income. Clearly, $\gamma<1$ implies backward-bending labour supply, the less plausible case because work time and earnings are strongly correlated in cross-section. Utility from work at this wage and optimal labour supply is then:

13. $$U^{*}_{em}=\frac{1}{\gamma-1}\left\{\frac{w(1-t)}{\bar{y}^{\beta}}\right\}^{\gamma-1}$$

The unemployed have utility from consumption of unemployment benefits, here denoted by *C*, similar to (11), though we have not yet derived equilibrium tax and mean earnings:

14. $$U_{un}=\frac{\gamma\delta}{\gamma-1}\left\{\frac{C}{\bar{y}^{\beta}}\right\}^{\frac{\gamma-1}{\gamma}}$$

The parameter $\delta\in(0,1]$ represents the loss of welfare from being unemployed, in addition to income loss, which is found in numerous surveys. While voluntary unemployment or non-employment in our simple model might be considered to be less debilitating than more realistic involuntary unemployment, it remains a signal of dependency and inability to supply labour that can earn an adequate wage. At least some ‘involuntary’ unemployment might be considered voluntary when benefits are preferred to available (poor) wages and conditions. By contrast, the universal basic income considered above is entirely non-discriminatory, and the participation decision in this case need not necessarily signal lack of ability to outside observers, but rather a choice between extra consumption or unpaid activity, more akin to other consumer choices. Furthermore, labour supply approaches zero for wages close to the minimum wage with basic income, so there is a seamless transition where the difference between employment and unemployment becomes negligible, whereas the categorical benefit induces a discontinuity – minimum labour supply has to be large enough to just compensate for loss of the benefit.

Now to obtain the marginal wage, *m*, we equate this unemployment utility with utility from work at wage *m,* so from (13) and (14) we get a similar expression to (3):

15. $$m^{\gamma}\left(1-t\right)^{\gamma}=\left(\gamma\delta\right)^{\frac{\gamma}{\gamma-1}}\,\overline{y}^{\beta(\gamma-1)}C$$

Mean income of the employed is given by (5) above, and we use the budget condition to define the benefit, *C*, received only by the unemployed, from (12) as

16. $$CF(m)=t\int_{m}^{1}wx^{*}dF=\frac{t\left(1-t\right)^{\gamma-1}}{\overline{y}^{\beta(\gamma-1)}}G\left(m\right)$$

Now we can substitute for *C* from (15) to eliminate mean earnings and get the new equilibrium tax:

17. $$t^{*}\left(\gamma,\delta,m\right)=\frac{m^{\gamma}F\left(m\right)}{m^{\gamma}F\left(m\right)+\varepsilon G\left(m\right)}$$

Here we write $\varepsilon\equiv\left(\gamma\delta\right)^{\frac{\gamma}{\gamma-1}}$ for simplicity. Comparing with the corresponding tax in the basic income case, (8), with given minimum wage and unemployment, we summarize results in the following:

<u>*Proposition* 2</u>:

(a) $t^{*}\left(\gamma,\delta,m\right)<\hat{t}\left(\gamma,m\right)$ when $\gamma\delta>1$, because then $\varepsilon>1$.

(b) However if $\gamma\delta<1$ while $\gamma>1$ still holds, then $\varepsilon<1$, the tax inequality is reversed, and $t^{*}\left(\gamma,\delta,m\right)>\hat{t}\left(\gamma,m\right)$.

(c) If $\gamma<1$, then $\varepsilon>1$, and we are back to the first case with a lower tax for categorical benefits.

Equilibrium mean earnings are found in the same way as in (9), but now with the different equilibrium tax which can generate higher or lower mean earnings:

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

Substituting (18) and equilibrium tax (17) into the FOC for individual labour supply (12) gives general equilibrium labour supply as a function of *m* and *w*. Comparing (18) with (9) we see that only the tax differs between these expressions. From (15) we have equilibrium benefits for the unemployed

19. $$C^*(m) = \frac{m^{\gamma}\left(1-t^*\right)^{\gamma}}{\varepsilon y^{*\beta(\gamma-1)}}$$

When the marginal wage and unemployment are small, the lower tax will provide higher consumption than with basic income, unless γ is very large, as might be expected.

Now equilibrium utility from (14) becomes

20. $$U^*_{un} = \frac{\gamma\delta}{\gamma-1} \left\{ \frac{C^*}{y^{*\beta}} \right\}^{\frac{\gamma-1}{\gamma}}$$

To reduce notation, define

21. $$\alpha \equiv \frac{\gamma-1}{1+\beta(\gamma-1)}$$

Substituting (18) into (19) and using (20) and (21) yields general equilibrium well-being of the unemployed, (where we suppress dependence on concern for relativity):

22. $$U^*_{un}(\gamma,\delta,m) = \frac{m^{\gamma-1}}{\gamma-1}\left(1-t^*\right)^{\alpha(1-\beta)} \left\{ \frac{1-F(m)}{G(m)} \right\}^{\alpha\beta}$$

Similarly, from (9) – (11) we can write general equilibrium utility of the unemployed with a basic income as:

23. $$\hat{U}_{un}(\gamma, m) = \frac{\gamma m^{\gamma-1}}{\gamma - 1}\left(1-\hat{t}\right)^{\alpha(1-\beta)}\left\{\frac{1-F(m)}{G(m)}\right\}^{\alpha\beta}$$

The similarity between these two expressions, under quite different welfare systems, is remarkable. We summarize results for two 'extreme' cases:

Proposition 3:

(a) When $\beta = 1$, welfare is independent of the tax rate, and the unemployed are *always* better off with basic income when $\gamma > 1$, for all *m*.

(b) When *m* is small the difference between the tax terms will generally also be small, and then large γ implies that the unemployed are better off with basic income.

However, these results do not tell us anything about welfare when the minimum wage, and hence unemployment, are chosen *optimally* under the respective benefit systems, in the more plausible case for the present simple model when $\beta < 1$. These comparisons are analytically intractable, so to obtain further insight we use numerical simulations.

4. *Simulations*

These simulations, under a variety of parameter settings, allow the main results to be presented graphically. Our initial focus will be on the Rawlsian case, maximising utility for unemployed individuals, but we also consider the utilitarian case[3]. We will explore whether the optimal BI is preferable to the optimal CB, and how this comparison varies with the type of social welfare function chosen and with variation in the importance of relative income. Of course, our simulations also provide evidence on the performance of the two welfare systems in the traditional case where there is no concern for relativity.

[3] These are the two commonly considered polar cases of maximal redistribution under the Rawlsian or maximin goal, and no redistribution beyond what is generated by decreasing marginal utility of consumption under the utilitarian objective of maximizing aggregate welfare.

We use the convenient beta distribution of wages and can consider different parameter values to vary skewness of the wage distribution. Realistically, the wage distribution is positively skewed (the right-hand tail representing the modest proportion of workers receiving very high wages). Although we also consider variations in the wage distribution (including the example of a symmetric wage distribution), the results are essentially similar – and so we do not report them here in detail. However, optimal choices made under a less skewed income distribution allow a higher effective minimum wage, lower unemployment rate and lower tax rate. Since this does not change with the level of concern for relative income, or with the choice of a BI system in place of CB, it can be seen as providing new support for reducing an aspect of income inequality.

The elasticity of labour supply has been much studied, with a wide range of results – depending on methodology used and which sub-group of the workforce is being analysed. However, in a meta analysis of more than 200 empirical labour supply elasticities from the literature, Evers et al (2008) found that a labour supply elasticity of 0.1 was typical for (predominantly full-time) male workers, while the labour supply of (often part-time) female workers tended to be more elastic (around 0.5). For our simulations, we use $\gamma = 1.5$ (labour supply elasticity of 0.5 under CB) as standard. However, unreported results demonstrate that there is little substantive impact of choosing quite a wide range of alternatives, such as $\gamma = 1.1$ or $\gamma = 2.0$ (unit elasticity under CB). Our simple model uses the same elasticity for the whole labour force, including very low wage workers who are likely to be marginal for some benefit-tax combinations, and responsive to policy change, and our choice represents a compromise with little effect on qualitative results.

Optimal utility under BI can only be compared meaningfully to its counterpart under CB for a given value of β (each particular type of preference is defined by degree of concern for relativity). All the figures below, (apart from Figure 3), are generated for the case of a skewed wage distribution, $\gamma = 1.5$ (indicating modestly inelastic labour supply), and $\delta = 1$ (so that no stigma is attached to unemployment under CB). Figures 1-9 each consider a range of values from zero to 0.9 for β (indicating the importance of relative income). Since the model is stylized for simplicity and neglects many important determinants of well-being, values of β cannot be compared directly with empirical findings on the weight of relative income in happiness regressions. While values close to one are implausible, the middle range seems to give 'reasonable' results, and the traditional case of no concern for relativity is certainly not supported by empirical studies, as discussed in the introduction.

In Figure 1, the optimal utility of the unemployed is plotted against β, and shows that CB gives more utility to the unemployed only for very low values of β (up to about 0.1). This is a somewhat surprising result, because the CB specifically targets the unemployed, yet it takes only a slight concern for relativity for BI to dominate, without higher unemployment. (With some realistic unemployment stigma under the CB system (via $\delta = 0.75$), BI *always* yields higher utility for the unemployed).

Figure 1: Optimal values of unemployment utility plotted against β for unemployment utility BI (red line), and CB (blue dashed line).

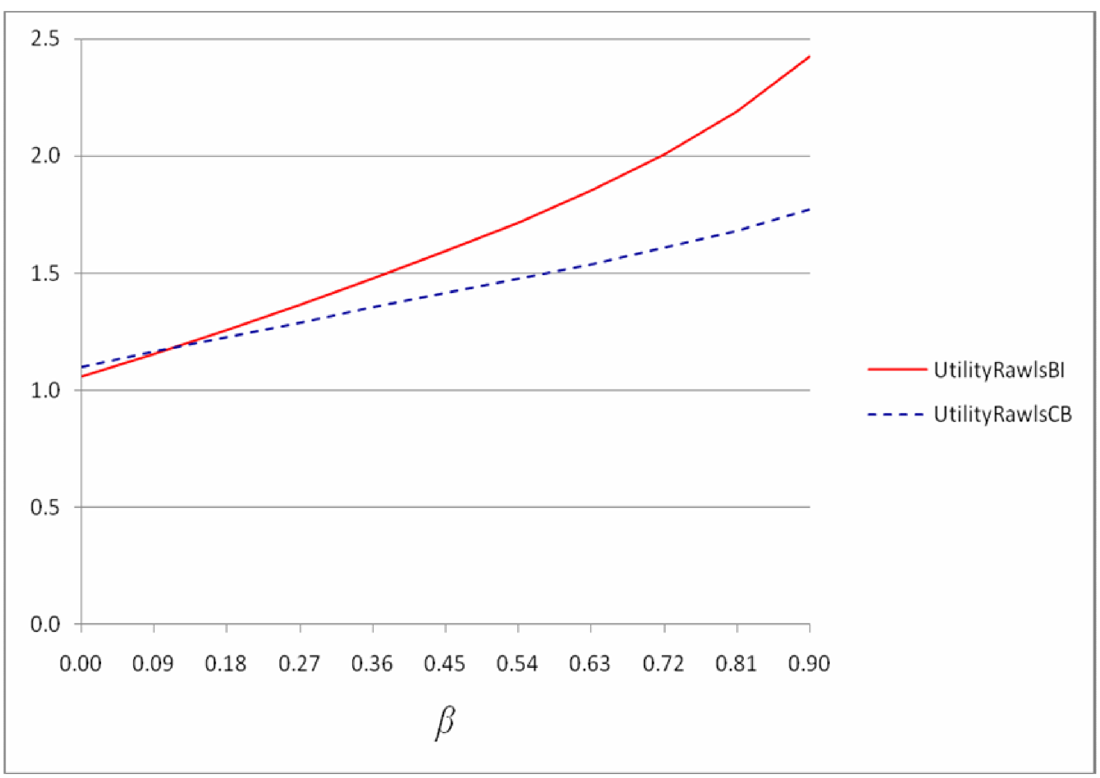
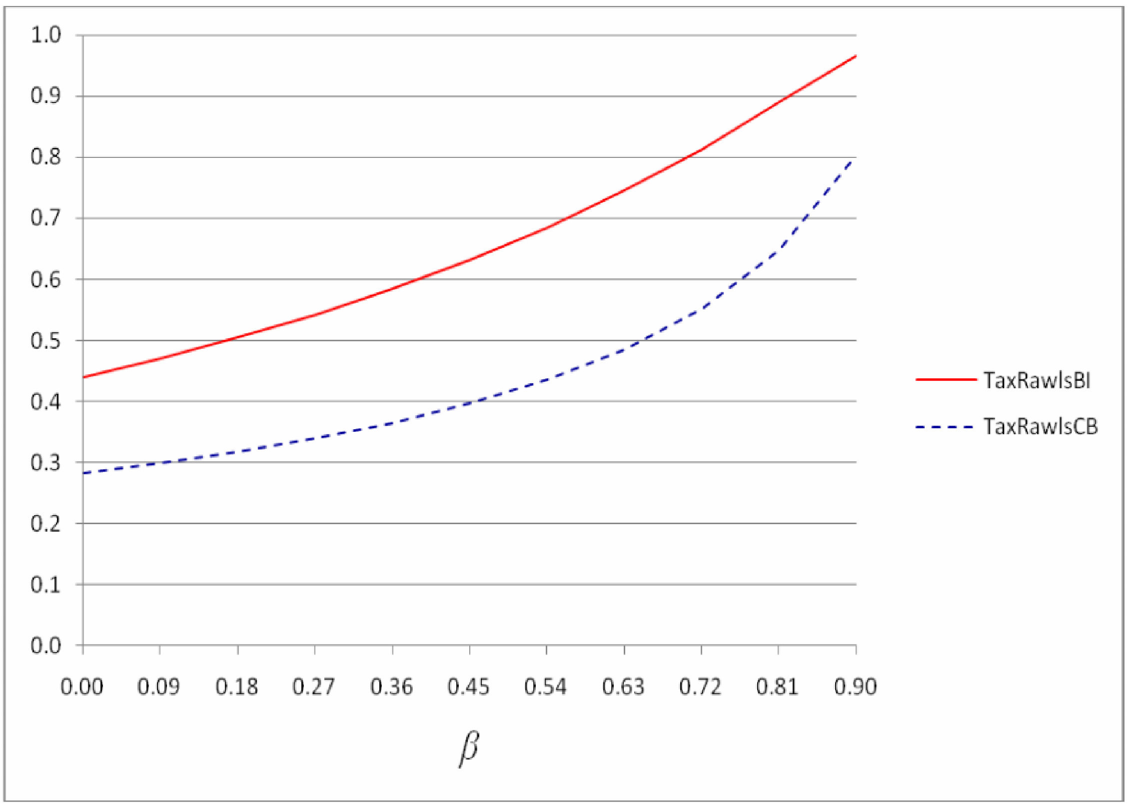


Figure 2 shows the optimal tax against β for the same combination of parameter values as in Figure 1. Since $\gamma\delta > 1$, Proposition 1 shows the optimal tax to be higher in the BI case, whatever the value of β. This is confirmed by Figure 2. However, we should note that the optimal level of the effective minimum wage differs across the two benefit systems (and also varies with β).

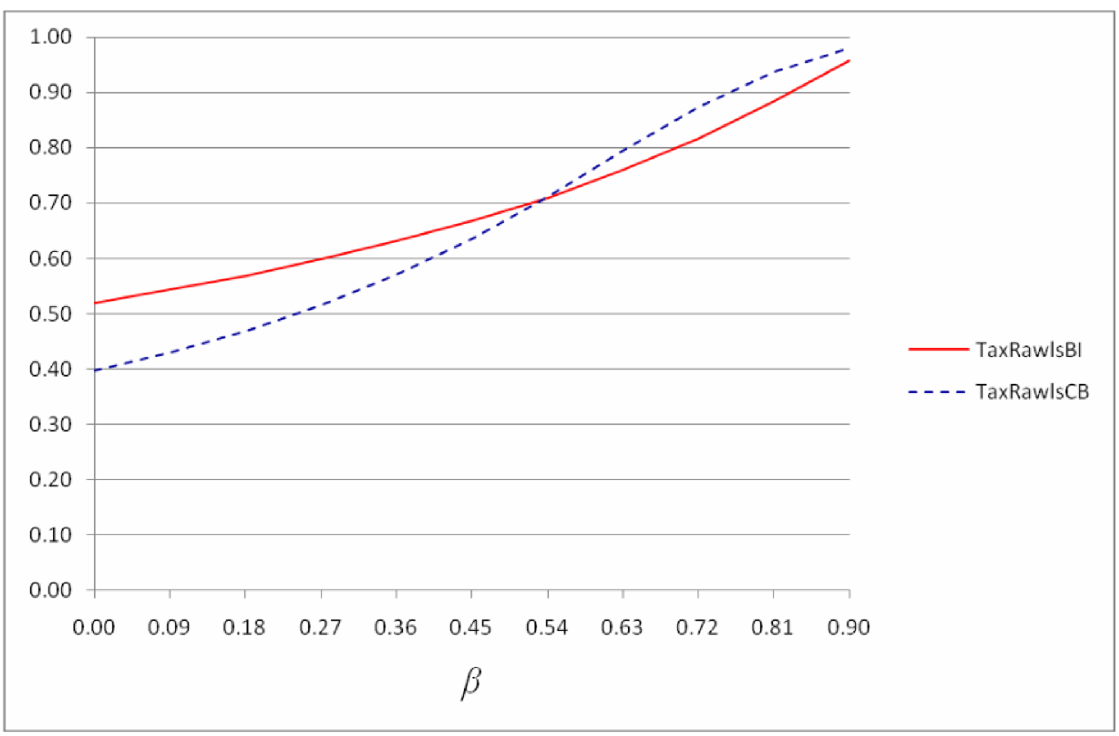
Figure 2: Optimal values of the tax rate plotted against β under BI (red line), and CB (blue dashed line).



To investigate the second part of Proposition 1, we note that a change to $\delta = 0.75$ reduces the tax difference. If we then consider the case of $\gamma = 1.1$ (holding $\delta = 0.75$), we can see from Figure 3 that the optimal tax rate is *not* always higher under BI. In fact, the two lines plotted in Figure 3 cross, with BI yielding a higher optimal tax only for lower values of β (up to about 0.55), and a lower optimal tax when β is larger. Although this may initially appear at odds with Proposition 1, in fact it is not. In Figure 3, we are comparing $t^*(\gamma,\delta,m^*)$ with

$\hat{t}(\gamma, \hat{m})$, or incorporating the optimal minimum wage under the two benefit systems, rather than making a simple comparison between $t^*(\gamma,\delta,m)$ and $\hat{t}(\gamma,m)$ with a given, arbitrary minimum wage.

Figure 3: Optimal values of the tax rate plotted against β under BI (red line), and CB (blue dashed line) with $\gamma = 1.1$, and $\delta = 0.75$ to capture unemployment stigma in the CB case.



Figures 4-7 are related. In Figure 4, optimal BI and CB for the Rawlsian case are compared, over the usual range of β – showing that CB is higher throughout.

Figure 4: Optimally chosen BI and CB (vertical axis) against β, Rawlsian case.

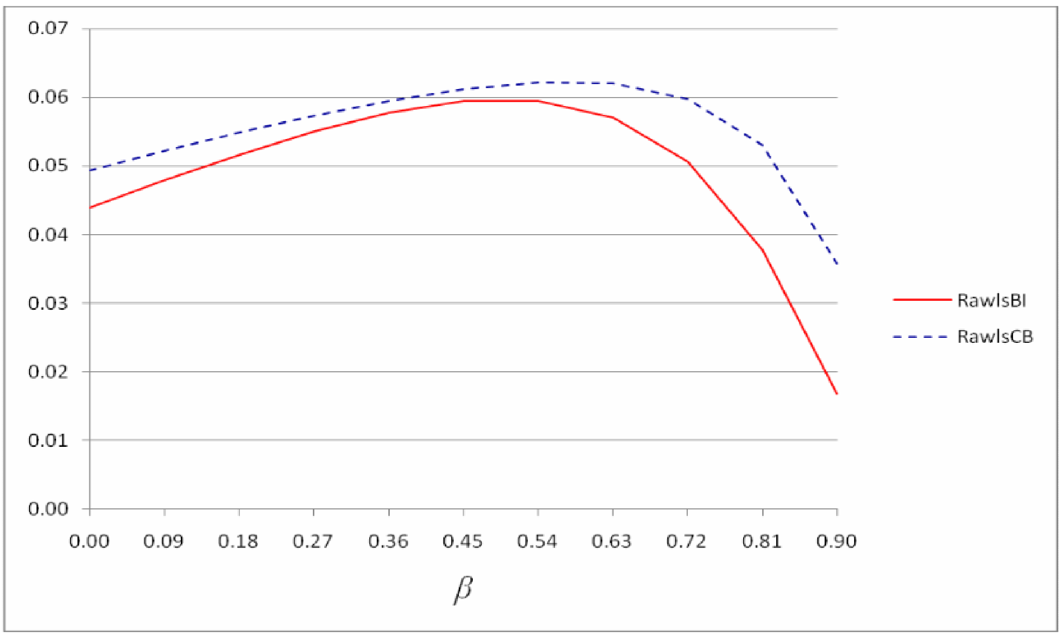


Figure 5 makes a similar comparison for the utilitarian objective and finds that the plots in this case cross twice, so that optimal BI is higher for mid-range values of β. Again this is far from obvious, and the 'inefficiency' of the CB, which delivers less well-being in spite of its greater magnitude over most of the range of relativity, is also noteworthy (see also Figure 10).

Figure 5: Optimally chosen BI and categorical benefit (vertical axis) against β (horizontal axis), utilitarian case.

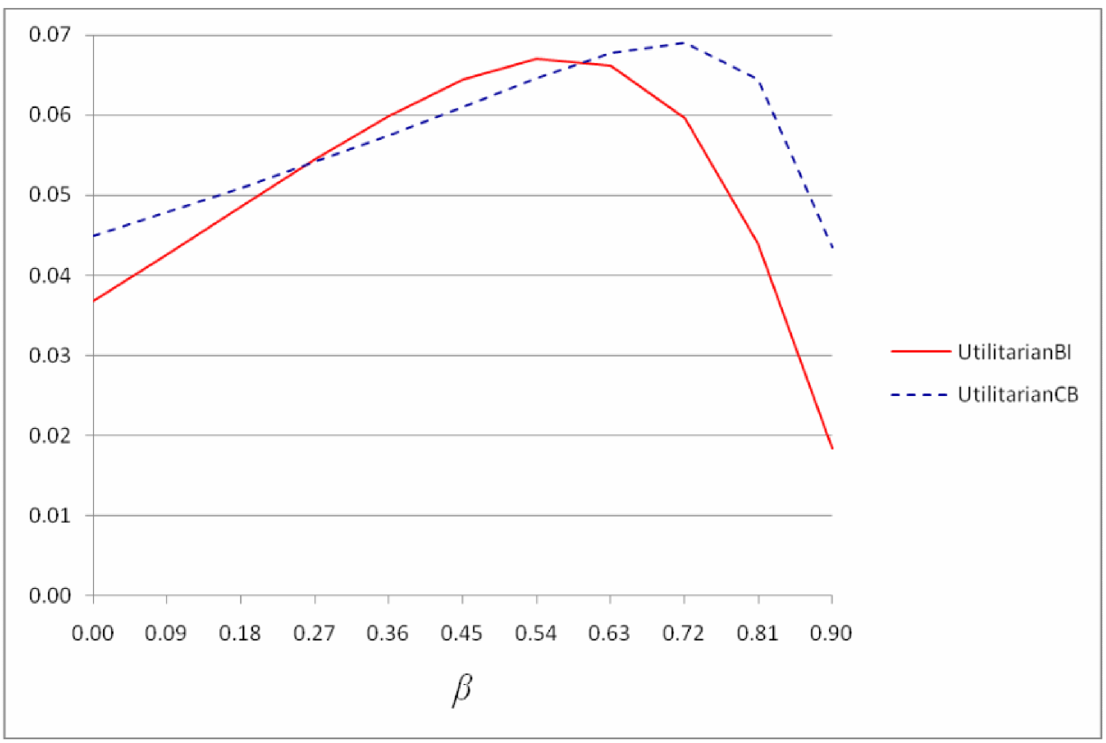


Figure 6 shows how optimally-chosen BI varies as β increases, for our two objectives. When β = 0, so that relative income is irrelevant, the Rawlsian objective gives a higher optimal BI than the utilitarian (by 19%), as expected. As β is increased, the optimal BI initially rises in both cases. However, the rise is – rather surprisingly – steeper for the utilitarian case, so the two lines cross at about β = 0.27. In both cases, optimal BI peaks[4] in the range [0.45,0.54] for β. Furthermore, optimal BI under both objectives then *declines* with still higher concern, converging to the same low level for β = 0.9. Intuitively, there are two opposing effects of the increasing externality from higher concern for relativity. Initially a higher tax reduces socially excessive labour supply, generating greater BI and higher unemployment, but for large β the shrinking tax base and revenues (shown below) combine to yield lower optimal BI.

Figure 6: Optimally chosen BI (vertical axis) against β (horizontal axis).

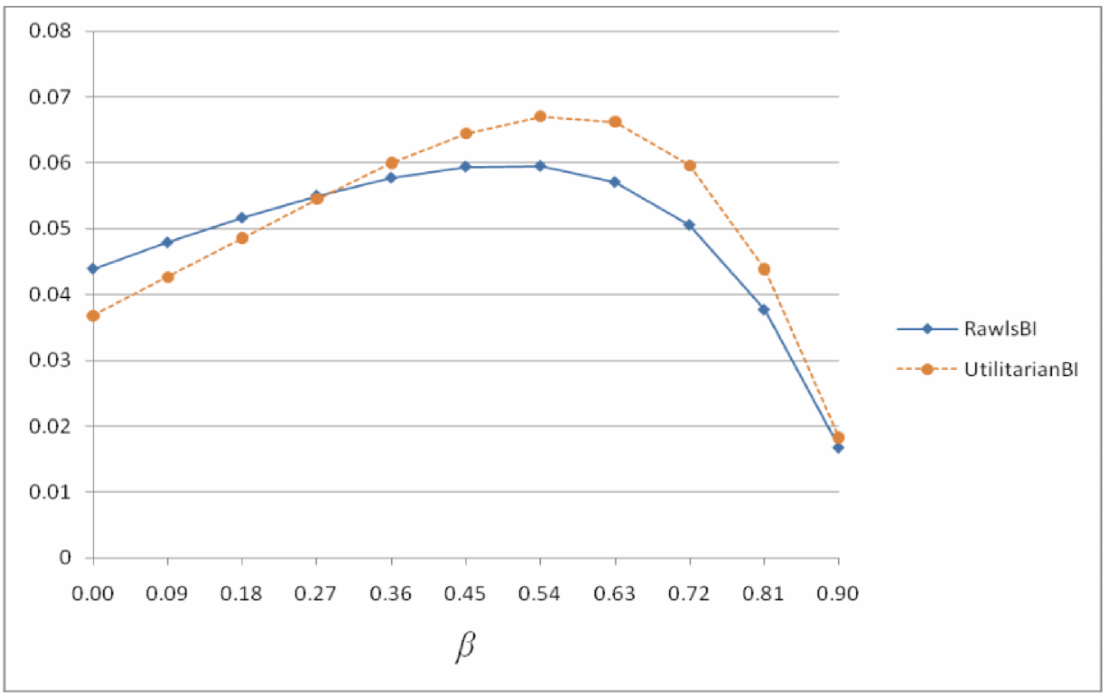


Figure 7 shows how the optimally chosen CB varies with β. When β = 0, so that relative income is irrelevant, the Rawlsian case gives a higher optimal CB than the utilitarian case (this result parallels our earlier finding for BI). As β is increased, the optimal benefit initially rises in both cases. However, the rise is a little steeper for the utilitarian case, so the

[4] Figure 6 reveals variations in optimal BI over β which are quite substantial though non-monotonic.

two lines cross at about $\beta = 0.45$. Optimal CB peaks[5] around $\beta = 0.54$ in the Rawlsian case, but closer to $\beta = 0.72$ under a utilitarian approach, and then again declines.

Figure 7: Optimally chosen CB (vertical axis) against β (horizontal axis).

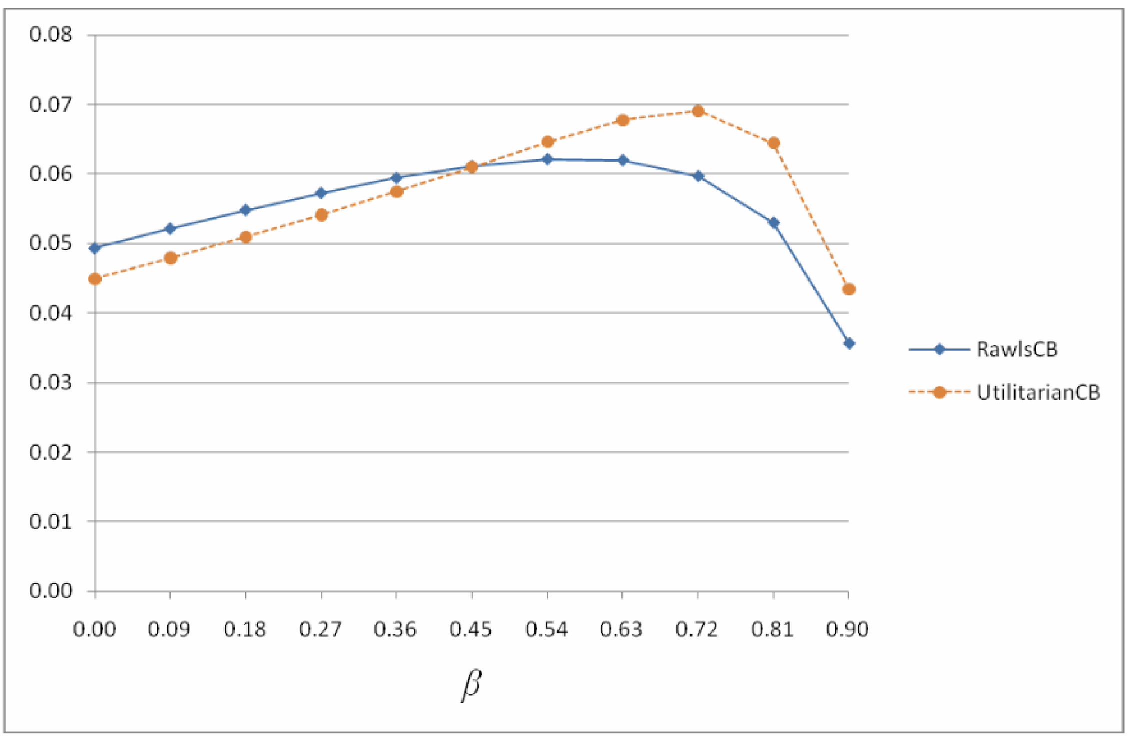


Figure 8 shows how all the optimal tax rates increase with β as expected, essentially to offset the increasing externality imposed by own earnings on others as concern for relativity rises. Equally intuitively, optimal tax with BI is generally greater than optimal tax with CB, whatever the social objective. Most interestingly, however, optimal Rawlsian and

[5] Figure 7 shows variations in optimal CB over β which are less substantial than those for optimal BI.

utilitarian taxes *converge* for high β, (remaining higher for BI than for CB). Intuitively, the growing weight of the externality in individual utility comes to dominate the differing social objectives, for high enough concern for relativity. However the high taxes for high β are rather implausible, suggesting that the middle of the range is more realistic.

As will be indicated in Figures 10-12, the behaviour of the optimal effective minimum wage (and corresponding non-employment) – as β is increased from zero – parallel that of the optimal tax rate, by rising with increasing concern for relative income and by being higher in the Rawlsian case than the utilitarian case[6]. However, the optimal effective minimum wage and non-employment are both lower for a BI system than for a CB, as expected.

Figure 8: Optimally chosen tax rate (vertical axis) against β (horizontal axis).

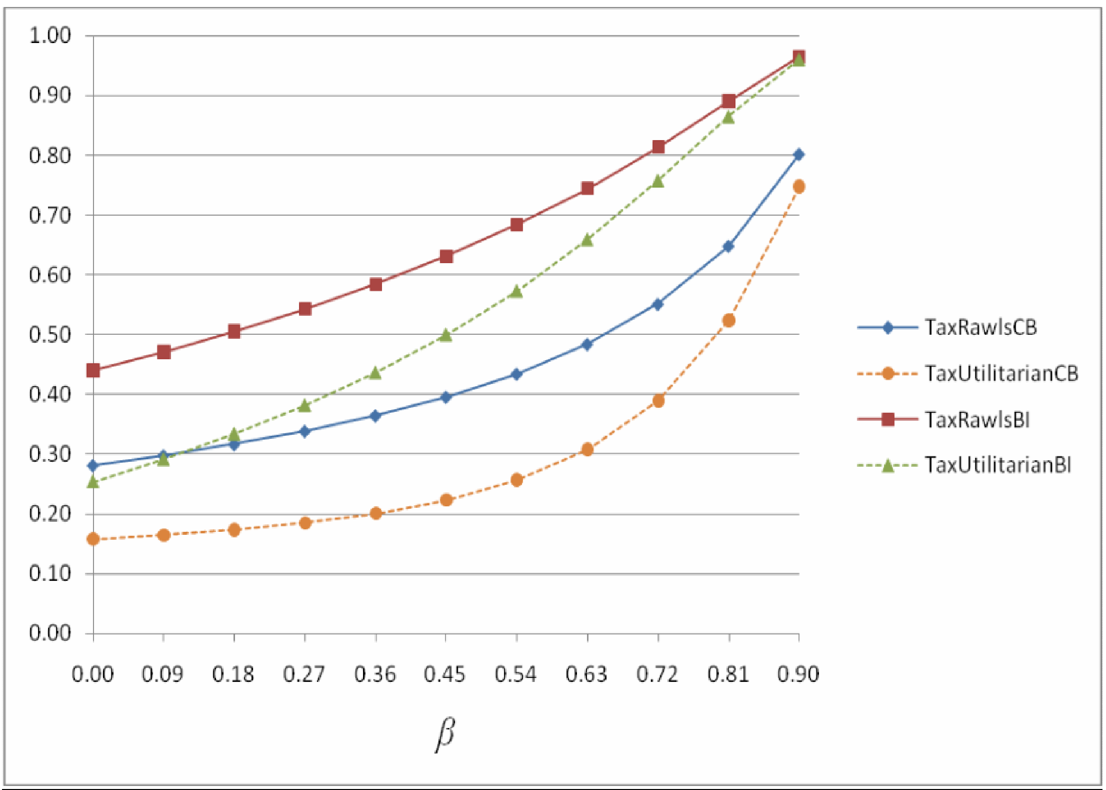


Figure 9 demonstrates how total (optimal) tax revenue, and hence 'size of government' varies with β. In terms of the public finances, we expect an optimal BI system to

[6] Again (for both the minimum wage and the unemployment rate), this gap diminishes as β rises under a basic income; but not under a categorical benefit until mid-range values of β are reached.

be more expensive than a corresponding CB system. Though more tax revenue must be collected under a Rawlsian (rather than utilitarian) objective[7] when relative income is unimportant, this inequality reverses – as soon as β reaches about 0.3 in the case of a BI, but only when β approaches 0.7 for a CB.

Figure 9: Tax revenue under optimal tax rate (vertical axis) against β (horizontal axis).

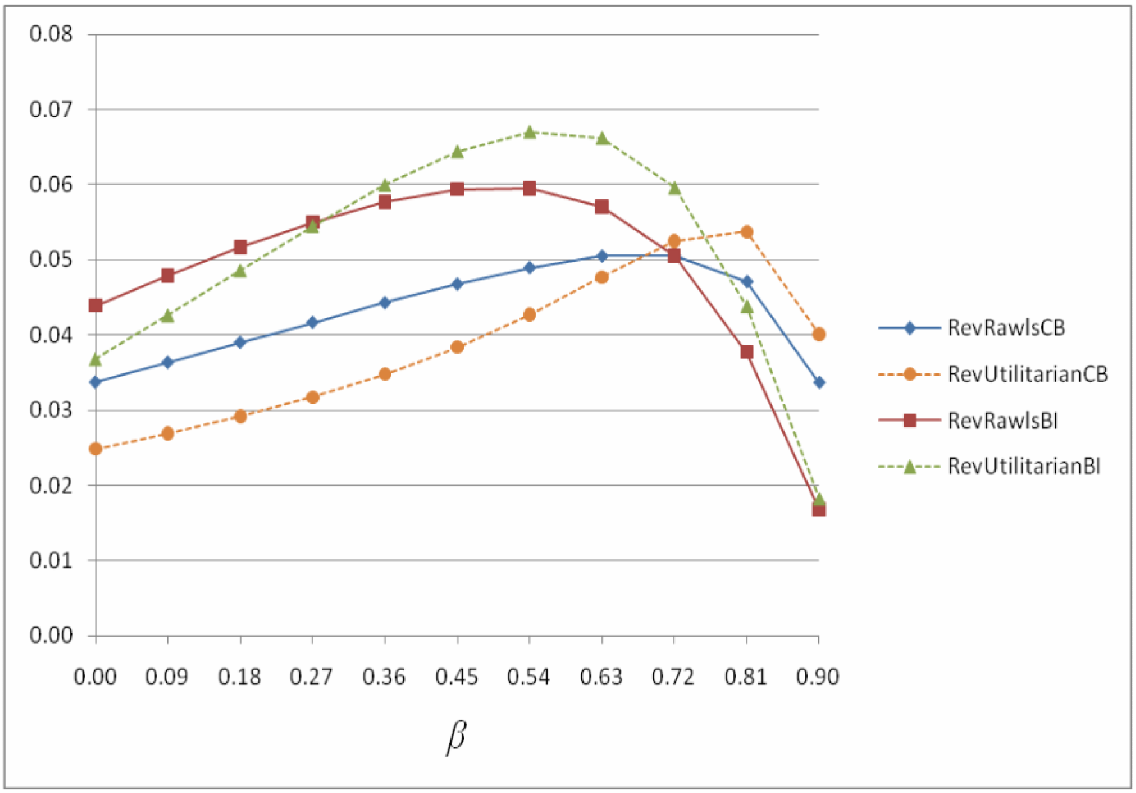
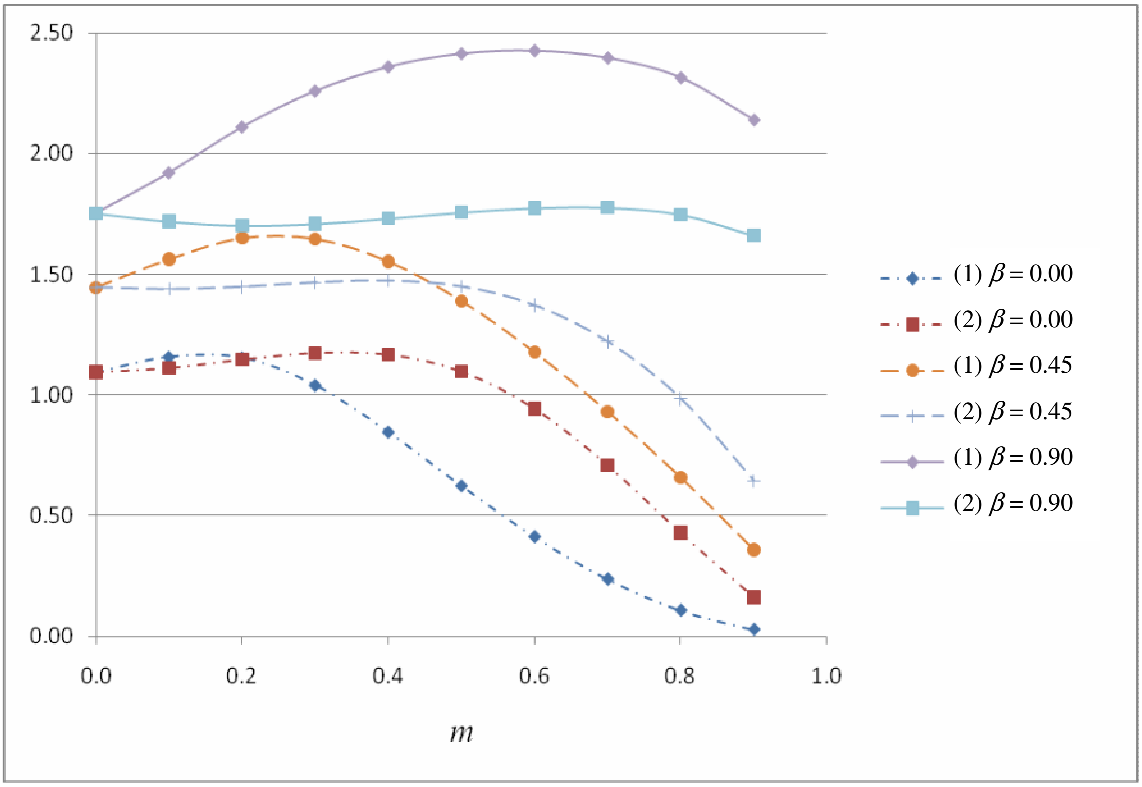


Figure 10 considers the utilitarian objective. We show how aggregate utility varies with the effective minimum wage, *m,* for three chosen values of β – zero (no concern for relative income), 0.45 (intermediate) and 0.9 (very high). For each value of β, we consider both BI and CB. Under BI, the optimal effective minimum wage (and thus the unemployment rate) increases with concern for relative income. With CB the initially fairly flat utility plot

[7] A higher effective minimum wage and higher tax rate both tend to reduce mean income, outweighing the opposite effect of a lower employment rate. In spite of also having lower employment to tax, the higher Rawlsian tax rate is initially sufficient to allow more tax revenue to be collected than in the utilitarian case.

means that an optimal minimum wage is difficult to identify, which is why we do not follow the presentation of the Rawlsian results in Figure 1. There are several interesting conclusions from Figure 10. With no concern for relativity, BI and CB yield approximately optimal and equal utilitarian welfare over an initial range of (low) minimum wages, though BI-well-being then falls rapidly below CB-well-being as m rises. For realistic intermediate (and also high) β, BI dominates CB by an increasingly wide margin. With BI, optimal unemployment is much lower than with CB (although the gap narrows for high β).

Figure 10: Utilitarian utility plotted against m, for three values of β, under BI (1) and CB (2).



This yields a tentative possible explanation for the view that BI is not an efficient transfer system. With traditional neglect of concern for relativity in policy making, and a 'political' minimum wage above the equivalent of 0.2 in Figure 10, the steep decline of BI welfare for perceived $\beta = 0$ appears to support CB. Yet with realistic concern for relativity, the welfare comparison is dramatically reversed.

For good reasons, we have concentrated so far on measures of social welfare, and the corresponding values taken by the minimum wage, unemployment, tax rate and the government budget. However, underlying this is a heterogeneous population of potential workers. Figures 11 and 12 offer some illustration of which individuals (within the ability distribution) tend to benefit more under the various policies and preferences we have considered. A black vertical line in each figure shows the halfway point in the population – at a wage level of just above 0.3, because of the negative skewness of the wage distribution. In Figure 11, Rawlsian policy leaves unemployed individuals (shown by the horizontal sections on the left) slightly better off under CB than BI when relative income is considered irrelevant. However, a CB leaves more individuals (over half of the population) without a job – such that the highest ability unemployed and the lowest paid working poor are better off with BI, when more people would work. Nonetheless, Figure 11 also shows that high ability individuals prefer the CB system because of the lower tax when β = 0. However, when relative income has even moderate importance (β = 0.36), *all* individuals prefer the BI system, regardless of their ability.

Figure 11: Individual utility (vertical axis) against wage rate or implied ability (horizontal axis) in the Rawlsian case.

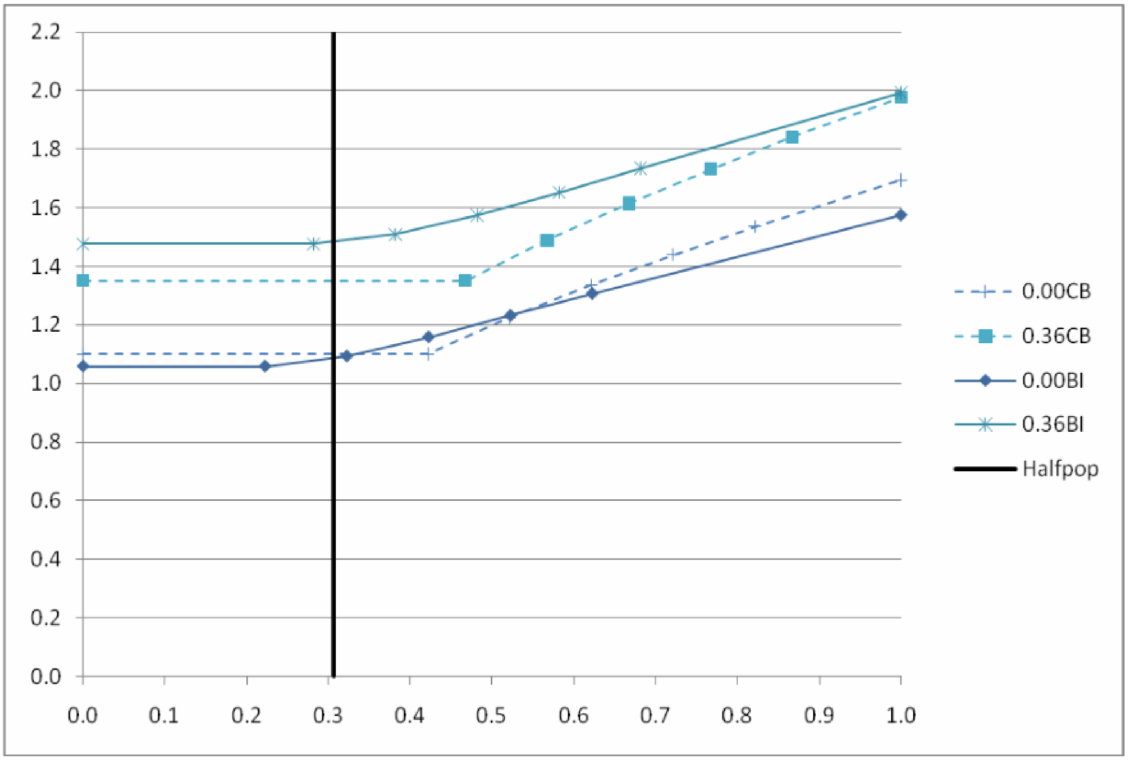
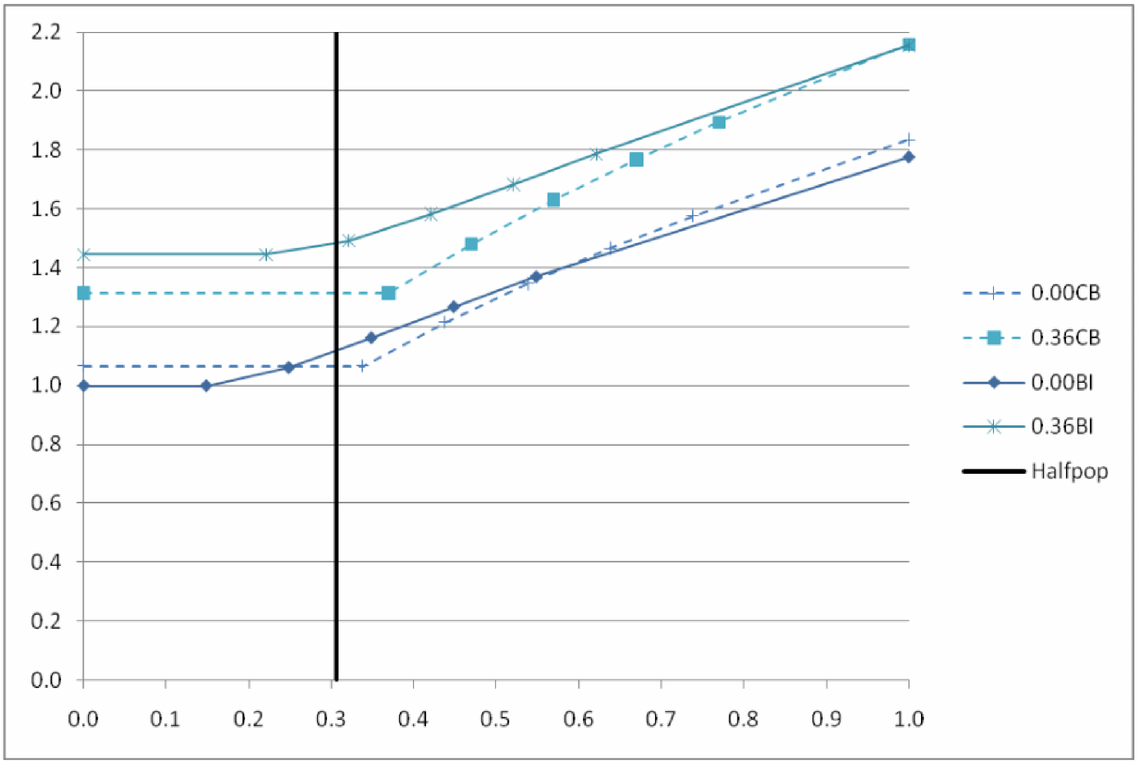


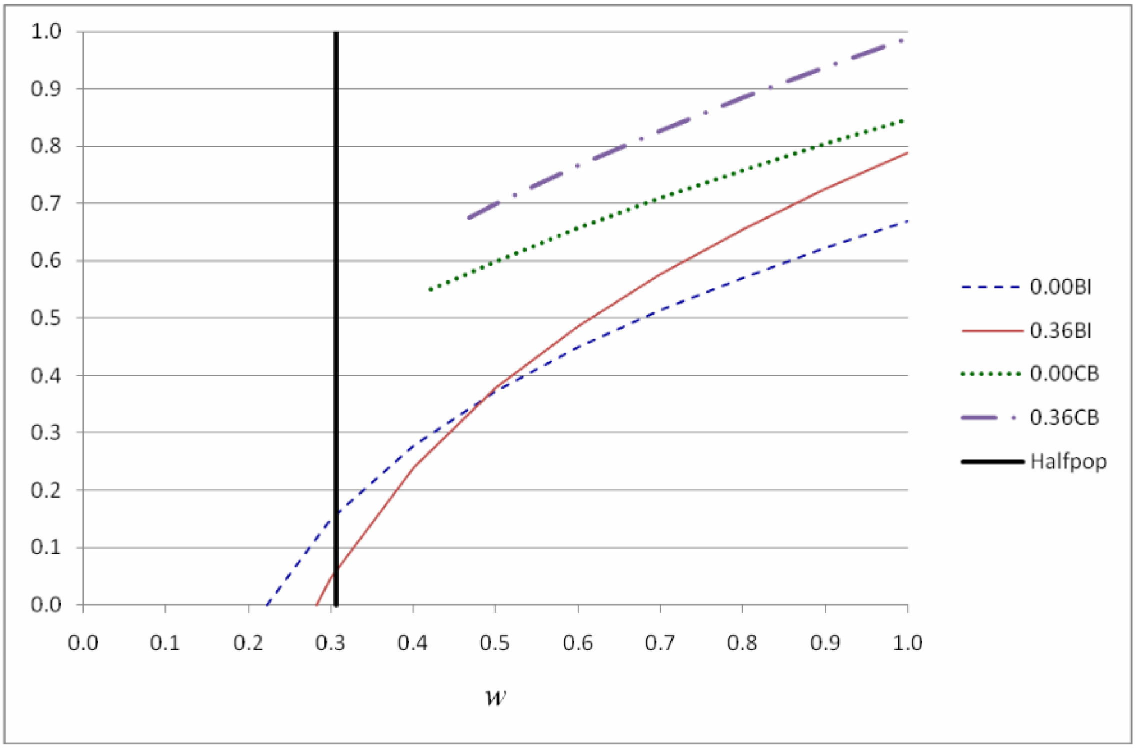
Figure 12 displays very similar results under a utilitarian social objective, while also showing higher employment rates (compared to each counterpart from Figure 11). Remarkably, well-being of the unemployed is almost the same under Rawlsian and utilitarian BI, and substantially lower in each case with CB. Furthermore, when $\beta = 0$, more mid-range ability individuals prefer the BI system over CB than with a Rawlsian objective. Clearly, there will be an intermediate value of β above which a majority of the population will prefer BI, for each objective.

Figure 12: Individual utility (vertical axis) against wage rate or implied ability (horizontal axis) in the utilitarian case.



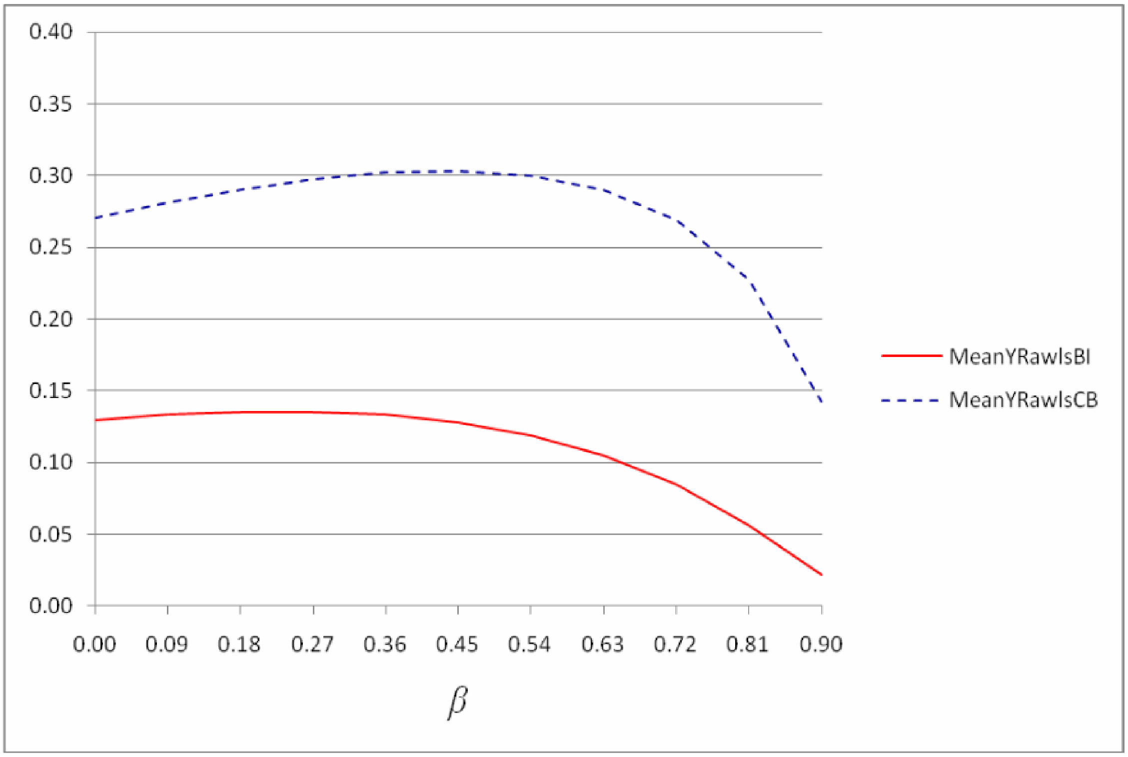
As noted in Section 2, optimal individual effort under a BI increases with concern for relative income (β) for a given effective minimum wage (m) and wage (w), and also rises with w. Figure 13 shows how optimal effort, now using *optimal* m, increases with the wage – in the Rawlsian case with BI. Lower unemployment evident in Figure 11 for $\beta = 0$ is reflected in positive optimal effort at a lower wage than when $\beta = 0.36$. At wages up to about 0.5 (more than half of the population, given the skewness of the wage distribution), optimal effort is *higher* for lower β, (with the optimal minimum wage). This is a surprising result, because we have seen that, for given m, optimal effort rises with β , so it due to the offsetting effect of the increasing optimal minimum wage. The two upper plots with CB show greater unemployment than with BI, and higher effort for all workers with higher β, as expected. Under the lower CB tax (Fig.2), effort is always higher than corresponding BI effort.

Figure 13: Optimal values of effort (with optimal m) plotted against w for the Rawlsian case under a BI for $\beta = 0$ and $\beta = 0.36$.



Following equation (11), we also noted that equilibrium mean income under a BI also increases with β, again for given m. Figure 14, below, demonstrates that – if the optimal minimum wage is used – mean income under a BI initially rises slightly with β, but then falls back for moderate and high concern for relativity as tax continues to rise. Further, mean income under a CB (with a similar path) is much higher than with BI, for any given β. This difference is enhanced by there being fewer low earners and more unemployment. The higher comparator income with CB also reduces well-being for all compared to BI, as shown in earlier Figures.

Figure 14: Optimal mean income (vertical axis) plotted against β (horizontal axis) for BI (red line), and CB (blue dashed line), $\gamma = 1.5$.



5. Conclusions

We have constructed a model which allows basic income (BI) and categorical benefit (CB) to be compared in a simple general equilibrium model – combining worker heterogeneity, extensive and intensive margins of labour supply, as well as including concern for relative income, and declining marginal utility of own consumption. Our simulations compare Rawlsian and utilitarian policy under these two fundamentally different systems of redistribution, yielding interesting and surprising results that could not be derived analytically. A major surprise is that modest concern for relativity implies *Pareto dominance* of BI, (in spite of associated higher tax), when compared to CB (with higher unemployment, and effort by the employed), under both Rawlsian and utilitarian goals. Another surprise under moderate relativity concern is that the two radically different policy objectives provide essentially the *same utility* to the non-employed, though high earners benefit from the lower utilitarian tax. (In the traditional case of no concern for relativity, the rich and most unemployed do prefer CB). While the levels of optimal BI and CB initially rise with concern for relativity, they then decline, though optimal unemployment, taxes and minimum wages all increase monotonically, with higher tax and lower individual effort and unemployment under BI as expected. While optimal unemployment levels appear high, they can be interpreted as 'non-employment' in a total population which includes individuals with arbitrarily low productivities who would not normally be included in the labour force.

These simulations have not generally included the realistic stigma or utility loss from unemployment under CB, which was included in our model. This would clearly enhance the relative advantage of BI, and we presented one example with stigma where the optimal Rawlsian tax becomes *higher* with CB than for BI when concern for relativity is important.

Overall, we have found a remarkable dominance of BI when relative income is important for individual well-being, as well as much less difference in the outcomes of Rawlsian and utilitarian policies than expected. Many important aspects of BI, and determinants of SWB, that have been discussed in the literature are neglected here, and should be included in future research on these important issues.

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