Dipartimento di scienze economiche, aziendali, matematiche e statistiche "Bruno de Finetti"

Working Paper Series, N. 3, 2011

A Note on the POUM Effect with Heterogeneous Social Mobility

FRANCESCO FERI
Dipartimento di Scienze Economiche, Aziendali, Matematiche e Statistiche
Università di Trieste

UNIVERSITÀ DEGLI STUDI DI TRIESTE

Working paper series

Dipartimento di Scienze Economiche, Aziendali, Matematiche e Statistiche “Bruno de Finetti”
Piazzale Europa 1
34127, Trieste
tel.: 040 5587023

EUT Edizioni Università di Trieste
Via E.Weiss, 21 - 34128 Trieste
Tel. ++40 558 6183
Fax ++40 558 6185
http://eut.units.it
eut@units.it

ISBN: 978-88-8303-358-2

Working Paper Series, N. 3, 2011

A Note on the POUM Effect with Heterogeneous Social Mobility

FRANCESCO FERI
Dipartimento di Scienze Economiche, Aziendali, Matematiche e Statistiche
Università di Trieste

ABSTRACT[1]

We study the determinants of the (steady-state) POUM effect in a model where the individuals evaluate their expected future income using both their current income and observable characteristics such as education, race or gender.

KEYWORDS: Social Mobility, Income Distribution, Inequality, Taxation.

[1] **Corresponding author:** Francesco Feri, Dipartimento di Scienze Economiche, Aziendali, Matematiche e Statistiche, Piazzale Europa 1, email: fferi@units.it; tel: 0405587023

1. Introduction

Social mobility has often been invoked to explain the low levels of redistribution in the modern democracies: given that today's poor may be the wealthy of tomorrow, the poor may not support high levels of redistribution. In other words, social mobility, understood as the possibility to make it up (or down) in the income ladder, could affect individual preferences for redistributive policies. This effect is denoted as "Prospect Of Upward Mobility" (POUM effect).

The first author to use this argument was Tocqueville (1835), who suggested that the difference in attitudes toward redistribution between Europe and the United States could be explained by presumed differences in social mobility. An early research that analyzes the relation between social mobility and redistribution is Hirschmann and Rothschild (1973). They consider that an individual's welfare depends on his present state of contentment as well as on his expected future contentment. More recently, Piketty (1995) addresses intergenerational mobility to explain heterogeneous preferences toward redistribution.[2]

Bénabou and Ok (2001b) (BO hereafter) formalize this idea: agents know the true mobility process and maximize the actual value of their expected incomes in future years. The main result is that the POUM effect depends on a particular property of the mobility process: when expected future income is a strictly concave function of current income, the fraction of people with an expected future income below the expected mean income is smaller than the fraction of people with current income below the mean income.

A crucial assumption in BO is that the income mobility process is the same for all individuals. To this respect, BO explicitly warn that "*it is fairly restrictive, especially in an intragenerational context*". As they further clarify, the assumption implies that "*one abstracts from life-cicle earnings profiles and other lasting heterogeneity such as race, or occupation, which would introduce additional state variables into the income dynamics*". Indeed, recent research supports the idea that preferences toward redistribution depend on some individual characteristics (Beckman and Zheng (2007) and Rainer and Siedler (2008)).

This paper elaborates on this explicit caveat of BO and extends their model to a case with two social groups characterized by different income dynamics. We show, for the case of a log-linear AR(1) specification of the income mobility processes, that the (steady-state) POUM effect depends on the concavity of expected incomes (w.r.t. current incomes) and the length of policy horizon. We find that more concave income mobility processes and longer policy horizons imply a stronger polarization in the preferences toward redistribution. Finally, to support these results, we present a preliminary estimation of the POUM effect using Italian data.

[2] Other related papers are those that link social mobility and future income prospects. For example, Dardanoni (1993) and Bénabou and Ok (2001a) consider mobility as an equalizer of opportunities and assess mobility processes according to the level of inequality in the distribution of expected future incomes. Alesina and La Ferrara (2005) and Ravallion and Lokshin (2000) provide empirical evidences on the POUM effect: they show that social mobility has a negative effect on the demand for redistribution.

The paper is organized as follows. In Section 2 we develop the model. In Section 3 the main results are analyzed and discussed. Section 4 concludes. All the proofs are in the Appendix.

2. The Model

We consider an economy populated by a continuum of individuals indexed by $i \in [0,1]$, whose income, y, lies in some interval $Y \equiv [0, \hat{y}]$, $0 < \hat{y} \leq \infty$ with mean μ_F. According to some personal characteristics, the population can be divided into two groups, indexed by $k \in \{a, b\}$. By n_k we denote the number of individuals in group *k*.

Individuals have to choose, under majority voting, a redistributive proportional scheme, that is defined as a function $r: Y \to R_+$ that associates to each gross income y_i a level of disposable income $r(y_i; \mu_F)$:

(1) $$r_\tau(y_i; \mu_F) = (1-\tau)y_i + \tau\mu_F\,, \ \ \tau \in [0,1]$$

In what follows we concentrate on the choice between two different redistributive schemes, absence of redistribution, r_0, and complete redistribution, r_1.[3]

Individuals are characterized by an income mobility process depending on the group to which they belong. For group k, the income mobility process is described by a function $M_k(x|w)$, that gives the probability that an individual with a current income $y_t = w$ will have at most $y_{t+1} = x$. We require that the income processes are stationary and that they are characterized by a unique invariant income distribution and by expected incomes that are increasing and continuous functions of the current income. We denote by F^k(y) the cumulative function of the steady-state income distribution, and we require that it is continuous and strictly increasing. We denote by μ_k the mean income in group *k* and we assume $\mu_a > \mu_b$.

To study how the income mobility influences the share of the population favorable to redistribution, our benchmark is the case without concerns on income mobility. To eliminate the consideration of mobility, in the benchmark we assume that in every period people vote for a redistribution policy that takes place in the same period. Then agent *i* prefers r_1 to r_0 if and only if $y_i \leq \mu_F$. The share of the population that votes for r_1 is given by:

(2) $$\delta = [n_a F^a(\mu_F) + n_b F^b(\mu_F)]/(n_a + n_b)$$

Now, we focus on a two-period scenario where voters have to choose at time *t* the redistribution scheme that will be enacted in *t+1*. Assuming rationality and risk neutrality, agent *i* prefers r_1 to r_0 if and only if $E\big(y_{i,t+1}|y_{i,t}\big) \leq \mu_F$. Then, for each group k, there exists a threshold $\tilde{y}_k$ such that each individual *i* (belonging to the group k) prefers r_1 to r_0 if and only if $y_{i,t} \in [0, \tilde{y}_k)$.[4] The share of the population that votes for r_1 is given by:

(3) $$\tilde{\delta} = [n_a F^a(\tilde{y}_a) + n_b F^b(\tilde{y}_b)]/(n_a + n_b)$$

[3] The analysis can be extended to any possible pair of proportional redistributive schemes. Indeed, an individual will prefer the more redistributive scheme if and only if his current income is below the mean.

[4] It follows from the assumption that $E\big(y_{i,t+1}|y_{i,t}\big)$ is an increasing and continuous function of $y_{i,t}$

The effect of the mobility concerns on the voting decisions is given by the difference between the benchmark and the two-period case in the proportion of the population voting for r_1, that is:

(4) $$P = \delta - \tilde{\delta}.$$

Variable P is a measure of the (steady-state) POUM effect and represents the share of the population with current income below the mean minus the share of the population with expected future income below the mean. The size of the coalition favoring r_1 is larger with mobility concerns than without them if and only if P is negative. Note that even if this measure of the (steady-state) POUM effect is related only to the steady-state income distribution, it is essential to show that our findings describe not just transitory, short-run effects, but stable, permanent ones as well.

The contribution of each group $k \in \{a, b\}$ to the (steady-state) POUM effect is given by:

(5) $$P_k = n_k\left(F^k(\mu_F) - F^k(\tilde{y}_k)\right)/(n_a + n_b)$$

When P_k is negative we say that group k is characterized by a Prospect Of Downward Mobility (PODM). The measure of the (steady-state) POUM effect, P, can be rewritten as:

(6) $$P = P_a + P_b$$

3. Results

We explore the characteristics of the income mobility processes that affect the (steady-state) POUM effect. To this aim, in order to have explicit solutions that allows us to study how the concavity of the income processes affects the (steady-state) POUM effect, we focus on a log-linear *AR(1)* specification of the income mobility processes. Specifically, the individual incomes evolve according to the stochastic process:

(7) $$\ln y_{i,t+1} = \rho_{0k} + \rho_{1k} \ln y_{i,t} + \varepsilon_{k,i,t+1} \quad k \in \{a, b\}$$

where y is the income and ε is an i.i.d individual error term. We assume $\rho_{1k} \in [0,1)$, and $\varepsilon_{k,i,t} \sim N(0, \sigma^2_{\varepsilon,k})\ \forall\, t$. Then, in the invariant income distribution, incomes are log-normally distributed, i.e. $\ln y_{i,t} \sim N(m_k, \sigma_k^2)\ \forall t$ where $m_k = \rho_{0k} + \rho_{1k} \cdot m_k$ and $\sigma_k^2 = {\rho_{1k}}^2 \cdot \sigma_k^2 + \sigma^2_{\varepsilon k}$. Given that $E(y_{i,t+1}|y_{i,t}) = {y_{i,t}}^{\rho_{1k}} \cdot exp[\rho_{0k} + \sigma^2_{\varepsilon,k}/2\,]$, parameter ρ_{1k} is a measure of concavity as well as of elasticity of expected incomes with respect to current incomes.[5] Moreover, it directly follows that:

(8) $$\tilde{y}_k = {\mu_F}^{\frac{1}{\rho_{1k}}} \cdot exp\left[-\left(\rho_{0k} + \frac{\sigma^2_{\varepsilon,k}}{2}\right)/\rho_{1k}\right]\ k \in \{a, b\}.$$

Definition 1. *Let $\Omega_k(m_k, \sigma_k^2) \equiv \Omega_k$, $k \in \{a, b\}$, be the set of log-linear AR(1) income mobility processes with invariant income distribution given by $\ln y \sim N(m_k, \sigma_k^2)$.*

[5] A widely used measure of concavity for a function $f(x)$ is given by $-f''(x)/f'(x)$, where a larger value implies a more concave function. In the log-linear $AR(1)$ process this measure is given by $(1 - \rho_{1k})/y_{i,t}$, then the lower ρ_{1k} is, the more concave the expected income mobility process is.

In order to produce the same invariant income distribution, all income processes in Ω_k must satisfy the two following conditions: *i)* $\rho_{ok} = m_k(1-\rho_{1k})$ and *ii)* $\sigma^2_{\varepsilon,k} = \sigma^2_k(1-{\rho_{1k}}^2)$. Therefore, across the income processes in Ω_k, the lower ρ_{1k} is, the greater $\sigma^2_{\varepsilon,k}$ is. In other words, more concave (less elastic) income process will be characterized by more skewness in the random shocks.

Suppose that in both groups steady state income distributions are log-normal with parameters (m_k, σ^2_k), $k \in \{a, b\}$. Then, for each group $k \in \{a, b\}$, any of the income processes in Ω_k could be possible. Given group sizes n_a and n_b, the thresholds (8) are fully determined by the parameters of the income processes that generate the respective income distributions. Then, the contribution of each group to the magnitude of the (steady-state) POUM effect (P_a and P_b) strictly depends on the specific operating income process (across all those in Ω_k).

A concave income transition function is characterized by a threshold $\hat{y}_k > \mu_k$ such that the expected income is higher than the current one if and only if the current income is below $\hat{y}_k$. [6] If only one group exists there is a subset of individuals with current incomes below (and near) μ_F but the expected ones above.[7] With two groups we have that $\mu_b < \mu_F < \mu_a$, then while the rich group threshold $\hat{y}_a$ is above μ_F (and therefore there is a subset of individuals with income below (and near) μ_F but the expected one above), the poor group threshold $\hat{y}_b$ could be above or below μ_F. In the first case we have some individuals (with income below μ_F) characterized by a POUM effect in the second case we have some individuals (with income above μ_F) characterized by a PODM effect. For the poor group the level of the concavity, determines the position of $\hat{y}_b$ respect to μ_F and, as a consequence, not only the magnitude the (steady-state) POUM effect but the direction too.[8] The following proposition highlights the effects of the concavity. Prior of the statement we define the following threshold $\bar{\rho}_b = 0.5\sigma^2_b(\ln \mu_F - \ln \mu_b)$.

Proposition 1. *Let be $n_a, n_b > 0$ and (m_k, σ^2_k), $k \in \{a, b\}$ such that $\mu_a > \mu_b$. For any income mobility process in $\Omega_k(m_k, \sigma^2_k)$, $k \in \{a, b\}$:*

i) P_a is always positive, P_b is positive if and only if $\rho_{1b} \geq \bar{\rho}_b$

ii) P_a is always decreasing in ρ_{1a}, P_b is decreasing in ρ_{1b} if and only if $\rho_{1b} \geq \sqrt{\bar{\rho}_b}$

Given the income distributions $N(m_k, \sigma^2_k)$, $k \in \{a, b\}$, the contribution to the (steady-state) POUM effect of the richer group is always positive and decreasing in ρ_{1a},[9] while the contribution of the poorer group is negative if and only if the income process is sufficiently concave (i.e. $\rho_{1b} \leq \bar{\rho}_b$). Moreover, if P_b is negative, then it is decreasing in concavity across all processes in Ω_b. Otherwise, when P_b is positive, the effect of the concavity is not monotonic (it is decreasing if and only if the concavity of the income mobility process is sufficiently high).

---

[6] The expected income is higher than the current income if and only if ${y_{i,t}}^{\rho_{1k}} \cdot exp[\rho_{0k} + \sigma^2_{\varepsilon,k}/2\,] > y_{i,t}$. Solving for $y_{i,t}$, we get:

$$y_{i,t} < exp\left[\frac{\rho_{0k}}{1-\rho_{1k}} + \frac{\sigma^2_{\varepsilon,k}}{2\,(1-\rho_{1k})}\right] = exp\left[m_k + \frac{\sigma^2_k}{2}(1+\rho_{1k})\right].$$

The right hand side defines $\hat{y}_k$ that is clearly higher than μ_k ($= \exp\,[m_k + \sigma^2_k/2]$).

[7] Note that in this case no one is characterized by a current income above μ_F and an expected income below it.

[8] I thank an anonymous referee for providing these insightful intuitions.

[9] i.e. a more concave income mobility process in Ω_a implies a larger P_a

The threshold $\bar{\rho}_b$ increases in parameter σ_b^2 and in the ratio μ_F/μ_b: the poorer group b is and/or the more dispersed the incomes are, the smaller the subset of income processes in Ω_b generating a positive P_b is.[10] Furthermore, if group b is poor enough and/or incomes are sufficiently dispersed, the threshold $\bar{\rho}_b$ can be larger than 1, so that P_b is always negative and increasing in ρ_{1b}. Thus, provided μ_b is sufficiently small, more concave (less elastic) income mobility processes cause stronger polarizations in the preferences toward redistribution, i.e. an increase (reduction) in the proportion of individuals in the poorer (richer) group preferring redistribution. Finally, we focus our attention on the proportions of the two groups (n_a, n_b). Given the income distributions, the ratio μ_F/μ_b decreases in the relative size of the poorer group (since μ_F decreases). As a consequence, the threshold $\bar{\rho}_b$ decreases too. Then, for a given value of ρ_{1b}, if the relative size of the poorer group is sufficiently high, P_b is positive. It is due to the fact that μ_F moves (near to μ_b) below threshold $\hat{y}_b$, so that some agents with income below μ_F have an expected income above it.

Summarizing, we see that in group a there is a subset of individuals characterized by a POUM effect as well as in group b (when it is sufficiently poor or the income transition process is sufficiently concave) there is a subset of individuals characterized by a PODM effect. Then, which one of the two effects dominates depends on the parameters, with a central role of the concavity of the income processes. As a direct application of Proposition 1, it is directly verifiable that, when $n_a < n_b$, given the income distributions and any generating income process in $\Omega_a(m_a, \sigma_a^2)$, sufficiently concave income processes in $\Omega_b(m_b, \sigma_b^2)$ imply that PODM effect of group b dominates the POUM effect of group a.[11]

Now we study how the length of the horizon, over which the redistribution scheme is set, affects the (steady-state) POUM effect. We assume that at time t individuals vote for a redistributive policy that will be implemented from *t+1* until *t+T*. Then agent i prefers r_1 to r_0 if and only if $\sum_{h=1}^{T} \delta^h E(y_{i,t+h}|y_{i,t}) \leq \sum_{h=1}^{T} \delta^h \mu_F$ where $0 < \delta \leq 1$ is a discount factor. Let P_{kT}, $k \in \{a, b\}$, be the contribution to the (steady-state) POUM effect of group k when the redistributive policy is implemented for T periods.

Proposition 2. *P_{aT} is always increasing in T and, if $\rho_{1b} \leq \bar{\rho}_b$, P_{bT} is decreasing in T.*

While the length of the policy horizon increases the contribution to the (steady-state) POUM effect of group a, its effect on the contribution of group b depends on the parameters. Given the income distribution, if the income process is sufficiently concave, then a larger policy horizon implies a smaller P_{bT}, i.e. a greater PODM effect. In such a case, a longer policy horizon causes a stronger polarization in the preferences toward redistribution.

Empirical Evidence

In this subsection our purpose is not to carry out a large empirical study or a detailed calibration, but to show how the results described above are empirically plausible. We perform, for the period 1989–2004, a preliminary empirical analysis using the Bank of Italy

[10] Note that the ratio μ_F/μ_b can be written as $(n_a\,\mu_a + n_b\,\mu_b)/(n_a + n_b)\,\mu_b$ that is decreasing in μ_b

[11] Given the income distributions, Proposition 1 says that for all the income process in $\Omega_b(m_b, \sigma_b^2)$ s.t. $\rho_{1b} \leq \bar{\rho}_b$, P_b is negative and increasing in ρ_{1b} (i.e. decreasing in concavity). Therefore, increasing the concavity of the income process, the PODM effect increases monotonically with an upper bound of n_b.

Survey on Italian Households Income and Wealth (SHIW). This survey collects data every two years from a sample of approximately 8000 households for each year.[12] Since 1989, part of the sample has comprised around 40% of households interviewed in previous surveys (panel households). This survey reports information on the household as well as of its components.[13] In our analysis we use the individual income, reported in euro and deflated at 2004 values.[14] The individual income distribution considered here shows, on average, 62.8% of individuals with an income below the average.

In order to illustrate how heterogeneity in the mobility process affects the measurement of the POUM effect, we compare two different measures computed under the following assumptions:

(m_1): the mobility process is the same for all the individuals,

(m_2): the mobility processes differ in accordance to the work status of the individuals; junior managers, managers and self-employed (group a) are characterized by a different mobility process in comparison all others (group b).[15]

Under each assumption, to measure the POUM effect, we go through the following steps: *i)* we estimate the log-linear AR(1) process in (7) with fixed effects;[16] *ii)* we compute the expected individual incomes;[17] *iii)* we compute the POUM effect. In Table 1, for each assumption we report the estimation results of the income mobility processes, the POUM effect (P_T), computed for different values of policy horizons T (assuming $\delta = 1$), and the groups' contributions to the POUM effect (P_{aT}, P_{bT}). Under assumption m_1, we find a positive and increasing in T POUM effect. Under assumption m_2, we find a negative and decreasing in T POUM effect: it results from a positive (and increasing in T) contribution of group a and a negative (and decreasing in T) contribution of group b.[18]

This exercise shows that the introduction of heterogeneity in the mobility process can change drastically the magnitude and the sign of the POUM effect. Under m_1, the estimated value of the income elasticity ($\rho_1 < 1$) implies a concave expected income function and a positive POUM effect. Then, our finding of a PODM effect under m_2 shows that concavity

[12] There is one gap of 3 years after the 1995's survey.

[13] A detailed description of this survey is available on www.bancaditalia.it.

[14] To deflate the values we use the annual coefficients provided by ISTAT.

[15] 82.3% of individuals belong to group b (Blue-collar workers, office workers, school teachers and not employed) and earn, on average, an income of 0.89 times the mean income of the whole population; 17.7% of individuals belong to group a and earn, on average, an income of 1.57 times the mean income (averages over the years considered in the survey).

[16] We assume individual effects u_i. Then, we estimate the process $\ln y_{i,t+1} = \rho_0 + \rho_1 \ln y_{i,t} + u_i + \varepsilon_{i,t+1}$ by GMM (see Arellano and Bond (1991) for details). As a consequence, we only use data from individuals that are included in the survey at least three consecutive periods, and we include year dummies.

[17] $E(y_{i,t+1}|y_t) = exp[\rho_0 + \rho_1 y_{i,t} + \sigma_\varepsilon^2/2]$. We compute the expected income for all the individuals sampled in the SHIW, including those that are not in the panel. In order to compute the expected future income in year *x*, we set the value for the term $exp[\rho_0 + \sigma_\varepsilon^2/2]$ such that the average of the expected incomes equals the average of income in year *x-1*.

[18] Using the log-linear AR(1) specification of the income mobility process, under m_1 the POUM effect has an upper limit: the threshold $\tilde{y}$ such that an individual prefers r_1 to r_0 if her current income $y_{i,t} \in [0, \tilde{y}_k)$ is $\tilde{y} \geq exp[\mu_F]$. This explains the evidence that the POUM effect (under m_1) remains constant for $T = 3,4$. Finally, P_{bT} remains constant for $T = 2,3,4$ because, for these policy horizons, all individuals in group a prefer r_0.

in the aggregate income transition function is not a sufficient condition for a positive POUM effect.

TABLE 1: estimates of ρ_1 and POUM effect under assumptions m_1 and m_2
($*$ significant at the 1%)

POUM effect					
Policy horizon T →		2	4	6	8
m_1	P_T	14.6	15.3	15.4	15.4
m_2	P_T	-5.4	-13.9	-17.6	-18.8
	P_{aT}	6.9	7.1	7.1	7.1
	P_{bT}	-12.3	-21.0	-24.7	-25.9
Estimates of ρ_1					
m_1		.211679*	(.0171521)		
m_2	*group* a	.1790161*	(.0439709)		
	group b	.2363868*	(.0188056)		

4. Conclusion

There are several directions to extend the results presented in the paper. For instance, one is to generalize our model to many groups, and to use more general income dynamics. Another possibility is to divide the population in groups not according to exogenous characteristics, but to the individual observed behavior using mixture regression models.

APPENDIX

Proof of Proposition 1.

We consider only the income processes in Ω_k, in the expression of $\tilde{y}_k$ we replace $\rho_{ok} = m_k(1-\rho_{1k})$ and $\sigma^2_{\varepsilon,k} = \sigma^2_k(1-\rho_{1k}{}^2)$. After some algebra, we get:

$$\tilde{y}_k = \mu_F{}^{\frac{1}{\rho_{1k}}} \cdot exp\left[-\frac{2\, m_k(1-\rho_{1k})+\sigma^2_k(1-\rho_{1k}{}^2)}{2\,\rho_{1k}}\right] = \left(\frac{\mu_F}{\mu_k}\right)^{\frac{1}{\rho_{1k}}} \cdot exp\left[m_k + \frac{\sigma^2_k \rho_{1k}}{2}\right] \quad (9)$$

By (5), $P_k \geq 0$ if and only if $\tilde{y}_k \leq \mu_F$. This condition is verified if and only if $\rho_{1k} \geq (2/\sigma^2_k)(\ln \mu_F - \ln \mu_k)$. If $k = a$ this inequality is satisfied for all possible values of ρ_{1a} (the right hand side is strictly negative). If $k = b$ the right had side is the threshold $\bar{\rho}_b$. This proves the first part of the proposition. The derivative in ρ_{1k} of the RHS of (9) is:

$$\left(\frac{\mu_F}{\mu_k}\right)^{\frac{1}{\rho_{1k}}} \cdot exp\left[m_k + \frac{\sigma_k^2 \rho_{1k}}{2}\right] \cdot \left(\frac{\sigma_k^2}{2} - \frac{1}{\rho_{1k}{}^2} \ln\left(\frac{\mu_F}{\mu_k}\right)\right).$$

It is negative (i.e. $\tilde{y}_k$ is decreasing (P_k is increasing) in ρ_{1k}) when ${\rho_{1k}}^2 \leq \left(2/\sigma_k^2\right)(\ln \mu_F - \ln \mu_k)$. If $k = a$ this inequality is never satisfied for all possible values of ρ_{1a} (the RHS is strictly negative). If $k = b$ the RHS is the threshold $\bar{\rho}_b$. Then, we can write it as:

$$\rho_{1k} \leq \sqrt{\frac{2}{\sigma_k^2} \ln \frac{\mu_F}{\mu_k}} = \sqrt{\bar{\rho}_b}.$$

This proves the second part of the proposition. ■

Proof of Proposition 2.

Agent *i* prefers r_1 to r_0 if and only if:

(10) $$\sum_{h=1}^{T} \delta^h E\left(y_{i,t+h} | y_{i,t}\right) \leq \sum_{h=1}^{T} \delta^h \mu_F$$ where

(11) $$E\left(y_{i,t+h} | y_{i,t}\right) = {y_{i,t}}^{{\rho_{1k}}^{h}} \cdot exp\left[\rho_{0k} \sum_{j=1}^{h} {\rho_{1k}}^{j-1} + \sigma_{\varepsilon,k}^2 \sum_{j=1}^{h} {\rho_{1k}}^{2(j-1)}/2\right] \ \forall\ h \geq 1.$$

It follows that the LHS of (10) is a continuous and strictly increasing function of $y_{i,t}$. Then, for each individual *i* in group *k* there exists a unique threshold $\tilde{y}_{k,T}$ such that she prefers r_1 to r_0 if and only if $y_{i,t} \in [0, \tilde{y}_k)$. Let $\ddot{y}_{k,h}$ be such that $E\left(y_{i,t+h} | \ddot{y}_{k,h}\right) = \mu_F$, i.e.:

$$\ddot{y}_{k,h}{}^{{\rho_{1k}}^{h}}\ exp\left[\rho_{0k} \sum_{j=1}^{h} {\rho_{1k}}^{j-1} + \sigma_{\varepsilon,k}^2 \sum_{j=1}^{h} {\rho_{1k}}^{2(j-1)}/2\right] = \mu_F.$$

Solving for $\ddot{y}_{k,h}$, we get:

$$\ddot{y}_{k,h} = \left(\frac{\mu_F}{\mu_k}\right)^{\frac{1}{{\rho_{1k}}^{h}}} \cdot exp\left[m_k + \sigma_k^2 {\rho_{1k}}^{h}/2\right]$$

Its derivative is:

(12) $$\frac{d\ddot{y}_{k,h}}{dh} = \left(\frac{\mu_F}{\mu_k}\right)^{\frac{1}{{\rho_{1k}}^{h}}} exp\left[m_k + \frac{\sigma_k^2 {\rho_{1k}}^{h}}{2}\right] \left(\frac{\sigma_k^2}{2} - \frac{1}{{\rho_{1k}}^{2h}} \ln\left(\frac{\mu_F}{\mu_k}\right)\right) {\rho_{1k}}^{h} \ln \rho_{1k}.$$

It is negative (i.e. $\ddot{y}_{k,h}$ is decreasing in h) when $\mu_k \geq \mu_F\ exp\left[-{\rho_{1k}}^{2h} \sigma_k^2/2\right]$.
Consider agents belonging to group a. By Proposition 1, we know that $\ddot{y}_{a,1} < \mu_F$ and,[19] by the above result, we have that $\ddot{y}_{a,h} > \ddot{y}_{a,h+1}\ \forall h \geq 1$. It is directly verifiable that $\ddot{y}_{a,T} < \tilde{y}_{a,T} < \ddot{y}_{a,1}$. Note that, for $y_{i,t} = \tilde{y}_{a,T}$, expression (10) holds with equality. Increasing the policy horizon of one period, for agent i with $y_{i,t} = \tilde{y}_{a,T}$ we have $\sum_{h=1}^{T+1} \delta^h E\left(y_{i,t+h} | y_{i,t}\right) > \sum_{h=1}^{T+1} \delta^h \mu_F$, because $E\left(y_{i,T+1} | \tilde{y}_{a,T}\right) > \mu_F$. It directly follows by $\ddot{y}_{a,T+1} < \ddot{y}_{a,T} < \tilde{y}_{a,T}$ and by the fact that (11) is strictly increasing. Given that the LHS of (10) is strictly increasing and a continuous function of $y_{i,t}$, we get $\tilde{y}_{a,T+1} < \tilde{y}_{a,T}$ and the result follows. Consider agents belonging to group b. Note that, when $\mu_b \leq \mu_F\ exp\left[-\rho_{1b} \sigma_b^2/2\right]$, by Proposition 1

[19] For $h = 1$ expression 0 is equal to (9).

we know that $\ddot{y}_{b,1} \geq \mu_F$ (cf. footnote 18) and, by the above result, we have that $\ddot{y}_{b,h} > \ddot{y}_{b,h+1}$ $\forall h \geq 1$. Since the proof for group b is very similar to the case of group a, it is omitted. ■

REFERENCES

A. Alesina and E. La Ferrara. Preferences for redistribution in the land of opportunities. *Journal of Public Economics*, 89(5):897–931, 2005.

M. Arellano and S. Bond. Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equation. *Review of Economic Studies*, 58(2):277-297, 1991.

S. R. Beckman and B. Zheng. The Effects of Race, Income, Mobility and Political Beliefs on Support For Redistribution. *Research on Economic Inequality*, 14:363-385, 2007

R. Bénabou and E. Ok. Mobility as Progressivity: Ranking Income Processes According to Equality of Opportunity. *NBER Working Paper*, 8431, 2001.

R. Bénabou and E. Ok. Social mobility and the demand for redistribution: The POUM hypothesis. *Quarterly Journal of Economics*, 116(2): 447–487, 2001.

A.O. Hirschman and M. Rothschild. The Changing Tolerance for Income Inequality in the Course of Economic Development. *Quarterly Journal of Economics*, 87(3):544-566, 1973.

T. Piketty. Social Mobility and Redistributive Politics. *Quarterly Journal of Economics*, 110(2):551-584, 1995.

H. Raine and T. Siedler. Subjective income and employment expectations and preferences for redistribution. *Economics Letters*, 99(3):449-453, 2008.

M. Ravallion and M. Lokshin. Who wants to redistribute? The tunnel effect in 1990s Russia. *Journal of Public Economics*, 76(1):87–104, 2000.

A. Tocqueville. *De la Démocratie en Amérique*. Pagnerre, Paris, 1835.