Job security, attitude towards risk and preference for social insurance:
A note on 'Earnings inequality and welfare spending' by Moene and Wallerstein

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TECHNICAL APPENDIX

I. PREFERENCES FOR A REDISTRIBUTION POLICY TARGETING ALL CITIZENS

Suppose that the policy targets the entire society, i.e., both the employed and the unemployed citizens. Then, the expected government expenditure is:

$$\int \pi_i s\omega dF_i + \int (1-\pi_i)\, s\omega dF_i = s\omega$$

Recall that government expected revenue is: $\tau(t)\Pi\omega$. Then, the expected budget constraint of the government can be written as follows.

$$\tau(t)\Pi\omega = s\omega$$

Equivalently,

$$s = \Pi\tau(t) \tag{A1}$$

Therefore, voter i's preferred tax rate is the solution to the following maximization problem.

$$\max_t U_i(t) = \pi_i u((1-t)\omega_i + \tau(t)\Pi\omega) + (1-\pi_i)u(\tau(t)\Pi\omega) \tag{A2}$$

The corresponding FOC is:

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$$U_i'(t) = \pi_i(-\omega_i + \tau'(t)\Pi\omega)u'((1-t)\omega_i + \tau(t)\Pi\omega) + (1-\pi_i)\tau'(t)\Pi\omega u'(\tau(t)\Pi\omega) = 0$$

That condition can be rewritten as:

$$\tau'(t)\Pi\omega u'(\tau(t)\Pi\omega) = \frac{\pi_i}{1-\pi_i}(\omega_i - \tau'(t)\Pi\omega)u'((1-t)\omega_i + \tau(t)\Pi\omega) \qquad \text{(A3)}$$

Therefore, voter i's preferred tax policy, t_i, is the tax rate t that solves equation (A3).

Note that, in addition to the tax policy t, the left-hand side (LHS) of equation (A3) depends exclusively on the average ex-ante wage ω and the aggregate parameter Π. Moreover, the LHS is a decreasing function of t. However, the right-hand side depends on voter i's characteristics π_i and ω_i. Our goal is to understand how the preferred policy t_i changes as voter i's characteristics change without affecting the aggregate parameters of the economy.

Define $h(\pi_i) = \frac{\pi_i}{1-\pi_i}$ and $f(\omega_i) = (\omega_i - \tau'(t)\Pi\omega)u'((1-t)\omega_i + \tau(t)\Pi\omega)$. Then, equation (A3) can be rewritten as:

$$\tau'(t)\Pi\omega u'(\tau(t)\omega) = h(\pi_i)f(\omega_i) \qquad \text{(A4)}$$

Therefore,

$$f'(\omega_i) = u'((1-t)\omega_i + \tau(t)\Pi\omega) + (\omega_i - \tau'(t)\Pi\omega)(1-t)u''((1-t)\omega_i + \tau(t)\Pi\omega)$$

$$f'(\omega_i) > 0 \Leftrightarrow u'((1-t)\omega_i + \tau(t)\Pi\omega) > -(\omega_i - \tau'(t)\Pi\omega)(1-t)u''((1-t)\omega_i + \tau(t)\Pi\omega)$$

Now,

$$\begin{aligned}(\omega_i - \tau'(t)\Pi\omega)(1-t) &= \omega_i(1-t) - (1-t)\tau'(t)\Pi\omega \\ &= \omega_i(1-t) + \tau(t)\Pi\omega - [\tau(t)\Pi\omega + (1-t)\tau'(t)\Pi\omega] \\ &= \omega_i(1-t) + \tau(t)\Pi\omega - [\tau(t) + (1-t)\tau'(t)]\Pi\omega\end{aligned}$$

Therefore, $(\omega_i - \tau'(t)\Pi\omega)(1-t) < \omega_i(1-t) + \tau(t)\Pi\omega$

Since u is strictly concave, $u''\big(\omega_i - \tau(t)(\omega_i - \Pi\omega)\big) < 0$. Therefore,

$$\begin{aligned}&(\omega_i - \tau'(t)\Pi\omega)(1-t)u''((1-t)\omega_i + \tau(t)\Pi\omega) \\ &\qquad > (\omega_i(1-t) + \tau(t)\Pi\omega)u''(\omega_i(1-t) + \tau(t)\Pi\omega)\end{aligned}$$

Thus,

$$f'(\omega_i) = u'((1-t)\omega_i + \tau(t)\Pi\omega) + (\omega_i - \tau'(t)\Pi\omega)(1-t)u''((1-t)\omega_i + \tau(t)\Pi\omega)$$
$$>$$
$$u'((1-t)\omega_i + \tau(t)\Pi\omega) + (\omega_i(1-t) + \tau(t)\Pi\omega)u''(\omega_i(1-t) + \tau(t)\Pi\omega)$$

Now,

$$u'((1-t)\omega_i + \tau(t)\Pi\omega) + (\omega_i(1-t) + \tau(t)\Pi\omega)u''(\omega_i(1-t) + \tau(t)\Pi\omega) > 0$$
$$\Leftrightarrow$$
$$1 > \frac{-(\omega_i(1-t) + \tau(t)\Pi\omega)u''(\omega_i(1-t) + \tau(t)\Pi\omega)}{u'((1-t)\omega_i + \tau(t)\Pi\omega)} = RRA(\omega_i(1-t) + \tau(t)\Pi\omega)$$

Therefore, if the coefficient of relative risk aversion of citizens is smaller than one, i.e., agents are not too risk averse, then the RHS of (A4) is an increasing function in income (whether $h(\pi_i)$ is increasing or, as in M&W 2003[1], constant) and, thereby, the preferred tax policy must decrease as income increases. This is the traditional M&R (1983)[2] result.

Suppose, now, that the CRRA is greater than one. Furthermore, suppose that unemployment risk is homogeneous as in M&W (2003). We will show next that if the CRRA is high enough, then there will be preference ordering reversal for a incomes above the mean income.

Recall that:

$$f'(\omega_i) = u'((1-t)\omega_i + \tau(t)\Pi\omega) + (\omega_i - \tau'(t)\Pi\omega)(1-t)u''((1-t)\omega_i + \tau(t)\Pi\omega)$$

Then,

$$f'(\omega_i) < 0 \Leftrightarrow 1 < (\omega_i - \tau'(t)\Pi\omega)(1-t)\frac{-u''((1-t)\omega_i + \tau(t)\Pi\omega)}{u'((1-t)\omega_i + \tau(t)\Pi\omega)}$$

$$\Leftrightarrow 1 < \frac{(\omega_i - \tau'(t)\Pi\omega)(1-t)}{(1-t)\omega_i + \tau(t)\Pi\omega}\frac{-((1-t)\omega_i + \tau(t)\Pi\omega)u''((1-t)\omega_i + \tau(t)\Pi\omega)}{u'((1-t)\omega_i + \tau(t)\Pi\omega)}$$

$$\Leftrightarrow 1 < \frac{(\omega_i - \tau'(t)\Pi\omega)(1-t)}{(1-t)\omega_i + \tau(t)\Pi\omega}RRA((1-t)\omega_i + \tau(t)\Pi\omega)$$

$$\Leftrightarrow RRA((1-t)\omega_i + \tau(t)\Pi\omega) > \frac{(1-t)\omega_i + \tau(t)\Pi\omega}{(\omega_i - \tau'(t)\Pi\omega)(1-t)}$$

But,

[1] Moene, Karl O., and Michael Wallerstein. 2003. "Earnings inequality and welfare spending – A disaggregated analysis." *World Politics* 55, n. 4: 485–516.
[2] Meltzer, Allan H., and Scott F. Richard. 1981. "A Rational Theory of the Size of Government." *Journal of Political Economy* 89, n. 5: 914–927.

$$\frac{(1-t)\omega_i+\tau(t)\Pi\omega}{(\omega_i-\tau'(t)\Pi\omega)(1-t)}=\frac{1+\frac{\tau(t)}{1-t}\Pi\frac{\omega}{\omega_i}}{1-\tau'(t)\Pi\frac{\omega}{\omega_i}}=\frac{\frac{\omega_i}{\omega}+\frac{\tau(t)}{1-t}\Pi}{\frac{\omega_i}{\omega}-\tau'(t)\Pi}$$

Now, for $\omega_i \geq \omega$,

$$\frac{\omega_i}{\omega}-\tau'(t)\Pi \geq 1-\tau'(t)\Pi \geq 1-\Pi \Rightarrow \frac{1}{\frac{\omega_i}{\omega}-\tau'(t)\Pi} \leq \frac{1}{1-\Pi}$$

and

$$\frac{\omega_i}{\omega}+\frac{\tau(t)}{1-t}\Pi \leq \frac{\widetilde{\omega}}{\omega}+\frac{\tau(t)}{1-t}\Pi \leq \frac{\widetilde{\omega}}{\omega}+\frac{\tau(t_{max})}{1-t_{max}}\Pi$$

Therefore, for $\omega_i \geq \omega$,

$$\frac{\frac{\omega_i}{\omega}+\frac{\tau(t)}{1-t}\Pi}{\frac{\omega_i}{\omega}-\tau'(t)\Pi} \leq \frac{1}{1-\Pi}\left[\frac{\widetilde{\omega}}{\omega}+\frac{\tau(t_{max})}{1-t_{max}}\Pi\right]=\frac{\Pi}{1-\Pi}\left[\frac{\widetilde{\omega}}{\Pi\omega}+\frac{\tau(t_{max})}{1-t_{max}}\right]$$

Let $m(\omega_i,t)=\frac{1}{1-\Pi}\left[\frac{\omega_i}{\omega}+\frac{\tau(t)}{1-t}\Pi\right]$. Then,

If, for $\omega_i \geq \omega$, $RRA((1-t)\omega_i+\tau(t)\Pi\omega) > m(\widetilde{\omega},t_{max})$, then $f'(\omega_i)$ is a decreasing function of ω_i in the range $[\omega,\widetilde{\omega}]$. Therefore, the preferred tax rate $t(\omega_i)$ is an increasing function of ω_i in that range. In particular, there is preference ordering reversal for citizens with income above the average income, in spite of the fact that the policy is pure redistribution and the risk of losing one's job is identical for all citizens.

The main rationale for that result is that pure redistribution plays the role of an imperfect substitute to unemployment insurance, when such policy does not exist, and richer citizens are exposed to higher consumption changes if they lose their jobs. Therefore, they are particularly favorable to the redistribution policy.

II. CALCULATIONS' DETAILS

PREFERENCES FOR A POLICY TARGETING THE EMPLOYED CITIZENS

$$\max_t \ (1-t)\omega_i+\frac{\Pi}{\overline{\Pi}}\tau(t)\omega$$

Since the objective function is strictly concave in t, the FOC determines voter i's preferred policy.

FOC:

$$\frac{\partial}{\partial t}: -\omega_i + \frac{\Pi}{\overline{\Pi}}\tau'(t)\omega = 0 \Longrightarrow \tau'(t) = \frac{\overline{\Pi}}{\Pi}\frac{\omega_i}{\omega}$$

Therefore, i's preferred policy is:

$$t_i^*(\omega_i) = (\tau')^{-1}\left(\frac{\overline{\Pi}}{\Pi}\frac{\omega_i}{\omega}\right)$$

Since $(\tau')^{-1}$ is decreasing, the higher i's income, the lower i's preferred tax rate. This is the traditional ordering (M&R, 1981).

PREFERENCES FOR A POLICY TARGETING THE UNEMPLOYED CITIZENS

$$\max_t U_i(t) = \pi_i u((1-t)\omega_i) + (1-\pi_i)u\left(\frac{\Pi}{1-\overline{\Pi}}\tau(t)\omega\right)$$

FOC:

$$U_i'(t) = \pi_i[-\omega_i]u'[(1-t)\omega_i] + (1-\pi_i)\frac{\Pi}{1-\overline{\Pi}}\tau'(t)\omega u'\left[\frac{\Pi}{1-\overline{\Pi}}\tau(t)\omega\right] = 0$$

$$\frac{\Pi}{1-\overline{\Pi}}\tau'(t)\omega u'\left(\frac{\Pi}{1-\overline{\Pi}}\tau(t)\omega\right) = \frac{\pi_i}{1-\pi_i}\omega_i u'((1-t)\omega_i)$$

Define $h(\pi_i) = \frac{\pi_i}{1-\pi_i}$ and $f(\omega_i) = \omega_i u'\big((1-t)\omega_i\big)$.

Then the FOC rewrites as:

$$\frac{\Pi}{1-\overline{\Pi}}\tau'(t)\omega u'\left(\frac{\Pi}{1-\overline{\Pi}}\tau(t)\omega\right) = h(\pi_i)f(\omega_i)$$

THE HOMOGENEOUS JOB SECURITY CASE WITH HIGH RISK AVERSION

Suppose $\pi_i =: \pi, \forall i$. In this case, $\Pi = \overline{\Pi} = \pi$, $\frac{\Pi}{1-\overline{\Pi}} = \frac{\pi}{1-\pi}$, and $h(\pi_i) = \frac{\pi_i}{1-\pi_i} = \frac{\pi}{1-\pi}, \forall i$.

Therefore, the FOC becomes:

$$\tau'(t)\omega u'\left(\frac{\pi}{1-\pi}\tau(t)\omega\right) = f(\omega_i)$$

Since the CRRA coefficient is higher than 1, function f is strictly decreasing in ω_i.

Indeed, $f'(\omega_i) = u'\big((1-t)\omega_i\big)+(1-t)\omega_i u''\big((1-t)\omega_i\big)$; therefore, $f'(\omega_i) < 0$ if and only if: $-\frac{(1-t)\omega_i u''((1-t)\omega_i)}{u'((1-t)\omega_i)} = CRRA\big((1-t)\omega_i\big) > 1$.

Now, suppose there is an increase exclusively in voter i's wage ω_i, that does not affect the aggregate parameters of the economy π and ω. Then, the right-hand side of the FOC decreases. Since u and τ are strictly concave functions, u' and τ' are strictly decreasing, and it must be the case that the preferred taxation $t_i^* = t(\omega_i)$ increases.

THE HETEROGENEOUS JOB SECURITY CASE WITH HIGH RISK AVERSION

Suppose now that $h(\pi_i) = h\big(\pi(\omega_i)\big)$ is an increasing function of income. Recall the first order condition:

$$\frac{\Pi}{1-\overline{\Pi}}\tau'(t)\omega u'\left(\frac{\Pi}{1-\overline{\Pi}}\tau(t)\omega\right) = h\big(\pi(\omega_i)\big)f(\omega_i) = \frac{\pi_i}{1-\pi_i}\omega_i u'((1-t)\omega_i)$$

A NUMERICAL EXAMPLE

$$u(\omega_i) = \frac{1}{1-R}{\omega_i}^{1-R}, \qquad R > 1.$$

$$\pi_i = \alpha\frac{\omega_i}{\widetilde{\omega}}, \qquad \alpha, 0 < \alpha < 1$$

Then,

$$h\big(\pi(\omega_i)\big) = \frac{\alpha\frac{\omega_i}{\widetilde{\omega}}}{1-\alpha\frac{\omega_i}{\widetilde{\omega}}} = \frac{\alpha\omega_i}{\widetilde{\omega}-\alpha\omega_i}$$

And,

$$u'(\omega_i) = {\omega_i}^{-R}$$

Thus,

$$f(\omega_i) = \omega_i((1-t)\omega_i)^{-R} = (1-t)^{-R}{\omega_i}^{1-R}$$

Therefore,

$$RHS(\omega_i) = h\big(\pi(\omega_i)\big)f(\omega_i) = (1-t)^{-R}\frac{\alpha{\omega_i}^{2-R}}{\widetilde{\omega}-\alpha\omega_i}$$

Taking derivatives,

$$\begin{aligned} RHS'(\omega_i) &= (1-t)^{-R}\frac{\alpha(2-R){\omega_i}^{1-R}(\widetilde{\omega}-\alpha\omega_i) - \alpha{\omega_i}^{2-R}(-\alpha)}{(\widetilde{\omega}-\alpha\omega_i)^2} \\ &= (1-t)^{-R}\alpha{\omega_i}^{1-R}\frac{(2-R)(\widetilde{\omega}-\alpha\omega_i)+\alpha\omega_i}{(\widetilde{\omega}-\alpha\omega_i)^2} \end{aligned}$$

Then, the sign of $RHS'(\omega_i)$ is the same as $(2-R)(\widetilde{\omega}-\alpha\omega_i)+\alpha\omega_i$.

(i) Since $(\widetilde{\omega}-\alpha\omega_i) > 0$ and $\alpha\omega_i > 0$, if $R < 2$, then $(2-R)(\widetilde{\omega}-\alpha\omega_i)+\alpha\omega_i > 0$ and $RHS'(\omega_i) > 0$.

(ii) More generally, $RHS'(\omega_i) < 0 \Leftrightarrow 2 - R < -\frac{\alpha\omega_i}{\widetilde{\omega}-\alpha\omega_i} \Leftrightarrow R > 2 + \frac{\alpha\omega_i}{\widetilde{\omega}-\alpha\omega_i} = 2 + h\big(\pi(\omega_i)\big)$

Now, $\max h\big(\pi(\omega_i)\big) = h\big(\pi(\widetilde{\omega})\big) = \frac{\alpha}{1-\alpha}$.

Therefore, if $R > 2 + \frac{\alpha}{1-\alpha}$, then it must be the case that $RHS'(\omega_i) < 0$.

NOTE: For $2 \le R \le 2 + \frac{\alpha}{1-\alpha}$, then, there exists $\widehat{\omega}$ such that:

If $\omega_i < \widehat{\omega}$, then $RHS'(\omega_i) < 0$.

If $\omega_i = \widehat{\omega}$, then $RHS'(\omega_i) = 0$.

If $\omega_i > \widehat{\omega}$, then $RHS'(\omega_i) > 0$.

More precisely, $\widehat{\omega}$ is such that $R = 2 + \frac{\alpha\widehat{\omega}}{\widetilde{\omega}-\alpha\widehat{\omega}} \Leftrightarrow \widetilde{\omega}R - \alpha\widehat{\omega}R = 2\widetilde{\omega} - 2\alpha\widehat{\omega} + \alpha\widehat{\omega} = 2\widetilde{\omega} - \alpha\widehat{\omega} \Leftrightarrow (R-2)\widetilde{\omega} = (R-1)\alpha\widehat{\omega} \Leftrightarrow \widehat{\omega} = \frac{1}{\alpha}\frac{R-2}{R-1}\widetilde{\omega}$.

Then,

$R = 2 + h\big(\pi(\widehat{\omega})\big)$ and $RHS'(\widehat{\omega}) = 0$. Since h and π are increasing functions, so is $2 + h\big(\pi(\omega)\big)$. Therefore,

If $\omega_i < \widehat{\omega}$, then $2 + h\big(\pi(\omega_i)\big) < R \Leftrightarrow R > 2 + h\big(\pi(\omega_i)\big) \Leftrightarrow RHS'(\omega_i) < 0$:

reversed preferences

If $\omega_i > \widehat{\omega}$, then $2 + h\big(\pi(\omega_i)\big) > R \Leftrightarrow R < 2 + h\big(\pi(\omega_i)\big) \Leftrightarrow RHS'(\omega_i) > 0$:

traditional preferences

THE ROLE OF AGGREGATE CONSUMER CONFIDENCE

$$\frac{\Pi}{1-\overline{\overline{\Pi}}}\tau'(t)\omega u'\left(\frac{\Pi}{1-\overline{\overline{\Pi}}}\tau(t)\omega\right) = h\big(\pi(\omega_M)\big)f(\omega_M) = \frac{\pi_M}{1-\pi_M}\omega_M u'((1-t)\omega_M) \tag{5''}$$

Let $g(\theta) = \theta u'(\theta\tau(t))$.

Then, $g'(\theta) = u'(\theta\tau(t)) + \theta\tau(t)u''\big(\theta\tau(t)\big) < 0 \Leftrightarrow 1 < -\frac{\theta\tau(t)u''(\theta\tau(t))}{u'(\theta\tau(t))} = RRA\big(\theta\tau(t)\big)$, which is true.

Thus, $g\left(\frac{\Pi}{1-\overline{\overline{\Pi}}}\omega\right) = \frac{\Pi}{1-\overline{\overline{\Pi}}}\omega u'\left(\frac{\Pi}{1-\overline{\overline{\Pi}}}\tau(t)\omega\right)$ is a decreasing function of $\frac{\Pi}{1-\overline{\overline{\Pi}}}$.

Therefore, the LHS is:

$$\tau'(t)g\left(\frac{\Pi}{1-\overline{\overline{\Pi}}}\omega\right)$$

Thus, if overall economic confidence decreases, the LHS increases.

Consider now the equilibrium policy that solves to FOC after a decrease in $\frac{\Pi}{1-\overline{\overline{\Pi}}}$:

$$\tau'(t)g\left(\frac{\Pi}{1-\overline{\overline{\Pi}}}\omega\right) = \frac{\pi_M}{1-\pi_M}\omega_M u'((1-t)\omega_M)$$

If t did not change, we would have an increase in the LHS and a decrease in the RHS, due to the shock (reducing $\frac{\pi_M}{1-\pi_M}$). This not possible. If there were a decrease in t, that would further increase the LHS and further decrease the RHS, which is also impossible. Therefore, $t = t_M$ must increase.

DISTRIBUTION OF RISK AND PREFERENCES FOR REDISTRIBUTION EXAMPLE

$$u(\omega_i) = \frac{1}{1-R}\omega_i{}^{1-R}, \qquad R > 1.$$

$$\pi_i(\beta) = \alpha\left(\frac{\omega_i}{\widetilde{\omega}}\right)^{\beta}, \qquad 0 < \alpha < 1, \qquad \beta > 0.$$

Then,

$$h(\pi(\omega_i)) = \frac{\alpha\left(\frac{\omega_i}{\widetilde{\omega}}\right)^{\beta}}{1-\alpha\left(\frac{\omega_i}{\widetilde{\omega}}\right)^{\beta}} = \frac{\alpha\omega_i^{\beta}}{\widetilde{\omega}^{\beta} - \alpha\omega_i^{\beta}}$$

And,

$$u'(\omega_i) = \omega_i{}^{-R}$$

Thus,

$$f(\omega_i) = \omega_i((1-t)\omega_i)^{-R} = (1-t)^{-R}\omega_i{}^{1-R}$$

Therefore,

$$RHS(\omega_i) = h(\pi(\omega_i))f(\omega_i) = (1-t)^{-R}\frac{\alpha\omega_i{}^{1+\beta-R}}{\widetilde{\omega}^{\beta} - \alpha\omega_i^{\beta}}$$

Taking derivatives,

$$RHS'(\omega_i) = (1-t)^{-R}\frac{\alpha(1+\beta-R)\omega_i{}^{\beta-R}\left(\widetilde{\omega}^{\beta} - \alpha\omega_i^{\beta}\right) - \alpha\omega_i{}^{1+\beta-R}\left(-\alpha\beta\omega_i^{\beta-1}\right)}{\left(\widetilde{\omega}^{\beta} - \alpha\omega_i^{\beta}\right)^2}$$

$$= (1-t)^{-R}\alpha\omega_i{}^{\beta-R}\frac{(1+\beta-R)\left(\widetilde{\omega}^{\beta} - \alpha\omega_i^{\beta}\right) + \alpha\beta\omega_i^{\beta}}{(\widetilde{\omega} - \alpha\omega_i)^2}$$

Then, the sign of $RHS'(\omega_i)$ is the same as $(1+\beta-R)\left(\widetilde{\omega}^{\beta} - \alpha\omega_i^{\beta}\right) + \alpha\beta\omega_i^{\beta}$.

(i) Since $\widetilde{\omega}^{\beta} - \alpha\omega_i^{\beta} > 0$ and $\alpha\beta\omega_i^{\beta} > 0$, if $R < 1+\beta$, then $(1+\beta-R)\left(\widetilde{\omega}^{\beta} - \alpha\omega_i^{\beta}\right) + \alpha\beta\omega_i^{\beta} > 0$ and $RHS'(\omega_i) > 0$.

(ii) More generally, $RHS'(\omega_i) < 0 \Leftrightarrow 1+\beta-R < -\frac{\alpha\beta\omega_i^{\beta}}{\widetilde{\omega}^{\beta}-\alpha\omega_i^{\beta}} \Leftrightarrow R > 1+\beta+\frac{\alpha\beta\omega_i^{\beta}}{\widetilde{\omega}^{\beta}-\alpha\omega_i^{\beta}} = 1+\beta+\beta h(\pi(\omega_i))$

Now, $\max h\big(\pi(\omega_i)\big) = h\big(\pi(\widetilde{\omega})\big) = \frac{\alpha}{1-\alpha}$.

Therefore, if $R > 1 + \beta + \beta\frac{\alpha}{1-\alpha}$, then it must be the case that $RHS'(\omega_i) < 0$.

NOTE: For $1 + \beta \leq R \leq 1 + \beta + \beta\frac{\alpha}{1-\alpha}$, then, there exists $\widehat{\omega}$ such that:

If $\omega_i < \widehat{\omega}$, then $RHS'(\omega_i) < 0$.

If $\omega_i = \widehat{\omega}$, then $RHS'(\omega_i) = 0$.

If $\omega_i > \widehat{\omega}$, then $RHS'(\omega_i) > 0$.

More precisely, $\widehat{\omega}$ is such that $R = 1 + \beta + \beta\frac{\alpha\widehat{\omega}^{\beta}}{\widetilde{\omega}^{\beta}-\alpha\widehat{\omega}^{\beta}} \iff \widetilde{\omega}^{\beta}R - \alpha\widehat{\omega}^{\beta}R = (1+\beta)\widetilde{\omega}^{\beta} - (1+\beta)\alpha\widehat{\omega}^{\beta} + \beta\alpha\widehat{\omega}^{\beta} = (1+\beta)\widetilde{\omega}^{\beta} - \alpha\widehat{\omega}^{\beta} \iff \big(R-(1+\beta)\big)\widetilde{\omega}^{\beta} = (R-1)\alpha\widehat{\omega}^{\beta}$

$$\iff \widehat{\omega} = \left[\frac{1}{\alpha}\frac{R-(1+\beta)}{R-1}\right]^{\frac{1}{\beta}}\widetilde{\omega}$$

Alternatively,

(i) If $\beta > R - 1$, then $RHS'(\omega_i) > 0$ and we have the traditional ordering.

(ii) If $\beta < (1-\alpha)(R-1)$ then $RHS'(\omega_i) < 0$ and we have the reversed ordering.

This last result follows from:

$$R > 1 + \beta + \beta\frac{\alpha}{1-\alpha} \Leftrightarrow \beta\left(1 + \frac{\alpha}{1-\alpha}\right) < R - 1 \Leftrightarrow \beta\frac{1}{1-\alpha} < R - 1 \Leftrightarrow \beta < (1-\alpha)(R-1).$$

III. Preferences for redistribution in Brazil: the 2008 World Financial Crisis, preference-ordering reversal and the 2013 street protests

This section explores a series of public opinion surveys conducted by the Latin American Public Opinion Project (LAPOP), Vanderbilt University. Every two years the LAPOP carries out the Americas Barometer survey, which currently covers 26 nations including all of North, Central and South America, and the Caribbean, including Brazil. Seven waves of surveys have been conducted for Brazil comprising the years of 2006, 2008, 2010, 2012, 2014, 2016/17 and 2018/19. In order to clearly distinguish the views of citizens on redistribution before and after the 2008 Financial Crisis, we analyze here the surveys corresponding to the years 2006 and 2014.

In order to test this paper model, we would need specific questions about the trade-off between taxation and unemployment insurance policy. A suitable question would be: “Are you willing to pay more taxes in order to increase the benefits of public unemployment insurance?” Or, symmetrically, “Are you willing to reduce the benefits of public unemployment insurance in order to reduce tax payments?”. Unfortunately, such specific questions where not found. However, there were similar questions in the 2006 and 2014 surveys regarding more general redistribution policies, that allows us to test a possible preference ordering reversal. Since, as the Online Appendix shows, policy preference ordering reversal may also occur for the pure redistribution case when redistribution targets the entire population, rather than only the citizens who remain employed, the present section presents empirical evidence of preference ordering reversal in society’s preference for redistribution, rather than in the context of unemployment policy.

THE DEPENDENT VARIABLE

The 2006 wave has a unique question that makes the tax-public policy trade-off clear. The question (PR7) is:

> “The government should provide less public services, such as health and education, in order to reduce taxes.”
>
> There were five categorical answers, going from totally disagree to totally agree.
>
> Furthermore, there was exactly one question (TD5) fitting our criterion in the 2014 wave:
>
> “Would you be willing to pay more taxes than you currently so that these taxes would be used to distribute to the poorer citizens?”
>
> There were 7 categorical answers, from “totally disagree” to “totally agree”.

All the dependent variables were re-coded in such a way that higher values mean higher support for redistribution. Therefore, for the 2006 dependent variable, the higher possible choice, 5, means “totally disagree”, whereas for the 2014 dependent variable, the higher possible choice, 7, means “totally agree”. Furthermore, the observations with “I don’t know” or no answer were removed from the corresponding sample.

THE MAIN EXPLANATORY VARIABLES

Income: The original income variable classifies respondents according to their household income brackets. There are several approaches for building our income variable. The simplest approach is to use the category classification (1 for the lowest income, 2 for the next lowest income bracket, etc.). The more precise one takes the average income in each bracket to represent the income of the corresponding respondent's household. The yet more precise approach corrects for the size of the household, separating adults from children, using the modified equivalence scales suggested by OECD[3]. Logarithm versions of the variable can also be used for the scaled income variable. The three approaches led to similar results. We present here the results of the third approach. The category classification based regressions can be obtained upon demand to the authors. The scales calculation was made according the following rule: each adult in a multi-person household counted for 0.75 and each child counted for 0.3. For example, a family of two adults and two kids has a scale of 2x0.75+2x0.3=2.1. The household income was, then, divided by the scale. This is a more precise calculation than the usual "per capita" approach. In order to build the scales, we used the following two questions in the surveys:

For the 2006 survey, "Including you, how many people live in your household?" (VS14) and "How many kids under 18 do you have" (VS15).

For the 2014 survey, "How many people live in your home presently?" (Q12C) and "How many kids under 13 live in your home?" (Q12Bn).

Note that the calculations are not precise for at least two reasons. First, for the 2006 survey, some of the kids under 18 may not live in the respondent's home. Second, the 2014 survey only considers kids under 13. We believe, however, these are reasonably good approximations for the composition of the household and the robustness of the results to other income adjustments reinforces our beliefs.

Our expectation is that there is a negative correlation between the income variable and the dependent variable if preferences follow the traditional M&R ordering. Conversely, we expect a negative correlation between these variables if there is preference ordering reversal.

THE ADDITIONAL CONTROL VARIABLES

There is a whole range of additional control variables that could help explain preferences for

[3] See "What are equivalence scales?" available in https://www.oecd.org/eco/growth/OECD-Note-EquivalenceScales.pdf, accessed January 17, 2017.

redistribution either based on extensions of this paper model[4] as well as based on a multitude of empirical studies on the topic[5].

Since the goal of this section is not to present a fully developed empirical study of the determinants of preferences for redistribution but rather an illustration of a possible preference reversal for the case of Brazil, we will not comment nor discuss in great detail these additional variables. They are, however, quickly described below.

Gender, Age, Years of schooling, Being a recipient of the Bolsa Familia conditional cash transfer (CCT) program, religiosity of the respondent. Religiosity is measured as the frequency of mass attendance. Geographic regions[6] and size of the municipality where the respondent lives. Trust in Brazilian institutions, and satisfaction with the workings of democracy. Satisfaction with the performance of the Government, and with the performance of the President. Proxies for left ideology[7] or right ideology[8]. Political interest and political sophistication (knowledge). Interest in politics and knowledge about the length of the presidential term as a proxy for Political sophistication, as well as general support for democracy. Finally, the 2014 regression significance increased with the addition of the composite variable consisting of multiplying the income variable with the southern region. Therefore, we added that variable to both regressions.

The empirical results: Preference-ordering reversal and the 2013 street protests

Due to the fact that the dependent variable changes in every wave, we run two different, independent regressions, one for year 2006 and one for the year 2014. Since the number of categories of the dependent variable also varied from five to seven, we decided to run robust

[4] Extensions not presented here for the sake of space include the effect of trust in the government and of left-right ideology. These extensions have been suggested respectively by John Nash Jr. and Kanako Yamaoka and are available upon demand. See also Holland 2018 for a recent contribution on the role trust in the government.

[5] Alesina and Giuliano 2009; Alesina et al. (2018); Beckman and Zheng 2007; Benabou and Ok 2001; Cruces et al. 2006; Dion and Birchfield 2010; Holland 2018; Luebker 2014; Lupu and Pontusson 2011; Page and Goldstein 2016; Piketty 1995.

[6] There are 5 big regions in Brazil, the northern, the northeastern, the center-western, the southeastern and the southern regions. For the sake of avoiding collinearity, the southeastern region was taken as the base region.

[7] Question ROS1 in the 2014 survey asks how much the respondent agrees with: “The Brazilian state, rather than the private sector, should be the owner of most important companies and industries in the country”. This is the proxy for leftist ideology.

[8] Question PR9 in the 2006 survey asks how much the respondent agrees with: “The less the government intervenes in the economy, the better”. This is the proxy for rightist ideology.

ordinary least square (OLS) regressions[9]. The corresponding results are presented in Table 1.

The regressions show a clear dynamic change in preference ordering. Indeed, for the initial year of 2006 we can see a positive correlation between the dependent variable and income significant at the 5% level. This supports the hypothesis of the effect of a positive economic environment: since Brazil was in a positive economic growth path, the poorer citizens did not seem to feel the need for such important provision of public good. They preferred lower taxes.

The country was severely hit by the international financial crisis in 2009, with null GDP growth. However, Lula government created an (artificial) warming of the economy, by reducing taxes on consumption goods and increasing government expenditure, which lead to a 7.5% growth in 2010. Such a GDP growth level had not happened in the country since the seventies and led many Brazilians to believe the international crisis had not reached the country, only to find out, in the following years, its real effects.

After the low growth of 2011, Brazilians became aware of the artificial growth of 2010. The 2014 surveys reflect its effect on the preference for redistribution ordering. Indeed, the regressions show now the traditional negative correlation between the dependent variable and income, compatible with M&R. In other words, the poorer a citizen is, the more government support he favors. This result, significant at the 5% level for the 2014 regression, suggests that a preference-ordering reversal has occurred, possibly because the poor citizens became aware of the severity of the world financial crisis and its damaging effects to the Brazilian economy, thereby, becoming more supportive of government programs.

The federal government, however, may not have been able to produce the improvement in public service standards that Brazilians were eager to receive. This mismatch between the citizens, who became increasingly eager for better public services, and the government, which had spent all its fiscal surpluses in engineering the artificial growth spurt of 2010, may be the reason why over a million Brazilians went to the streets during the months of June and July 2013 to demonstrate against the rise of public transportation cost and the low quality of public services[10].

[9] We also run ordered logit regressions that yielded similar results. However, the lack of overall support for the proportional odds ratio hypothesis suggested that we should maintain the OLS approach. The logit regressions are available upon request to the authors.

[10] See Bugarin and Silva 2014 for details on the 2013 street protests.

Table 1 – Income, economic confidence, economic shock and preference for redistribution: Robust OLS regressions for Brazil, 2006 and 2014

Year	2006		2014	
The main explanatory variables				
Income (log, scaled)	0.0673	**	–0.2035	**
The basic controls				
Male (gender)	–0.0083		0.1045	
Age	–0.0010		–0.0142	***
Years of schooling	0.0141		–0.0309	*
Bolsafamilia CCT recipient	0.1089	**	0.4812	***
Religiosity (Mass attendance)	–0.0304		0.0481	
The regional variables				
Northern region	0.1359		–0.1721	
Northeastern region	0.3750	***	0.6404	***
Center-western region	0.1373		0.6139	***
Southeastern region (reference)				
Southern region	0.5115		–4.7930	***
Income*Southern region	0.0054		0.6004	***
Municipality size	–0.0410		–0.0100	
The trust in institutions variables				
Trust in Brazilian institutions	–0.0409		0.1395	**
Satisfied with workings of democracy	–0.1357	**	–0.0837	
The satisfaction with the government				
Government performance evaluation	–0.0379		0.1621	***
President's performance evaluation	–0.0546		–0.0857	
The ideology variables				
Leftist ideology			0.0398	
Rightist ideology	–0.2369	***		
Political participation				
Interest in politics	0.0902	**	–0.1039	
Knows length Presidential term	0.222		0.4964	***
Support for democracy				
Supports democracy	–0.0353		–0.0287	
Constant	4.9300	***	4.0752	***
R^2	14.68		13.96	
Number of observations	983		1289	

*: Statistically significant at the 10% level

**: Statistically significant at the 5% level

***: Statistically significant at the 1% level

Source: Authors' calculations.

Regarding the additional control variables, there is strong support for redistribution from the part of recipients of the Bolsa Familia Conditional Cash transfers program, as well as from citizens living in the poorer Northeastern region. Support for redistribution also appears to be stronger among politically sophisticated citizens, either for the more interested in politics (in 2006) or the more politically knowledgeable (those who know the presidential term's length, in 2014). Conversely, older or better educated (2014) or right-oriented citizens (2006) and citizens satisfied with the workings of democracy in the country (2006) tended to favor smaller governments.

REFERENCES

Alesina, Alberto F., and Paola Giuliano. 2009. "Preferences for Redistribution." Working Paper no. 14825. Cambridge: National Bureau of Economic Research. http://www.nber.org/papers/w14825.

Alesina, Alberto, F., Stefanie Stantcheva, and Edoardo Teso. 2018. "Intergenerational mobility and preferences for redistribution." *American Economic Review* 108, n. 2: 521–54.

Beckman, Steven R., and Buhong Zheng. 2007. "The effects of race, income, mobility and political beliefs on support for redistribution." *Research on Economic Inequality* 14: 363–385.

Benabou, Roland, and Efe Ok. 2001. "Social Mobility and the Demand for Redistribution: the POUM Hypothesis." *Quarterly Journal of Economics* 116, n. 2: 447–487.

Bugarin, Mauricio, and Jose R. C. Silva. 2014. "From the *Diretas Já* to the *Passe Livre* street demonstrations: 30 years of citizen-led institutional consolidation in Brazil." *Iberoamericana* 36, n.1: 9–26.

Dion, Michelle, and Vicki Birchfield. 2010. "Economic Development, Income Inequality, and Preferences for Redistribution." *International Studies Quarterly* 54, n.2: 315–334.

Holland, Alisha C. 2018. "Diminished Expectations: Redistributive Preferences in Truncated Welfare States." *World Politics* 70, n. 4: 555–594.

Luebker, Malte. 2014. "Income inequality, redistribution, and poverty: Contrasting rational choice and behavioral perspectives." *Review of Income and Wealth* 60, n. 1: 133–154.

Lupu, Noam and Jonas Pontusson. 2011. "The structure of inequality and the politics of redistribution." *American Political Science Review* 105, n. 2: 316–336.

Meltzer, Allan H., and Scott F. Richard. 1981. "A Rational Theory of the Size of Government." *Journal of Political Economy* 89, n. 5: 914–927.

Moene, Karl O., and Michael Wallerstein. 2003. “Earnings inequality and welfare spending – A disaggregated analysis.” *World Politics* 55, n. 4: 485–516.

Page, Lionel, and Daniel G. Goldstein. 2016. “Subjective beliefs about the income distribution and preferences for redistribution.” *Social Choice and Welfare* 47, n. 1: 25–61.

Piketty, Thomas. 1995. “Social Mobility and Redistributive Politics.” *Quarterly Journal of Economics* 110, n. 3: 551–583.