National Transfer Accounts: Concepts and Theories

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I will discuss two different lines of theory bearing on NTA

1. Macroeconomic consequences
2. Micro basis for intergenerational transfers

Both are just brief sketches.

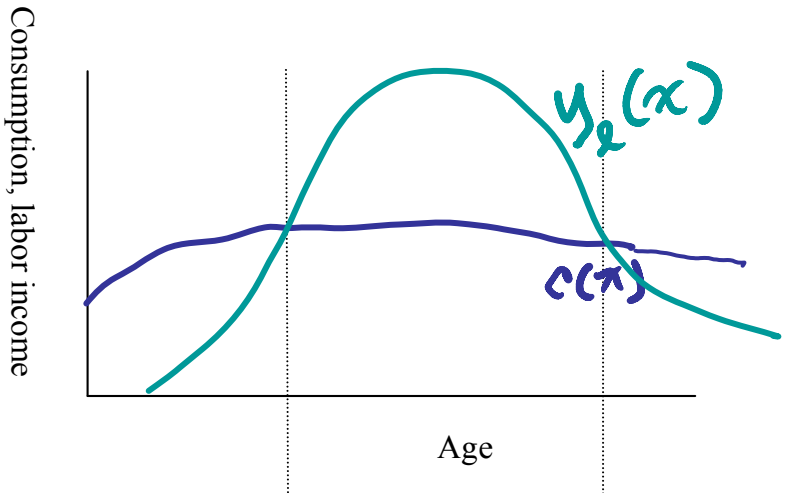
Part I. Some macroeconomic consequences of transfers

Begin with age profiles of consumption and labor income

- These are not fundamental and immutable for a country. They are influenced by interest rates, existing public and private transfer programs, and income.
- Nonetheless, it is useful to treat them as given, at least initially.

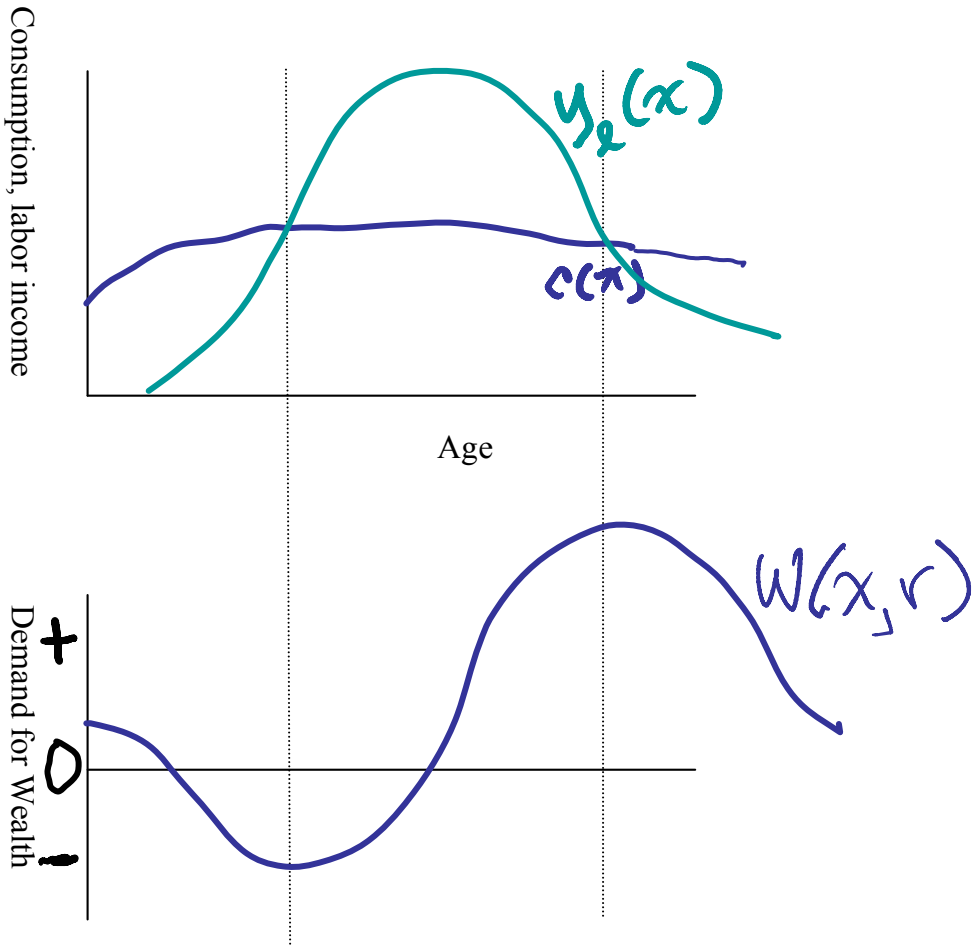
- Most NTA estimates are cross-sectional, but much of the theory is longitudinal. So construct pseudo longitudinal profiles.
- Assume that the cross-sectional age profiles of consumption and income are expected to shift upwards at the rate of productivity growth.

Here are illustrative age profiles.
For simplicity, assume these are fixed over time, so longitudinal and cross-sectional profiles are identical.



- Suppose that individuals have to fund their own life cycle deficits by borrowing, saving, dissaving etc.
- Let's consider how much wealth an individual at age x would have to hold in order to be able to consume c(a) along the age profile, while earning $y_l(a)$.
- This amount is what we call "life cycle wealth" at age x, W(x,r). It depends on the interest rate r, but only through discounting here.

Here is the value of W(x,r) for different ages x.
W starts at 0 at age 0 in special where r=n, the population growth rate.
But typically it will not.



The demand for life cycle wealth for an individual at age x

$$W(x,r) = \int_x^{\omega} e^{-r(a-x)} \left[l(a)/l(x) \right] \left[c(a) - y_l(a) \right] da$$

discount

survival from x to a

life cycle deficit

- W is the amount of wealth needed by an individual at age x to consume according to c(a) over the rest of her life, with labor income $y_l(a)$, if the interest rate is r.
- W(x,r) is cost of an annuity to make up survival-weighted life cycle deficit.

The aggregate demand for life cycle wealth is the population-weighted average of W(x,r)

$$W(r) = \int_0^{\omega} W(x,r) Pop(x)\, dx \Big/ Pop$$

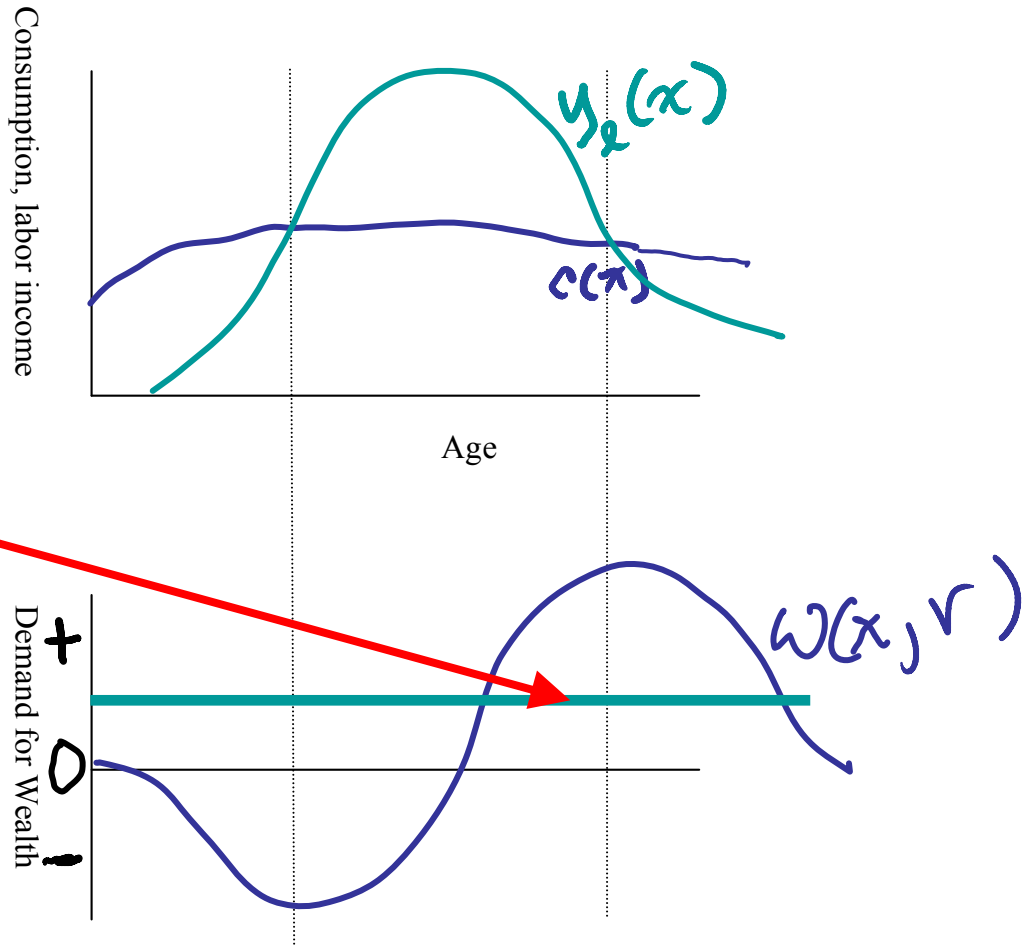
life cycle wealth at age x

pop at age x

- "Golden rule" is special case when r=n, the pop gr rate
- In this case the demand for life cycle wealth is 0 at birth.

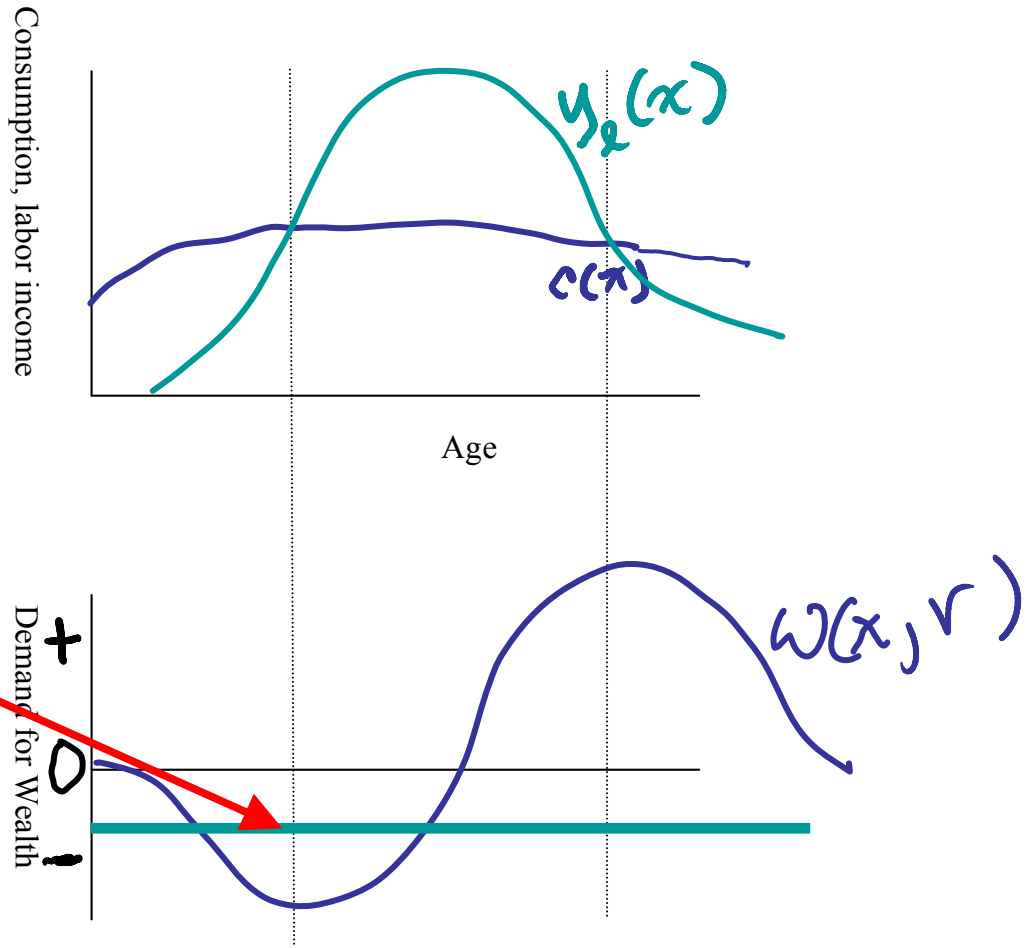
W(r) is the population-weighted average of W(x,r).

In a an old population, the ages with positive W(x,r) get more weight, and W(r) may be positive. Second dividend.



W(r) is the population-weighted average of W(x,r).

In a young population, the ages with negative W(x,r) get more weight, and W(r) may be negative.



An elegant result due to Willis (1988) for golden rule case (r=n)

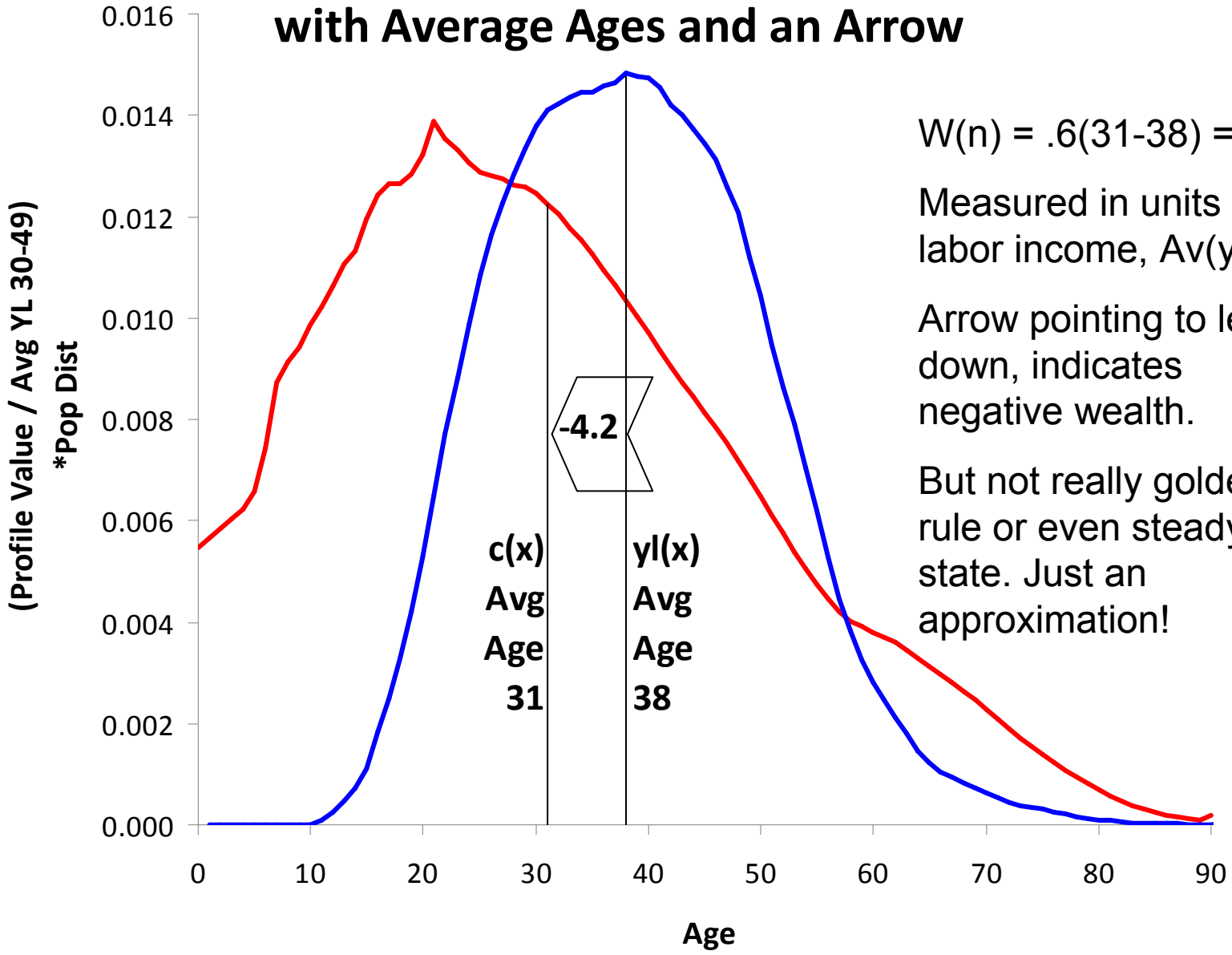
$$W(n) = c\left(A_c - A_{yl}\right)$$

per capita consumption

average ages of consuming and earning (age or income) population-weighted.

- Based on this result, we can draw an arrow diagram.
- Arrow has tail at A_{yl} and head at A_c
- Thickness of arrow is c (per capita income)
- Area of arrow is W(n), life cycle wealth per capita in a golden rule economy with pop gr rate n.

Population-Weighted Profiles for Indonesia, with Average Ages and an Arrow



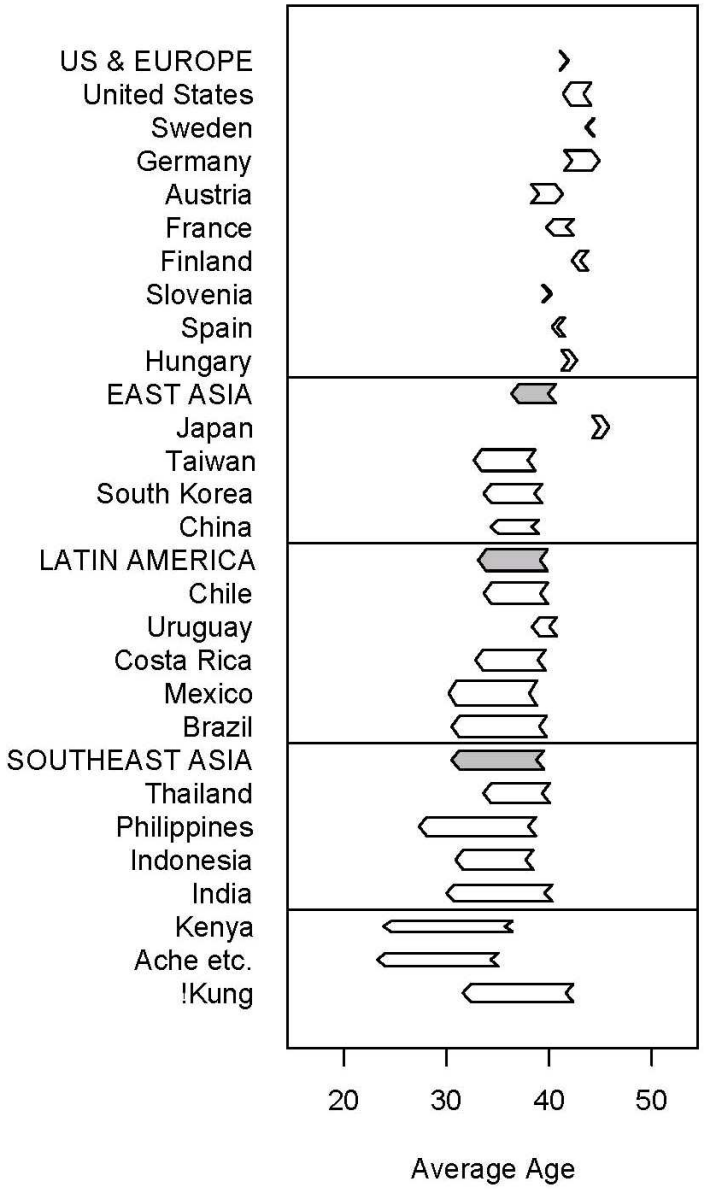
W(n) = .6(31-38) = -4.2

Measured in units of labor income, Av(yl).

Arrow pointing to left, or down, indicates negative wealth.

But not really golden rule or even steady state. Just an approximation!

Arrow diagrams for 23 NTA countries plus 2 hunter gatherer groups, by region and per capita GDP within groups



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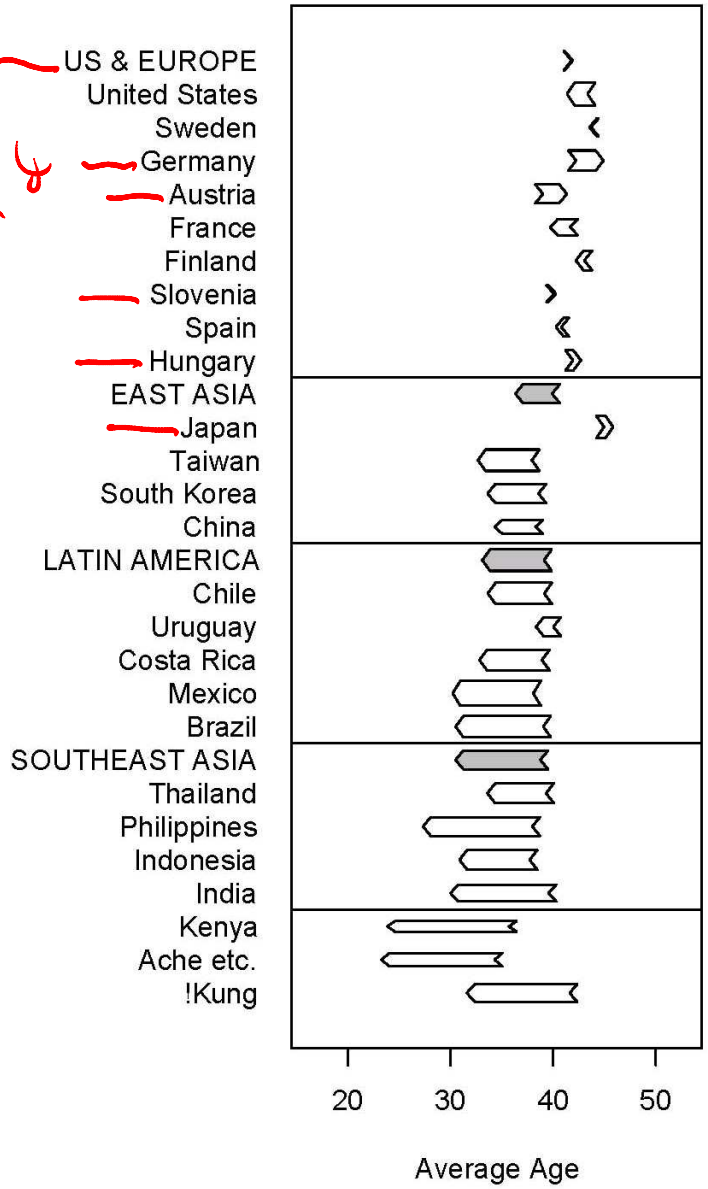
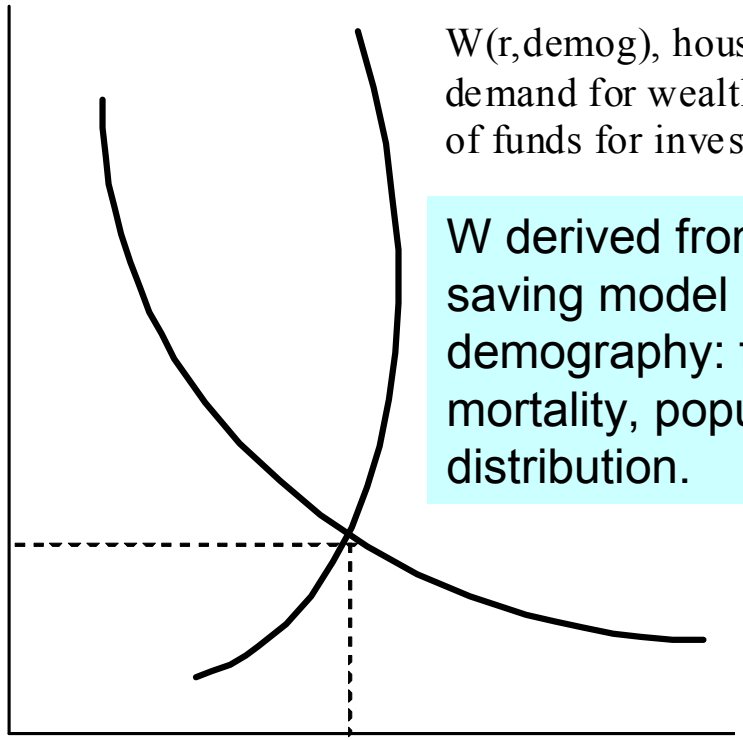


Hypothetical case (Tobin, 1967)

- The only demand for wealth is life cycle wealth.
- Wealth can be held only as capital, K.
- Then demand for life cycle wealth by individuals is also the supply of funds for investment in K.
- The demand for investment in K depends on r. At high r, less demanded.
- The condition that: W(r) = K(r) determines the interest rate.

Tobin: Producer's demand for capital and households' supply of funds for investment in closed economy



W derived from life cycle saving model and realistic demography: fertility, mortality, population age distribution.

K_D derived from a production function

Population aging shifts the supply of wealth curve to right, raising capital intensity (second dividend)

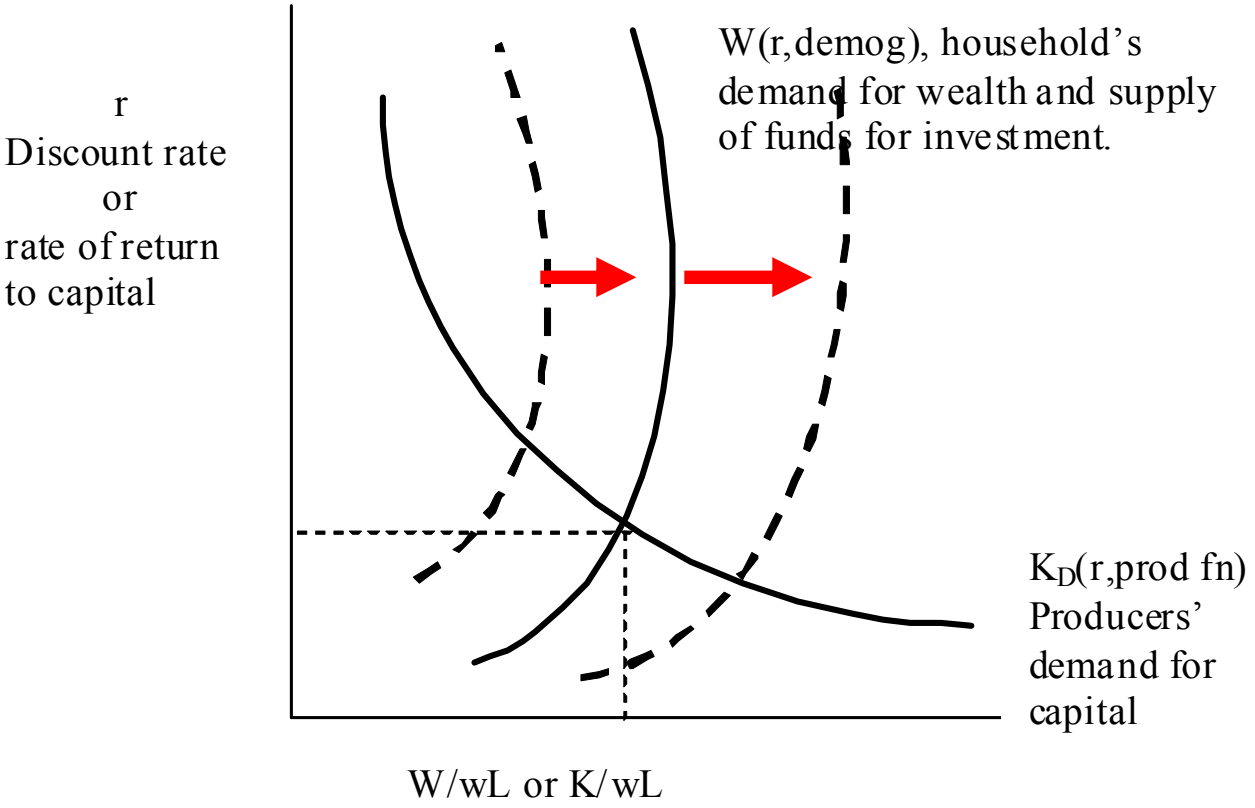
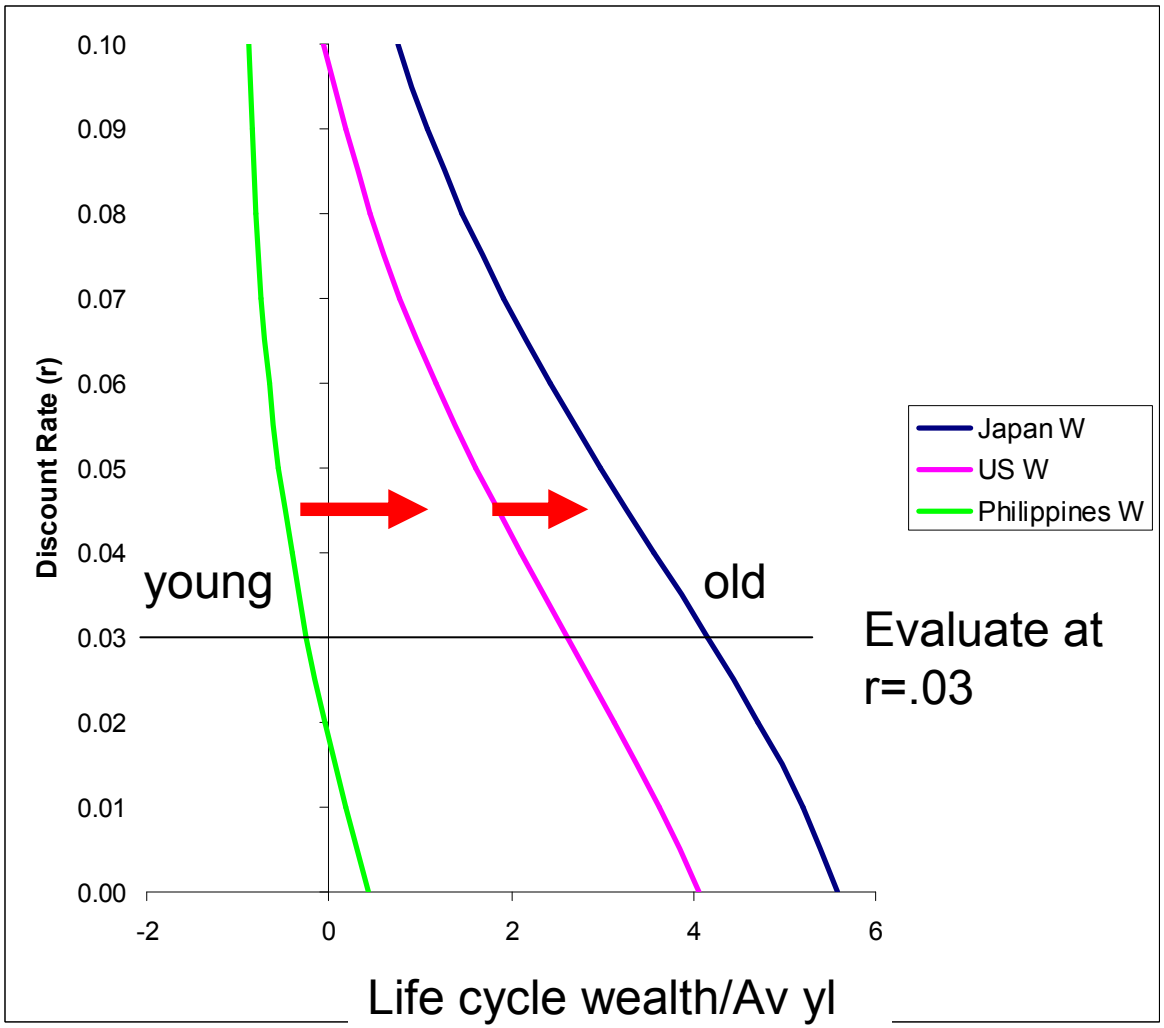


Illustration from NTA: Population aging raises the aggregate demand for wealth, W(r). Calculation assumes prod gr = 2%/yr.



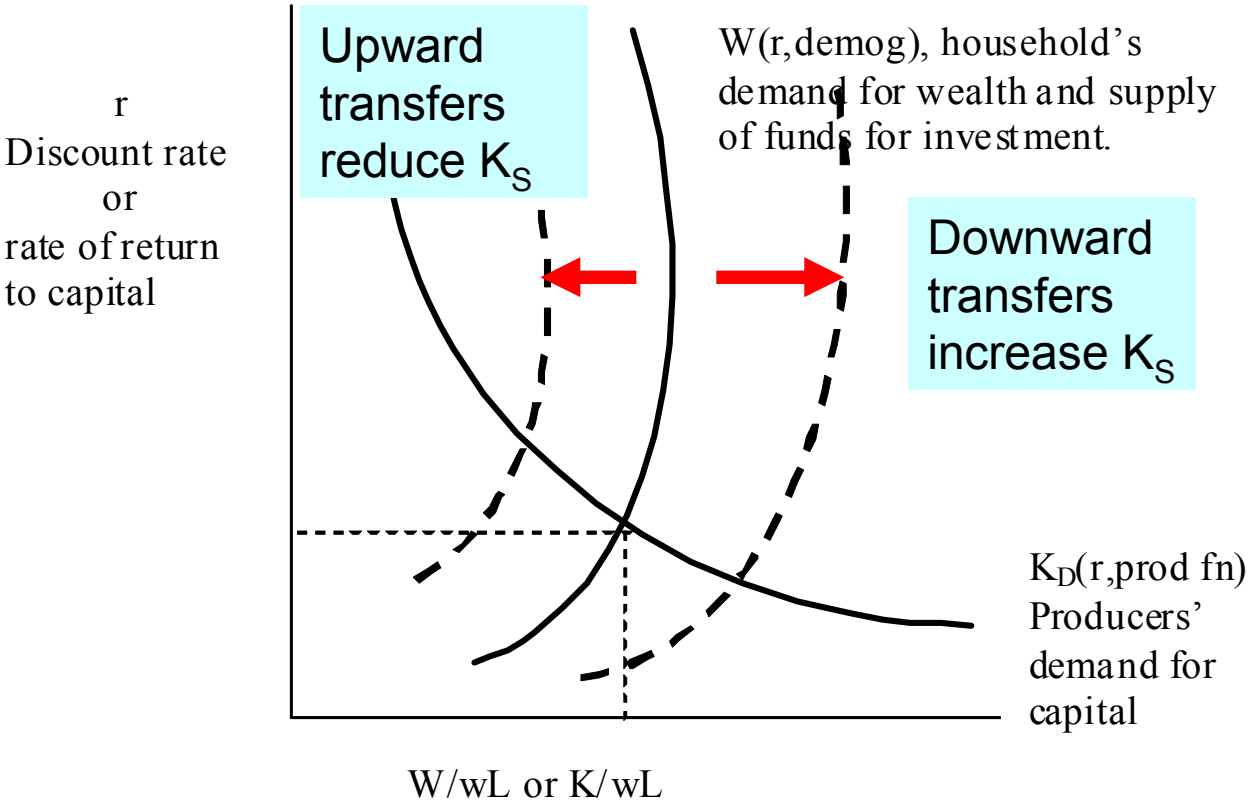
Transfer systems also matter

- Household demand for W(r) can be satisfied either by capital or by transfer wealth:

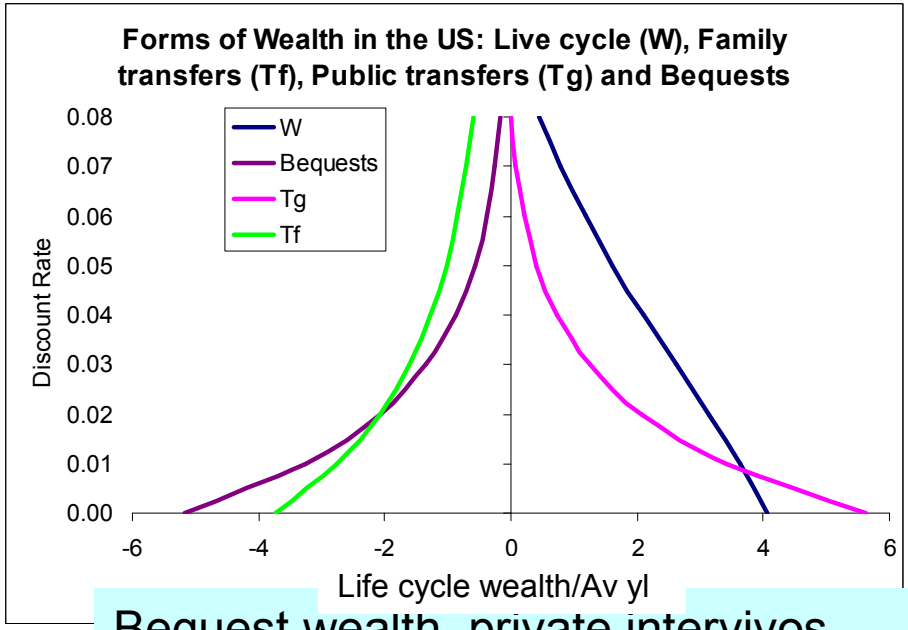
  $W(r)=K(r)+T(r); \qquad K(r)=W(r)-T(r)$

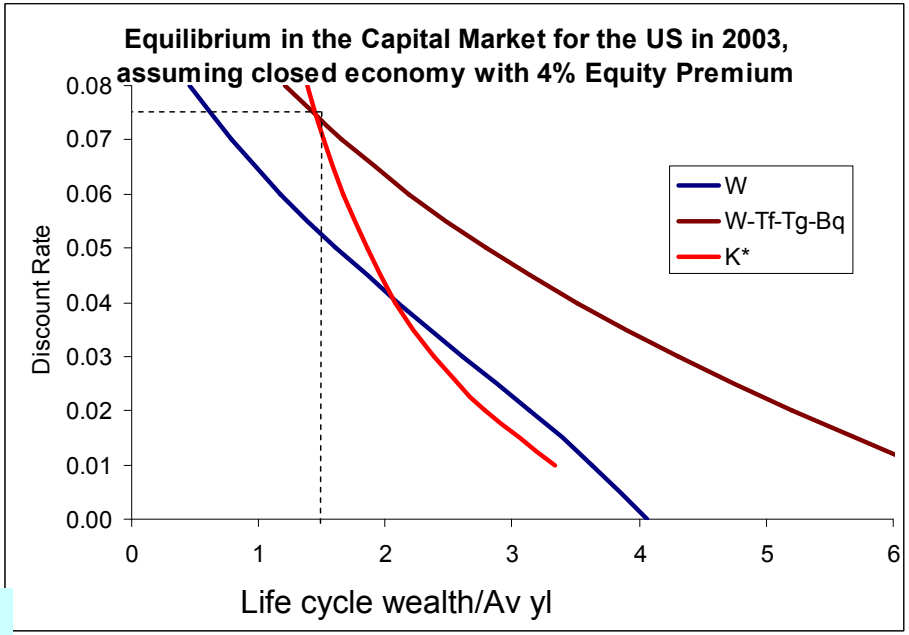
- Upward transfers generate positive transfer wealth and reduce supply of funds for K
  - Public transfers (pensions, health care, long term care)
  - familial support for elderly
- Downward transfers generate negative transfer wealth and increase supply of funds for K
  - Public (education, family allowances)
  - Private (rearing kids, planned bequests, adult and elder transfers to young adults)

Transfer systems shift household supply of funds for K



Forms of wealth in the US and the implied supply of funds for capital (Tobin-Willis diagram)





- Bequest wealth, private intervivos transfers, and public transfers are of similar magnitude, but different signs.

  Each is about as important as life cycle wealth!

Could get very misleading results if private transfers, including bequests, are ignored.

What is the effect of population aging on lifetime consumption?

- Lifetime consumption C(r) is the present discounted value, weighted by survival, of consumption, evaluated at birth.
- Arthur and McNicoll (1977) showed that:

$$\left(dC/dn\right)/C = A_c + A_{yl} - K/C$$

The left side is the proportional effect on life time consumption of a small increase in the population growth rate.

Faster pop growth causes capital dilution (-K/C) but also makes the population younger.

- A younger population is good if the population is old, and has $A_c > A_{yl}$.
  - There are more young people to support the elderly, and C rises.
  - Is this larger or smaller than the capital dilution effect, that reduces C?

Another result from Willis tells us the answer for golden rule case

$$d \ln C(r,n) / dn = T/C$$

- If transfer wealth is positive, then faster population growth will contribute more by making population younger than it will cost by reducing capital per worker.

Remember

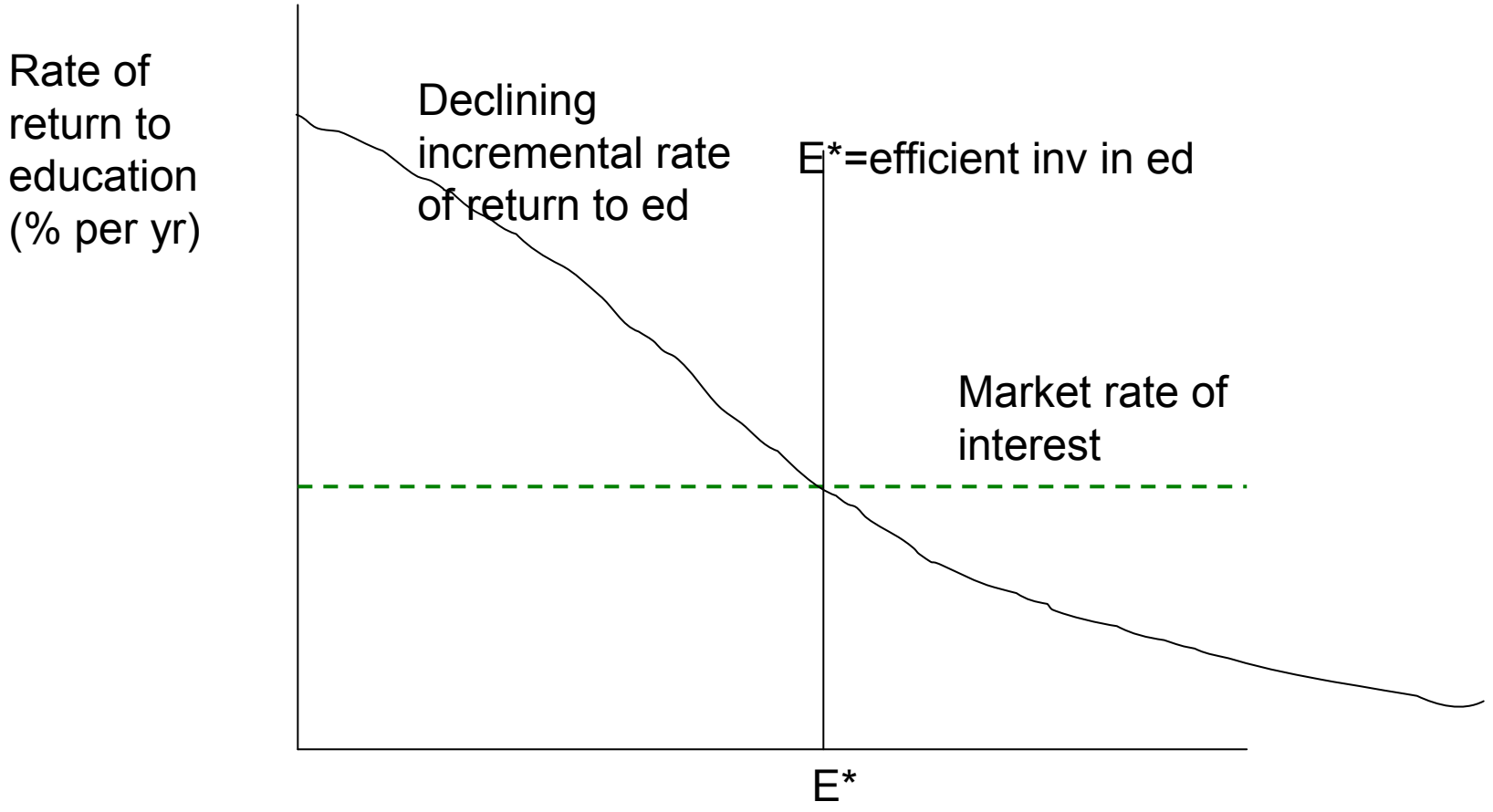
- For a specific country, all these kinds of questions are better addressed by explicit calculation, simulation or projection than by these comparative static special cases.

Part II: The microeconomics of fertility, human capital, and transfers in context of development, institutions and policy.

- Basic ideas are from Becker, Willis, Becker-Barro, Becker-Murphy.

- Parents are altruistic. They care about
  - Their own wellbeing, now and in old age
  - The wellbeing of their children
- Parents decide to spend X on each child.
- Parents may use X to raise their children's life time utility in two ways
  1. giving them **capital** (cash or output) directly
  2. investing in their **human capital** which raises their earning capacity in the future.
- How much of X should parents invest in child's HK?

Optimal investment in education is to point where rate of return to one more dollar of education equals market rate of interest (rate of return to human capital = rate of return to physical capital)



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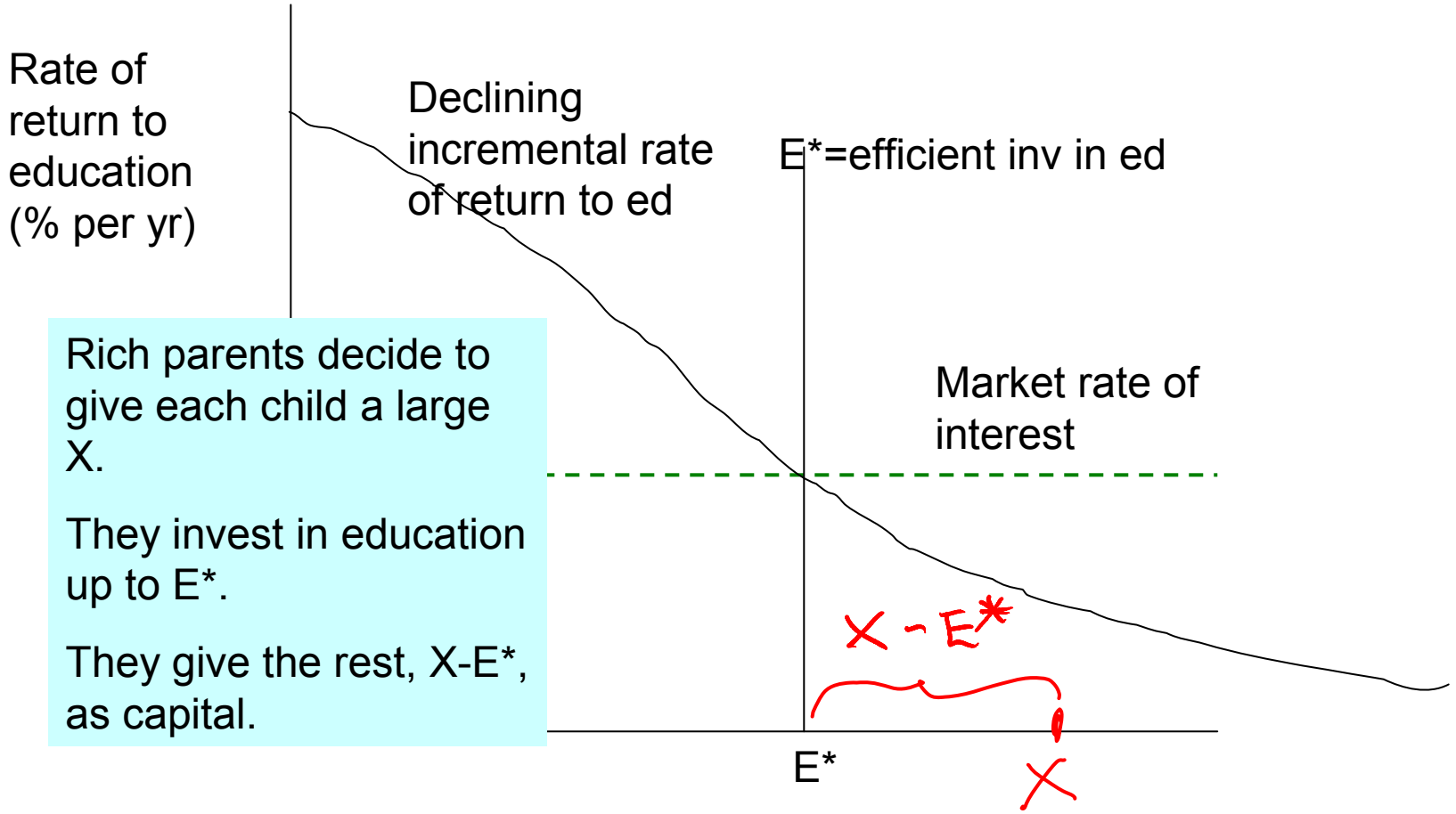

Rich parents decide to give each child a large X.

They invest in education up to E*.

They give the rest, X-E*, as capital.

E = Amount invested in a child's education

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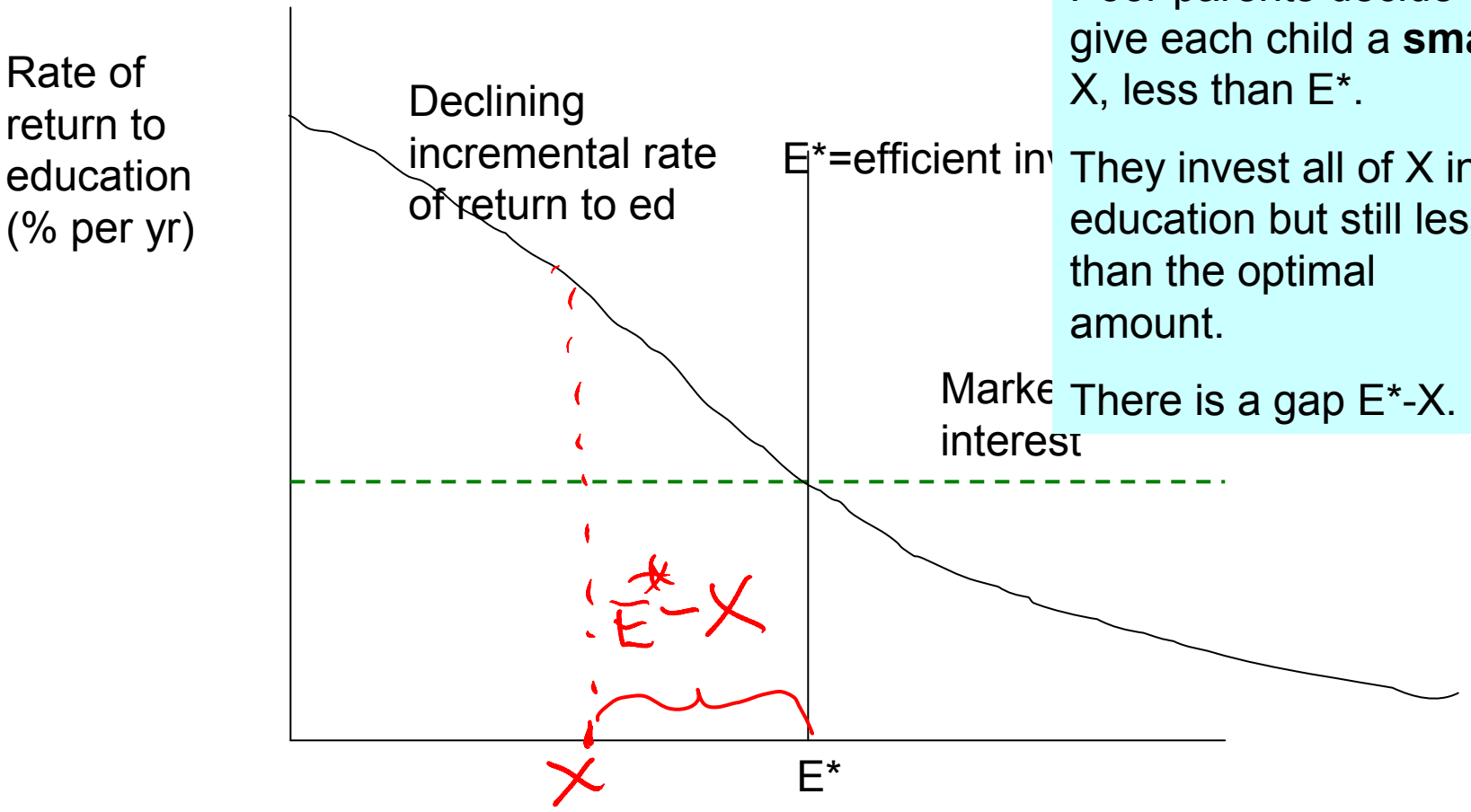


Poor parents decide to give each child a **small** X, less than E*.

They invest all of X in education but still less than the optimal amount.

There is a gap E*-X.

E = Amount invested in a child's education

Why doesn't parent loan the child the additional cost E*-X?

- Parent would like to loan this to child, but only if she is confident that the loan will be paid back.
- Usually, there are no institutions or contracts that guarantee repayment.

- Then society is stuck at a low level of education and per capita income.
- Incomes could be higher if more was invested in education and less in capital, but the family is unable to achieve this.

A role for the public sector

- Introduce public education
  - Tax parents to pay for public education of their children.
  - Moves investment in HK closer to optimal.
  - But leaves parents worse off.
- Later introduce public pensions
  - Compels children to pay taxes to provide public pension for their parents
- Now every generation is better off

- This theory can generate many hypotheses depending on context
  - Enforcement of repayment of parental loans?
  - Rate of return to HK vs K?
  - Public education? Public pensions?
  - Do parents have access to credit?
- It also tells us to be cautious in interpreting all flows between children and parents as transfers rather than exchanges.

Many ideas and implications for NTA

- Part of what a parent gives child may be a transfer, motivated by altruism.
- When income is low, and rate of return to Ed is low, parents invest little in HK, have high fert, and receive less old age support.
- For same parent, part may also be a loan, for which repayment in old age is expected.
- Some of support given by adult children to elderly parents may be repayment of earlier loans.
- Economic development raises incomes and also raises rate of return to HK.
  - Parents want to invest more in HK, but this requires reducing fertility.
- Some cultures enforce repayment of parents (E. Asia?) so investment in HK is higher, and transfers (or repayments) to elderly are also higher.

One simple idea: Quantity-Quality tradeoff

- Parents choose between number of children and amount to invest per child (Quantity-quality tradeoff)
- As economies develop parents opt for fewer children and spend more per child (Becker; Becker and Lewis, Willis).
- Aging (low fertility) will be accompanied by more human capital, regardless of causal direction.
- The human capital “response” helps to offset the negative effect of population aging on the support ratio.

Empirical Relationship between Human Capital and Fertility

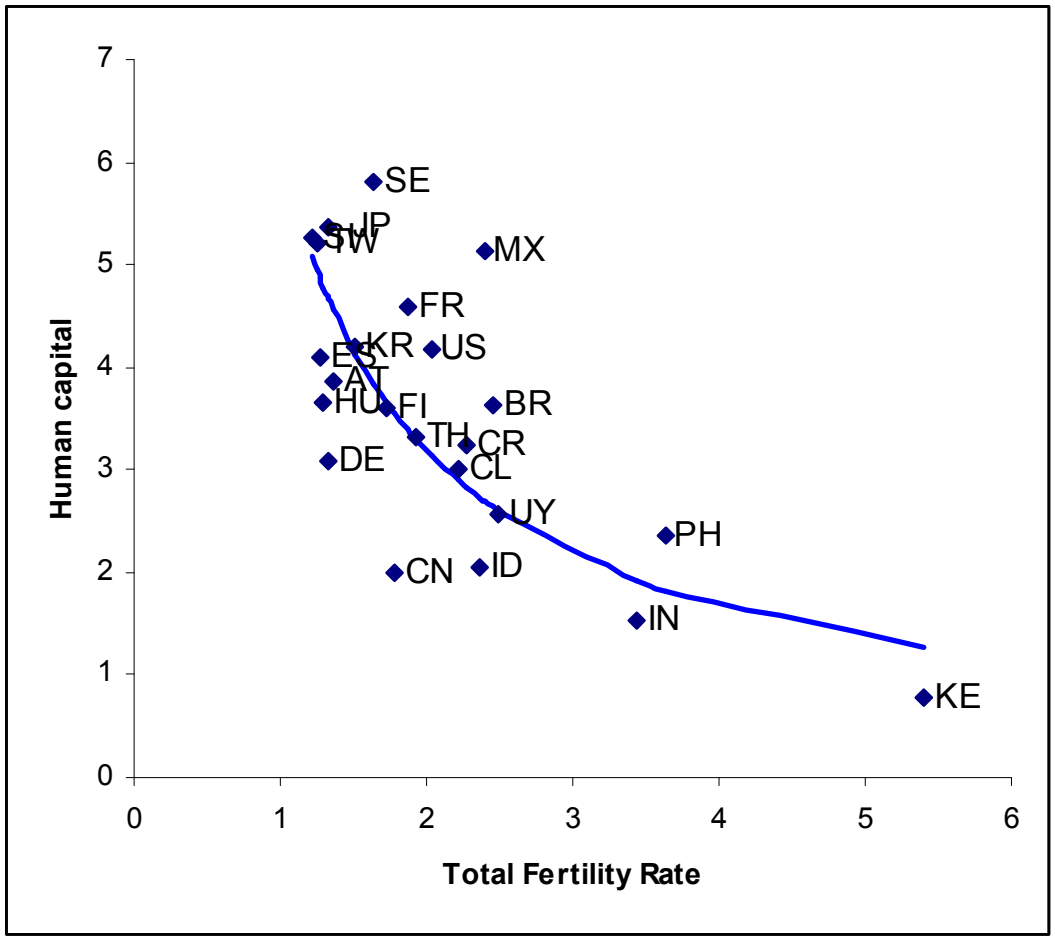
- NTA measure of Human Capital (HK) investment
  - NTA measures **public and private** spending per capita at each age for **health and for education**
  - Sum these for ages 0-17 for health and 0-26 for education
  - Normalize on average labor income ages 30-49
- Compare HK to Fertility in preceding five years
- See Lee and Mason, 2009, *European Journal of Population*

Cross-sectional Relationship

Estimated elasticity

$d \ln HK / d \ln TFR$

is -0.913

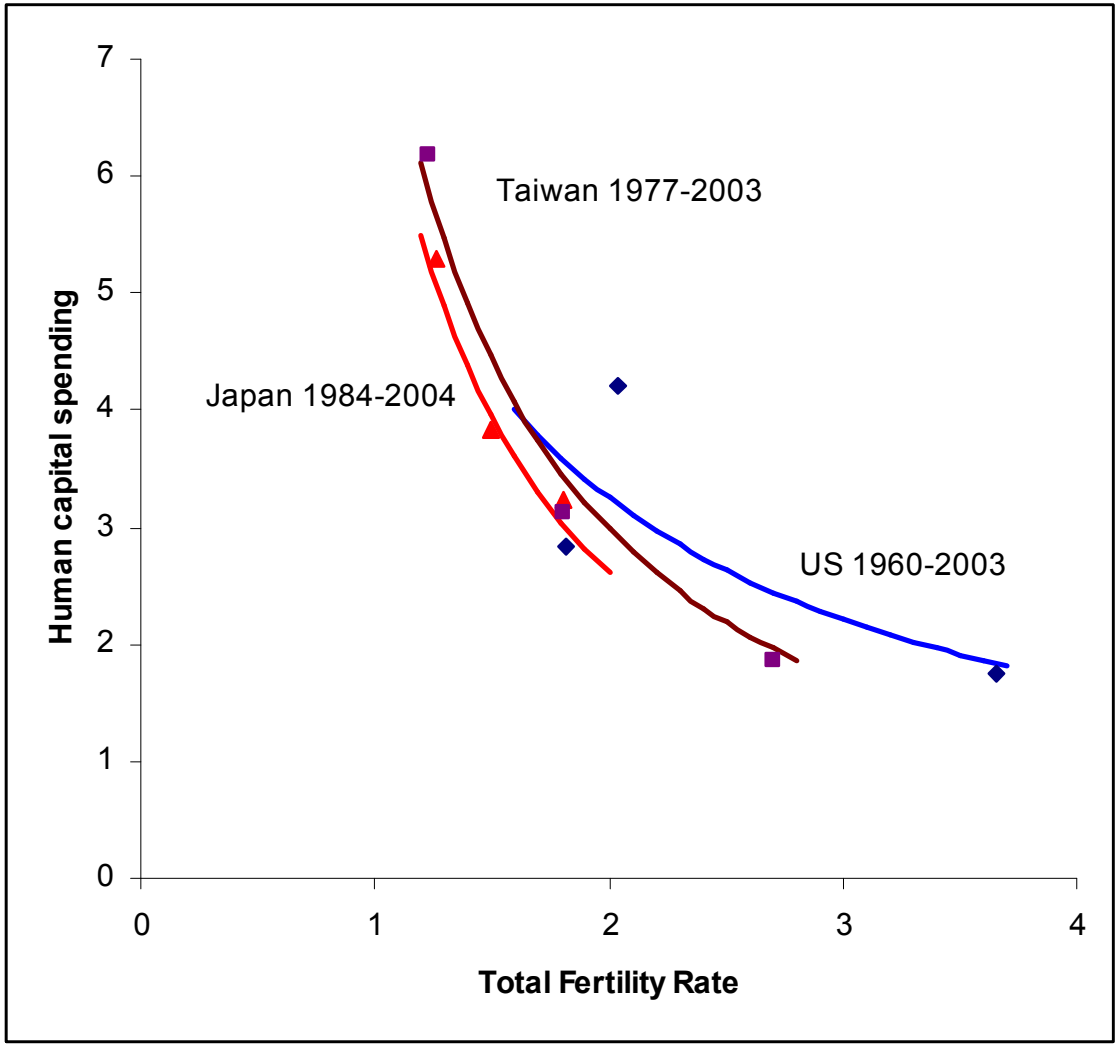


Source: Lee and Mason, forthcoming, European Journal of Population (2009).

Time Series Relationship

Estimated elasticities	
Japan	-1.46
Taiwan	-1.40
United States	-0.72

Number of Observations	
Japan	5
Taiwan	27
United States	23



Population aging is accompanied by increased investments in HK of children

- Raises the productivity and earnings of labor force in future
- Substitutes HK for number of workers
- Offsets falling support ratios.