Demographic Transition

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A. Introduction

- **Long-term trend in population (Western Europe, Maddison 1982/1995):**
  - **500-1500: rising pop, no per capita output growth**
  - **1500-1870: rising pop, rising per capita output**
  - **after 1870: declining pop, rising per capita output**

- **Fertility decline since mid-1800:**
  - **reducing infant mortality enables lower fertility given the same desired quantity of children**
  - **rising income makes education more affordable and encourages the trade-off of quantity for quality in childbearing**
  - **rising opportunity cost increases childbearing cost**

- **Roles of demographic transition played in economic development:**
  - **high fertility is associated with low development (Malthusian trap)**
  - **high within-country fertility differentials are associated with high income inequalities (Kremer-Chen 2000)**

- **Literature:**
  - **Kuznets (1958), Becker (1960), Easterlin (1968): quality-quantity trade-off in childbearing under static, partial equilibrium**
  - **Lee (1987): quality-quantity trade-off in a dynamic, non-optimizing setup**
  - **Razin & Ben-Zion (1975), Becker-Barro (1989), *Wang-Yip-Scotese (1994)*, Palivos (1995): quality-quantity trade-off in exogenous growth setups**
  - ***Becker-Murphy-Tamura (1990)*: quality-quantity trade-off in an endogenous growth setting**
  - **Galor-Weil (2000): long-run demographic transition**
  - **de la Croix and M Doepke (2003): larger differentials in fertility induce widened inequalities**
  - ***Greenwood-Seshadri-Vandenbroucke* (2005): baby boom/baby burst**
  - **Moav (2005): better returns to child-labor can be a barrier to growth**
  - **Soares (2005): reduction in infant mortality leads to lower fertility rate and higher human capital accumulation, thereby raising long-run growth**
  - **Doepke-Zilibotti (2008): changing children quality via intergenerational behavioral transmission**
  - **Bara-Leukhina (2009): demographic transition and industrial revolution**
  - **Jayachandran & Lleras-Muney (2009): maternal mortality**

B. Fertility Choice in Dynamic General Equilibrium: Wang-Yip-Scotese (1994)

- **Key: endogenous consumption/leisure/childbearing choice**

1. Optimization (enjoy consuming, taking leisure and having kids):

max $\int_0^{\infty} [U(c(t)) + V(\chi(t), \mu(t))] e^{-\rho t} \, dt$

s.t. $\chi(t) + \ell(t) + s(\mu(t)) = 1$

$c(t) + \dot{k}(t) = f(k(t), \ell(t)) - \mu(t)k(t)$

where childbearing/childrearing requires time and resources cost

2. Main findings:

- **Empirical findings:**
  - **In response to a preference shift away fertility, fertility falls but income rises**
  - **This (negative) fertility preference shocks explain about 80% of movements in fertility and 25% of movements in output**

C. Quantity-Quality Trade-off in Becker-Murphy-Tamura (1990)

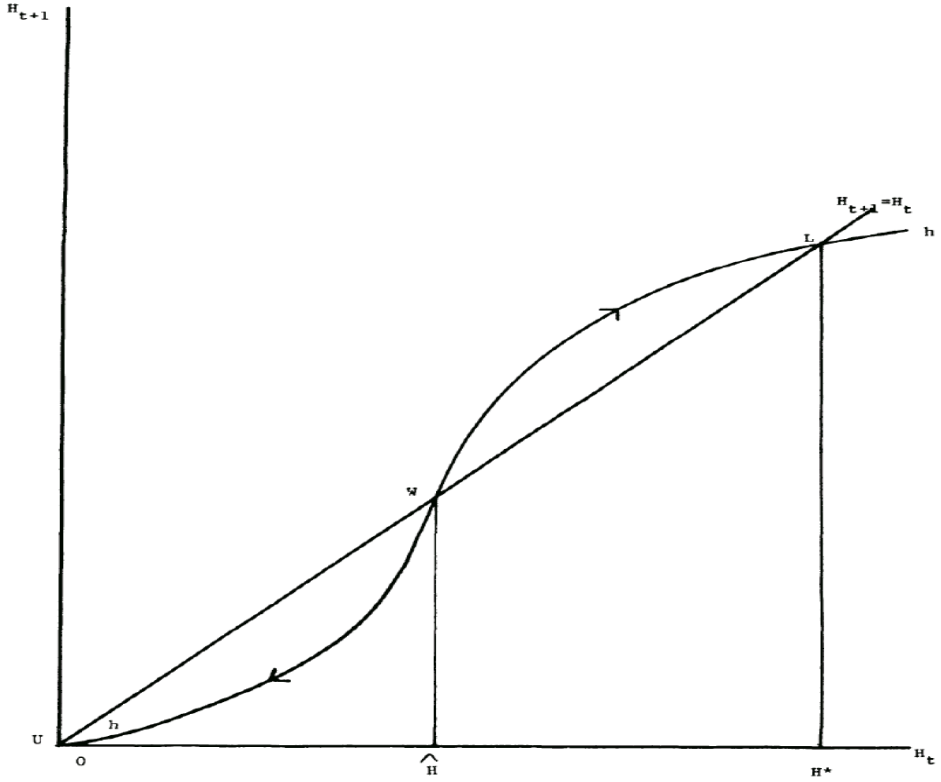
- **Becker-Barro (1989) dynasty preference + Ben-Paroth (1967) human capital accumulation**

1. The Model

- **Dynasty preference:** $V_t = u(c_t) + a(n_t)n_t V_{t+1}$, **with the degree of altruism per child, *a*(n), decreasing in the number of children (n)**
- **Human capital accumulation:** $H_{t+1} = Ah_t(bH^0 + H_t)^{\beta}$, **which depends on**
  - **child endowment (H^0)**
  - **parental human capital (H_t)**
  - **parental time devoted to childrearing (h)**
- **Budget constraint:** $c_t + fn_t = Dl_t(dH^0 + H_t)$
  - **total spending = consumption + childrearing expenses**
  - **output is linear in effective labor (D·L)**
- **Time constraint:** $T = l_t + n_t(v + h_t)$
  - **v = the exogenous time devoted to childrearing**
  - **h = the endogenous time input into childrearing**

2. Equilibrium (with b=d=β=1, $a(n) = \alpha n^{-\epsilon}$, $u(c) = \frac{c^{\sigma}}{\sigma}$):

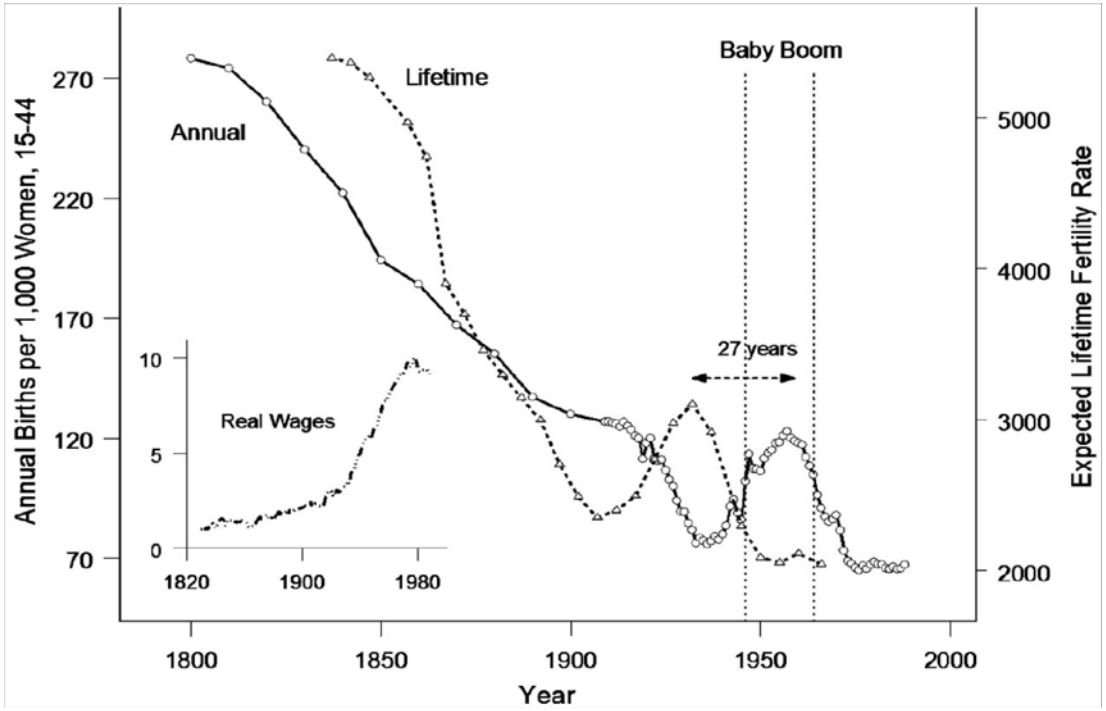
- **(c)** $\alpha^{-1} n_t^{\epsilon} \left(\frac{c_{t+1}}{c_t}\right)^{1-\sigma} \geq R_{ht} = A(l_{t+1} + h_{t+1} n_{t+1})$
- **(n)** $(1 - \epsilon)\alpha n_t^{-\epsilon} V_{t+1} = u'(c_t)[(v + h_t)(H^0 + H_t) + f]$
- **Two BGPs:**
  - **high v => H = h = 0 (trap)**
  - **low v => H > 0, h > 0 (high equilibrium)**
- **Main Findings:**
  - **multiple equilibria**
  - **quantity-quality tradeoff**
  - **negative relatioship between population growth and output growth**
  - **higher exogenous childbearing time cost (v) can lead to a low growth trap**



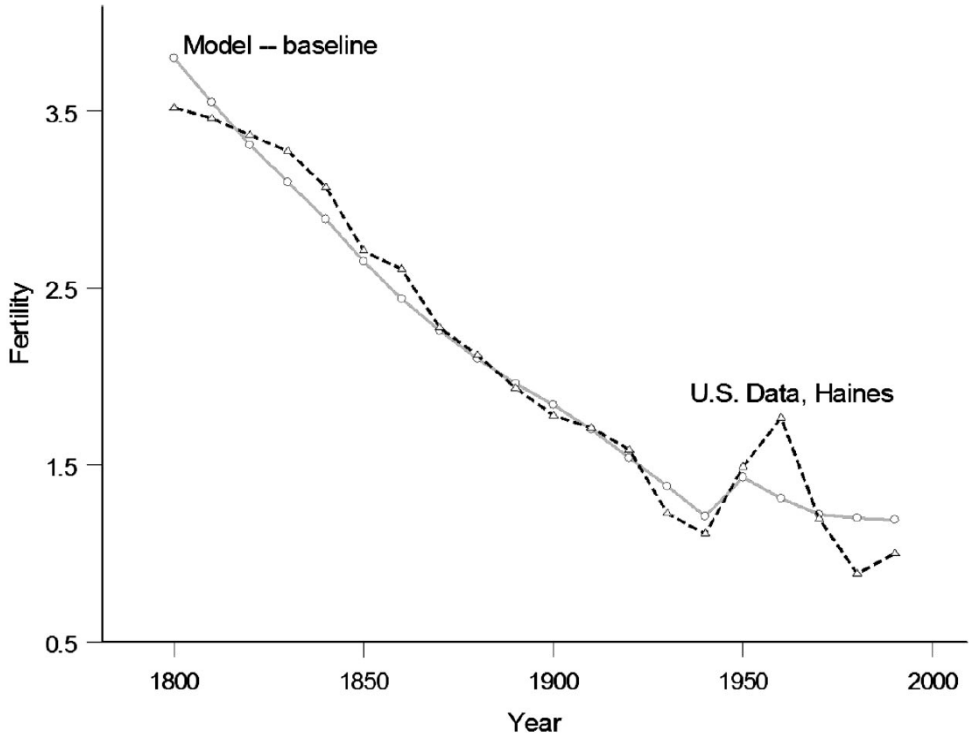
- **Problems:**
  - **unrealistic characterization of the high/low equilibrium: low trap is more likely due to the following factors**
    - **subsistence consumption**
    - **infant mortality**
    - **high child-labor demand**
    - **poor early childhood development**
  - **inability to characterize the longer demographic transition between 1500 and 1870, particularly the observation that population growth and output growth are positively related, which is likely due to:**
    - **subsistence consumption**
    - **strong income effect of fertility choice at low level of economic development (nutrition channel)**

D. Baby Boom and Baby Bust: Greenwood-Seshadri-Vandenbroucke (2005)

- **Basic Idea:**
  - **better job opportunity or higher market wage for women**
    => higher opportunity costs for childbearing
    => secular decline in fertility and increase in children education
    => sustained increase in human capital & sustained growth
  - **technical progress in producing household durables**
    => lower costs of rearing children
    => post WWII baby boom
  - **this reversed the earlier trend of demographic transition**



- **Main results:**
  - **better household technology => higher fertility**
  - **lower household technology price => higher fertility**
  - **higher market good technology => lower fertility**
- **Calibrated model fits the data well**
- **Problems: while the market wage channel (via market goods technology) is well accepted, the household technology channel faces serious challenge:**
  - **the timing could be off by 20-50 years (http://1920newtechnologyhanyoung.weebly.com/appliances.html)**
  - **counterfactual test using Amish (Pennsylvania) shows little household technology-led fertility increase**

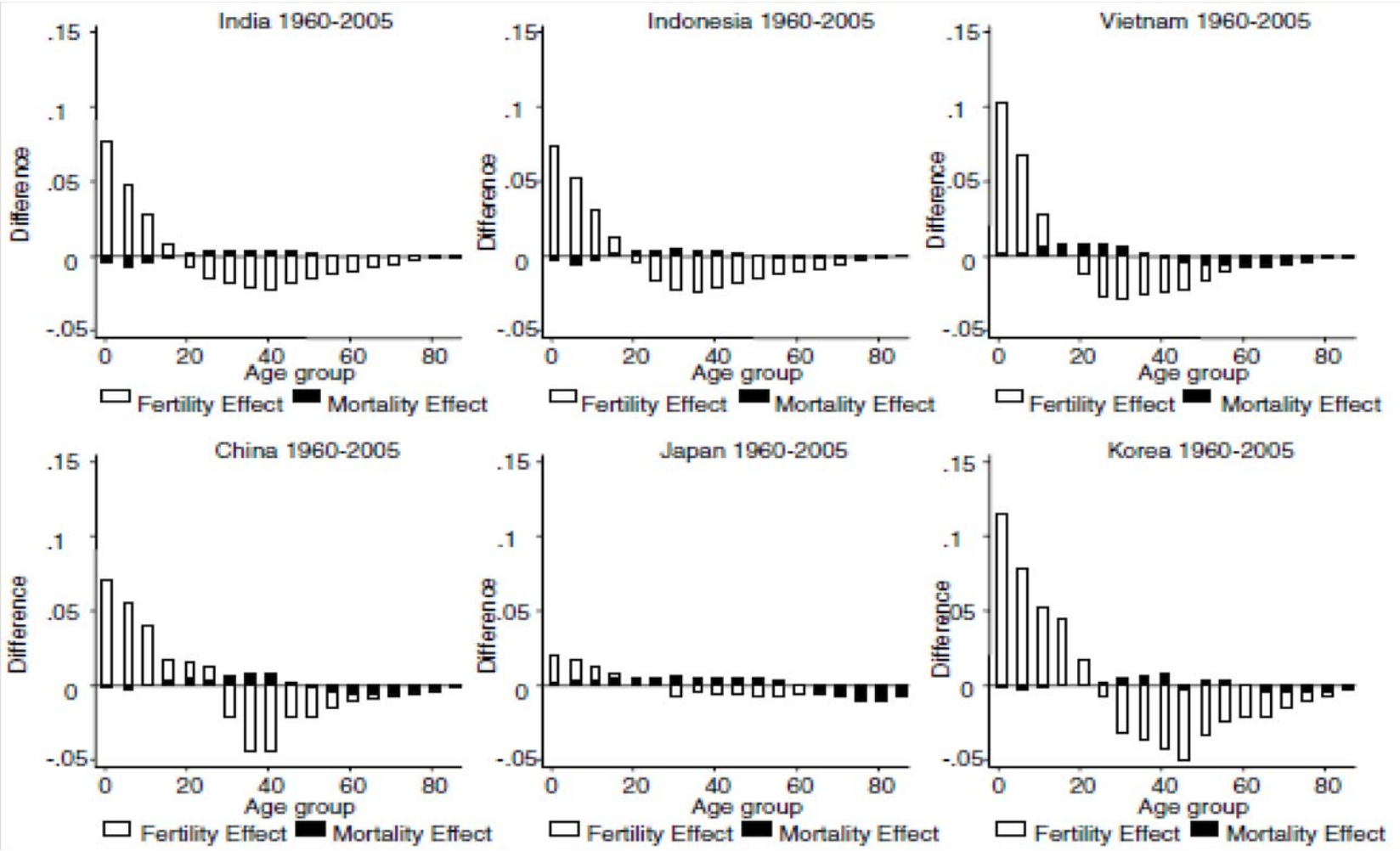


E. A Challenging National Security Issue

- With longer life expectancy and nonsustainably low fertility below the replacement level of 2.1, many countries have become aging society:
  - rising dependency
  - lower productivity
  - reduced education scale economy
  - more vulnerable public health hazard
  - tightened government budget
  - compromised living standard

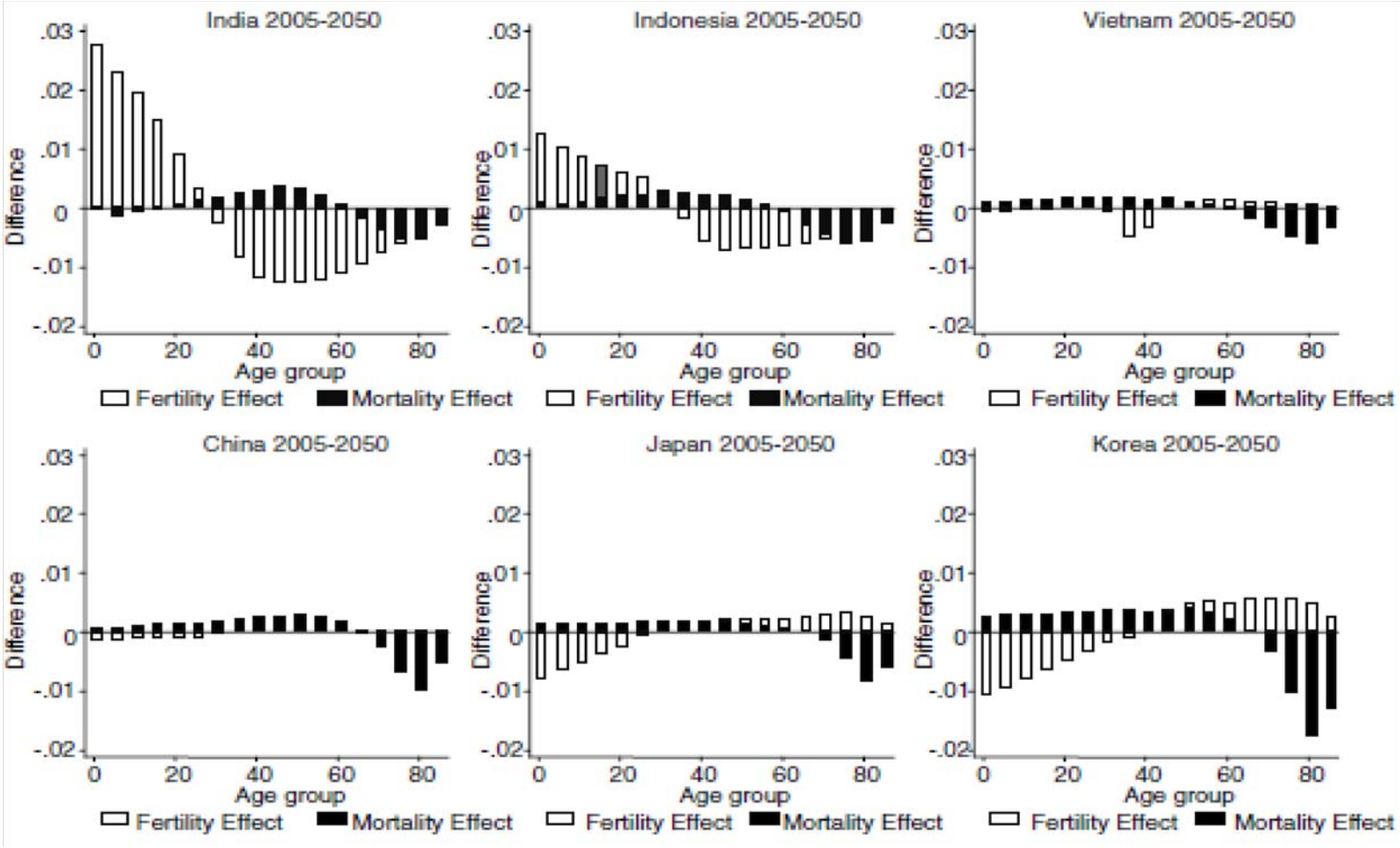
- Bloom-Canning-Findlay (NBER volume 2010) provide a comprehensive overview of East Asian issues
  - Asia vs. world average
    - comparable per capital GDP in 2005 (US$10,529 vs. $9,887)
    - lower fertility (TFR) than world average (2.63 vs. 3.03)
    - longer life expectancy than world average (72.7 vs. 68.6)
  - East Asia's low-fertility/longevity issue is more prominent
    - in these economies, fertility's influence on age structure stronger than mortality at early stage (1960-2005) and they become comparable at later stage (predicted 2005-2050)

- **influence of fertility and mortality on age structure: 1960-2005**



- **except Japan, fertility plays a major role in ageing**

- **influence of fertility and mortality on age structure: 2005-2050**



- **in less developed countries, longevity plays greater role after 2005**
- **in China/Vietnam, longer life expectancy is the sole driver**