A model of conditional and unconditional social security in an efficiency wage economy: the economic sustainability of a basic income

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Central to efficiency wage models is the idea that a worker's productivity depends on the (real) wage rate received. Firms find it profitable to pay wages above the market-clearing level, despite the existence of involuntary unemployment. The rationale behind the link between productivity and wages can be divided into four broad groups, all well documented in the efficiency-wage literature: reduced shirking, lower turnover, adverse selection, and fairness. Firms set (efficiency) wages in order to motivate, retain, and attract workers. In Keynesian macroeconomics, the levels of real wages and social benefits serve a dual role: They are not only a cost of input, but also the main determinant of aggregate demand. Thus, while for the individual producer the labor-demand curve slopes downward, the aggregate labor-demand curve need not, especially if producers are demand-constrained in the goods market (Bowles and Boyer, 1995, pp. 143–145). If employment growth is aggregate demand- and wage-led and the economy faces insufficient aggregate demand, a general rise in wages and benefits may be accompanied by lower unemployment. But as Bowles (1992, p. 558) himself admits, econometric evidence suggests that this is an unlikely scenario for open economies. For a small open economy like the Netherlands, with an import and export quote both higher than 50 percent, a significant part of the favorable effect on aggregate demand caused by higher real wages and benefits will leak away abroad. Moreover, an increase in producer costs will reduce the demand for export goods. Here we concentrate on a third aspect of the role of wages, that is, its effect on motivation, work quality, and morale. If workers' productivity

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is endogenous, it is optimal for firms not to minimize wages per worker (that is, to buy labor as cheaply as possible) but instead to minimize efficiency wages (wage costs per efficiency unit of work).

Although the empirical relevance of efficiency-wage theory in explaining involuntary unemployment is still debated, theoretically, it offers coherent explanations of several labor-market phenomena.[1] Among these are real-wage rigidity and dual labor markets. A decline in demand or a decline in the price charged for the firm's product will lead not to lower wages but to lower employment. The dual labor market follows from, or at least is compatible with, an efficiency-wage framework because, according to Akerlof and Yellen, "the wage–productivity nexus is important in some sectors of the economy but not in others. For sectors where the efficiency wage hypothesis is relevant—the primary sector—we find job rationing and voluntary payment by firms of wages in excess of market-clearing; in the secondary sector, where the wage-productivity relationship is weak or nonexistent, we should observe full neoclassical behavior. The market for secondary workers clears, and anyone can obtain a job in this sector, although it might be at lower pay" (1986, p. 3).

In modern welfare states, however, there are at least two reasons why clearance of secondary labor markets will not occur. First, the minimum-wage legislation precludes profitable employment of workers with a labor productivity below the gross minimum-wage rate. Second, conditional (that is, means- and income-tested) social security is necessarily accompanied by poverty traps.

The purpose of this article is to identify the circumstances under which the introduction of a basic income in an efficiency-wage economy leads to the desirable effects of lower unemployment, nondecreasing real incomes and profits, and an increase of secondary- versus primary-sector wages (i.e., reduced income inequality among workers). The following mechanisms bring about these effects in an efficiency-wage economy. Under a basic income scheme, there is no need for minimum wages and there is no poverty trap. Because all adults already receive a basic income at subsistence level, this will strengthen their terms of negotiation with potential employers, thus removing the rationale of protecting workers by means of minimum-wage legislation. The level of the basic income serves as a floor below which nobody can sink. At

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[1] See Akerlof and Yellen (1986) for a critical examination of the explanatory power of efficiency-wage models.

present, much potential work at the bottom end of the labor market (one can think of day-care services, home-cleaning services, more civil servants to shorten waiting lines at government offices, environmental cleaning, etc.) is not realized. From the demand side, these labor-intensive services are too expensive (one has to pay at least the minimum-wage labor costs). From the supply side, the unemployed face extremely high marginal tax rates (the poverty trap). In principle, provided that work incentives among the formerly unemployed are sufficient, the demand for labor at wage levels below the minimum wage can be effectively realized under a basic income scheme. Whether such employment will come about all depends on the demand and supply conditions in the secondary labor market.

In the next section, the links between efficiency wages and social security arrangements are discussed, and this is followed by specification of a model for an efficiency-wage economy with conditional social security. We depart from a dual labor market, in which efficiency wages are paid in the primary sector but not in the secondary sector. Ideally, the basic income framework should incorporate the effect of better terms of negotiation of workers against employers in the secondary labor market, whereby employers are forced to compensate workers for the greater disutility attached to secondary jobs. They are not obliged to do so under conditional social security. After an overview of the conditions that must be met for the basic income scheme to be superior in terms of employment, real incomes, and profits, the paper gives a numerical example and conclusions.

Efficiency wages and social security arrangements

For simplicity, suppose that we characterize the generosity of the social security arrangements by one parameter, the level of the minimum wages.[2] Raising this level will have many mutually complementary and reinforcing effects. First, it will improve the workers' fallback position, and therefore employers must offer higher wages to induce workers to expend the same level of effort. In an efficiency-wage framework, effort above a self-chosen level (which Bowles calls "the whistle while you work" level), is costly for the worker to provide, and the amount of effort

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[2] In the Netherlands, the level of social assistance benefit is tied to the net minimum wage (the social assistance benefit equals 70 percent of the net minimum wage of a full-time worker).

a worker will expend depends on the cost of job loss (the difference between the value attached to one's job compared with one's next best alternative). Second, raising both the means-tested benefit level and the minimum wage not only extends the poverty trap but also makes it more difficult for employers to offer profitable employment for low-productivity workers. The extension of the poverty trap boosts the amount of voluntary unemployment (for some workers it is possible to find a job, but the value they attach to leisure is greater than what they gain by taking a part-time or full-time job), while the higher minimum wage will increase the amount of involuntary unemployment, particularly among workers with a low productivity level. Third, if it is true that a higher minimum wage and social security benefit cause higher unemployment, policy makers face the danger of what we will call a social security trap. Unless labor-productivity growth is high, more unemployment brings about lower tax revenues, which are needed to finance government outlays for social security benefits. So, as more people become unemployed, labor costs will rise as a result of higher taxes, which are needed to finance the higher social security outlays. But higher labor costs will lead to more layoffs, since the productivity of marginal workers will no longer be high enough to outweigh the higher labor costs.

To stand up to this problem, the welfare state must be essentially "productivist"—in that there should be privileged treatment of paid labor in the fight for full employment—and austere—in that those receiving unemployment benefits have a duty to accept a job offer.[3] Therefore, the benefits offered must be lower than wages. Those receiving benefits must remain available for the labor market and are expected to resume work as soon as possible. Moreover, benefits for the unemployed who were formerly employed are tied to both the spell of employment and the previous wage received, but will always be lower than the previous wage. It is interesting to see that both the level and the conditions of the benefit for the last category are much more generous than for those who lack any labor-market experience. Stuurman (1995, p. 176) infers from this that the unemployed without any labor-market experience must still be disciplined, and that to have this experience or not is seen as a personal desert or deficiency, which will give rise to differential treatment in the case of unemployment.

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[3] In the Netherlands, this rule has recently been seriously sharpened in order to assess whether unemployed or disabled have fulfilled their duty. The underlying criterion is still the "availability" for the labor market.

If the scenario above contains some truth, it illustrates the difficulty policy makers face in improving the expectations of the least-advantaged members of society. The main cause of the difficulty here lies in the fact that the economic process and the kind of social security provided are strongly intertwined. A too generous welfare regime might induce its own decline. Given the adverse effects of conditional social security on the working of the labor market, it is interesting to investigate whether unconditional social security by means of a basic income can improve the proper functioning of the labor market, mainly by removing the poverty trap and the need for minimum wages.

As we said, we shall depart from a dual-labor-market perspective. Ideally, limited access to the primary sector ought to be an endogenous outcome of the process, not an assumption. However, several articles have proven the existence of dual labor markets as a result of differences in monitoring and turnover costs between jobs (e.g., Bowles, 1990). In our model, we abstract from the differences in these costs and concentrate on the incentive and fairness effects of wages on effort expended. Workers in the primary sector have unlimited access to jobs in the secondary sector, but not the other way around. Recruitment of new workers in the primary sector is supposed to occur among graduates leaving school. We postpone for further research the phenomenon of greater compensatory justice, which is likely to occur under unconditional social security. A basic income at subsistence level will surely strengthen employees' terms of negotiation with employers. Under conditional social security, the duty for the unemployed to accept common, current, going work means that employers are not forced to compensate workers for the disutility suffered in toiling jobs, although a binding minimum-wage constraint in the secondary sector may attenuate this effect. Since there are more potential workers than there are jobs for them to fill, employers can offer low wages even for dirty jobs because the workers have no other choice. Things change under a basic income scheme. Whereas a refusal of a job offer is followed by a cut in social assistance or unemployment benefits under the conditional scheme, a job searcher keeps his or her right to a basic income (which is paid out regardless of income or employment status and readiness to work) under the unconditional scheme. Thus, whereas the disutility suffered plays no role in the conditional scheme, it is an important determinant of the equilibrium wage level if the unconditional scheme is in force.

Our approach differs in several respects from earlier attempts to model social security arrangements in an efficiency-wage framework. Jones

(1987) studied the equilibrium effects of minimum-wage legislation in a dual labor market with identical workers. The main shortcoming of his model, in our view, is that the unemployed receive no benefits at all. The dual-labor-market structure is due to differences in job characteristics, where the output of jobs in the secondary segment is easily monitored while monitoring in the primary sector is expensive and difficult. The main ingredient in Jones's model is the derivation of the nonshirking condition for workers in the primary sector, where the disciplinary device for workers is the cost of job loss in the case of detected shirking. Although the minimum wage is a binding constraint in the secondary market only, it nevertheless affects the employment and wage level of the primary sector. Bowles's (1992) labor-extraction model approaches the problem of switching from conditional to unconditional social security mainly from the side of a utility-maximizing framework, while largely abstracting from the dual-labor-market perspective. Most other articles on efficiency wages also derive the effort decision of workers and the nonshirking equations from a framework in which utility is maximized and in which workers are free to choose between different alternatives (e.g., Shapiro and Stiglitz, 1984; Bowles, 1991, 1992; Bulow and Summers, 1986). We assume that workers do not have the opportunity to balance utility derived from working with utility derived from non-working or shirking on the job. Instead, workers prefer employment in the primary sector to employment in the secondary sector and above unemployment. The utility attached to different positions is therefore discontinuous.

A dual labor market with conditional social security

The model presented here is quite similar to the one developed by Klundert (1989, 1990), who demonstrated very insightfully the general properties. One main difference is that he does not incorporate the effects of taxation.

The key variable to characterize conditional social security, given that the nominal unemployment and social assistance benefit[4] ($\bar{w}$) is institutionally tied to the net minimum wage, is the level of the net minimum wage, which depends on the gross minimum wage (w_m) and the tax rate (t). If we depart from a fixed nominal gross minimum wage, the social security system is given by:

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[4] We assume that there is just one benefit.

(1) $$\bar{w} = k w_m (1-t), \quad 0 < k < 1.$$

Throughout this paper, the minimum wage is assumed to act as a binding constraint on labor demand in the secondary sector.

The production functions are of the Cobb-Douglas type. The difference between both sectors is that in the primary sector p, there is a relationship between effort on the one hand and relative wages and the unemployment level on the other, while in the secondary sector s, we do not have efficiency wages since monitoring is costless and all workers expend the required level of effort (say, unity). The production function for s therefore reads:

(2) $$Y_s \equiv A_s L_s^{\beta_s}, \quad 0 < \beta_s < 1,$$

with Y_s denoting production and A_s the technology parameter for s. Producers in sector s maximize the profit function[5]:

$$\Pi \equiv Y_s - w_s L_s,$$

with the price of the product produced in the secondary sector as numeraire. Profit maximization in the secondary sector s gives the following first-order condition:

(3) $$\frac{\partial \pi_s}{\partial L_s} = 0 \rightarrow L_s^d = \left(\frac{\beta_s A_s}{w_s} \right)^{1/1-\beta_s}.$$

It follows from (3) that labor demand varies inversely with the prevailing (minimum) wage level.

In the efficiency-wage sector p, the production function reads:

(4) $$Y_p \equiv A_p (e L_p)^{\beta_p}, \quad 0 < \beta_p < 1,$$

with effort, denoted by e, dependent on relative wages and unemployment:

(5) $$e \equiv -a + h \left(\frac{w_p}{w_s} \right)^{\gamma_1} \left(\frac{L_u}{L} \right)^{\gamma_2}, \quad a > o, \quad 0 < \gamma_1 < 1, \quad \gamma_2 \leq 1.$$

So effort is higher, the higher wages in p compared with the wages in s,

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[5] Capital is assumed to be fixed. As the production function exhibits decreasing returns to scale, Euler's theorem, which states that factor rewards equal the value of the production, does not apply.

and the higher the rate of unemployment (L_u/L, where L is the total labor force).[6] It makes no difference whether we use gross or net wage rates in (5), because we assume a single proportional tax rate without tax allowances.

Producers maximize profits,

$$\Pi_p \equiv pY_s - w_p L_p,$$

with p as the relative price of the product produced in sector p. Profit maximization in the efficiency-wage sector p yields the following first-order conditions:

(6)
$$\frac{\partial \pi_p}{\partial L_p} = 0 \rightarrow \frac{w_p}{pe} = \beta_p A_p (eL_p)^{(\beta_p - 1)}$$

and

$$\frac{\partial \pi_p}{\partial w_p} = 0 \rightarrow p \frac{\partial Y_p}{\partial (eL_p)} \frac{\partial e}{\partial w_p} = 1.$$

After rearranging, the Solow condition results:

(7)
$$\left(\frac{w_p}{w_s}\right)^{\gamma_s} = \frac{a}{h(1-\gamma_1)\left(\frac{L_u}{L}\right)^{\gamma_2}}.$$

Equation (7) tells us that the profit-maximizing primary-wage level depends positively on the secondary-wage level and negatively on the level of unemployment.

Substitution of the Solow condition (7) in (5) gives the equilibrium effort level (equilibrium values will be denoted by asterisks):

$$e^* = \frac{a\gamma_1}{1-\gamma_1}.$$

At first sight this may seem a surprising result. It suggests that the equilibrium effort level does not depend on relative wages and unemployment at all, but only on two fixed parameters. This would imply that $\partial e/\partial w_p = 0$.

However, the case where the effort level is really constant, whatever the level of wages and unemployment, is different. If workers in p always expend an effort level equal to e^*, irrespective of w_p^* (e.g., because monitoring is such that they are forced to do so), the profit-maximizing wage rate with involuntary unemployment would be somewhere in the interval $[w_s, w_p^*]$. If effort depends positively on the relative wage level and unemployment, employers in p ensure that the configuration of the relative wage level (w_p^*/w_s) and unemployment is such that (7) applies, which results in e^* given above. In the appendix we deploy an alternative effort function with an *equilibrium* effort level dependent on relative wages and unemployment.

We are particularly interested in the effect social security arrangements have on labor supply. To incorporate these effects into the model, we use the labor-supply function discussed in Browning and Johnson (1984, p. 187):

$$L_v = (1 - MTR\delta)(1 + \phi ATR)L, \qquad \delta, \phi > 0,$$

with MTR and ATR equal to the marginal and average tax rate respectively. Since we abstract from tax allowances and use a single proportional tax rate (no tax brackets), the MTR is equal to the ATR, which holds for all workers (under the basic income scheme, however, the ATR differs among various categories of workers and depends on the difference between taxes paid and benefits received; see below). Analytically, labor-supply responses can be divided into substitution and income effects. Here δ is a measure of the substitution effect while ϕ is a measure of the strength of the income effect. A lower δ corresponds to a stronger substitution effect, or alternatively, labor supply is rather sensitive to changes in the *marginal* tax rate. A higher value for ϕ implies a stronger income effect, giving the increase in labor supply due to a rise in the average tax rate.

The labor-supply equation above has the advantage that it concentrates on the effects of taxation-*cum*-benefits on labor supply: Without any taxation and social benefits, everybody in the labor force supplies their labor (but not necessarily at a high effort level). As a consequence, any system of social security with positive tax rates will have a negative effect on total labor supply, given plausible values for δ and ϕ.[7]

[7] Browning and Johnson (1984, p. 188) take the most plausible case to be $\delta = 3.25$ and $\phi = 0.2$. In the simulation in the section on conditions to be met, we set $\delta = 2.0$, which means that labor supply is more sensitive to the marginal tax rate than in their

Given this general form of the labor-supply function, we can derive the labor supply for both sectors. The total labor force (L) is divided into two homogeneous groups: L_m, workers with a potential productivity of q which is below the minimum wage, and $L–L_m$, workers whose productivity depends on whether they work in the primary or the secondary sector. The assumption that there are L_m workers with an insufficient productivity level entails not only that all L_m workers are unemployed but also, given the system of social security in force, that they all face the poverty trap (that is, a marginal tax rate equal to 100 percent). Total labor supply therefore equals:

$$L^x_{s+p} = (1 - MTR^\delta)(1 + \varphi ATR)(L - L_m).$$

The $L–L_m$ workers are a homogeneous group who all try to find employment in the primary sector, but only some of them will succeed. Therefore, labor supply for sector s equals:

(8) $$L^x_s = L^x_{s+p} - L^d_p.$$

Again, we assume that the minimum wage will act as a binding constraint (labor supply outweighs labor demand) in sector s:

(9) $$w_s = w_m \quad \text{with } L^x_s > L^d_s.$$

Total unemployment ($L_u = L - L^d_s - L^d_p$) can now be divided into three groups:

(10) $$L_u = L_m + (L^x_s - L^d_s) + (L - L_m - L^x_{s+p}).$$

The final bracketed term in the above expression can be considered to be voluntary unemployment because not all members of the labor force actually supply their labor. The first two terms represent involuntary unemployment due to the minimum wage: L_m persons' productivity does not compensate the minimum-wage labor costs, and total labor demand in sector s is restricted by the binding minimum wage (that is, $L^x_s > L^d_s$ at $w_s = w_m$).

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most plausible case (the magnitude of the negative substitution effect is greater). Given that the single, proportional, and therefore marginal tax rate of a basic income regime is much higher than the single, proportional tax rate of "tagged" conditional social security, this implies that the negative substitution effect on labor supply is stronger under the first regime.

Given homothetic utility functions, we can describe product demand as:

$$(11) \qquad \frac{Y_s}{Y_p} = \frac{\alpha}{1-\alpha} p, \quad 0 < \alpha < 1.$$

Finally, for the government budget to balance, it is required that

$$(12) \qquad t(w_s L_s + w_p L_p) = \overline{w}(L_u + \mu L),$$

with μ a parameter that links the dependent population (children, old-aged, disabled, etc.) to the total labor force.

Since we used Cobb-Douglas production functions for both sectors, the share of labor in sector s, $L_s w_s$ equals $\beta_s Y_s$, and in sector p, $L_p w_p$ equals $p \beta_p Y_p$. Dividing both shares and substituting for p from (11) gives a relationship between the employment ratio and the wage ratio:

$$(13) \qquad \frac{L_p}{L_s} = \frac{(1-\alpha)\beta_p w_s}{\alpha \beta_s w_p}.$$

Equation (13) expresses that the relative employment levels vary inversely with the relative wage levels.

The model can now be solved recursively. The secondary wage follows from (9) which determines by (3) secondary labor demand and consequently secondary output by (2). Given secondary employment, primary employment L_p, and total unemployment L_u can be derived from (7), (10), and (13). The other variables follow in a straightforward manner.

Before we present the results, we would like to point to some characteristics of the model. A minimum wage higher than the potential productivity of the L_m workers causes massive unemployment for this group. If the minimum wage is set at a level high enough to make it a binding constraint, that is, $L_s^s > L_s^d$ at $w_s = w_m$, there is queuing for jobs in both sectors, which means that total labor supply is greater than total labor demand. The $L-L_m$ workers have limited access not only to jobs in the primary sector but also to jobs in the secondary sector. Labor demand in s is constrained by the minimum wage, and given the level of the minimum wage, employers in the primary sector set a wage according to (7). As long as the minimum wage remains a binding constraint, moderate increases or decreases in labor supply have no effect at all on equilibrium outcomes.

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A dual labor market with unconditional social security

We stated above that, as soon as a basic income (b) is implemented, there is no need for a minimum wage. For the model, this means that we cannot start with the minimum-wage constraint which enables the model to be solved recursively. In the absence of wage constraints or wage rigidity, the (secondary) labor market clears (see equation [9'] below) and all unemployment will be voluntary. Instead of assuming that the unemployment benefit is tied to the exogenously given minimum wage, we make the assumption (see equation [1']) that the level of the basic income is tied to the net wage earned in the secondary sector.

Below we present the set of equations describing the economy with unconditional social security, where apostrophes are used to indicate variables under unconditional social security.

(1')
$$b = k' w_s' (1 - t'), \quad k' > 0;$$

(2')
$$Y_s' \equiv A_s (L_s')^\beta, \quad 0 < \beta_s < 1$$

where
$$\Pi_s' \equiv Y_s' - w_s' L_s';$$

(3')
$$\frac{\partial \pi_s'}{\partial L_s'} = 0 \rightarrow L_s^{d'} = \left(\frac{\beta_s A_s}{w_s'}\right)^{1/(1-\beta_s)}$$

(4')
$$Y_p' \equiv A_p (e' L_p')^{\beta_p}, \quad 0 < \beta_p < 1$$

where
$$\Pi_p' \equiv p' Y_p' - w_p' L_p';$$

(5')
$$e' \equiv -a + h \left(\frac{w_p'}{w_s'}\right)^{\gamma_1} \left(\frac{L_u}{L}\right)^{\gamma_2}, \quad a > 0, \quad 0 < \gamma_1 < 1;$$

(6')
$$\frac{\partial \pi_p'}{\partial L_p'} = 0 \rightarrow \frac{w_p'}{p' e'} = \beta_p A_p (e' L_p')^{(\beta_p - 1)}$$

and
$$\frac{\partial \pi_p'}{\partial w_p'} = 0 \rightarrow p' \frac{\partial Y_p'}{\partial (e' L_p')} \frac{\partial e'}{\partial w_p'} = 1;$$

(7') $$\left(\frac{w_p{}'}{w_c{}'}\right)^{\gamma_2} = \frac{a}{h\,(1-\gamma_1)\left(\frac{L_u{}'}{L}\right)^{\gamma_3}}$$

and

$$e\,'* = \frac{a\gamma_1}{1-\gamma_1}\,;$$

(8') $L_s{}' = (1 - MTR_s{}'^{\delta})\,(1 + \varphi ATR_s{}')\,(L - L_m) - L_p{}' +$

$(1 - MYT_m{}'^{\delta})\,(1 + \varphi ATR_m{}')\,qL_m\,;$

(9') $$L_s^s{}' = L_s^d{}'\,;$$

(10') $L_u{}' = L - (1 - MTR_s{}'^{\delta})\,(1 + \varphi ATR_s{}')\,(L - L_m) -$

$(1 - MTRm{}'^{\delta})\,(1 + \varphi ATRm{}')\,Lm\,;$

(11') $$\frac{Y_s{}'}{Y_p{}'} = \frac{\alpha}{1-\alpha}\,p{}'\,;$$

(12') $$t{}'\,(w_s{}'\,L_s{}' + w_p{}'\,L_p{}') = bL\,(1 + \mu)\,;$$

(13') $$\frac{L_p{}'}{L_s{}'} = \frac{(1 - \alpha)\,\beta_p\,w_s{}'}{\alpha\,\beta_s\,w_p{}'}\,.$$

Equation (1') describes the level of the basic income, which is endo-genous in our model. The RHS of equation (12') states that this basic income is paid to everybody, irrespective of labor-market status. Equations (2')–(7') are similar to what is stated in the preceding section, as well as (11') and (13'). Equations (8')–(10') require further discussion.

In the labor-supply equation proposed by Browning and Johnson, actual labor supply depends on average and marginal tax rates. As the basic income is paid unconditionally to everybody and financed by a single proportional tax rate, the marginal tax rate is equal for all ($MTR_s{}'$ $= MTR_m{}'$). The average tax rate is defined as:

$$ATR{}' \equiv \frac{t{}'\,w{}' - b}{w{}'}\,.$$

Thus, the average tax rate is positive for those who pay taxes which outweigh the benefits received in the form of a basic income. The L_m workers have a potential productivity of q compared with the other workers in s. Their gross wage rate therefore equals q multiplied by the wage rate in s. Hence, their average tax rate becomes:

$$ATR_m{}' \equiv \frac{t{}'\, q\, w_s{}' - b}{q\, w_s{}'},$$

and for the other workers in s:

$$ATR_s{}' \equiv \frac{t{}'\, w_s{}' - b}{w_s{}'}.$$

Some of the $L–L_m$ workers succeed in finding a job within the primary sector. The L_m workers will only supply q per person. Thus, total labor supply in s as expressed in equation (8') is composed of both the $(L–L_m)$ and qL_m groups (the effective labor supply of this group), weighted by the factors that measure the influence of the taxation-*cum*-benefits structure on labor supply, and primary employment $L_p{}'$ subtracted. Equation (9') expresses secondary-labor-market clearing. As a consequence, all unemployment under the basic income regime is of a voluntary nature—for example, all those who do not search for work because of the basic income received and the high marginal tax rate necessary to finance the basic income. The negative effect of the high marginal tax rate on labor supply and in turn on employment is compensated by a withdrawal rate less than 100 percent for the unemployed,[8] and by the fact that labor demand is not restricted by a binding minimum-wage constraint. Equation (10') measures unemployment in persons and is the reason why we have left out the factor q for the L_m workers. Since there is labor-market clearance in the secondary sector, all those who cannot find employment in the primary sector but are willing to supply labor will find work in the secondary sector.

[8] In fact, the withdrawal rate here equals the marginal tax rate as all earnings are taxed at this rate. Under conditional social security arrangements, the social benefits of recipients with small positive earnings are reduced pound for pound.

Conditions to be met

For the transition from conditional to unconditional social security to be advisable from an ethical and economical point of view, we propose seven criteria that ideally should be met simultaneously. The first three are that real net incomes of secondary- and primary-sector workers and the unemployed may not decrease. The other four are that unemployment must decrease, profits in both sectors should not decrease, and finally that real GDP should not decrease. The last condition is automatically met if all other conditions are met, but may still be met if not all of them are fulfilled. If all conditions are met simultaneously, the transition is a real Pareto improvement.

So far the model has been presented in nominal terms. To evaluate the effect on real net incomes and profits, a price index is needed. The consumer price index is defined as:

$$p_c \equiv p_s^\alpha \, p_p^{1-\alpha} \,.$$

We take p_s and p_c' as numeraire in both models, in which case,

$$p_c \equiv p_p^{1-\alpha} \qquad p_c{}' = p_p{}'^{1-\alpha} \,.$$

The seven conditions can now be stated as:

(C1)
$$yr_c{}' - yr_s = \frac{w_s{}'(1-t{}')+b}{p_c{}'} - \frac{w_c(1-t)}{p_c} \geq 0\,;$$

(C2)
$$yr_p{}' - yr_p = \frac{w_p{}'(1-t{}')+b}{p_c{}'} - \frac{w_p(1-t)}{p_c} \geq 0\,;$$

(C3)
$$yr_u{}' - yr_u = \frac{b}{p_c{}'} - \frac{\overline{w}}{p_c} \geq 0\,;$$

(C4)
$$Lu{}' < Lu\,;$$

(C5)
$$\pi r_s{}' - \pi r_s = \frac{\pi_c{}'}{p_c{}'} - \frac{\pi_s}{p_c} \geq 0\,;$$

(C6)
$$\pi r_p{}' - \pi r_p = \frac{\pi_p{}'}{p_c{}'} - \frac{\pi_p}{p_c} \geq 0\,;$$

(C7)
$$GDP\,' - GDP = \frac{Y_s\,' + p\,'\,Y_p\,'}{p_c\,'} - \frac{Y_z + pY_p}{p_c} \geq 0\,.$$

In the basic-income literature, much emphasis is placed on showing that a basic income improves the position of the least advantaged members of society (Rawlsian justice) (Van der Veen, 1991; Van Parijs, 1995). According to Rawls's principle of equal liberties and the difference principle, "Each person is to have an equal right to the most extensive total system of equal basic liberties compatible with a similar system of liberty for all" and "social and economic inequalities are to be arranged so that they are ... to the greatest benefit of the least advantaged" (Rawls, 1971, p. 302). If we were to adopt a rather *ad hoc* strategy for identifying the least advantaged by using an index comprised of net income alone, it is obvious that a basic income regime would be outperformed by a regime that redistributes benefits more selectively to the poor only ("tagging"). After all, a basic income is paid out to all irrespective of wealth, whether in the form of stocks or flows. In contrast, poor men's reliefs are only supplied to those with an income below the social minimum. Nevertheless, in general terms, Rawlsian justice defends the idea of a basic income in that the difference principle applies not only to income but to all social values—such as liberties and opportunities, powers and prerogatives, income and wealth, and the bases of self-respect. "There is no doubt," says van Parijs, "that an unconditional income confers upon the weakest more bargaining power in their dealings with both potential employers and the state, and hence a greater potential for availing themselves of powers and prerogatives, than a transfer contingent upon the beneficiary's availability for work and the satisfaction of a means test. Finally, Rawls mentions the social basis of self-respect, and there is again little doubt that a transfer system that is not targeted at those who have shown themselves 'inadequate' and involves less administrative control over its beneficiaries is far less likely to stigmatize them, humiliate them, make them ashamed of themselves, or undermine their self-respect" (1991, p. 105).

A problem to be overcome is deciding who should be labeled as the least advantaged. Strictly, the lowest real income is the income of the unemployed. But all unemployment under the basic income scheme is of a voluntary type, due to clearance of the secondary labor market. All workers who look for work, even those (L_m) with the lowest productivity, can find work. The relevant criterion for evaluating whether the

expectations of the least advantaged are improved is therefore the real net income of secondary-sector workers, provided that the basic income is around subsistence level and provided that all unemployment is really voluntary.[9] Under conditional social security, the unemployed have a duty to accept common, current, going work, but because of involuntary unemployment, the highest net income they can attain is the social benefit. In such a case, the unemployed are the least advantaged. Under the basic income scheme, with no involuntary unemployment, some workers may choose to live from the basic income alone, having no duty to accept jobs even though ample job opportunities exist. In this case, it is not more than reasonable to ask them to carry the burden of their own choices—that is, to have a low income and plenty of leisure. In that case, the membership of the least advantaged shifts to the group of secondary-sector workers, or at least both groups are on the same footing. There-fore, the third condition need not be fulfilled, and the real test is whether the change from conditional to unconditional social security can pass the other six.

A numerical example

In order to present a numerical example, the values of a number of parameters and exogenous variables were chosen. These are:

$k = 0.7$; $\mu = 0.33$; $A_x = 2.73$; $A_p = 3.0$; $\alpha = 0.5$; $a = 0.2$;
$h = 1.6$; $\gamma_1 = 0.9$; $\gamma_2 = 0.2$; $\beta_x = 0.8$; $\beta_p = 0.5$; $\phi = 0.2$;
$\delta = 2.0$; $L = 100$; $L_m = 20$; $q = 0.7$; $w_m = 1.0$.

In the Netherlands, there is a lack of empirical data on the efficiency-wage relationship and the dual labor market; for this reason, parameters and exogenous variables are set in a way that achieves a reasonable outcome for the model of conditional social security. These values remain unchanged for the model of unconditional social security; thus, we are able to obtain comparative static results.

In the models, it appears that the share of labor parameter in the secondary sector (and to a lesser extent in the primary sector), is crucial

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[9] Even if these rather stringent conditions are met, some may even propose that the basic income must be set at the highest possible level for reasons of justice (Van Parijs, 1995; Van der Veen, 1991; Van der Veen and Van Parijs, 1987). A basic in-come at the highest possible level is also warranted if one wants to strengthen the terms of negotiation of workers as much as possible.

because it determines the wage elasticity of labor demand:

$$E^{L}_{w_s} \equiv \frac{\partial L_s}{\partial w_s} \frac{w_s}{L_s} = -\frac{1}{1-\beta_s}.$$

We will perform the simulation for two values of β_s—0.8 and 0.5. The value 0.8 implies that the demand for labor in the secondary market is extremely responsive to the secondary wage level, while the value 0.5 implies a more moderate response.

Table 1 gives the outcomes for the endogenous variables in the conditional and unconditional models of social security. Table 2 states the conditions for the same set of parameter values we used for conditional social security, but for varying levels of k' (see equation [1']). The row beneath the column numbers in Tables 2 and 4 shows the sign that is needed in order to meet the conditions. For β_s equal to 0.8, $k = 0.7$, and $w_s = w_m = 1.0$, the outcomes for the endogenous variables of the model for conditional social security are summarized in the first two rows of Table 1.

Table 2 shows that all the conditions we proposed are met if $k' < 0.8$, except that the real net income of (voluntary) unemployed decreases (condition 3). For $k' = 0.6$, the real net income of the unemployed decreases by 33 percent (−0.08/0.24), which may bring them below the subsistence level. Column 11 shows that, for $k' > 0.4$, the net income differential between workers in s and p narrows, where

$$y_s'/y_p' \approx \frac{w_s'(1-t')+b}{w_p'(1-t')+b}.$$

Results for the same exercise, but with $\beta_s = 0.5$ are summarized in Tables 3 and 4. We have adjusted the technology parameters by a similar magnitude in order to ensure that secondary-sector employment for $w_s = 1$ equals 50 when there is conditional social security. In running the model for unconditional social security, we use these adjusted parameters so that we have comparative static results.

Column 10 in Tables 1 and 3 shows that the highest real basic income is obtained for values of k' that do not enable all conditions to be met. The aim of maximizing the real net income of the lowest income positions is therefore in conflict with the aim of maximizing real GDP, employment, profits, and the real net income of primary- and secondary-sector workers. It illustrates that chosing the level of the basic income is an exercise in restraint.

Table 1
Outcomes of the model of (un)conditional social security ($\beta_s = 0.8$)

	1	2*	3	4	5	6	7	8	9	10	11
k	t	L_s	L_p	L_u	w_s	w_p	Y_s	Y_p	p	$\overline{w}/p_c$	y_s/y_p
0.7	0.36	50.0	18.8	31.2	1.0	1.66	62.5	17.5	3.5	0.24	0.6

k'	t'	L_s'	L_p'	L_u'	w_s'	w_p'	Y_s'	Y_p'	p'	b/p_c'	y_s'/y_p'
0.3	0.26	69.6	18.5	6.4	0.94	2.21	81.4	17.3	4.7	0.10	0.49
0.4	0.34	65.1	19.2	10.4	0.95	2.01	77.2	17.6	4.4	0.12	0.56
0.5	0.40	60.7	19.4	14.9	0.96	1.88	73.0	17.7	4.1	0.14	0.61
0.6	0.47	56.2	19.2	19.9	0.98	1.80	68.2	17.6	3.9	0.16	0.66
0.7	0.53	51.7	18.6	25.3	0.99	1.73	64.2	17.4	3.7	0.17	0.70
0.8	0.58	47.3	17.8	30.9	1.01	1.68	59.8	17.0	3.5	0.18	0.73
0.9	0.63	42.8	16.7	36.8	1.03	1.65	55.2	16.5	3.4	0.19	0.76
1.0	0.68	38.3	15.5	42.9	1.05	1.63	50.5	15.8	3.2	0.19	0.78

* L_s is measured in effective units so each L_m worker counts as q. Therefore, $L = L_s' + L_p' + L_u'$ does not sum up to 100. $L = 100$ only holds if all L_m workers are unemployed.

Table 2
Conditions to be met

	1	2	3	4	5	6	7
	+	+	+	–	+	+	+
k'	C1	C2	C3	C4	C5	C6	C7
0.3	0.07	0.28	–0.14	–24.7	0.90	2.24	9.0
0.4	0.08	0.20	–0.11	–20.8	0.77	1.93	7.7
0.5	0.08	0.13	–0.10	–16.2	0.58	1.46	5.8
0.6	0.08	0.08	–0.08	–11.2	0.35	0.87	3.5
0.7	0.08	0.03	–0.07	–5.9	0.07	0.18	0.7
0.8	0.07	–0.01	–0.06	–0.3	–0.24	–0.60	–2.4
0.9	0.05	–0.05	–0.05	5.6	–0.58	–1.45	–5.8
1.0	0.04	–0.09	–0.05	11.7	–0.95	–2.38	–9.5

Tax rates increase in k'. Secondary employment (and output) declines sharply for rising k', irrespective of β_s (see column 2 of Tables 1 and 3), while primary employment (and output) is rather constant. The reduction in unemployment is therefore largely due to increasing secondary employment and, more specifically, to the absence of a minimum-wage constraint. The first column of Tables 2 and 4 shows that the real income of secondary-sector workers will always rise, even for quite high tax rates.

Table 3
Outcomes of the model of (un)conditional social security
($\beta_s \approx 0.5$; $A_s = 14.14$; $A_p = 15.0$)

	1	2	3	4	5	6	7	8	9	10
k	t	L_s	L_p	L_u	w_s	w_p	Y_s	Y_p	p	$\overline{w}/p_c$
0.7	0.26	50.0	27.9	22.1	1.0	1.79	100	106	0.94	0.52
k'	t'	L_s'	L_p'	L_u'	w_s'	w_p'	Y_s'	Y_p'	p'	b/p_c'
0.3	0.24	62.4	26.0	6.0	0.89	2.15	112	103	1.09	0.19
0.4	0.31	58.1	26.9	9.6	0.93	2.00	108	105	1.03	0.25
0.5	0.38	54.0	27.1	13.8	0.96	1.92	104	105	0.99	0.30
0.6	0.44	50.0	26.8	18.4	1.00	1.87	100	104	0.96	0.34
0.7	0.50	46.0	26.0	23.5	1.04	1.84	96	103	0.93	0.38
0.8	0.56	42.1	24.9	28.8	1.09	1.84	92	100	0.91	0.40
0.9	0.61	38.2	23.5	34.4	1.14	1.86	87	98	0.90	0.42
1.0	0.66	34.3	21.9	40.3	1.21	1.89	83	94	0.88	0.44

Table 4
Conditions to be met

	1	2	3	4	5	6	7
	+	+	+	−	+	+	+
k'	C1	C2	C3	C4	C5	C6	C7
0.3	0.10	0.42	−0.32	−16.3	2.01	2.01	8.1
0.4	0.13	0.27	−0.27	−12.5	1.52	1.52	6.1
0.5	0.15	0.16	−0.22	−8.3	0.64	0.64	2.6
0.6	0.16	0.07	−0.18	−3.7	−0.52	−0.52	−2.1
0.7	0.17	−0.01	−0.15	1.4	−1.92	−1.92	−7.7
0.8	0.16	−0.08	−0.11	6.7	−3.55	−3.55	−14.2
0.9	0.15	−0.14	−0.10	12.3	−5.37	−5.37	−21.5
1.0	0.13	−0.21	−0.08	18.2	−7.39	−7.3	−29.6

Conclusion

This paper has addressed the introduction of a basic income in a dual-labor-market economy in which efficiency wages are paid in the primary sector. We distinguished two schemes of social security, labeled conditional and unconditional. In the conditional scheme, social benefits are "tagged," that is, they are only given to the poor and unemployed, while in the unconditional scheme the basic income is paid out irrespective of labor-market status. Moreover, we assumed that

benefits in the conditional scheme are tied to the net minimum wage of a full-time worker and that the minimum wage acts as a binding constraint in the secondary labor market.

The model shows that a moderate basic income can be compatible with lower unemployment, higher GDP, higher real incomes for workers, lower income inequality between workers, but a lower real income for the (voluntary) unemployed. The gain in employment is for a large part concentrated in the secondary sector, while primary-sector employment and output are more or less unaffected by the introduction of a basic income. The real winners from a transition from conditional to unconditional social security are the secondary-sector workers. This effect may be even stronger if we take into account a phenomenon that is likely to occur in the basic income scheme, that of greater compensatory justice when workers are compensated for disutility suffered from working. The results may be of relevance for the evaluation of the economical and ethical (dis)advantages of a welfare state reform toward a negative income tax or basic income.

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Variables and parameters

Variables

L = Total labor force;

L_u = Number of unemployed persons;

L_i = Employment in sector i, $i = s, p$;

Y_i = Production in sector i, $i = s, p$;

b = Basic income;

e_i = Effort if working in sector i, $i = s, p$;

w_i = Nominal wage in sector i, $i = s, p$;

t = Tax rate

π_i = Profit in sector i, $i = s, p$;

p = Price level;

$\overline{w}$ = Nominal minimum social assistance benefit;

w_m = Nominal minimum wage.

Parameters

k Parameter that ties the benefit to the net secondary wage;

A_i Technology sector i, $i = s, p$;

β_i Curvature production function sector i, $i = s, p$;
δ Parameter for the effect of the marginal tax rate (MTR) on labor supply;
ϕ Parameter for the effect of the average tax rate (ATR) on labor supply;
α Product demand parameter;
μ Fraction of dependent population to total labor force;
a, h, γ_1, γ_2 Effort parameters.

Appendix

The properties of the model are rather sensitive to the specification of the effort function. In the section on the dual labor market with conditional social security, we saw that the *equilibrium* effort level is a function of two parameters only (see equation [7] and below). Here we will assume that both sectors pay efficiency wages and that the effort level is partly determined by the net *income* (instead of wages) relative to one's next best alternative.

Suppose the effort function under conditional social security for sector s reads:

$$e_s \equiv -a + h \left(\frac{w_s (1 - t)}{\overline{w}} \right)^{\gamma} \left(\frac{L_u}{L} \right)^{\gamma_2}, \quad 0 < \gamma_1 < 1, \quad \gamma_2 \leq 1,$$

and for sector p:

$$e_p \equiv -a + h \left(\frac{w_p (1 - t)}{w_s (1 - t)} \right)^{\gamma}, \quad 0 < \gamma_1 < 1.$$

Workers in p can always find employment in s if necessary; thus, we have left out the level of unemployment in the effort equation for p.

The Solow conditions derived by the same method as outlined in the text are:

(Sc$_s$)

$$\left(\frac{w_s (1 - t)}{\overline{w}} \right)^{\gamma_1} = \frac{a}{h (1 - \gamma_1) (\frac{L_u}{L})^{\gamma_2}}$$

and

(Sc_p)
$$\left(\frac{w_p(1-t)}{w_s(1-t)}\right)^{\gamma} = \frac{a}{h(1-\gamma_1)} \; .$$

The equilibrium effort levels are now:

$$e_s* = e_p* = \frac{a\gamma_1}{1-\gamma_1} \; .$$

For a scheme of *unconditional* social security, in which, again, the relative net income figures as an argument, the corresponding effort functions become:

$$e_s{}' \equiv -a + h\left(\frac{w_s{}'(1-t')+b}{b}\right)^{\gamma_1}\left(\frac{L_u{}'}{L}\right)^{\gamma_2} ,$$

$$0 < \gamma_1 < 1, \quad \gamma_2 \le 1 ,$$

and for sector p:

$$e_p{}' \equiv -a + h\left(\frac{w_p{}'(1-t')+b}{w_s{}'(1-t)'+b}\right)^{\gamma_1}, \quad 0 < \gamma_1 < 1 .$$

The Solow conditions are:

(Scs')

$$\left(\frac{w_s{}'(1-t')+b}{b}\right)^{\gamma_1} = \frac{a}{h\left(1 - \gamma_1 \dfrac{w_s{}'(1-t')+b}{w_s{}'(1-t')(1-\gamma_1)+b}\right)\left(\dfrac{L_u{}'}{L}\right)^{\gamma_2}}$$

and

(Sc_p')

$$\left(\frac{w_p{}'(1-t')+b}{w_s{}'(1-t')+b}\right)^{\gamma_1} = \frac{a}{h\left(1 - \gamma_1\left(\dfrac{w_p{}'(1-t')}{w_p{}'(1-t')+b}\right)\right)} \; .$$

For $b = k'(1-t')w_s{}'$, the equilibrium effort levels can be written as:

$$e_s{}'* = \frac{a\gamma_1 w_s{}'(1-t')}{w_s{}'(1-t')(1-\gamma_1)+b} = \frac{a\gamma_1}{(1-\gamma_1)+k'} ,$$

and for sector p:

$$e_p{}'* \equiv \frac{a\gamma_1\, w_p{}'\,(1-t')}{w_p{}'\,(1-t')\,(1-\gamma_1)+b}.$$

Comparing the equilibrium effort levels for sectors s and p of both schemes shows that they will always be lower for a positive basic income ($k' > 0$, $b > 0$), because:

$$e_s* = \frac{a\gamma_1}{1-\gamma_1} > e_s{}'* = \frac{a\gamma_1}{1-\gamma_1+k'}, \quad k' > 0,$$

and

$$e_p{}'* < e_p* <-> \frac{1}{e_p{}'*} = \frac{1-\gamma_1}{a\gamma_1} + \frac{b}{a\gamma_1\, w_p{}'\,(1-t')} > \frac{1}{e_p*} = \frac{(1-\gamma_1)}{a\gamma_1}.$$

It also shows that the equilibrium effort level may depend on relative wages and other income.