A Pareto Efficiency Rationale for the Welfare State

Dilip Mookherjee and Stefan Napel

Ascea Summer School in Development Economics
June 2014
When countries develop and increase their capacities to provide safety nets and basic needs, questions arise about the scope and nature of such systems:

- What kinds of support should be phased out?
- Which ones need to be retained and/or augmented?

What kind of welfare state to aim for in the long run?
Public support varies a lot, e.g., between Europe and US.
There’s strong disagreement re. public provision/subsidies in health, food or unemployment, esp. in the US.
But need for some kind of public support for primary and secondary schooling seems accepted universally.
What is the theoretical argument underlying this?

Is there an *efficiency*-based rationale for public education/subsidies which applies irrespective of the state of development? Irrespective of preferences for redistribution?
Arguments for underinvestment in human capital are usually based on credit market failures (e.g., Friedman 1955, Loury 1981, Ljungqvist 1993, Galor & Zeira 1993)

However, none of these models show the existence of feasible *Pareto-improving* interventions involving public subsidies for education (only *welfare-improving* ones involving some redistribution)
Mookherjee & Ray (2003) showed: Despite absence of educational loan markets, there always exist steady states that are constrained efficient, and even unconstrained efficient (under suitable assumptions)

Intuition:
If the country is sufficiently ‘developed’, enough parents can afford to educate their kids

In that model, there also exist ‘less developed’ steady states with underinvestment
Does this suggest arguments for public education support are conditional on level of development?

Or is something missing in the model?

In this paper, we argue something essential was missing: heterogeneity of learning abilities.

Once we incorporate such heterogeneity, there is an argument for Pareto-improving public subsidies for education, irrespective of history or state of development.
Other Reasons why Ability Heterogeneity is Important

- Essential to explain mobility in steady state
- Cuts down the set of steady states drastically when there are important indivisibilities in investment, and allows local comparative statics need for policy analysis (Mookherjee & Napel 2007)
- There are other ways of generating locally determinate steady states, e.g., divisible investments or ex post heterogeneity in investment returns (Mookherjee & Ray 2003; Banerjee & Newman 1993, Bénabou 2002)
- But it’s not possible/easy to obtain generic inefficiency in such models (as far as we know)

Calibrated models fitted to US/Mexican data examine effects of education subsidies funded by income taxes (Abbott, Gallipoli, Meghir & Violante 2013, Heathcote 2003, Cespedes 2011).

No clear theoretical result concerning (in)efficiency of laissez faire.

Exception: Bénabou (1996) shows asymptotic inefficiency.
Considerable debate in both developed and developing countries (e.g., conditional vs unconditional cash transfers)

Traditional ‘public economics’ argument in favor of cash: Pareto-dominate in-kind transfers if citizens know what is best for themselves (Friedman, Tobin)

Formalized by optimal taxation models (MIRRLEES 1971, ATKINSON & STIGLITZ 1976)
Cash vs In-Kind Transfers: contd.

- These are static models, with no effects on investment incorporated.
- Cannot address long run ‘supply-side’ concern that transfers to the poor undermine investment incentives and breed ‘welfare dependence’.
Such concerns are less severe when transfers are conditioned on investments.

Empirical papers assessing effects of CCTs relative to UCTs in Mexico (Cespedes 2011) show positive macro and welfare effects where majority of households were better off; but not all.

**Question:** Can CCTs be designed to generate Pareto improvements over UCTs? For what kinds of preferences and technology?
This Paper

- OLG model, altruistic parents invest in education of their children, whose learning abilities are heterogeneous and privately observed
- Parents cannot borrow against children’s income to finance these investments; cannot insure against ability risk
- Baseline model: Barro-Becker altruism; two occupations; no financial bequests
- Abstract from endogenous labor supply, productivity/income risk
- Fiscal policy: transfers conditioned on parent’s income and educational investments
Main Results in Baseline Model

1. Laissez faire competitive equilibria outcomes are (interim-) Pareto dominated by fiscal policy where education subsidies for parents in any occupation are funded by income/consumption taxes on the same occupation.

2. Fiscal policies consisting of income-based transfers alone are (interim-) Pareto dominated by transfers that condition on education expenditures.

In both cases, there are also macroeconomic improvements.
Outline

1 Baseline Model
2 Extensions
   • Paternalistic Altruism
   • Continuous Investment
   • Financial Bequests
Two occupations: unskilled and skilled ($c \in \{0, 1\}$)

Continuum of households: $i \in [0, 1]

Each household has one adult and one child in each generation $t = 0, 1, 2, \ldots$

Utility of adult in household $i$ in generation $t$:
$$V_{it} = u(k_{it}) + \delta V_{i,t+1}$$

$\delta \in (0, 1)$, $u$ strictly increasing, strictly concave, smooth; $u \to -\infty$ as $c \to -\infty$
Household Consumption and Investment

- Household in occupation $c$ earns $w_{ct}$ in period $t$
- Decides investment $I_{ct} \in \{0, 1\}$ in child’s education, financed out of earnings
  \[ \Rightarrow \text{consumes } w_{ct} - I_{ct}x, \text{ where } x \text{ is education cost borne} \]
- Talent heterogeneity:
  $x$ is i.i.d. with smooth c.d.f. $F$ with full support on $[0, \infty)$
- Draw of $x$ observed by parent before deciding $I_{ct}$; remains private information of $i$
Firms and Production

- CRS production function $G(\lambda_t, 1 - \lambda_t)$, where $\lambda_t$ is proportion of educated agents at $t$
- Wage $w_t$ equals marginal product of worker $g_c(\lambda_t)$ in occupation $c$; smooth; $g_1$ decreasing; $g_0$ increasing
- Educated workers can work in either occupation; uneducated only in unskilled
$w_{1t}(\lambda_t)$

$g_0(\lambda_t)$

$g_1(\lambda_t)$

$w_{0t}(\lambda_t)$

$g_c(\bar{\lambda})$
Government observes parent’s income/occupation and investment decision

- Transfers conditioned on income: \( \tau_{ct} \)
- Transfers conditioned on education investment: \( e_{ct} \)
- The government must balance its budget at every \( t \)
- “Laissez faire” corresponds to \( \tau_{ct} \equiv e_{ct} \equiv 0 \)
A dynamic competitive equilibrium (DCE) given fiscal policy
\( \{ \tau_{1t}, \tau_{0t}, e_{0t}, e_{1t} \}_{t=0,1,2,...} \) is \( \{ \lambda_t, l_{1t}(x), l_{0t}(x) \}_{t=0,1,2,...} \) s.t.

1. investment decisions \( l_{ct} \) maximize individual utility under correctly anticipated competitive wages

2. period \( t - 1 \) investments aggregate to skill proportion \( \lambda_t \)
Interim Pareto dominance:
\[ W_{ct} \equiv E_x V_t(c, x) \] higher for every \( c, t \)

Macroeconomic dominance:
investment threshold \( x_{ct} \) higher for every \( c, t \)
\[ \rightarrow \] higher p.c. education, income, upward mobility; lower market wage inequality
Complex Effects of Fiscal Policy

- Consumption utility sacrifice of investment is lowered by income-based transfers and education subsidies, especially for poor households.
- Such redistribution also lowers benefits of investing.
  → Net effects of redistribution are very ambiguous.
- Additional complexity arises from:
  - dynamic GE effects: greater skill supply lowers wage gap, which further lowers investment benefits.
  - effects on consumption insurance (w.r.t. x shocks).
Inefficiency of Laissez Faire Outcome

Theorem

Consider any laissez faire DCE starting from an arbitrary skill ratio $\lambda_0$ at $t = 0$. There exists a balanced budget fiscal policy with educational subsidies for each occupation funded by income taxes, and an associated DCE which interim Pareto as well as macroeconomically dominates the original DCE.
Theorem

Consider any DCE given an initial skill ratio $\lambda_0$ and a balanced budget fiscal policy consisting of income transfers alone ($e_{ct} = 0$ for all $c, t$), satisfying:

(a) income transfers are weakly progressive
(b) post-transfer skilled income still exceeds unskilled income, and
(c) transfers $\tau_{ct}$ are uniformly bounded.

Then there exists another such policy with income transfers combined with educational subsidies ($e_{ct} > 0$ for all $c, t$) and an associated DCE which interim-Pareto as well as macroeconomically dominates the original DCE.
Underlying Idea

- Parents finance investment at the expense of consumption and bear ‘ability’ risk: consumption varies with $x$ realization.
- Those with low $x$ realization have investment opportunity, those with high don’t.
- Ideally those with investment opportunity should borrow from those without, but cannot.
- Educational subsidy eases financing constraints; income tax on same occupation smooths consumption without complex redistribution effects.
Consumption Variations w.r.t. Child Ability, with $e_{ct} \equiv 0$
Outline of the Argument

- **Step 1:** Vary transfers for occupation $c$: raise $e_{ct}$ by amount $\epsilon(1 - \mu_t)$, lower $\tau_{ct}$ by $F(x_{ct})\epsilon$, for small $\epsilon > 0$
- If $\mu_t = 0$ this would reduce spread of consumption of occupation $c$ in a mean-preserving way (assuming household behavior is unchanged)
- Construct $\mu_t$ in such a way to ensure interim expected utility of consumption of occupation $c$ households is unchanged
Effects of Steps 1 and 2 of Fiscal Policy Variation on Parental Consumption

\[
\begin{align*}
  w_{ct} - I_t(c,x) \cdot x \\
  w_{0t} - x_{0t} \\
  w_{1t} \\
  c=0 \\
  c=1 \\
  0 \\
  x_{0t} \\
  x_{1t}
\end{align*}
\]
Effects of Steps 1 and 2 of Fiscal Policy Variation on Parental Consumption

\[ w_{ct} + \tau_{ct} = I_t(c,x) \cdot (x - e_{ct}) \]

Mookherjee-Napel
Rationale for Welfare State
Outline of the Argument, contd.

Suppose for the time being, wages are unchanged

- Future return from education is unchanged, so behavior of households in the other occupation \( d \neq c \) remains unchanged
- In occupation \( c \), increase in investment owing to higher education subsidy
- Change in investment behavior of occupation \( c \) households was endogenous response, so by Envelope Theorem continues to have zero first-order effect on their utility
Outline of the Argument, contd.

- **Step 2:** Vary fiscal policy to neutralize changes in market wages, to ensure that after-tax wages faced by households remain unchanged.

- Then we have a DCE with higher skill ratio and utilities unchanged at every date.

- **Step 3:** Check that government budget surplus improves since:
  - Tax system is progressive and there are fewer unskilled now.
  - $\mu_t > 0$, i.e., we lowered mean transfer to occupation $c$.
  - Wage neutralization policy has zero first-order effect owing to CRS in production.
We have therefore constructed a variation which results in zero first-order effect on utility, and positive first-order effect on skill ratio and net revenues.

**Step 4:** Vary fiscal policy one more time to distribute increased revenues back to households in a way that raises their utility uniformly, without altering utility differentials (and education incentives).

Last step preserves investment decisions of households, and we are done.
Extensions

(1) Paternalistic altruism: Parents trade off own consumption and child *income*

(2) Continuous education choices:  
\[ e_t \in [0, \bar{e}] \] with wages \( w_t(e_t) \) and investment cost \( l(e_t; x) \)

(3) Financial bequests:  
Option to transfer wealth from \( t \) to \( t + 1 \) with exogenous rate of return

- Findings generalize to (1)–(2) rather straightforwardly
- Inefficiency finding extends to (3), but optimal fiscal policy concerning very rich parents is the opposite of before
Summary

- Provided arguments for a welfare state based on the Pareto criterion, and for transfers to the poor to be conditioned on education investments.
- Main role is to provide insurance against ability risk, which is not typically available on private markets.
- Alternatively view their role as providing a way for ‘non-investors’ to finance investment expenditures of ‘investors’.
- Argument for educational subsidies restricted to poor households that leave no financial bequests.
- Empirical significance of this group: in the US calibrated model of Abbott et al. (2013) shows bottom one-third of the population falls in Case B, while top 5% are in Case A.
Future Work

- To what extent do the results extend when we incorporate
  - labor supply
  - income risk
  - intra-family correlation in ability?

- Analogous arguments for investment subsidies for liquidity constrained firms which are funded by taxes on such firms?
Paternalistic altruism (Becker & Tomes 1979): $I_{ct}(x)$ maximizes

$$u(w_{ct} - lx) + \delta Y(w_{l,t+1})$$  \hspace{1cm} (1)

where $Y$ is strictly increasing, concave

Extension is straightforward:
- consumption varies with child ability just as before
- wage neutralization preserves benefits of investment
Extension 2: Continuous Investment

- Education choice \(e \in E \equiv [0, \bar{e}]\) yields wage \(w(e)\)
- Education cost \(I(e; x)\) is parameterized by learning cost parameter \(x\)
- \(I\) is increasing, differentiable;
  \(I(0, x) \equiv 0; I_{ex} > 0; I_e \rightarrow \infty\) as \(x \rightarrow \infty\)
- Optimal investment behavior gives rise to similar non-monotone pattern of consumption variation w.r.t. \(x\); then same argument as in the indivisible case works
Namely, $e$-educated parent who faces parameter $x$ solves

$$V(e|x) \equiv \max_{0 \leq e' \leq \bar{e}} \left[ u(w(e) - l(e'; x)) + \delta W(e') \right]$$

where $W(e') = E\tilde{x} V(e'|x)$

The optimal investment policy is:

$$e'(e; x) \begin{cases} = 0 & \text{if } x \geq x^*(e) \text{ or } x = 0, \\ > 0 & \text{otherwise} \end{cases}$$

with $x^*(e)$ defined by $\partial l(0; x^*(e))/\partial e' = \delta W'(0)/u'(w(e))$

→ Qualitatively same consumption pattern as in baseline
Extension 3: Financial Bequests

- Allow parents to supplement human capital investments with financial bequests (as in Becker & Tomes 1979)
- Let rate of return $r$ on financial bequests be exogenous
- Two occupations again
- Paternalistic altruism: parent with wealth $W$ and cost $x$ chooses financial bequest $b \geq 0$ and education investment $I \in \{0, 1\}$ to maximize

$$u(W - b -Ix) + \delta Y(W')$$

- $Y$ is a strictly increasing and strictly concave function of the child’s future wealth

$$W' = (1 + r)b + lw_1 + (1 - l)w_0$$
Reformulate as follows:
Parent chooses transfer to child $C(W; x) \geq 0$ to maximize $u(W - C) + \delta Y(R(C; x))$, where

$$R(C; x) = \begin{cases} (1 + r)(C - x) + w_1 & \text{if } C > x \text{ and } \frac{w_1 - w_0}{x} > 1 + r, \\ (1 + r)C + w_0 & \text{otherwise} \end{cases}$$

Nonconvex budget set if the child is smart enough s.t. rate of return on education exceeds $r$
Budget Sets $R(C; x)$

\[ R(C; x') = \frac{w_1 - w_0}{1 + r} \]

\[ R(C; x''') = \frac{w_1 - w_0}{1 + r} \]

\[ R(C; 0) = \frac{w_1 - w_0}{1 + r} \]

\[ R(C; \infty) = \frac{w_1 - w_0}{1 + r} \]

\[ x^* = \frac{w_1 - w_0}{1 + r} \]
Sufficiently wealthy parents leave financial bequests always (Case A)

\[ R(C; x) \]

\[ C^*(x \mid W >> w_1) \]
Poor parents never leave financial bequests (Case B)
Consumption of Case A and Case B parents

\[ W - C^*(x \mid W \gg w_1) \]

\[ w_0 - C^*(x \mid W = w_0) \]

\[ w_0 - x' \]

0
Our previous arguments do not apply to Case A parents.

However they apply in reverse form:
An educational tax on Case A parents that funds an income tax rebate for them will raise their interim utilities.

Previous arguments continue to apply to Case B parents.
This implies that laissez faire continues to be inefficient

A Pareto-improving fiscal policy:
- Provide educational subsidies to Case B funded by income taxes on them
- Do reverse policy for Case A parents

Macro effects: ambiguous in general

The policy could be designed to leave aggregate skill ratio unchanged, or increased

Compositional effects will raise aggregate efficiency further