Active citizen's income, unconditional income and participation under imperfect competition : A normative analysis

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Abstract

Various types of basic income schemes are considered to compensate the allocative inefficiencies induced by unemployment benefits. A dynamic general equilibrium model of a unionised economy is developed in which participation to the formal labour market is endogenous and the budget of the State has to balance. It is shown that basic income schemes reduce the equilibrium unemployment rate. Assuming that job-search is costly to monitor, the normative analysis suggests that only the active population should be eligible to the basic income. Introducing such an 'active citizen's income' can be a Pareto-improving reform.

Keywords: Basic income; wage bargaining; unemployment benefits; participation; moral hazard; optimal taxation; sanction.

JEL classification : E64, H20, J38, J58, J65.

1 Introduction

Two goals are notoriously difficult to reconcile, namely the goal of providing jobs to all participants to the labour market and the goal of providing adequate income to all. In combination with minimum wages, if any, guaranteed minimum income schemes and/or unemployment insurance and assistance are used to alleviate the consequences of joblessness. These benefits also raise the reservation wage and so lead to an inefficient level of employment. To answer that problem, public authorities can reduce unemployment benefits but then one of the two goals is left aside. Policy measures that apply merely to the inflow of new employees (such as those activating unemployment benefit[1]) also fall short of the two goals. Other measures that apply to the stocks of unemployed and of employed people have therefore to be found. One of them consists in issuing an employment subsidy to firms without reconsidering the level of benefits (see Phelps (1997) and Drèze and Sneessens (1997)). These recommendations have been influential in several countries (e.g. France and Belgium). Alternatively, the government can use refundable tax credits to provide an adequate income to working individuals or families (the EITC in the US and the WFTC in the UK). As such, this second approach does not tackle the problem of providing adequate income to those who remain jobless. *'Basic income' schemes* provide a third approach. A wide spectrum of proposals can be ranged under that heading. The most well-known variant is the *'unconditional income'* (UCI for short), i.e. a lump-sum transfer which is handed out to each individual (with possibly some restrictions based on age) without means test and without work requirement (see Lange, 1936, Meade, 1948, and Van Parijs, 1995). Atkinson (1995a) has argued that the scheme should be conditional on participation. The latter would not be restricted to participation to the labour market but should rely on a wider definition of social contribution. A narrowly interpreted version of a basic income would restrict the scheme to the formal active population only. Hence, let us call it an *'active citizen's income'* (ACI for short).

One can wonder whether basic income schemes are actually a way of reconciling the two goals mentioned above. As such, this question is underspecified. The assessment crucially depends on the characteristics of the proposal. Consider an economy where an 'unemployment benefit' is paid to jobless people provided that they are available for employment and making efforts to search for a job. As is often the case, consider that the level of this benefit is in a way or another proportional to wages. Two cases are

[1] I.e. maintaining the income transfer when people find a job.

then considered. For a given level of wages, either the basic income is higher than the preexisting unemployment benefit and it replaces them (the so-called *full* basic income) or it is lower than this benefit (the so-called *partial* basic income). In the latter case, the instantaneous net income of the unemployed is left unchanged (at given wages), as the level of unemployment benefits is adjusted to top up the basic income. Combining the two dimensions (UCI or ACI on the one hand, full or partial basic income schemes on the other), this paper deals with four different proposals. Their effects on (un)employment and on income are analysed in steady state.

To achieve a coherent view about the consequences of these proposals, one needs a framework that combines at least four characteristics. First, it should be a general equilibrium model with an explicit budget constraint of the State. Second, given the pervasive unemployment problem in many countries, it should highlight the working of the labour market and allow for the possibility of involuntary unemployment. Third, it should allow for some heterogeneity between economic agents. Fourth, the analysis cannot avoid the issue of labour market participation. It is often true that the participation rate has no long-run effect on the unemployment rate. Yet, it typically affects the level of wages.

The model developed in this paper combines these four requirements. It draws upon Manning (1993), Cahuc and Zylberberg (1999) and Van der Linden (2002). A general equilibrium setting is developed in which collective bargaining causes unemployment. In the absence of unions, other mechanisms (such as turnover costs or search frictions) would also lead to a non competitive setting with endogenous unemployment. For these reasons, this paper deliberately ignores the possibility that unemployment could disappear by simply putting unions' bargaining power to zero. All along, their bargaining power is positive and taken as given. It should be stressed that the qualitative conclusions of this paper would also be reached in theoretical settings with rent-sharing or efficiency wages[2].

Each individual can be inactive, unemployed or employed. Focusing on the population of working age only and ignoring the relevant issues raised by the existence of disabilities and sickness, an 'inactive' is someone who is not interested in joining the formal labour force. Only those who are inactive enjoy 'leisure' (during the working hours). 'Leisure' refers to a range of time-consuming informal activities such as home production or performing work in the underground or 'black' economy. The pay-off in inactivity is randomly distributed among the agents. Except when there is a UCI, the government does not guarantee a minimum income to those who devote their time endowment to leisure. Such a

[2]When effort in work is continuous.

guarantee is restricted to those who are seeking for a job on the formal labour market. However, search effort is private information. Therefore, those who are inactive can also decide to claim unemployment benefits without searching for a job. To cope with this moral hazard problem, the government can monitor unemployed individuals randomly to determine whether they are available and searching for a job. Failure to meet this requirement leads to a sanction (Boadway and Cuff, 1999, and Boone, Fredriksson, Holmlund and van Ours, 2002). Willingness-to-work tests are costly. Depending on the way basic income schemes are framed, these tests can become less intensive or even useless. Moreover, since they have a different effect on the payoff in inactivity, a UCI and an ACI have also a different impact on the participation rate and hence on the balance-budget tax rate. Finally, how the basic income affects the income of the unemployed has a lot of direct and indirect effects through wage bargaining. By integrating these various dimensions, this paper offers a coherent view about the effects of the four variants of 'basic income schemes'.

Several papers have adopted an efficiency wage setting to compare the impact of unconditional income and conditional income-replacement schemes (Bowles, 1992, Atkinson, 1995b, and Groot and Peeters, 1997). In the present paper, the effects of basic income schemes are derived in a more general dynamic setting in which endogenous labour market participation and investment are more rigourously introduced.

Turning to general equilibrium analyses where wages are bargained over, Van der Linden (2002) looks at the dynamic effects of basic income schemes in a model of a unionised economy where the size of the labour force is exogenous. This paper concludes that basic income schemes have favourable effects on the level of unemployment. Simulation exercises indicate that the introduction of a partial basic income can be a Pareto improvement even if the allowance is also handed out to inactive people. A closely related paper is Lehmann (2002), in which the same issue is dealt with in an equilibrium matching model with heterogeneous skills. Van der Linden (2000) provides a comparison between reductions in social security contributions and basic income schemes. Under certain conditions, it is shown that these policies have similar effects on the unemployment rate. Contrary to all these papers, the present one deals with the issue of participation to the formal labour market. It turns out that this extension has dramatic consequences in the case of a UCI.

The rest of the paper is organised as follows. Section 2 presents the model and develops the positive analysis. Section 3 is devoted to the normative analysis. In Section 4, I turn to a numerical analysis. Section 5 concludes the paper.

2 The model

This section develops a general equilibrium model with imperfect competition on the labour market and, for simplicity, perfect competition on the market for the produced good. This good is the numeraire. It can be consumed or invested. The model considers also two other goods, namely homogeneous labour and capital. The basic structure of the model can be found in Cahuc and Zylberberg (1999) and Van der Linden (2002). Due to space limitation, the presentation will only sets out the essentials in a steady state. While Cahuc and Zylberberg (1999) only consider two states (employment, unemployment), this paper adds a third state, namely inactivity. The purpose of the model is to highlight the relationships between basic income schemes on the one hand, participation, employment and welfare on the other. Variations in the participation rate will not affect unemployment but well the marginal tax rate. The model considers a small economy facing an exogenous interest rate r. The setting is deterministic and assumes infinitely lived agents with perfect foresight. For simplicity, there is no growth. In each period t, there are n identical firms and P individuals of working age, of which N are active on the (formal) labour market. n and P are exogenous while N is endogenous. This paper considers a unionised economy in which each of the n employers bargains over wages with a firm-specific union. The employer decides unilaterally on employment and on the level of investment. In a given period t, the sequence of decisions is as follows :

1. Each firm decides upon its current investment level which will increase its capital stock in $t+1$. Therefore, the capital stock is predetermined in period t.

2. A decentralised bargaining over the current wage level takes place in each firm. In accordance with observed behaviour, wages are only set for one period. If an agreement is reached, the employees receive each a *net* real wage w_t at the end of the period. Otherwise, workers immediately leave the firm and start searching for a job. In firms where there is a collective agreement, the firm determines labour demand for the current period. Given w_t, the employment level is fixed by labour demand and production occurs. In the absence of a collective agreement, nothing is produced during the current period. Yet, the firm will have the opportunity to bargain and to hire workers (without hiring costs) in $t+1$.

3. A proportional tax on earnings, τ, is adjusted in order to balance the current public budget constraint (τ captures income taxes and social security contributions).

4. At the end of the period, an exogenous fraction, $q \in (0,1)$, of the employees leaves the firm and enters unemployment.

To solve the model, let us move backwards.

Workers

Individuals are assumed to be risk neutral. This assumption does not claim to be realistic. It is made for tractability reasons.[3] It implies that the role of unemployment benefits and basic income schemes on risk-sharing is ignored. Someone who is out of the labour force 'enjoys leisure'.[4] Leisure is worth l_0 in real terms and is untaxed. The population is made of equally productive workers but their innate ability to enjoy leisure differ. This paper simply assumes that l_0 is drawn from a given distribution. Let l_0 be uniformly distributed over the interval $[0, \mathcal{L}]$, with $0 < \mathcal{L} < +\infty$. Let V_0 denote the discounted value of the real net income stream of someone who is out of the labour force. In this paper, either the basic income is a UCI and the inactive population receives this transfer ($\nu = 1$) or it is restricted to the active population and called an ACI ($\nu = 0$). If B is the real level of the (untaxed) basic income,

$$V_0 = \frac{l_0 + \nu B}{1 - \beta}, \tag{1}$$

where $\beta = \frac{1}{1+r}$ is the discount factor common to all agents ($0 < \beta < 1$).

Let $V_{u,s}$ (respectively, $V_{u,ns}$) denote the discounted value of the real net income stream of an unemployed who is searching (resp., who is not searching). In order to participate one needs $V_0 \leq \max\{V_{u,ns}, V_{u,s}\}$.[5] Let $\bar{l}_0$ denote the value of leisure for which there is indifference between participation and non participation: $\bar{l}_0 = (1-\beta)\max\{V_{u,ns}, V_{u,s}\} - \nu B$. The participation rate, p, is then simply $\frac{\bar{l}_0}{\mathcal{L}}$. It has to be checked whether $0 \leq p \leq 1$.

Let Z be the level of (untaxed) real unemployment benefits. By definition, in the case of a partial (resp., a full) basic income the instantaneous income of an unemployed, v_u, is equal to Z (resp., B with $B \geq Z > 0$). To keep things simple, search effort is a binary variable. a is the endogenous probability of leaving the unemployment pool. D_s is a fixed

[3] See Van der Linden (2002) for a discussion of the effects of basic income schemes with risk-averse workers but an exogenous labour supply.

[4] The very broad meaning of this word has been explained in the introduction. It should be added that how people use 'leisure' is not an issue for the other agents. Some propositions like the Atkinson's 'participation income' list activities (among what is here called 'leisure') that give the right to a basic income because they are in a way or another valuable for the other members of society (see Atkinson, 1995a). This type of externality is left aside here.

[5] By assumption, nobody is forced to stay out of the labour force for reasons such as a poor health or home duties. People have the choice to participate or not.

cost of search ($0 \le D_s \le v_u$). V_e denotes the average intertemporal discounted income in employment. The intertemporal discounted income of job-seekers is then given by:

$$V_{u,s} = v_u - D_s + \beta\{aV_e + (1-a)V_{u,s}\} \text{ or } V_{u,s} = \frac{v_u - D_s + \beta a V_e}{1-\beta(1-a)}, \tag{2}$$

Those who pretend to search for a job and claim unemployment benefits[6] must fulfil minimal requirements that are time-consuming. Therefore, they can only benefit from a share ζ of l_0 ($0 \le \zeta < 1$). Search effort can only be observed through monitoring. At the end of each period, when this makes sense (see below), a fraction m of the unemployed is randomly monitored ($0 \le m \le 1$). Those who do not search are then sanctioned: They lose their benefit and have to pay a fraction χ of the benefits they collected during the current period ($0 < \chi \le 1$). Monitoring the unemployed is costly (see below).[7] The intertemporal discounted income of those who do not search for a job is given by:

$$\begin{aligned} V_{u,ns} &= v_u + \zeta l_0 + \beta\{m(V_0 - \chi v_u) + (1-m)V_{u,ns}\} && (3)\\ &= \frac{((1-\beta)\zeta + \beta m)l_0 + (1-\beta)(1-\beta\chi m)v_u + \beta m \nu B}{(1-\beta)(1-\beta(1-m))}. && (4)\end{aligned}$$

When $V_{u,ns} \ge V_0$, i.e. when $(1-\beta\chi m)v_u \ge (1-\zeta)l_0 + \nu B$, it can be checked that $\frac{\partial V_{u,ns}}{\partial m} < 0$. It can also be seen that V_0 is always higher or equal to $V_{u,ns}$ in the case of a full UCI ($\nu = 1, B \ge Z$). Consequently, only a comparison between V_0 and $V_{u,s}$ is then needed to deal with participation and the rate of monitoring m can be put to zero. Otherwise, one has to verify that $V_{u,s} > V_{u,ns}$ for those who participate to the labour market (i.e. for those such that $l_0 < \bar{l}_0$). One assumes that such a constraint is satisfied and return later on to that issue.

Let us now turn to the present-discounted value of a job held in a given firm j. The instantaneous income is $w_j + B$, where w_j is the net wage in firm j. Working entails a fixed cost D_w with $0 \le D_w \le w_j$ and presumably $D_w \ge D_s$. At the end of any period t, an employee leaves the firm with an exogenous probability q. He is then unemployed at the beginning of period $t+1$. The intertemporal discounted income associated with a job in firm j, $V_{e,j}$, is then given by the following expression:

$$V_{e,j} = w_j + B - D_w \; + \; \beta\{q[aV_e + (1-a)\max\{V_{u,ns}, V_{u,s}\}] \; + \; (1-q)V_{e,j}\}, \tag{5}$$

[6]The latter look more like an unemployment assistance scheme than an unemployment insurance.

[7]Since Becker (1968), it is well known that by raising χ, monitoring costs can be reduced without affecting the incentive of cheating. However, for various reasons, the literature about fines adopts the realistic assumption that punishments cannot be raised above a certain value. It should also be stressed that an important simplification is introduced here, namely that sanctions are made without errors.

where V_e is of the same form as (5) with only one difference : The average net real wage in the economy, w, replaces w_j.

The endogenous hiring rate a can be derived in the following way. The current unemployment level, U_t, is made of those who where unemployed at the beginning of this period and who are not currently hired : $U_t = (1 - a_t)(U_{t-1} + qL_{t-1})$, where L designates aggregate employment. The identity $U_t \equiv p_t P - L_t$ can be substituted in the last equality. After division by P, the value of the hiring rate, a, is given by the next expression:

$$a = \mathcal{A}(\frac{p}{e}) \equiv \frac{q}{\frac{p}{e} - (1 - q)},\ \mathcal{A}' < 0, \tag{6}$$

where e is the steady-state employment rate ($e \equiv \frac{L}{P}$). The unemployment rate $u = 1 - \frac{e}{p}$.

Firms

Assume n identical firms using two inputs (labour L_j and capital K_j) and endowed with an homogeneous of degree one Cobb-Douglas technology : $(\lambda L_j)^{\alpha} K_j^{1-\alpha}, \lambda > 0, 1 > \alpha > 0, j = 1, ..., n$. Given the sequence of decisions summarised above, the capital stock is predetermined when wages are bargained. To model this bargaining, one needs a profit function conditional on K_j. Assume that profits are untaxed. For a given stock K_j, labour demand in firm j is given by $L_j(K_j) = K_j \lambda^{\frac{\alpha}{1-\alpha}} \left(\frac{w_j(1+\tau)}{\alpha}\right)^{\frac{1}{\alpha-1}}$, and current optimal profits net of investment by $\pi_j(K_j) = (1-\alpha) K_j \left(\frac{w_j(1+\tau)}{\alpha\lambda}\right)^{\frac{\alpha}{\alpha-1}}$.

Wage bargaining

At the beginning of period t, the number of occupied workers in firm j is $(1-q)L_{j,t-1}$. Each of them keeps his job in period t if $(1 - q)L_{j,t-1} \leq L_{j,t}$. This condition is obviously verified in steady state. Therefore, a firm-specific union (worried by the interest of occupied workers only) maximises $V_{e,j}$. It is assumed that if the bargaining fails, the workers immediately leave firm j and search for a job elsewhere in the economy. Redundant workers are assumed to be immediately rehired in another firm with probability a. Hence, the steady-state outside option is

$$V_g = aV_e + (1 - a) \max\{V_{u,ns}, V_{u,s}\} \tag{7}$$

and the contribution of workers to the Nash product is $V_{e,j} - V_g$.

The optimal steady-state discounted profit of firm j, $\Pi_j(K_j)$, can be defined by the following relationship : $\Pi_j(K_j) = \pi_j(K_j) - I_j + \beta\Pi_j(K_j)$, where I_j is the optimal level of investment in steady state. If the bargaining fails in period t, nothing is produced but investment and future profits are not affected since the firm will have the opportunity to bargain and to hire workers again in period $t+1$ (without incurring hiring costs). Therefore, the firm's component in the Nash product, i.e. the difference between intertemporal discounted profits in case of an agreement, Π_j, and in the absence of an agreement, $-I_j + \beta\Pi_j$, is simply $\pi_j(K_j)$.[8]

It is plausible and therefore assumed that when they bargain over wages, the firm-specific union and the firm owner take the tax rate τ, the average wage w, the unemployment outflow rate a and the level of Z and B as given. Conditional on a predetermined capital stock K_j and ignoring constant and predetermined terms, the Nash program can be written in the following way :

$$\max_{w_j}(w_j)^{\frac{\alpha(1-\gamma)}{\alpha-1}}(V_{e,j} - V_g)^{\gamma}, \tag{8}$$

where γ is the exogenous bargaining power of the union ($0 \leq \gamma \leq 1$). The first-order condition of this problem can be written as

$$V_{e,j} - V_g = \mu w_j, \text{ with } \mu = \frac{\gamma(1-\alpha)}{\alpha(1-\gamma)} \geq 0. \tag{9}$$

By assumption, the 'mark-up' μ is lower than 1 (i.e. $\gamma < \alpha$), so that the second-order condition is satisfied. The intertemporal rent of an employee, $V_{e,j} - V_g$, is positive if γ is positive.

Investment and the factor-price frontier

The timing of investment is such that $K_{j,t+1} = I_{j,t} + (1-\delta)K_{j,t}$, δ being the positive depreciation rate. Therefore, in steady state, $I_j = \delta K_j$. However, to understand the model correctly, a general characterisation of the investment problem is needed out of steady state. At the beginning of any period t, the level of investment, $I_{j,t}$, should be chosen in order to maximise $\Pi_j(K_{j,t}) = \pi_j(K_{j,t}) - I_{j,t} + \beta\Pi_j(K_{j,t+1})$. This problem can easily be solved (see Cahuc and Zylberberg, 1999).[9] Recall that the technology is homogeneous of degree one. Therefore the first-order conditions only determine the capital-labour ratio. Moreover, they imply that the anticipated wage, $w_{j,t+1}$, should be the same in each firm :

$$(1+\tau_{t+1})w_{j,t+1} = C, \text{ where } C \equiv \alpha\lambda\left(\frac{\delta+r}{1-\alpha}\right)^{\frac{\alpha-1}{\alpha}} > 0. \tag{10}$$

With constant returns to scale and a perfectly competitive goods market, this equality is simply the requirement that firms break even when all factors are chosen optimally.

[8]For a more detailed argument, see Cahuc and Zylberberg (1999).

[9]Among other things, Cahuc and Zylberberg (1999) explains why the so-called 'hold-up' problem is not an issue here.

Equation (10) implies that the anticipated real wage cost is determined by exogenous parameters characterising the economy (namely, r, α, λ and δ).

The equilibrium unemployment rate

Since all firms and unions' characteristics are identical, in equilibrium, $w_j = w$ and $V_{e,j} = V_e$, $\forall j \in \{1, ..., n\}$. Moreover, when it is needed, the incentive constraint holds. Then (7) implies that

$$V_e - V_g = (1-a)(V_e - V_{u,s}). \tag{11}$$

Combining (2), (5), (6), (9) and (11) leads to the following wage-setting equation :

$$\frac{w + B - D_w - (v_u - D_s)}{\mu w} + \beta(1-q) = 1 + \frac{q}{\frac{p}{e} - 1}. \tag{12}$$

Let us assume that the replacement ratio is constant ($\frac{Z}{w} = z, z \in (0,1)$).[10] Since the model assumes risk-neutral workers, the level of z cannot be endogeneized in a meaningful way.[11] Hence, z will be taken as a given parameter. Let us also assume that the level of the basic income is proportional to the unemployment benefits ($B = \xi Z = \xi z w$, $\xi \geq 0$). ξ will be called the basic income-unemployment benefit ratio or the *'basic income ratio'* for short. A partial basic income is characterised by $\xi < 1$ and a full one by $\xi \geq 1$. Let $\mathcal{I}(\xi) = \max\{\xi, 1\}$. Hence, $v_u = \mathcal{I}(\xi) z w$. Furthermore, to simplify somewhat the analytics, let the fixed costs be proportional to w in equilibrium ($D_s = d_s w$, $D_w = d_w w$ with $\mathcal{I}(\xi) z \geq d_s \geq 0, 1 \geq d_w \geq 0$ and presumably $d_w \geq d_s$).

The wage-setting equation (12) determines then the $\frac{p}{e}$ ratio and, hence, the equilibrium unemployment rate, u :

$$\frac{p}{e} = \mathcal{D}(\xi, z) \equiv 1 + \frac{q}{E(\xi, z) - 1} \text{ and } u = \frac{q}{E(\xi, z) - (1-q)}, \tag{13}$$

where $E(\xi, z) \equiv \frac{1 - (\mathcal{I}(\xi) - \xi) z - (d_w - d_s)}{\mu} + \beta(1-q)$. One obviously needs to check whether $p \geq e$ and $0 \leq u < 1$. These inequalities are satisfied if $E > 1$. E is minimal when $\xi = 0$. To guarantee that $E > 1$, it is henceforth assumed that $1 - d_w - (z - d_s) > \mu(1 - \beta(1-q))$.

Several important implications can be derived from (13). First, nor the size of the labour force nor the tax rate τ influence the equilibrium unemployment rate. This result is fairly standard in this type of model. Moreover :

> **Proposition 1** *(i) In the partial basic income case, the equilibrium unemployment rate, u, decreases with the basic income ratio ξ; (ii) in the full basic income case, the equilibrium unemployment rate is independent of ξ and z.*

[10] This assumption is supported by Figure 2.2 in OECD (1996).

[11] In particular, a reform that would introduce a basic income scheme and at the same time would reduce z cannot be studied in a sensible way.

Proof From (13), the basic income ratio only influences u through E *via* the expression $1-(\mathcal{I}(\xi)-\xi)z-(d_w-d_s)$. When $\xi<1$, $\mathcal{I}(\xi)=1$ and $\frac{\partial E}{\partial \xi}>0$. This implies proposition *(i)*. When $\xi\geq 1$, since $\mathcal{I}(\xi)=\xi$, u is not a function of ξ nor of z (proposition *ii*). ■

As a corollary, the equilibrium unemployment rate reaches its minimum as soon as $\xi=1$. The role of the basic income can be understood in an intuitive way. Unions bargain in order to generate a rent for their members (see condition (9)). Yet, the way bargaining affects real outcomes is here more subtle than in models where it determines the wage cost. Under the assumption of perfect foresight, the wage cost is exogenous (see (10)). However, bargaining defines the intertemporal rent of an employee V_e-V_g (see (9)) and ultimately the unemployment rate. To see how, consider the equilibrium equality (11). It establishes that the difference in intertemporal income between an employed worker and a redundant one, V_e-V_g, is proportional to the same difference between an employed and an unemployed, $V_e-V_{u,s}$. The coefficient of proportionality, $1-a$, is positively related to the equilibrium unemployment rate. Now, from (2) and (5), in steady-state equilibrium, $V_e-V_{u,s}=\frac{w+B-D_w-(v_u-D_s)}{1-\beta(1-q)(1-a)}$. Therefore, taking (9) into account, equation (11) can be rewritten as

$$\mu=\frac{1-a}{1-\beta(1-a)(1-q)}\left[\frac{w+B-D_w}{w}\left(1-\frac{v_u-D_s}{w+B-D_w}\right)\right]. \tag{14}$$

So, for a given 'mark-up' parameter μ, there is a positive relationship between the hiring rate, a, and the term between brackets, which is equal to $1-(\mathcal{I}(\xi)-\xi)z-(d_w-d_s)$. The latter is the numerator of $E(\xi,z)$. In (14), each of the two ratios between brackets points to a different mechanism through which the basic income influences the steady-state unemployment rate.

The first ratio is related to the literature about the relationship between wage bargaining and progressive taxation (see e.g. Lockwood and Manning, 1993, Koskela and Vilmunen, 1996, Goerke, 2001). According to this literature, for a given level of taxes, the higher the marginal tax rate, the lower the increase in the after tax wage for a given increase in the negotiated wage and so the lower the pressure for higher wages. Let η designate the so-called coefficient of residual income progression, i.e. the elasticity of the net income of an employed worker $(w+B-D_w)$ with respect to w. As η decreases, the tax schedule becomes more progressive. Here, $\eta\equiv\left(\frac{w+B-D_w}{w}\right)^{-1}=(1+\xi z-d_w)^{-1}$. As ξ increases, η decreases and progressivity increases. Therefore, from (14), a positive adjustment of the hiring rate a is needed. Put another way, u decreases.

The second ratio, $\frac{v_u - D_s}{w+B-D_w}$, captures the role of the '*effective* replacement ratio' (namely, the ratio between instantaneous net income levels in unemployment and in work). An increase in the 'effective replacement ratio' decreases the bracketed term in (14) because the rent $V_e - V_{u,s}$ shrinks in relative terms. To comply with the optimality condition (14), this needs to be compensated by a decrease in a. If the partial basic income ratio increases, the 'effective replacement ratio', $\frac{z-d_s}{1+\xi z-d_w}$, becomes lower because the basic income favours in-work net income without influencing z. This lowers the equilibrium unemployment rate. On the contrary, an increase in the full basic income ratio boosts the 'effective replacement ratio' and has the opposite effect on unemployment. With risk-neutral workers, the latter effect exactly compensates the first one (hence, proposition *(ii)* in Proposition 1).

The incentive constraint

Up to now, it has been assumed that jobless individuals who participate to the labour market have an incentive to search for a job. Formally, it has been assumed that the inequality $V_{u,s} > V_{u,ns}$ is satisfied for those who participate (people with l_0 such that $l_0 < \bar{l}_0$). I now return to that condition and therefore ignore the case where $\nu = 1$ and $\xi \geq 1$. If $V_{u,s} \geq V_{u,ns}$ for $l_0 = \bar{l}_0$, then, one has $V_{u,s} > V_{u,ns} > V_0$ for $l_0 < \bar{l}_0$ since $0 < \frac{\partial V_{u,ns}}{\partial l_0} < \frac{\partial V_0}{\partial l_0}$. And for $l_0 > \bar{l}_0$, one has $V_0 > V_{u,ns} > V_{u,s}$. So, one can focus on the relationship between $V_{u,s}$ and $V_{u,ns}$ for $l_0 = \bar{l}_0$.

In equilibrium, from (2), (4) and (10), $V_{u,s}$ and $V_{u,ns}$ can respectively be written as the following functions:

$$\mathcal{V}_{u,s}(\xi, a, \tau) \equiv \frac{\beta a(1+\xi z - d_w) + (1-\beta(1-q(1-a)))(\mathcal{I}(\xi)z - d_s)}{(1-\beta)(1-\beta(1-a)(1-q))}\frac{C}{1+\tau}, \tag{15}$$

$$\mathcal{V}_{u,ns}(\xi, l_0, m, \tau) \equiv \frac{((1-\beta)\zeta + \beta m)l_0 + [(1-\beta)(1-\beta\chi m)\mathcal{I}(\xi)z + \beta m\nu\xi z\,]\,\frac{C}{1+\tau}}{(1-\beta)(1-\beta(1-m))} \tag{16}$$

The monitoring rate m is the instrument that should be adjusted so as to satisfy the incentive constraint. Since monitoring the unemployed is costly, the lowest possible value of m should be selected. Because $\frac{\partial V_{u,ns}}{\partial m} < 0$ for $l_0 = \bar{l}_0$, it is sensible to look for a solution to $\mathcal{V}_{u,s}(\xi, a, \tau) = \mathcal{V}_{u,ns}(\xi, \bar{l}_0, m, \tau)$. One should check that this solution lies in the interval $[0, 1]$. If it happens to be negative, m can be put to zero and $\mathcal{V}_{u,s}(\xi, a, \tau) > \mathcal{V}_{u,ns}(\xi, \bar{l}_0, 0, \tau)$. Replacing a by $\mathcal{A}(\mathcal{D}(\xi, z))$, denoting $E(\xi, z)$ by E and taking the definition of $\bar{l}_0$ into account, Equation $\mathcal{V}_{u,s}(\xi, a, \tau) = \mathcal{V}_{u,ns}(\xi, \bar{l}_0, m, \tau)$ has an explicit solution m given by:

$$\frac{1}{\beta\chi}\left[1 - \frac{\zeta\nu\xi}{\mathcal{I}(\xi)} - (1-\zeta)\frac{\beta(E-1)(1+\xi z - d_w) + [E(1-\beta) + \beta q](\mathcal{I}(\xi)z - d_s)}{\mathcal{I}(\xi)z(E - \beta(1-q))}\right]. \tag{17}$$

Consider first the characteristics of (17) in the absence of any basic income. The rate (17) will lie between 0 and 1 if parameter ζ fulfils the following conditions:

$$1 - \frac{z}{1-d_w} \leq \zeta \leq 1 - \frac{z(1-\beta\chi)}{z-d_s} \tag{18}$$

Recalling that $0 < \chi \leq 1$ and $0 \leq \zeta < 1$, these conditions can only make sense if d_s is sufficiently small, namely if $d_s \leq \beta\chi z$, and if χ is sufficiently large, namely if $\chi \geq \frac{1}{\beta}(1 - \frac{z-d_s}{1-d_w})$. The latter inequality can only be satisfied if the right-hand side is lower than 1. This means that the discount factor should be sufficiently large ($\beta \geq (1 - \frac{z-d_s}{1-d_w})$). These conditions are from now on added to the assumptions made previously.

Consider now that a partial basic income is introduced. When $\xi < 1$, it can easily be checked that the derivative of the monitoring rate (17) with respect to ξ is negative. Since a partial basic income has favourable effects on in-work income and on the chances of getting a job, less money has to be invested in monitoring the unemployed. If it happens that $\mathcal{V}_{u,s}(\xi, a, \tau) > \mathcal{V}_{u,ns}(\xi, \bar{l}_0, 0, \tau)$, m is obviously zero. Turning to the case of a full ACI ($\xi \geq 1, \nu = 0$), increasing ξ has an ambiguous effect on (17). It cannot a priori be ruled out that for sufficiently high values of ξ, m becomes higher than 1. The simulation exercise below will take care of this possibility.

The equilibrium participation rate

Expression (15) allows to define the participation rate p in equilibrium as:

$$\mathcal{P}(\tau, a, \xi) \equiv \frac{C}{\mathcal{L}(1+\tau)} \left[\frac{\beta a(1 + \xi z - d_w) + (1 - \beta(1 - q(1-a)))(\mathcal{I}(\xi)z - d_s)}{(1 - \beta(1-a)(1-q))} - \nu\xi z \right], \tag{19}$$

$\nu \in \{0, 1\}$. Looking at (19), one should expect that the direct effect of ξ on participation is very different whether ν is zero (the ACI case) or one (the UCI case). For, in the first case, increasing ξ only raises $V_{u,s}$, while, in the second case, both $V_{u,s}$ and V_0 increase. When $\nu = 1$, it can be checked that an increase in the *partial* basic income ratio has a negative marginal effect on participation. On the contrary, the increases in $V_{u,s}$ and V_0 compensate each other in the case of the full UCI. Table 1 summarises the marginal effects of ξ on $\mathcal{P}(\tau, a, \xi)$ when τ and a are given.

In addition to the direct effect summarised in Table 1, basic income schemes can also influence the hiring rate, a, and the balanced-budget marginal tax rate, τ. Better employment prospects have a favourable effect on participation: $\frac{\partial \mathcal{P}}{\partial a} > 0$. Equation (6) tells that a is a decreasing function of $\frac{p}{e}$. Moreover, from (13), $\frac{p}{e}$ is a function of ξ, with $\frac{\partial \mathcal{D}}{\partial \xi} < 0$ when $\xi < 1$ and $\frac{\partial \mathcal{D}}{\partial \xi} = 0$ when $\xi \geq 1$. Therefore, increasing the partial basic income ratio has a positive effect on the hiring rate and, because $\frac{\partial \mathcal{P}}{\partial a} > 0$, this raises the participation rate. This effect is not present in the full basic income case.

	Partial basic income $\xi < 1, \mathcal{I}(\xi) = 1$	Full basic income $\xi \geq 1, \mathcal{I}(\xi) = \xi$
ACI ($\nu = 0$)	$\frac{\partial \mathcal{P}}{\partial \xi} > 0$	$\frac{\partial \mathcal{P}}{\partial \xi} > 0$
UCI ($\nu = 1$)	$\frac{\partial \mathcal{P}}{\partial \xi} < 0$	$\frac{\partial \mathcal{P}}{\partial \xi} = 0$

Table 1: The partial effect of the basic income-unemployment benefit ratio on the participation rate.

The intuition why $\frac{\partial \mathcal{P}}{\partial \tau} < 0$ is easy to grasp. The balanced budget constraint varies according to the type of basic income one considers. Total receipts are the product $\tau w e P$. Public spending differ whether the basic income is partial or full, universal or restricted to active people. Let $\Gamma \cdot w$ be the marginal cost of monitoring. The total monitoring cost is then $\Gamma\ w\, m\,(p-e)\,P$. The balanced-budget tax rate τ can be written as:

$$\mathcal{T}(p,e,\xi,m) \equiv \begin{cases} \frac{z}{e}\left[p - e + \xi(e + \nu(1-p))\right] + \Gamma\, m(\frac{p}{e} - 1) & \text{if } \xi < 1 \\ \frac{\xi z}{e}\left[p + \nu(1-p)\right] + \Gamma\, m(\frac{p}{e} - 1) & \text{if } \xi \geq 1, \end{cases} \tag{20}$$

where $m = 0$ if $\xi \geq 1$ and $\nu = 1$. In these expressions, the n firm owners are included in the inactive population.[12] From (20), it is easily checked that $\frac{\partial \mathcal{T}}{\partial p} \geq 0, \frac{\partial \mathcal{T}}{\partial e} < 0$, $\frac{\partial \mathcal{T}}{\partial \xi} > 0$ and $\frac{\partial \mathcal{T}}{\partial m} > 0$. When $\nu = 0$, it is convenient to rewrite $\mathcal{T}(p,e,\xi,m)$ as a function of the ratio $\frac{p}{e}$, say $T\left(\frac{p}{e}, \xi, m\right)$, with $\frac{\partial T}{\partial \frac{p}{e}} > 0$. Now, since $\frac{\partial \mathcal{P}}{\partial \tau} < 0$, increasing the basic income ratio has a negative effect on participation through its direct positive influence on the marginal tax rate. In the case of a partial basic income, there are also two opposite effects coming from the declines in unemployment and in the monitoring rate. The net impact of a partial basic income on taxes cannot be signed analytically. Numerical simulations however show that a higher partial basic income ratio implies more heavy taxes except for very particular values of the parameters. Therefore, the net impact of a partial basic income on the participation rate should be considered as ambiguous, even in the case of an ACI. For obvious reasons, this is also true in the case of a full ACI.

In sum, clear-cut analytical conclusions about the net effect of the basic income ratio on participation can only be derived for a full UCI. In that case, this net effect is negative. Section 4 will report simulation results.

[12] Perfect competition on the goods market and the constant-returns-to-scale assumption imply that firms break even if condition (10) applies. So, it is convenient to consider firm owners as members of the inactive population.

3 The effect of basic income schemes on the utility levels

Within a *welfarist* perspective, the steady-state intertemporal discounted income (or utility) levels $V_e, V_{u,s}$ and V_0 are relevant indicators for a normative analysis.[13] From (5) and (10), it can be checked that

$$V_e = \mathcal{V}_e(\xi, a, \tau) \equiv \frac{[1-\beta(1-a)](1+\xi z - d_w) + \beta q(1-a)(\mathcal{I}(\xi)z - d_s)}{(1-\beta)(1-\beta(1-a)(1-q))}\frac{C}{1+\tau}, \tag{21}$$

with $V_e > V_{u,s}$.

In general, basic income schemes have rather intricate effects on $V_e, V_{u,s}$ and V_0. For the basic income ratio, ξ, has not only a direct impact on $V_{u,s}$ and V_e but also indirect effects through the hiring rate a and the marginal tax rate τ. The net impact on the intertemporal discounted income levels is therefore far from clear. For given values of $\nu \in \{0,1\}$ and $z \in (0,1)$, Expressions (6), (13), (19) and (20) allow to write $V_k = \mathcal{V}_k(\xi, \mathcal{A}(\mathcal{D}(\xi,z)), \tau),\ k = e,\ \{u,s\}$, with $\tau = \mathcal{T}(p, e, \xi, m),\ p = \mathcal{P}(\tau, a, \xi), e = \frac{p}{\mathcal{D}(\xi,z))}$ and m given by (17) or one of its boundary values. Conditional on τ, it can easily be verified that increasing ξ or a pushes up the intertemporal income levels of the employed and the unemployed. Moreover, from (1) and $B = \xi z w = \xi z \frac{C}{1+\tau}$, it is clear that $\frac{\partial V_0}{\partial \xi}$ is positive if $\nu = 1$ and zero otherwise. Conditional on τ, the hiring rate has obviously no effect on V_0. Not surprisingly, a marginal increase in τ has a negative effect on V_e, $V_{u,s}$ and, if $\nu = 1$, on V_0.

These partial results can now be combined to yield the net effect of a marginal increase in ξ on the various intertemporal income levels. The net effect of ξ on V_0 is zero if $\nu = 0$. If $\nu = 1$, the sign is typically ambiguous. In the other states, the net effect can be decomposed as follows if $\nu = 0$:[14]

$$\begin{array}{cccccccccccl}
\frac{dV_k}{d\xi} = & \frac{\partial V_k}{\partial \xi} & + \frac{\partial V_k}{\partial a} & \frac{d\mathcal{A}}{\frac{p}{e}} & \frac{d\mathcal{D}}{d\xi} & + \frac{\partial V_k}{\partial \tau} & [\frac{\partial T}{\partial \xi} & + \frac{\partial T}{\partial \frac{p}{e}} & \frac{d\mathcal{D}}{d\xi} & + \frac{\partial T}{\partial m} & \frac{dm}{d\xi}] & \lesseqgtr 0, \quad k = e, \{u,s\} \\
 & > 0 & > 0 & < 0 & \leq 0 & < 0 & > 0 & > 0 & \leq 0 & > 0 & \lesseqgtr 0 &
\end{array}$$

where $\frac{d\mathcal{D}}{d\xi} < 0$ and $\frac{dm}{d\xi} \leq 0$ in the case of a partial basic income. The sign of $\frac{dV_k}{d\xi}$ is generally ambiguous if, as one should expect, a higher basic income implies more heavy taxes.

The following property can nevertheless be shown:

Proposition 2 *The intertemporal discounted income of those currently employed, V_e, increases with the level of the partial active citizens' income ratio ξ.*

[13] Since only steady-state values are considered, nothing is said about the path between two equilibria. This issue is addressed by Van der Linden (2002).

[14] A similar but more intricate expression can be derived if $\nu = 1$.

Proof If $\nu = 0$ and $\xi < 1$, it can be checked that $\frac{\partial V_e}{\partial \xi} + \frac{\partial V_e}{\partial \tau}\frac{\partial T}{\partial \xi}$ is equal to

$$\frac{qzw}{(1-\beta)(1-\beta(1-a)(1-q))(1+\tau)}\left[\frac{(1-\beta)z}{E-1} + (1-\frac{\beta}{E})\frac{\Gamma m + d_w}{E-1} + \frac{\beta}{E}d_s\right] > 0.$$

This is a sufficient condition for Proposition 2. ■

The same property does not always hold for the unemployed. It can be shown that $\frac{\partial V_{u,s}}{\partial \xi} + \frac{\partial V_{u,s}}{\partial \tau}\frac{\partial T}{\partial \xi}$ has an ambiguous sign. This sign is negative for sufficiently low values of Γ, m, d_w and d_s. Then, the favourable effect of the partial basic income on the hiring rate has to be strong enough in order to conclude that $\frac{dV_u}{d\xi} > 0$. The level of the discount factor β appears to be crucial here. For the impact of a higher partial basic income ratio on taxes (and hence on unemployment benefits) is a current effect while the improvement in the hiring probability is discounted.

4 A numerical example

I now conduct computational experiments that in particular illuminate the normative implications of basic income schemes and the importance of participation decisions.

4.1 Calibration

As far as possible, the calibration is based on data for the E15 area at the end of the nineties. Each period is assumed to last a quarter. r is assumed to be equal to 0.024 (10% on a yearly basis). Let us assume a very standard value for α, namely 0.7. In accordance with the results of Burda and Wyplosz (1994), the value of the separation rate $q =$ is 0.05. Following OECD (2001a), the net replacement ratio z is fixed to 0.7. The participation and employment rates are respectively equal to 69% and 61%. With these values, Equation (13) yields $\mu = 0.55$ (hence, $\gamma = 0.56$). The net wage is normalised to 1. The disutility parameters d_w and d_s are arbitrarily fixed to 0.15 and 0.1. Parameter $\mathcal{L}$ is then chosen so as to reproduce the participation rate when $\xi = 0$. This yields $\mathcal{L} = 1.17$. Assuming $\zeta = 0.7$ and $\chi = 0.8$, the calibrated value of m solves Equation (17) and is equal to 0.84. So, jobless individuals who claim unemployment benefits but would not search face a probability of being sanctioned equal to 84%. This rate guarantees that all the registered unemployed search for a job. Following Boone, Fredriksson, Holmlund and van Ours (2002), the cost of monitoring is calibrated as follows. Table 3 of OECD (2001b) provides data about the Public Employment Service (PES) staff.[15] The ratio

[15] The calibration is based on average values for Belgium, Denmark, Finland, Ireland, The Netherlands, Portugal, Sweden and the United Kingdom.

between the PES staff and the working age population P is about 0.0009. Assuming that half of the working time of PES officers is devoted to meetings with the unemployed, an upper-bound of the marginal cost of monitoring is given by the following equation $\Gamma \cdot w \cdot 0.84 \cdot (0.69 - 0.61) = 0.0009 \cdot 0.5 \cdot w$. This equality yields $\Gamma = 0.0067$. The budget of the State is then balanced when $\tau = 0.092$. The following subsection comment on a sensitivity analysis with respect to Γ. Other sensitivity analyses have been conducted with respect r, ζ, χ, d_w and d_s but are not mentioned here. The conclusions below are reasonably robust to these changes. In particular, as long as the discount rate r is not too large, it turns out that introducing a partial ACI is a Pareto-improvement.

4.2 Simulation results

Taking the calibrated values of the parameters, Figure 1 deals with the introduction of an ACI ($\nu = 0$). This figure and the following one will not display V_0 but well $E_{l_0}[V_0|V_0 > V_{u,s}]$, which is the expectation over l_0 of the discounted utility V_0 derived by those who choose to be inactive. Dashed lines represent the case where the participation rate is kept exogenous. Figure 1 highlights the favourable effects of an ACI on labour market indicators. The unemployment rate strongly declines and then stays constant for $\xi \geq 1$ (Proposition 1). As long as $\xi < 1$, the monitoring rate m needed to induce search effort is shrinking with ξ. The opposite tendency takes place with a full ACI. The decreases in unemployment and in m are insufficient to outweigh the direct effect of an ACI on public expenses. Therefore, the balanced budget tax rate τ is strongly rising with ξ. This increase is absorbed entirely by workers whose net wages and allowances are reduced. An ACI nevertheless favours in-work net income. Finally, the three welfare indicators, $V_e, V_{u,s}$ and $E_{l_0}[V_0|V_0 > V_{u,s}]$, are increasing with ξ.[16] An unreported sensitivity analysis shows that these conclusions are reinforced when Γ rises. When $\nu = 0$, the tax rate is a function of the p/e ratio and not of p and e separately. Therefore, only the evolution of the employment rate is different when participation is taken as exogenous.

Figure 2 is devoted to the case of a UCI. The collapse of the employment and participation rates is striking. The rise in taxes is so large that now both net wages and in-work net income decline. These evolutions are underestimated when participation is assumed to be fixed (see the dashed lines). After a negligible improvement for very low values of ξ, both V_e and $V_{u,s}$ are strongly reduced. For higher values of Γ, the decline in the monitoring

[16] A higher value of $V_{u,s}$ means more participants to the labour market. As the inactive population is characterised by the upper-part of the distribution of l_0, it is easily seen that $E_{l_0}[V_0|V_0 > V_{u,s}]$ increases with $V_{u,s}$.

rate has a stronger impact on public expenses. An unreported sensitivity analysis suggests that a small UCI can be justified on normative grounds when Γ is sufficiently large. As an example, when $\Gamma = 0.67$ (i.e. 100 times the calibrated values!), $\xi = 0.1$ would be optimal. Returning to the bottom of Figure 2, a key conclusion is that whether participation is endogenous or not deeply influences the assessment.

5 Conclusion

To contribute to the debate about the consequences of a basic income in countries plagued with unemployment, this paper has proposed a dynamic and general equilibrium model in which wages are fixed by collective bargaining and labour supply responds along the extensive margin. There is no doubt that the introduction of a basic income influences the decision to participate. The participation rate has no long-run effect on the unemployment rate but it affects the level of taxes needed to finance public outlays and therefore it influences the net wage and ultimately welfare.

Focusing on steady-state properties, this paper has shown that the equilibrium unemployment rate decreases strongly as a partial basic income is introduced and this effect is maximal when the ratio between the basic income and the unemployment benefits is just equal to one. The performances of a UCI and an ACI are here strictly equal. The partial basic income increases the progressivity of the tax schedule and it favours in-work net income. These mechanisms explain the favourable effect on the unemployment rate. The amount of monitoring needed to induce job-search effort therefore declines as a partial basic income is introduced. Handing out a basic income that produces a maximal effect on unemployment is nevertheless generally expensive. Given the current taxation rules in many countries, it has been assumed that the basic income should be financed by a tax on earnings. It turns out that the decreases in unemployment and in the monitoring rate are insufficient to compensate the direct effect of a basic income on public spending. The tax rate has therefore to increase in order to balance the budget of the State. This effect is mechanically higher in the case of a UCI. Since proportional taxes are absorbed entirely by workers, this has a negative effect on net earnings and, hence, on the level of unemployment benefits and on participation to the formal labour market. These effects turn out to be strong in the case of a UCI. Simulation results indicate that a UCI has a harmful net effect on the intertemporal discounted income levels of the employed and the unemployed when the extensive margin is taken into account. On the contrary, simulation results show that a partial ACI is often a Pareto-improvement compared to a situation without basic income.

The detrimental effects of high taxes would be reinforced if the model was extended to deal with the intensive margin (number of hours worked) or with investment made by individuals to promote skills and efficiency on the one hand and to evade taxes on the other. Then, the advantage of an ACI over a UCI would be reinforced. The normative conclusions of this paper could nevertheless change if 'inactive' people became eligible to a basic income provided that they develop 'activities' (other than paid work) generating a sufficiently strong positive external effect on the welfare of others (as in the Atkinson's 'participation income').

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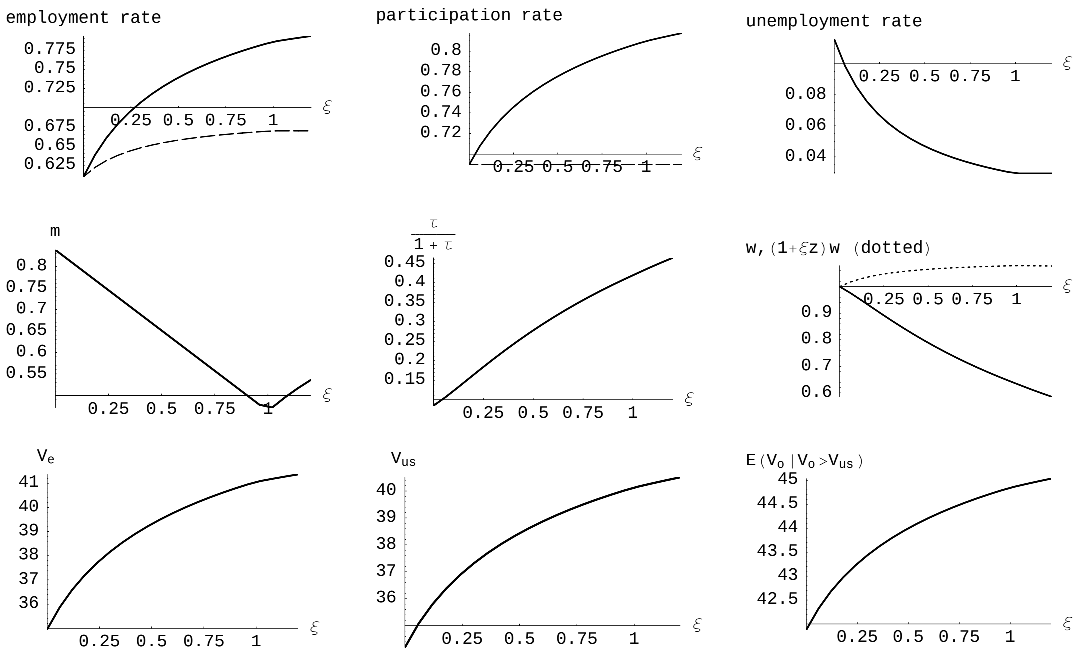

Figure 1: Active Citizen's Income: The effects of increasing the basic income-unemployment ratio ξ. Dashed lines correspond to the case where the participation rate is exogenous.

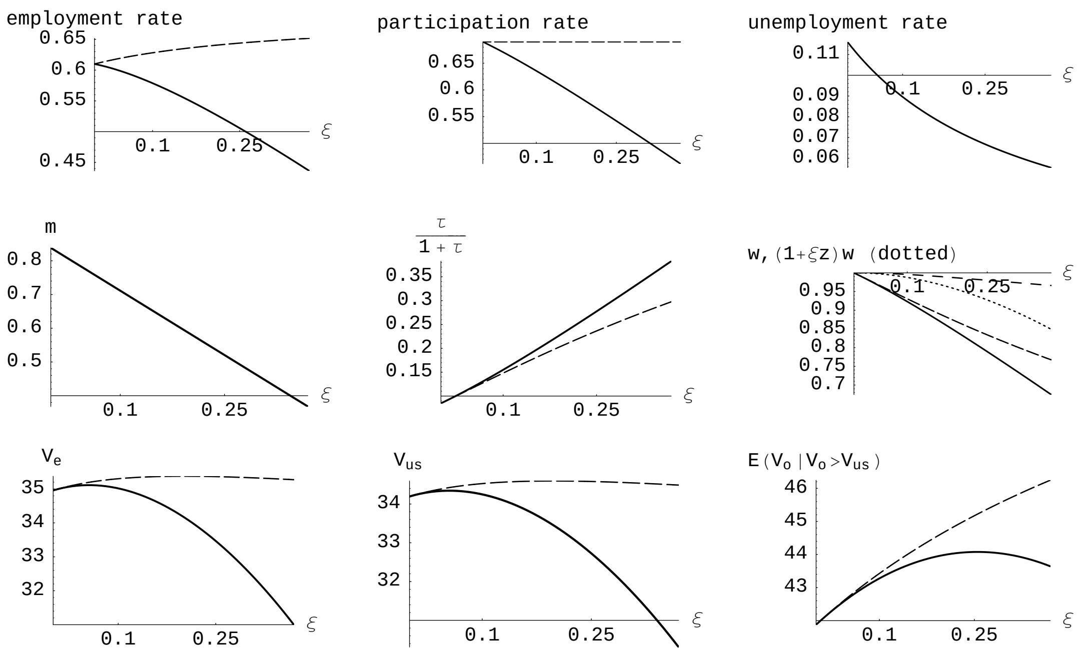

Figure 2: Unconditional income: The effects of increasing the basic income-unemployment ratio ξ. Dashed lines correspond to the case where the participation rate is exogenous.