Equity and efficiency effects of redistributive policies

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- Redistributive policies *may* increase raise efficiency as well as enhance equity
- Goal: to quantify the relative performance of current redistributive policies in terms of efficiency and inter/intra generational equity

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- Q4: What are the relative merits of each class of policies?

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- Stationary distribution over states

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- *Demographics* Discrete time, two-period lived agents. First period is a child (no economic decision), second period is an adult.

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- *Budget Constraint*:

$$a_{t+1} + e_t + c_t = [1 + r(1 - \tau_a)]a_t + (1 - \tau_h)w_t h_t(1 - n_t) + g_t$$

$$a_{t+1}, e_t, c_t \geq 0 \text{ and } 0 \leq n_t \leq 1$$

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  - Start with h_t , a_t
  - Decide childcare and work: n_t and $1 - n_t$
  - Children ability (θ_t) is revealed
  - Decide c_t, e_t and a_{t+1}

Household Problem at $t = 0$

Given h_0, a_0, choose c_0, a_1, e_0, n_0 to maximize

$$\max_{n_0} E_0(\max_{c_0,e_0,a_1}(U(c_0) + \max_{n_1} E_1(\max_{c_1,e_1,a_2}(\beta U(c_1) +$$
$$\ldots + \max_{n_t} E_t(\max_{c_t,e_t,a_{t+1}}(\beta^t U(c_t) + \ldots))))))$$

subject to:

$$a_{t+1} + e_t + c_t = [1 + r(1 - \tau_a)]a_t + (1 - \tau_h)w_t h_t(1 - n_t) + g_t$$

$$a_{t+1}, e_t, c_t \geq 0, 1 \geq n_t \geq 0$$

$$h_{t+1} = X(\theta_t, h_t, n_t, \tilde{e}_t)$$

$$t \geq 0$$

Recursive Representation

$$J(a,h;Z) = \max_{0 \leq n \leq 1} \int V(a,h,\theta,n;Z) d\Theta(\theta) \tag{1}$$

where

$$V(a,h,\theta,n;Z) = \max_{c,e,a'} U(c) + \beta J(a',h';Z') \tag{2}$$

subject to:

$$a' + e + c \leq [1 + r(1-\tau_a)]a + (1-\tau_h)wh(1-n) + G(a,h;Z) \tag{3}$$

$$a', e, c \geq 0 \tag{4}$$

$$Z' = \Psi(Z) \tag{5}$$

Firm

- The firm produces the final good with a CRS production function $F(K, H)$ that is strictly increasing and strictly concave.
- The first order conditions for the firm are:

$$F_K = r + \delta \tag{6}$$

$$F_H = w \tag{7}$$

Government

- Education: lump sum ($\bar{e}$) , and tuition subsidy (s^T)

$$\tilde{e} = \bar{e} + (1 + s^T)e$$

- Money Transfers: elegibility (t) , and generosity (g)

$$g_t = \max\{0, g - ty\}, y \equiv [1 + r(1 - \tau_a)]a + (1 - \tau_h)wh(1 - n)$$

$$entitled = \{(a, h) : g - ty \geq 0\}$$

$$y^* = \frac{g}{t}$$

- Non redistributive government expenditure c_g
- Expenditure is financed by τ_a and τ_h

Stationary RCE

A stationary RCE is a pair of value functions $V(a, h, \theta, n(a, h); Z)$, $J(a, h; Z)$ and policy functions $a'(a, h, \theta, n(a, h); Z)$, $c(.)$, $e(.)$, $n(a, h)$; an aggregate labor supply H and capital stock K; price functions R, W; a time-invariant policy for the government $\{t, g, t^S, \bar{e}, c_g, \tau_a, \tau_h\}$; and a stationary measure Z^* over $[a_{min}, a_{max}] \times [h_{min}, h_{max}]$ such that:

- the value and policy functions solve the households' recursive problem given R, W
- H, K satisfy firms' first order conditions given R, W

Stationary RCE - cont

- the aggregate state is consistent with individual decision rules (factor markets clear):
  - $H = \int_a \int_h h(1 - n(a,h))dZ^*$
  - $K = \int_a \int_h a dZ^*$
- the government satisfies fiscal budget constraint

$$\tau_a r K + \tau_h w H = s^T E + \bar{e} + \int_a \int_h 1_{y \leq y^*}(g - ty)dZ^* + c_g$$

$$E = \int_a \int_h \int_\theta e(a,h,\theta,n(a,h))d\Theta dZ^*$$

- the law of motion for (a,h) can be derived from the households' policy functions

Calibration: Functional Forms

- Preferences:

$$u(c) = \frac{c^{1-\sigma} - 1}{1 - \sigma}$$

- Production Function:

$$F(H, K) = H^{1-\alpha} K^{\alpha}$$

- Human Capital Production Function

$$X = A\theta h^{\gamma_1} n^{\gamma_2} \tilde{e}^{\gamma_3}$$

$$\ln(\theta) \sim N(0, \sigma_\theta^2)$$

Calibration

Parameters taken from previous studies

Parameter	Description	Value	Source
σ	risk aversion	2	literature
β	discount	$(0.93)^{25}$	literature
δ	depretiation	(1 - 0.91^{25})	literature
α	capital share	0.36	literature
τ_h	tax on human capital	0.4	literature
τ_a	tax on physical capital	0.36	literature
s_e	share of gov exp in edu	0.154	data
s_{NIT}	share of gov exp in NIT	0.071	data
t	deduction rate	0.67	legislation

Calibration - cont

Parameters calibrated to match moments

	Parameter	Value
γ_1	$X(\theta, h, n, \tilde{e})$: parental HC	0.33
γ_2	$X(\theta, h, n, \tilde{e})$: childcare time	0.12
γ_3	$X(\theta, h, n, \tilde{e})$: expenditures	0.24
A	$X(\theta, h, n, \tilde{e})$: constant	1.51
σ_θ	std dev log ability	0.45
ξ	% gov education on lump-sum	0.33

Match of the model with the data

Description	Model	US Data
Gini	0.3408	0.32
Coefficient of variation	0.6678	0.69
Mean/Median	1.2427	1.13
Skewness	1.8720	3.49
Corr($\ln(X), \ln(X_{-1})$)	0.3966	0.4
Educational Expenditure / GDP	6.71	7.02
People without bequest	46.33	45
$\frac{childcaretime}{childcaretime+worktime}$	2.5	2.63

Economy without redistributive policies

Description	No redistribution	Baseline
Distribution of earnings		
Gini	0.3198	0.3408
C.V.	0.6146	0.6678
Correlation	0.3297	0.3966
Measures of efficiency [a]		
Aggregate output	56.41	100
Average Welfare	2	1
Certainty equivalent ($\tilde{c}$)	63.36	100

[a] Welfare is computed as $EJ(a, h; Z)$ while $\tilde{c}$ solves $J(a, z; Z) = \frac{U(\tilde{c})}{1-\beta}$

Economy without redistributive policies

Description	No redistribution	Baseline
Distribution of assets		
Distribution of assets Gini	0.5548	0.6643
C.V.	1.0938	1.3477
Zero bequests (%)	28.58	46.33
Distribution of consumption		
Gini	0.2259	0.2699
C.V.	0.4228	0.5062
Corr.	0.9062	0.9160

Targeting Money Transfers

Change the deduction rate t holding constant s_{NIT}.

t^{NIT}	0.0	0.33	0.5	0.67*	1.0
Distribution of earnings					
Gini	0.3197	0.3319	0.3377	0.3408	0.3720
C.V.	0.6159	0.6586	0.6667	0.6678	0.6957
Corr.	0.3285	0.3947	0.4069	0.3966	na
% on welfare	100	40.33	29.44	26.62	10.31
Distribution of assets					
Gini	0.5428	0.6742	0.6662	0.6643	0.5933
C.V.	1.0585	1.3714	1.3494	1.3477	1.1509
Zero bequests (%)	23.99	46.84	46.51	46.33	35.8
Distribution of consumption					
Gini	0.2080	0.2803	0.2722	0.2699	0.2191
C.V.	0.3939	0.5186	0.5083	0.5062	0.4103
Corr.	0.9078	0.9229	0.9218	0.9160	0.8371
Measures of efficiency					
Aggregate output	106.03	99.39	99.87	100	105.18
Average welfare	1	5	4	3	2
Certainty equivalent	106.07	99.22	99.91	100	105.40

Targeting Educational Transfers

Change ξ holding constant s_E.

% Equalization	0	25	33*	50	75	100
Distribution of earnings						
Gini	0.3576	0.3477	0.3408	0.3264	0.2975	0.2758
C.V.	0.6894	0.6735	0.6678	0.6297	0.5838	0.5308
Corr.	0.4617	0.4174	0.3966	0.3417	0.2685	0.2378
% on welfare	22.83	24.17	26.62	24.88	27.58	25.89
Distribution of assets						
Gini	0.6340	0.6489	0.6643	0.6376	0.6278	0.6146
C.V.	1.2544	1.2996	1.3477	1.2489	1.2183	1.1900
Zero bequests (%)	43.57	45.12	46.33	45.02	44.51	43.22
Distribution of consumption						
Gini	0.2610	0.2632	0.2699	0.2468	0.2245	0.2186
C.V.	0.4793	0.4887	0.5062	0.4493	0.4070	0.4002
Corr.	0.9152	0.9113	0.9160	0.8925	0.8483	0.8126
Measures of efficiency						
Aggregate output	102.98	102.41	100	101.62	101.88	105.87
Average welfare	4	5	6	3	2	1
Certainty equivalent	102.17	102.02	100	101.86	101.97	104.94

Money versus Education

Change s_E holding constant $s_R = s_{NIT} + s_E$

% Edu	0	25	50	68*	75	100
Distribution of earnings						
Gini	0.3710	0.3683	0.3499	0.3408	0.3382	0.3205
C.V.	0.7347	0.7244	0.6873	0.6678	0.6528	0.6108
Corr.	0.4897	0.4642	0.4146	0.3966	0.3743	0.3243
% on welfare	49.27	44.01	35.16	26.62	20.59	0
Distribution of assets						
Gini	0.7973	0.7247	0.6976	0.6643	0.6295	0.5209
C.V.	2.6252	1.5355	1.4383	1.3477	1.2413	1.0034
Zero bequests (%)	64.35	59.84	53.66	46.33	41.95	22.65
Distribution of consumption						
Gini	0.3055	0.2763	0.2705	0.2699	0.2519	0.2009
C.V.	0.8426	0.5173	0.5025	0.5062	0.4629	0.3823
Corr.	0.9139	0.9125	0.8996	0.9160	0.9074	0.9045
Measures of welfare						
Aggregate output	38.52	62.68	85.91	100	105.81	127.30
Average welfare	6	5	4	3	2	1
Certainty equivalent	43.91	69.40	89.83	100	104.50	120.08

Money versus Education

Change s_E holding constant $s_R = s_{NIT} + s_E$ when $t = 0$

% Edu	0	25	50	68	75	100
Distribution of earnings						
Gini	0.3257	0.3243	0.3211	0.3197	0.3237	0.3205
C.V.	0.6229	0.6225	0.6161	0.6159	0.6189	0.6108
Corr.	0.3312	0.3274	0.3251	0.3285	0.3280	0.3243
% on welfare	100	100	100	100	100	0
Distribution of assets						
Gini	0.5571	0.5604	0.5318	0.5428	0.5346	0.5209
C.V.	1.0884	1.0973	1.0341	1.0585	1.0350	1.0034
Zero bequests (%)	32.10	27.16	24.47	23.99	23.34	22.65
Distribution of consumption						
Gini	0.2046	0.2065	0.1987	0.2080	0.2072	0.2009
C.V.	0.3736	0.3857	0.3740	0.3939	0.3905	0.3823
Corr.	0.8978	0.9078	0.9105	0.9078	0.9108	0.9045
Measures of efficiency						
Aggregate output	45.24	66.46	88.18	100	104.79	120.06
Average welfare	6	5	4	3	2	1
Certainty equivalent	51.82	72.66	91.25	100	103.18	113.20

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- Incentive compatibility (government and family)?