

Lectures on Fertility, Education, Growth, and Sustainability

3c. Population policy

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Optimal Fertility (1)

In many countries,
fertility \neq
perceived optimal fertility

→ natalistic policies
(e.g. family benefits)
in Europe.



Optimal Fertility (2)

→ population control in China - one-child policy



[Sweet Achievement]

Optimal Fertility (3)

We do not question the notion of optimal fertility.

Assumption: It is meaningful to aim at a fertility rate that would be judged optimal.

Question: How to reach such a desired level.

We suggest tradable procreation rights.

Let us explore this idea.

→ it will give insights on some properties of the endogenous fertility model.

Tradable quotas, not a new idea

Widely implemented to combat

- air pollution [Clean Air Act Amendments]
- overproduction [milk quotas in the EU]
- overexploitation of natural resources [individual fishing quotas].

Proposed in other areas - not implemented:

- inflation control (Lerner & Colander, 1980)
- asylum policy (Schuck & Hathaway and Neve, 1997)
- deficit control (Casella, 1999).
- airport noise reduction (Bréchet & Picard 2006)
- population control (Boulding, 1964)

Boulding's proposal

Context: Anxiety that earth may not be able to sustain an ever increasing population.

Proposal (1964: 135-136):

I think in all seriousness, however, that a system of marketable licenses to have children is the only one which will combine the minimum of social control necessary to the solution to this problem with a maximum of individual liberty and ethical choice...We would then set up a market in which the rich and the philoprogenitive would purchase licenses from the poor, the nuns, the maiden aunts, and so on.

Other aspects

- long-run tendency toward **equality in income**: the rich would have many children and become poor and the poor would have few children and become rich.
- The price of the certificate would reflect the general desire in a society to have children.

Introducing procreation rights

Fertility objective: ν children per person on average in the economy.

The objective should be biologically feasible:

Assumption

$$0 < \nu < \frac{1}{\phi}. \quad (\text{C1})$$

We can think to apply such an objective to a country, or at the global level (more interesting?)

Implementation Sequence inside a country

	Allowances (price $g_t \geq 0$)	Exemptions (price $q_t \geq 0$)
<i>At majority</i>	receives ν rights	
<i>At each birth</i>	cedes back one right	if number births $> \nu$ receives 1 right
<i>At menopause</i>		if $n_t < \nu < 0$ gives back $\nu - n_t$ rights
<i>Over complete life</i>	Procreation and exemption rights can be sold and purchased	

Take the benchmark model - interpret agents as households or as countries

The budget constraint for an adult becomes:

$$c_t^i = [\omega^i(1 - \phi n_t^i) - n_t^i e_t^i] + g_t(\nu - n_t^i) + q_t(n_t^i - \nu). \quad (1)$$

Only the difference $g_t - q_t$ matters. We call this difference “procreation price”:

$$p_t = g_t - q_t.$$

p_t positive $\rightarrow g_t > 0$ and $q_t = 0$, fertility is discouraged

p_t negative $\rightarrow g_t = 0$ and $q_t > 0$, fertility is promoted.

Definition (Equilibrium with Procreation Rights)

Given initial population sizes N_0^A and N_0^B , an equilibrium is a sequence of individual quantities (c_t^i, e_t^i, n_t^i) , group sizes (N_t^i) , and prices (p_t) such that

- Consumption, education and fertility maximize households' utility subject to the budget constraint ;
- Group sizes evolve as in the benchmark model.
- Labor market clears, i.e. $N_t^i(1 - \phi n_t^i) = L_t^i \forall i$;
- Asset market clears, i.e.

$$\sum_i (n_t^i - \nu) N_t^i = 0 \quad (2)$$

Fertility and Education Choices

Effect of income:

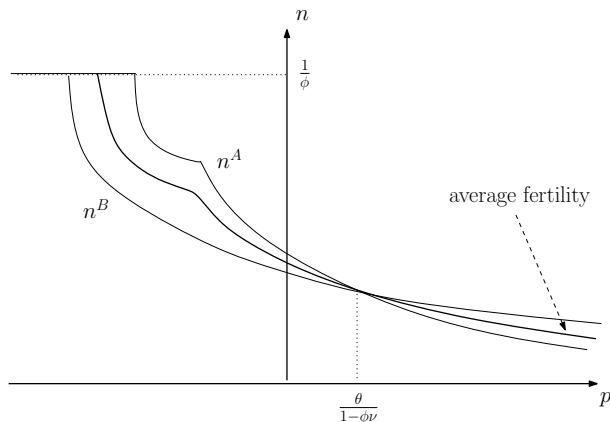
- for procreation price below a threshold, rich parents have fewer children
- if procreation is sufficiently taxed, rich parents have more children
- rich parents spend more on education

Effect of procreation price:

- fertility rates are decreasing function of procreation price.
- Investment in education is increasing in procreation price.

Proposition (Fertility and Procreation Price)

The individual fertility rate n is a decreasing function of procreation prices $p \in (-1/\nu, +\infty[$.



Because fertility is a decreasing function of p , we can use a fixed point argument to show:

Proposition (Existence and Uniqueness of Equilibrium)

If $\tilde{p}(\omega^B) > -1/\nu$ the equilibrium procreation price exists and is unique.

Tradable entitlements implement the target population level.

Inequality

How does the introduction of procreation rights affect inequality?

Resource gap between skilled and unskilled in the benchmark model:

$$\Delta^B = \omega^B(1 - \phi\tilde{n}^B) - \omega^A(1 - \phi\tilde{n}^A).$$

with fixed quotas:

$$\Delta^F = \omega^B(1 - \phi\nu) - \omega^A(1 - \phi\nu).$$

with tradeable quotas:

$$\Delta^T = \omega^B(1 - \phi n^B) - \omega^A(1 - \phi n^A) + p(n^A - n^B).$$

From benchmark to fixed quotas

For population control:

$$\frac{\Delta^F - \Delta^B}{\phi} = \underbrace{(\hat{n} - \nu)(\omega^B - \omega^A)}_{\text{productivity effect} > 0} + \underbrace{\omega^B(\hat{n}^B - \hat{n}) - \omega^A(\hat{n}^A - \hat{n})}_{\text{differential fertility effect} < 0}$$

From benchmark to tradable quotas

$$\begin{aligned}
 \frac{\Delta^T - \Delta^B}{\phi} &= \underbrace{(\hat{n} - \nu)(\omega^B - \omega^A)}_{\text{productivity effect } > 0} + \\
 &\underbrace{\left[\omega^B(\hat{n}^B - \hat{n}) - \omega^A(\hat{n}^A - \hat{n}) \right] - \left[\omega^B(n^B - \nu) - \omega^A(n^A - \nu) \right]}_{\text{differential fertility effect}} \\
 &+ \underbrace{\frac{p}{\phi}(n^A - n^B)}_{\text{tradability effect}} \quad (3)
 \end{aligned}$$

Redistributive aspect of tradability

Proposition

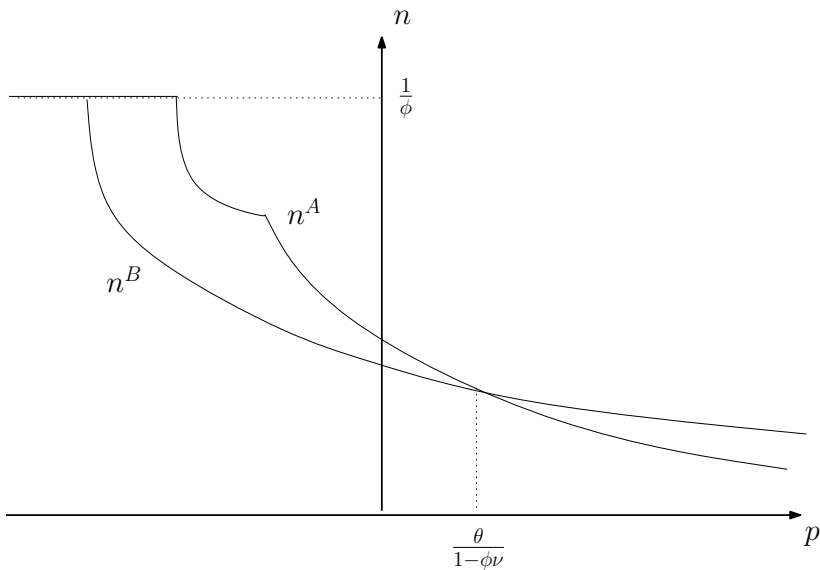
(i) If $\theta > 0$, tradability is redistributive ($\Delta < 0$) if and only if

$$p < 0 \text{ or } p > \min \left\{ \frac{\theta}{1 - \phi\nu}, \hat{p}(\omega^A), \tilde{p}(\omega^A) \right\}.$$

(ii) If $\theta = 0$ tradability always redistributive.

Natalist policy

Population control



Education, social mobility and long-run income

Proposition (Education and Procreation Price)

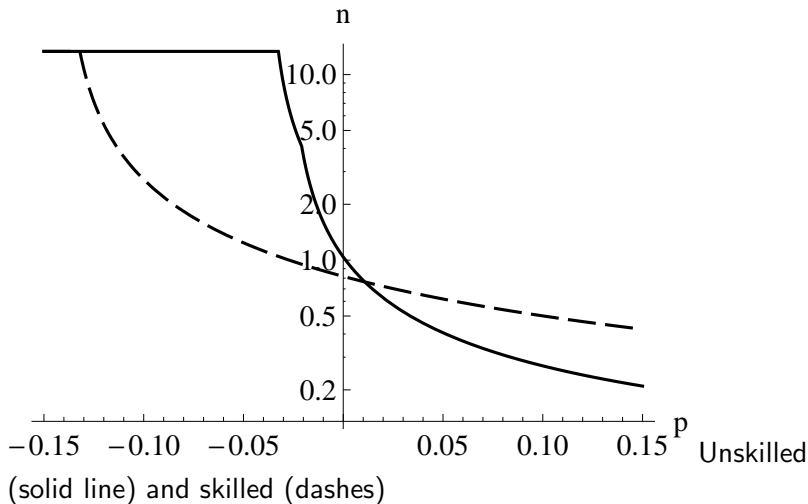
Investment in education e is increasing in procreation price p .

Pro-natalist policy reduces long-run average income

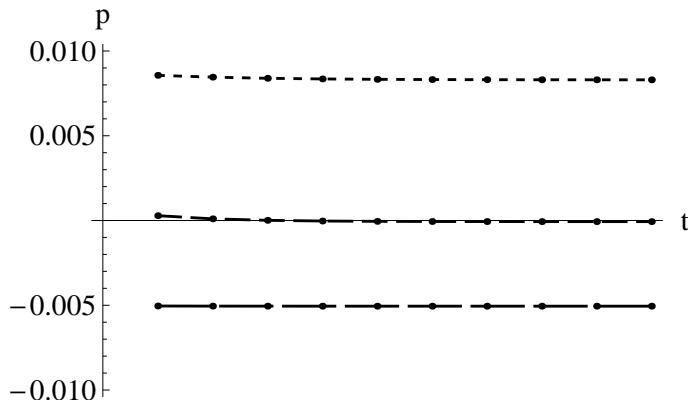
While being redistributive for generation P (parents), it will tend to increase income inequalities between generations P and C (children)

Need for education policy, e.g. public education

Fertility as a Function of Income and Procreation Price in the Example

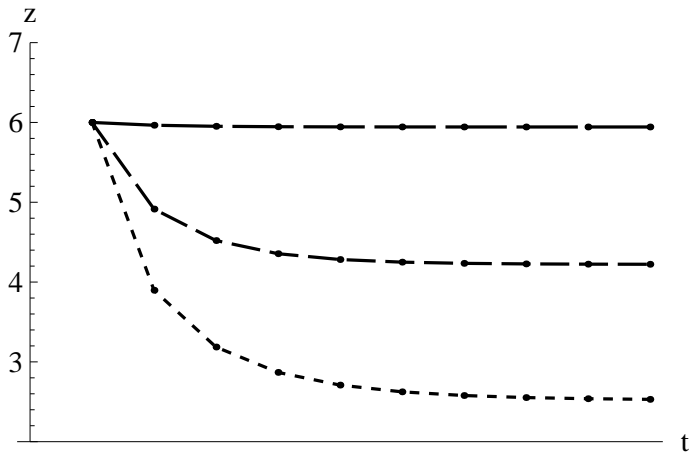


The Procreation Price in the Example.



Anti-natalist (dots), neutral (short dashes), pro-natalist (long dashes)

The ratio of unskilled to skilled



Anti-natalist (dots), neutral (short dashes), pro-natalist (long dashes)

Grandfathering

Alternative to equal allocation of procreation quotas.

Applicable for countries, not for individuals.

Conditioning on the past:

Those whose grandfather or father was already enfranchised would be exempted from poll tax and/or literacy requirements to vote.

For pollution permit: grants larger shares of emission rights to those who already emit more : anti-redistributive because larger polluters are richer.

In the procreation case, countries with high fertility are poorer. Grandfathering is redistributive.

Conclusion

Idea of tradable procreation permits + generalization to procreation exemptions.

At the country level and at the global level

Anti-redistributive ? Tradability is in general redistributive except with cheap procreation allowances.

Human capital: natalist policy would be bad for education, while population control would be good.

Grandfathering can make population control more redistributive at the Global level.