Welfare analysis of alternative poverty alleviation policies

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Abstract

This study compares the social welfare under welfare benefits programs and under universal basic income, subject to the balanced budget condition. The results show that, as the proportion of the poor class increases, both optimal levels and social welfare tend to decrease. A comparative analysis of the optimal social welfare reveals that basic income achieves higher social welfare than welfare benefits do when the proportion of the poor class is low; by contrast, welfare benefits achieve higher social welfare than basic income does when the proportion of the poor is high.

Keywords: Basic income, Welfare benefit, Welfare analysis

JEL codes: H2, H5, I3

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1 Introduction

Poverty is a severe problem in several countries worldwide. Many governments have implemented means-testing welfare benefits programs to save people from poverty. However, in recent years, there has been growing interest in universal basic income as a new instrument for poverty reduction.

Universal basic income has a long history[1]. Thomas Paine and Thomas Spence proposed the concept of basic income at the end of the 18th century (Paine, 1796; Spence, 1797). Subsequently, Joseph Charlier proposed a basic income in which land rent would be shared by the whole society and used as a source of revenue (Charlier, 1848). In the 1920s, C. H. Douglas proposed a system of *social credit*, in which a national dividend of five pounds per month would be financed by seigniorage; this proposal is a type of basic income system (Douglas, 1924). Atkinson (1995) presented the *basic income/flat tax* proposal, a combination of linear income taxation and basic income. Recently, the historian Rutger Bregman published a book on basic income (Bregman, 2017a,b).

On the one hand, basic income differs from welfare benefit programs. It does not require means-testing people, thus reducing administrative costs as well as the procedural and psychological costs borne by poor people. On the other hand, basic income may require huge fiscal expenditure compared to welfare benefits programs.

Many economists have considered the effects of welfare programs on labor supply. Moffitt (2002) presents a review of empirical and theoretical research on the effect of welfare systems on labor supply. Kleven and Kopczuk (2011) present a model of screening in means-testing welfare benefits programs. Their model proposes an optimal welfare system based on the trade-off between targeting efficiency and incomplete execution by raising screening intensity.

Ghatak and Maniquet (2019) present theoretical aspects of the basic income system; particularly, they explain the desirability and feasibility of basic income. Cremer and Roeder

[1] Van Parijs and Vanderborght (2017) and Gentilini et al. (2019) present useful surveys and explanations of universal basic income

(2015) present a political model in which welfare programs means-testing or a basic income system is adopted by voting.

This paper presents a simple analysis of welfare comparison between welfare benefits programs and basic income under the balanced budget condition. The results of the analysis imply that the social welfare under optimal basic income is higher than that under the optimal welfare benefit when the proportion of the poor is low; by contrast, welfare benefits programs achieve higher social welfare than basic income does when the proportion of the poor is high.

The rest of this paper is arranged as follows: Section 2 explains the basic setting of the model; Section 3 analyzes the players' behavior under the basic income system; Section 4 analyzes the players' behavior under the welfare benefits system; Section 5 investigates the optimal levels of basic income and welfare benefits and the welfare comparison, and the final section concludes.

2 Model

The basic setting follows Besley and Coate (1992) and Kurita et al. (2020). There is an economy with a finite player set I. The population is divided into two classes: the poor and the rich. The proportion of the poor class in the total population is $\beta \in (0, 1)$. Furthermore, the poor class is split into the needy and non-needy types. The proportion of the needy type is $\gamma \in (0, 1)$. To simplify the notation, I describe the needy poor as type 1, the non-needy poor as type 2, and the rich as type 3. Let I_k denote the set of type $k \in \{1, 2, 3\}$ players.

Following Besley and Coate (1992), I assume that the needy poor individuals cannot work while the non-needy poor can work and earn income ω. Formally, the non-needy poor players exhibit two actions $a_i \in \{W, N\}$, where W corresponds to working and N corresponds to not working, $i \in I_2$. If non-needy-poor players choose to work, they suffer from labor disutility θ, and θ is uniformly distributed in $\Theta \in [0, 1]$. For simplicity, the size of the total population is assumed to be 1.

The rich class (type 3) has the following utility:

$$U_3 = u(c_3), \tag{1}$$

$$c_3 = y - t, \tag{2}$$

where $u(\cdot)$ is the well-behaved concave utility function from consumption, y is the income for the rich, and t is the tax, which is determined by the government budget constraint. The utility for the poor class (type 2 and 3) is shown in the next section.

The labor market is assumed to be perfectly competitive and the firm produces the good using only labor. The representative firm has the following profit function:

$$\pi = F(L) - \omega L, \tag{3}$$

where $F(\cdot)$ is the production function, L is the input level of labor, and ω is the wage. Thus, the first order condition is given by

$$\frac{\partial \pi}{\partial L} = \omega. \tag{4}$$

I assume that the production technology gives constant returns, wherein $F'(L) = \alpha$, $\alpha > 0$ reflects the labor productivity. Therefore, ω is equal to α in the equilibrium.

3 Basic income system

The model compares the *basic Income* system with the *welfare benefits programs*. Let *BI* and *WB* denote *basic income* and *welfare benefits programs* . Under *BI*, all players receive basic income B, and the government budget constraint is given by

$$(1 - \beta)t = B. \tag{5}$$

In (5), the left-hand side is the tax revenue, and the right-hand side is the total cost for *BI*. The balanced tax under *BI* is as follows:

$$t_{BI} = \frac{B}{1-\beta}. \tag{6}$$

The utilities for the needy poor (type 1) and the rich (type 3) are given as follows:

$$U_1 = u(B), \tag{7}$$

$$U_3 = u(y + B - t_{BI}), \tag{8}$$

Here, by the government budget constraint (5), the net income for the rich class is given by:

$$y + B - t_{BI} = y - \frac{\beta}{1-\beta}B. \tag{9}$$

That is, the basic income system reduces income for the rich, and the result is natural.

The non-needy poor (type 2) players have utility as follows:

$$U_2 = \begin{cases} u(\omega + B) - \theta & \text{if } a_{i\in I_2} = W, \\ u(B) & \text{if } a_{i\in I_2} = N, \end{cases} \tag{10}$$

Non-needy poor players make decisions under a trade-off between increasing income by working with labor disutility, and giving-up working income without disutility. I define the critical level of θ as follows:

$$u(\omega + B) - \hat{\theta}_{BI} = u(B), \tag{11}$$

Equation (11) indicates that the non-needy poor players with $\theta \geq \hat{\theta}_{BI}$ prefer not to work and the others prefer to work. For notational simplicity, let θ_- and θ_+ denote $\theta < \hat{\theta}$ and $\theta \geq \hat{\theta}$, respectively.

Since $\hat{\theta}_{BI} = u(\omega + B) - u(B)$, the equilibrium employment under BI is given by

$$L_{BI}(\omega) = \beta(1-\gamma)[u(\omega + B) - u(B)], \tag{12}$$

Since the labor market is competitive, the market clearing condition is given by

$$\omega = \alpha, \tag{13}$$

For the numerical simulation in section 5, I specify the utility function as the following constant relative risk aversion utility function[2],

$$u(c) = -\frac{1}{c}. \tag{14}$$

Equilibrium outcomes are summarized in the following proposition:

Proposition 1 *In the equilibrium under BI, the following outcomes are realized:*
Equilibrium employment is given by

$$L^*_{BI} = \beta(1-\gamma)\left[-\frac{1}{(\alpha + B)} - \frac{1}{B}\right],$$

The utility of the needy type player is given by

$$U^*_{1,BI} = -\frac{1}{B},$$

The utility of the non-needy type player with θ_- is given by

$$U^*_{2,BI,W} = -\frac{1}{\alpha + B} - \theta_-,$$

[2]This specific form of the utility function is often used in optimal taxation(Tuomala, 2016; Tanninen et al., 2019)

The utility of the non-needy type player with θ_+ is given by

$$U^*_{2,BI,N} = -\frac{1}{B},$$

The utility of the rich player is given by

$$U^*_{3,BI} = -\frac{1}{y - \frac{\beta}{1-\beta}B}.$$

The proposition 1 shows straightforward results. Since basic income is a simple and universal scheme, the effect of a change in the level of basic income on equilibrium is intuitive.

4 Welfare benefits programs

Next, I analyze the welfare benefits system *WB*. Under *WB*, players need to claim to taking up welfare if they hope to obtain welfare. For simplicity, all claimers among the poor class players can take up welfare, following Besley and Coate (1992). The actions for non-needy players must be reconsidered: *working without welfare* or *taking up welfare without working*. Let W and N denote the former and latter, respectively. Furthermore, needy players have the following choices: *taking up welfare* (T) or *not* (NT).

The level of welfare benefit is $b(< \omega)$, and the non-needy player's utility is as follows:

$$U_2 = \begin{cases} u(\omega) - \theta & \text{if } a_{i\in I_2} = W, \\ u(b) & \text{if } a_{i\in I_2} = N. \end{cases} \tag{15}$$

This setting reflects that the government can confirm the employment status of welfare claimers; however, it cannot confirm *eligibility*. Besley and Coate (1992) refers to non-needy players taking up welfare as *welfare fraud*. The critical level of θ under *WB* is as follows:

$$\hat{\theta}_{WB} = u(\omega) - u(b), \tag{16}$$

The needy poor player's utility is given by

$$U_1 = \begin{cases} u(b) & \text{if } a_{i\in I_1} = T, \\ u(0) & \text{if } a_{i\in I_1} = NT, \end{cases} \tag{17}$$

Thus, since b is positive, all the needy players take up welfare.

The rich class has the following utility:

$$U_3 = u(y - t_{WB}), \tag{18}$$

where t_{WB} is determined by the following government budget constraint:

$$(1-\beta)t_{WB} = bm. \tag{19}$$

Here, m is the total number of players who take up welfare benefits and

$$m = \beta[\gamma + (1-\gamma)(1-\hat{\theta}_{WB})]. \tag{20}$$

Equilibrium outcomes are summarized in the following proposition:

Proposition 2 *In the equilibrium under WB, the following outcomes are realized:*

Equilibrium employment is given by

$$L^*_{WB} = \beta(1-\gamma)\left[-\frac{1}{\alpha} + \frac{1}{b}\right],$$

The utility of the needy player is given by

$$U^*_{1,WB} = -\frac{1}{b},$$

The utility of the non-needy player with θ_- is given by

$$U^*_{2,WB,W} = -\frac{1}{\alpha} - \theta_-,$$

The utility of the non-needy player with θ_+ is given by

$$U^*_{2,WB,N} = -\frac{1}{b},$$

The utility of the rich player is given by

$$U^*_{3,WB} = -\frac{1}{y - t_{WB}},$$

Tthe tax is given by

$$t_{WB} = \frac{b\beta}{1-\beta}\left[\gamma + (1-\gamma)\left(1 + \frac{1}{\alpha} - \frac{1}{b}\right)\right].$$

From propositions 1 and 2, the equilibrium outcomes in the welfare benefits programs are more complex than those in the basic income system. The reason is that players consider taking up (or not taking up) welfare under the welfare benefits system.

5 Welfare analysis

This section provides a welfare analysis of basic income and welfare benefits. I suppose that the policymaker is benevolent, whose objective function is the social welfare function. I define the social welfare function as follows:

$$SW = \beta\left[\gamma u(c_1) + (1-\gamma)u(c_2)\right] + (1-\beta)u(c_3). \tag{21}$$

From Proposition 1, social welfare under BI is given by

$$SW_{BI}(B) = \beta \left[\gamma u(B) + (1-\gamma) \left\{ \hat{\theta}_{BI} u(\alpha + B) + (1 - \hat{\theta}_{BI}) u(B) \right\} \right] + (1-\beta) u(y - t_{BI}). \quad (22)$$

From Proposition 2, social welfare under WB is given by

$$SW_{WB}(b) = \beta \left[\gamma u(b) + (1-\gamma) \left\{ \hat{\theta}_{WB} u(\alpha) + (1 - \hat{\theta}_{WB}) u(b) \right\} \right] + (1-\beta) u(y - t_{WB}). \quad (23)$$

Moreover, I define B^* and b^* as follows:

$$B^* = \arg\max SW_{BI}(B), \quad (24)$$

$$b^* = \arg\max SW_{WB}(b). \quad (25)$$

Since it is impossible to obtain analytically the social optimal levels of BI and WB, I numerically solve them and substitute the numerical solutions (B^* and b^*) into social welfare functions ($SW_{BI}(B)$ and $SW_{WB}(b)$), respectively. Table 1 summarizes the results of the numerical calculation.

The results show that, as β increases, both optimal levels and social welfare tend to decrease. In the social welfare comparison, when β is low, the optimal value of social welfare under BI is higher than the optimal value under WB. However, when the β is high, the optimal value of social welfare under WB is higher than the optimal value under WB. This is attributed to the fact that the increase in the tax burden is lesser than that of BI since lower b^* strengthens work incentives and reduces the number of welfare recipients. The result of the above analysis implies that BI achieves higher social welfare than WB does when the proportion of low-income groups is small, while WB achieves higher social welfare than BI does when the proportion of low-income groups increases.

Table 1: Numerical results: $u(c) = -\frac{1}{c}, \alpha = 80, \gamma = 0.5, y = 100$

β	B^*	b^*	$SW_{BI}(B^*)$	$SW_{WB}(b^*)$	Higher SW
0.1	89.8469	90.000	-0.0111097	-0.0111111	BI
0.2	79.8492	79.8001	-0.0124961	-0.0125	BI
0.4	59.859	59.8623	-0.0166485	-0.0166493	BI
0.45	54.8629	54.8895	-0.0181556	-0.0181513	WB
0.5	49.8677	49.9213	-0.019962	-0.0199485	WB
0.55	44.8733	44.9577	-0.0221664	-0.0221371	WB
0.75	24.9081	25.1497	-0.0396501	-0.0393162	WB

6 Conclusion

In this paper, I present a comparative analysis of social welfare between basic income and welfare benefits programs in an economy with three types of players: the needy poor, the non-needy poor, and the rich. The contribution of this paper is to show that basic income realizes greater social welfare than welfare benefits do when the size of the poor class is small, while the converse is true when the size of the poor class is large.

There is a problem of *stigma* associated with welfare programs (Besley and Coate, 1992). Stigma can reduce the incentive to take up welfare programs among eligible poor people, as shown in Kurita et al. (2020) and Itaya and Kurita (2020)[3]. In future work, I will extend the model in this paper to contain endogenous welfare stigma, welfare fraud, and incomplete take-up of welfare programs.

This research conducts a simple analysis; in particular, the model is static, with a single-year fiscal equilibrium as a constraint, and does not consider budget balances and debt financing intertemporally. Under a dynamic setting, the impact of the adoption of basic income on people's decision-making may vary significantly depending on the government's commitment, labor market liquidity, and search frictions. I will attempt to clarify these questions by extending this research to a dynamic model in the future.

[3]This phenomenon is called *non-take-up welfare* or *incomplete take-up*, in which eligible poor people do not claim to take up.

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