

Evaluating Policies Against Poverty using Agent Based Modelling^(*)

*Valutazione delle Politiche Contro la Povertà con
Modelli Agent Based*

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Riassunto: Obiettivo di questa nota è di dimostrare il potenziale ruolo degli studi di simulazione per la valutazione degli effetti di politiche di contrasto alla povertà, in alternativa ai modelli teorici, sofisticati, ma basati su ipotesi molto restrittive, impiegati tradizionalmente nella letteratura economica. Come esempio preliminare, si impiega un modello di *job search* per valutare gli effetti dei sussidi di assistenza sulle carriere lavorative e nella povertà. Il disincentivo a lavorare risulta molto marcato in alcuni contesti. Il tasso di disoccupazione e la durata media della disoccupazione sono molto influenzati dalla durata potenziale del sussidio, e in misura minore, dal suo importo. In alcune circostanze, sussidi abbastanza generosi riducono il tasso di povertà, che si innalza invece fortemente in assenza di limiti di tempo nell'erogazione del supporto.

Keywords: job search, micro-simulation, social assistance benefit, welfare dependence.

1. Introduction

The effect of income support policies has been the object of extensive theoretical (Rogerson *et al*, 2005) and empirical research (Moffit, 1992). Focus is on work disincentives. The leading paradigm is rational choice: if the benefit is rather convenient with respect to work, individuals choose welfare and stay out of the labor market. The body of work from the empirical literature confirms that transfer programs considerably reduce work effort. More recently, research has dealt with the impact of reforms of social assistance on labor supply: work requirements, sanctions, time limits, education or training programs. On a different perspective, cultural and psychological mechanisms may also affect individuals' choices as time on welfare grows longer, making it progressively harder to gain autonomy from public support (*welfare trap*). Statistical investigation of these effects is domain of the dynamic welfare participation literature.

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Aim of our research project, which is still in its infancy, is to investigate comparatively the effects on unemployment and poverty dynamics of different broad types of policies against poverty: pure income support (social assistance benefits), workfare policies and active labor market programs, aimed at re-qualification and human capital development. These effects are difficult to investigate empirically, as it is hard to separate the consequences of the specific policies under study from the effects of other policies at work and from macro changes occurring in the meantime. For this reason, we follow a different approach, carrying out an agent based (Tesfatsion, 2001) simulation study. The use of simulations is motivated by the fact that, given the complexity of the model (extensions are briefly sketched in par.4), it would be difficult to derive analytically all the relevant results. In this note we develop a simple discrete-time job search model, assuming we are dealing with “weak” individuals, with low skills and low job opportunities. Labor market features are taken as given. We explore the consequences of income support for poor individuals, on unemployment rates, absolute poverty rates, and individual event history data on unemployment and poverty.

2. The model

Let $U = f(C, L)$ be the utility function associated with consumption C and leisure L . We operate in a rigid labor market with full time jobs only. Income is w if employed, C_0 if unemployed with no benefit, and B with income support, where $C_0 < B < w$. Standardizing total time to 2, we fix minimum time for leisure L to 1, hours of work $h=1$ and time devoted to job search $0 \leq s \leq 1$. No search on the job is allowed: $L+h=2$, so that $L=1$, for the employed, and $L+s=2$ for the unemployed. Market wage is always higher than individuals' reservation wage: $U_U = f(C_0, 2) < U_E = f(w, 1)$, where U_U and U_E are the utilities of being unemployed and employed respectively. Thus, it is more convenient to work rather than not work. The probability to find a job given search effort is $p(s)$, an increasing function of s , with $p(0)=0$, and $p(1)=p_{max} < 1$.

The population is homogeneous with respect to preferences and probability to find a job. Heterogeneity is allowed instead across time. We let p_{max} progressively decrease with elapsed time in unemployment, as skill loss and loosening of social networks are likely to occur when out of the labor market, reducing the effectiveness of job search.

The employed are satisfied with work, but they may lose their current job with probability δ . The unemployed, instead, choose whether to search for work or not. Assuming that individuals base their choice on present utility $U_{U,t}$ and the expected utility for one time period ahead, the optimal search effort is determined by maximising the following¹ with respect to s :

$$V_{U,t} = U_{U,t} + [U_{U,t+1}(1 - p_t(s_t)) + U_{E,t+1}p_t(s_t)]R \quad (1)$$

$0 < R < 1$ is a discount factor. $U_{U,t}(s) = U_{U,t+1}(s) = U_U(s)$, reaching the maximum value with no search². V_E is the utility of being employed, and does not depend on s . Although present utility is maximised with $s=0$, future expected utility is minimised with no

¹ We do not refer to expected discounted utility with an infinite horizon because an analytical solution may not be easily obtained when job opportunities deteriorate with time in unemployment.

² Note that $U_{U,t}$ depends on s_t , while $U_{U,t+1}$ depends on s_{t+1} . We assume that individuals choose the optimal value of s_t by setting $s_t = s_{t+1}$.

search, because $p(s)=0$. It is easy to show that job search is convenient when the differential utility of being employed and unemployed ($U_E - U_U(s=0)$) and the effectiveness of job search $p(s)$ are high, and the cost of job search $U_U(s=0) - U_U(s)$ is low, where $U_E \geq U_U(s=0) \geq U_U(s)$.

Aim of the note is to compare environments where no policies against poverty or unemployment are at work, with other environments where income support is granted to poor people. We consider temporary benefits of various amount, potential duration, and delay. People are assumed to consume all their earnings (no savings), thus, the unemployed are always poor and vice-versa with no benefit. If a benefit reaching the poverty threshold is allowed, the unemployed are not poor while assisted.

A Cobb-Douglas³ utility function $U=C^2L$ is employed. Probability to find a job is $p=\gamma(k)s$, with $\gamma(k)=p_{max}<1$ and $\gamma(k+1)\leq\gamma(k)$, k being elapsed time in the current spell of unemployment. Being employed again allows to recover the original value $\gamma(0)$.

Expression (1) takes different forms, according to whether the benefit is currently provided and whether it is expected at time $t+1$ if still unemployed. We distinguish the following cases: (i) income support is currently provided and the individual is still eligible at time $t+1$; (ii) no benefit is provided or time for benefit has already expired; (iii) allowance is next to expiration, so that no benefit is expected at time $t+1$; (iv) no subsidy is currently provided, but it will be if still unemployed at time $t+1$ (in the case of delay). In case (i) expression (1) is equivalent to:

$$V_{U,t}(k) = B^2(2-s) + [B^2(2-s)(1-\gamma(k)s) + W^2\gamma(k)s]R \quad (2)$$

a quadratic function of s . Since the quadratic coefficient is positive, (2) is maximized either in $s=0$ or in $s=1$. We derive that individuals find job search convenient when:

$$B < W \sqrt{\frac{\gamma(k)R}{R+1+\gamma(k)R}} \quad (3)$$

Coherently with the literature, if benefit is high enough, income support acts as a work disincentive. Similar results hold for cases (ii)-(iv). Notice that the optimal search strategy changes with time, thus, it does not reach an equilibrium point.

3. Simulations and results

We generate working, poverty and welfare participation histories for a population of 1000 individuals with a working life of 500 time units (we may think of each unit as a month). Individuals “dying” are replaced by fresh ones, so that the overall dimension of the population is unchanged. At time $t=1$ individuals (whose “age” is random) are all at the beginning of their first unemployment spell. The process is run from time $t=1$ to time $t=1000$. Stationarity is reached after approximately 500 time units.

Parameters are set as follows. *Market conditions*: $C_0=0.5$ and $w \in \{2, 2.5, 3\}$. *Job turnover*: $\gamma(0)=0.3$, $\gamma(k+1)=(1-\theta)\gamma(k)$, with $\theta=0$ (no loss of skills) or $\theta=0.05$; $\delta=0.01$.

³ Function $U=C^2L$ is chosen as it allows more reasonable values of the parameters compared to $U=CL$.

Discount factor: $R=0.95$. *Policy features:* benefit level $B \in [0.6, 1.2]$, potential duration of the benefit $\in [1, 6]$, with the addition of the case of unlimited benefit, delay $\in [0, 6]$.

Results strongly depend on the characteristics of the market – with low wages (a weak work incentive) and skill loss, all the reported effects seem to be stronger. According to our model, income support policies create substantial work disincentives. Unemployment rates are hardly affected by the policy if the benefit is low and of short duration, but can reach 100% of our population if the benefit has no time limits. Benefit level affects the unemployment rate with a threshold effect. If the beginning of the welfare spell is delayed with respect to the unemployment spell, the unemployment rate is sometimes substantially lower. We find similar effects on the average duration of the first unemployment spell, that can be as high as 380 months. On the other hand, in some circumstances income support lowers the absolute poverty rate, if the benefit overtakes the poverty threshold and market wage is high. With no time limits and a low support, however, poverty rates can be much higher than with no assistance policy. Similar conclusion holds for the average length of poverty spells. Delay may affect statistics on poverty, although not always in the same direction.

4. Future developments

We sketch here some of the extensions we are planning to develop in future work: (i) Add psychological and cultural effects (see Contini, Negri, 2005) to purely “economic” factors based on the rational choice paradigm; (ii) Allow for heterogeneity of individual abilities (affecting the probability to find a job), and heterogeneity of wages; (iii) Make different assumptions about the way individuals evaluate their alternatives: instead of maximising complicated expected utility functions, learning processes based on past experience or on the experience of “neighbours” may be a more realistic practice. Since a purely analytical approach is difficult to carry on in this context, simulation studies can be very useful. Agent modeling in particular, allowing for interaction among individuals, makes the modeling of cultural effects and the implementation of learning processes based on other people’s behavior quite straightforward.

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