Economic Growth in a Cooperative Economy

Thomas Brzustowski and Francesco Caselli

Backlash against Capitalism

- Politics
  - Leftward shift (of leftist parties)
  - Re-legitimization of "socialism"
- Academia and Public Intellectuals
  - Tsunami of "Crisis of Capitalism" books
  - Proposals to reform corporate governance
    - Employee role in management ("Democratizing Work")
    - Dropping "shareholder value"
    - Rethinking the corporation's purpose

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    - Dynamic challenge: Capital accumulation
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  - Qualitative features of growth path and steady state

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  - Qualitative features of growth path and steady state
  - Quantitative comparison with corporation-based economy

Economic Literature on Cooperatives

- Cooperative size and static efficiency in PE
  - Ward (1958, 1967), Domar (1966), Hansmann (1996)
- Existence and Pareto Optimality in GE
  - Vanek (1970), Laffont and Moreaux (1983), Dreze (1989)
- Worker heterogeneity and incentives
  - Kremer (1997), Levin and Tadelis (2005)
- Pooled Investment
  - Rey and Tirole (2007)
- Consumer cooperatives
  - Hart and Moore (1996, 1998)

Institutional Differences

	Capitalism	Cooperativism
Firm objective	max profits	max utility
Capital ownership	individuals	cooperatives
Capital market	yes	no
Labour market	yes	yes
Product market	yes	yes
Free entry	yes	yes

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- Problem: present bias
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- Modelling implication
  - Two-period OLG framework
    - Infinite horizon alternatives either very complicated (tracking workers through cooperatives) or uninteresting (lifetime attachment)

Physical Environment

- Demographics: constant cohorts of measure L
- Life cycle: work as Y, consume as Y and O
- Preferences: $U(c^Y, c^O)$
- Technology: $F(k, l)$

Capitalist Economy

- Firms

$$\max_{k,l}\{F(k,l) - r_t k - w_t l\}$$

- Consumers

$$\max_{c_t^Y, c_{t+1}^O} U(c_t^Y, c_{t+1}^O)$$

$$c_t^Y = w_t - \kappa_{t+1}$$
$$c_{t+1}^O = r_{t+1}\kappa_{t+1}$$

- Market clearing and free entry

Cooperative concept

- Coop with l_t young workers, l_{t-1} former workers, capital k_t

$$c_t^Y = \frac{F(k_t, l_t) - T_t - k_{t+1}}{l_t}$$

$$c_{t+1}^O = \frac{T_{t+1}}{l_t}$$

- Simplifying assumption

$$T_t = \tau F(k_t, l_t)$$

  - Literal interpretation: legal requirement, articles of association
  - Broader interpretation: inter-generational social security game
  - Removes l_{t-1} as a state variable

Investment decision

- Coop with l_t young workers, capital k_t

$$\max_{k_{t+1}} U(c_t^Y, c_{t+1}^O)$$

$$c_t^Y = \frac{(1-\tau)F(l_t, k_t) - k_{t+1}}{l_t}$$

$$c_{t+1}^O = \frac{\tau F(l_{t+1}, k_{t+1})}{l_t}$$

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- Next: Determination of l_t, l_{t+1} (allocation mechanism)

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- Production, Investment decision, Payments to young and old workers

Equilibrium selection

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- Implication

$$\big(\mathcal{L}(k_{it}), \mathcal{K}(k_{it})\big) \in \arg\max_{l,k} U\left(\frac{(1-\tau)F(l, k_{it}) - k}{l}, \frac{\tau F\big(\mathcal{L}(k), k\big)}{l}\right)$$

- k and l trade offs

Example

- Technology (Incumbents)

$$F(k,l) = Ak^{\alpha}(l - \underline{l})^{\beta} \quad \alpha + \beta < 1$$

  - Fixed cost
  - Decreasing returns to variable inputs
  - (Entrants use some technology $G(l)$)

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- Preferences

$$U(c^Y, c^O) = \log c^Y + \delta \log c^O$$

Capitalist equilibrium

$$l_t = \frac{1-\alpha}{1-\alpha-\beta}\underline{l} \equiv l_{cap}$$

$$\kappa_{t+1} = \frac{\delta}{1+\delta} A(1-\alpha)^{\alpha}\beta^{\beta}\left(\frac{1-\alpha-\beta}{\underline{l}}\right)^{1-\alpha-\beta}\kappa_t^{\alpha}$$

Cooperative Equilibrium

$$l_t = \frac{1+\delta}{1+\delta-\beta(1+\delta\alpha)}\underline{l} \equiv l_{coop}$$

$$k_{t+1} = \frac{\delta\alpha}{1+\delta\alpha}(1-\tau)A\left(\frac{\beta(1+\delta\alpha)}{1+\delta-\beta(1+\delta\alpha)}\underline{l}\right)^{\beta} k_t^{\alpha}$$

Steady state convergence

- Subject to restrictions on $G(l)$ ... ▸ Details
- ... For any initial $\{k_{i0}\}$ converge to steady state with
  - $l_i^* = l_{coop}$, all i
  - $k_i^* = k^*$ of law of motion above

Firm Size and Static Efficiency

- Static social planner problem

$$\max_{l} \quad \frac{L}{l} F\left(\frac{K}{L/l}, l\right)$$

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- Coops inefficiently small

$$l_{eff} = l_{cap} \geq l_{coop}$$

$$\text{equiv.} \quad Z_{eff} = Z_{cap} \geq Z_{coop}$$

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- Sources of inefficiency
  - $\delta = 0$

$$l_{eff} = \frac{1-\alpha}{1-\alpha-\beta}\underline{l} \geq \frac{1}{1-\beta}\underline{l} = l_{coop}$$

  - $\alpha = 0$

$$l_{eff} = \frac{1}{1-\beta}\underline{l} \geq \frac{1+\delta}{1+\delta-\beta}\underline{l} = l_{coop}$$

Capital Accumulation and Dynamic Efficiency

- Golden Rule saving

$$\max_{s}\{Y_{eff}(L,K) - sY_{eff}(L,K)\} \quad s.t. \quad K = sY_{eff}$$

  - $s_{gold} = \alpha$
- Equilibrium saving rates
  - $s_{cap} = \frac{\delta}{1+\delta}(1-\alpha)$
  - $s_{coop} = \frac{\delta\alpha}{1+\delta\alpha}(1-\tau)$

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- Equilibrium saving rates
  - $s_{cap} = \frac{\delta}{1+\delta}(1-\alpha)$
  - $s_{coop} = \frac{\delta\alpha}{1+\delta\alpha}(1-\tau)$
- Cooperative economy dynamically efficient

$$s_{coop} \leq s_{gold}$$

Steady State Output

- If symmetric steady state

$$\frac{Y^*}{L} = (s^*)^{\frac{\alpha}{1-\alpha}} (Z^*)^{\frac{1}{1-\alpha}}$$

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- Recall
  - $Z_{coop} \leq Z_{cap}$
  - $s_{coop} \leq or \geq s_{cap}$

Quantification (log utility case)

Parameter	Target	Data	Value
α	rK/Y	0.33	0.33
β	$\underline{I}/I$	0.18	0.55
δ	K/Y	3/25	0.22

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τ	Max U		0.12

Quantitative implications (log utility case)

$\frac{I_{coop}}{I_{cap}}$	0.35
$\left(\frac{Z_{coop}}{Z_{cap}}\right)^{\frac{1}{1-\alpha}}$	0.78

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s_{cap}	0.12
s_{coop}	0.06
$\left(\frac{s_{coop}}{s_{cap}}\right)^{\frac{\alpha}{1-\alpha}}$	0.71

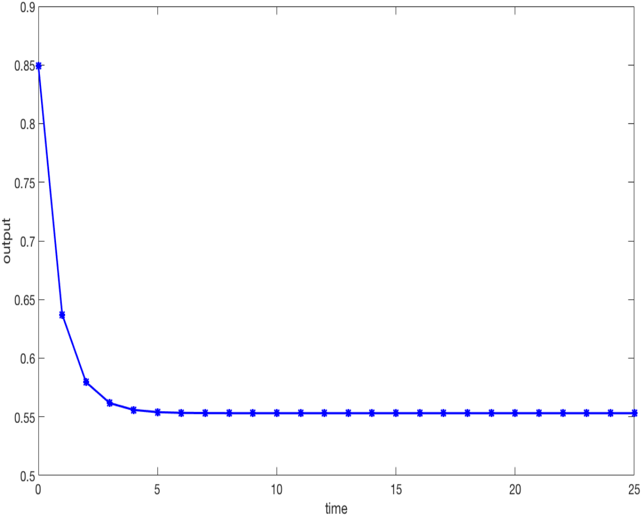
Quantitative implications (log utility case)

$\frac{l_{coop}}{l_{cap}}$	0.35
$\left(\frac{Z_{coop}}{Z_{cap}}\right)^{\frac{1}{1-\alpha}}$	0.78
s_{cap}	0.12
s_{coop}	0.06
$\left(\frac{s_{coop}}{s_{cap}}\right)^{\frac{\alpha}{1-\alpha}}$	0.71
$\frac{Y_{coop}}{Y_{cap}}$	0.55

Thought Experiment

- at t_0 capitalist steady state
- at t_1 capital redistributed to $N = L/l_{coop}$ cooperatives

Dynamics of Output



Welfare Loss

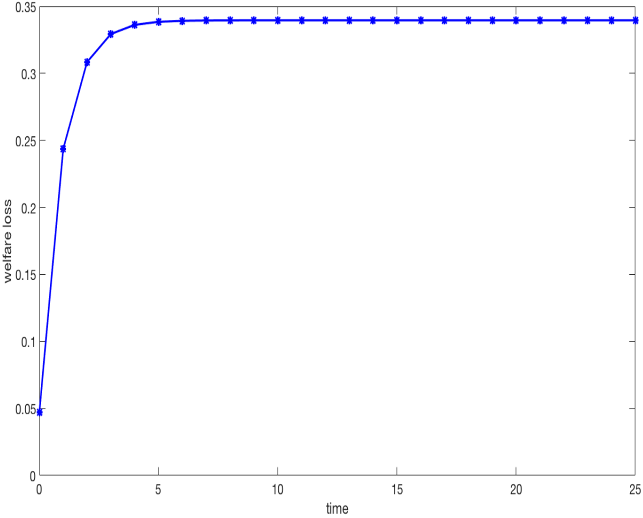
- Equivalent variation

$$U(c^Y_{t,coop} + X_t, c^O_{t+1,coop} + X_t) = U(c^Y_{*,cap}, c^O_{*,cap})$$

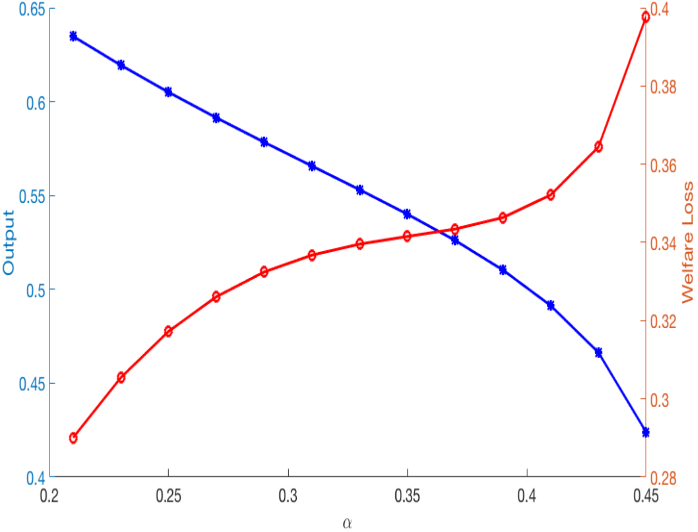
- Welfare loss

$$2X_t/(c^Y_{*,cap} + c^O_{*,cap})$$

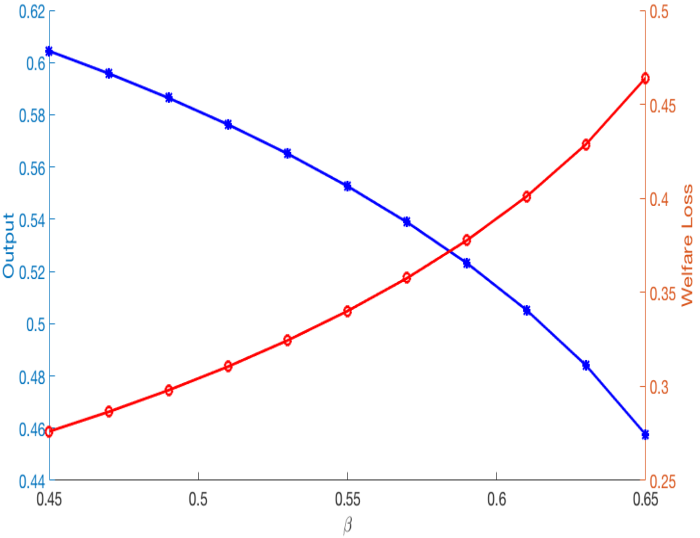
Dynamics of Utility



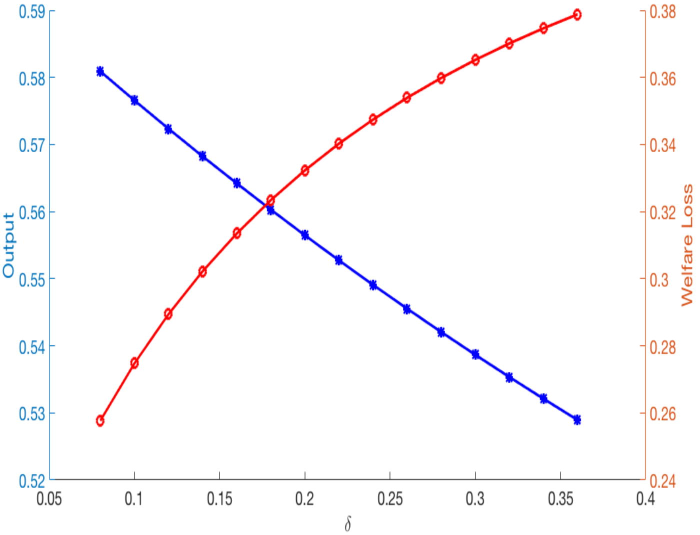
Robustness: α



Robustness: β



Robustness: δ



Example 2

Same technology but

$$U(c^Y, c^O) = \frac{(c^Y)^{1-\sigma}}{1-\sigma} + \delta \frac{(c^O)^{1-\sigma}}{1-\sigma}$$

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$$\sigma = 2$$

Calibration

			log	IES $=2$
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Quantitative Implications

	log	IES $= 2$
$\left(\frac{Z_{coop}}{Z_{cap}}\right)^{\frac{1}{1-\alpha}}$	0.78	0.69
$\left(\frac{s_{coop}}{s_{cap}}\right)^{\frac{\alpha}{1-\alpha}}$	0.71	1.05
$\left(\frac{Y_{coop}}{Y_{cap}}\right)$	0.55	0.73

Conclusions

- Dynamic extension of models of cooperative production
- To do (this paper)
  - Institutional variations
    - Inter-cooperative capital market
    - Self-management with private ownership
  - Coexistence
  - Money, Social Security
  - Endogenize τ
- To do (next paper(s))
  - Richer model with microeconomic heterogeneity
  - Quantify inequality-efficiency trade off

Restrictions on $G(l)$

- Assumption 1: $\mathcal{U}_e \leq \mathcal{U}(k^*_{coop})$
- Assumption 2: $\mathcal{L}_e \geq l_{coop}$
- Assumption 3: $\mathcal{U}_e \leq \mathcal{U}\left(\mathcal{K}_e\right)$
- Example

$$F(0, l) = B(l - \underline{l}_e)^\gamma,$$

  - For 1 and 3: B small
  - For 2:

$$\gamma \in \left(0, (1+\alpha)/(1+\alpha\delta)\right),$$

$$\underline{l}_e \geq \left[1 + \delta - \gamma(1+\alpha\delta)\right] / \left[1 + \delta - \beta(1+\alpha\delta)\right] \underline{l}$$

◂ Back