THE EFFECT OF EDUCATION ON THE DEMOGRAPHIC DIVIDEND: AN ANALYSIS OF THE BRAZILIAN CASE

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Our goal in this paper is to replicate this, which uses data from Mexico and Spain, in the Brazilian context.
Economic Support Ratio (ESR): Combines economic and demographic information. It is a proxy for the first demographic dividend.

Mason (2005) and Mason and Lee (2006):

\[
g\left(\frac{Y(t)}{N(t)}\right) = g(SR) + g(Pr)
\]

\[
C(t) = \sum_i N_i(t) \cdot c_i
\]

\[
L(t) = \sum_i N_i(t) \cdot l_{y_i}
\]

\[
g(ESR) = g(L) - g(C)
\]
To analyze the role of educational attainment in the demographic dividend in the context of the Brazilian demographic transition.
Decompose the economic support ratio (ESR) with three effects: Age, education, and rate, using a decomposition method -- Da Gupta (1993)

Simulate using population projections by age and education stratum, as produced by the Wittgenstein Centre for Demography and Global Human Capital (WICD), available in five-year intervals between 1970 and 2100, with different scenarios
**DECOMPOSITION**

- Mason (2005) and Mason and Lee (2006):

  \[ ESR = L - C \]  \hspace{1cm} (1)

  \[ C(t) = \sum_i N_i(t) \cdot c_i \]  \hspace{1cm} (2)

  \[ L(t) = \sum_i N_i(t) \cdot l_i \]  \hspace{1cm} (3)

- Renteria et al. (2006):

  \[ C(t) = \sum_j C_j(t) = \sum_i \sum_j N_{ij}(t) \cdot c_{ij} \]  \hspace{1cm} (5)

  \[ L(t) = \sum_j L_j(t) = \sum_i \sum_j N_{ij}(t) \cdot l_{ij} \]  \hspace{1cm} (6)

\[ g(ESR) = g(L) - g(C) \]  \hspace{1cm} (4)
DECOMPOSITION

\[ g(ESR) = g(L) - g(C) = \frac{L(t + x) - L(t)}{L(t)} - \frac{C(t + x) - C(t)}{C(t)} = \frac{R_L + A_L + E_L}{L(t)} - \frac{R_C + A_C + E_C}{C(t)} = g(R) + g(A) + g(E) \]

Given that,

\[ L(t + x) - L(t) = [\bar{R}(t + x) - \bar{R}(t)] + [\bar{A}(t + x) - \bar{A}(t)] + [\bar{E}(t + x) - \bar{E}(t)] \]

\[ C(t + x) - C(t) = [\bar{R}(t + x) - \bar{R}(t)] + [\bar{A}(t + x) - \bar{A}(t)] + [\bar{E}(t + x) - \bar{E}(t)] \]
DECOMPOSITION

Operationalization:

- **STEP 1:** Calculate rate, education, and age both in consumption and labor income

\[
\tilde{R}(t + x) - \tilde{R}(t) = \sum_{i,j} \frac{N_{ij}(t+z) + N_{ij}(t)}{2} \cdot l_{ij}(t + x) - \sum_{i,j} \frac{N_{ij}(t+z) + N_{ij}(t)}{2} \cdot l_{ij}(t)
\]

\[
\tilde{E}(t + x) - \tilde{E}(t) = \sum_{i,j} \frac{l_{ij}(t+z) + l_{ij}(t)}{2} \cdot \frac{a_{ij}(t+z) + a_{ij}(t)}{2} \cdot e_{ij}(t + x) - \sum_{i,j} \frac{l_{ij}(t+z) + l_{ij}(t)}{2} \cdot \frac{a_{ij}(t+z) + a_{ij}(t)}{2} \cdot e_{ij}(t)
\]

\[
\tilde{A}(t + x) - \tilde{A}(t) = \sum_{i,j} \frac{l_{ij}(t+z) + l_{ij}(t)}{2} \cdot \frac{e_{ij}(t+z) + e_{ij}(t)}{2} \cdot a_{ij}(t + x) - \sum_{i,j} \frac{l_{ij}(t+z) + l_{ij}(t)}{2} \cdot \frac{e_{ij}(t+z) + e_{ij}(t)}{2} \cdot a_{ij}(t)
\]

Where,

\[
a_{ij}(t) = \left( \frac{N_{ij}(t)}{N_j(t)} \cdot \frac{N_i(t)}{N(t)} \right)^{\frac{1}{2}}
\]

\[
e_{ij}(t) = \left( \frac{N_{ij}(t)}{N_i(t)} \cdot \frac{N_j(t)}{N(t)} \right)^{\frac{1}{2}}
\]
DECOMPOSITION

Operationalization:

- **STEP 1:** Calculate rate, education, and age of both consumption and labor income

\[
\bar{R}(t + x) - \bar{R}(t) = \sum_{i,j} \frac{N_{ij}(t+x) + N_{ij}(t)}{2} \hat{y}_{ij}(t + x) - \sum_{i,j} \frac{N_{ij}(t+x) + N_{ij}(t)}{2} \hat{y}_{ij}(t)
\]

\[
\bar{E}(t + x) - \bar{E}(t) = \sum_{i,j} \frac{ly_{ij}(t+x)+ly_{ij}(t)}{2} \cdot \frac{a_{ij}(t+x)+a_{ij}(t)}{2} \cdot e_{ij}(t + x) - \sum_{i,j} \frac{ly_{ij}(t+x)+ly_{ij}(t)}{2} \cdot \frac{a_{ij}(t+x)+a_{ij}(t)}{2} \cdot e_{ij}(t)
\]

\[
\bar{A}(t + x) - \bar{A}(t) = \sum_{i,j} \frac{ly_{ij}(t+x)+ly_{ij}(t)}{2} \cdot \frac{e_{ij}(t+x)+e_{ij}(t)}{2} \cdot a_{ij}(t + x) - \sum_{i,j} \frac{ly_{ij}(t+x)+ly_{ij}(t)}{2} \cdot \frac{e_{ij}(t+x)+e_{ij}(t)}{2} \cdot a_{ij}(t)
\]

Where,

\[
a_{ij}(t) = \left( \frac{N_{ij}(t)}{N_{j}(t)} \cdot \frac{N_{i}(t)}{N(t)} \right)^{\frac{1}{2}}
\]

\[
e_{ij}(t) = \left( \frac{N_{ij}(t)}{N_{i}(t)} \cdot \frac{N_{j}(t)}{N(t)} \right)^{\frac{1}{2}}
\]

The same calculations are performed for labor income and consumption.
Operationalization:

- **STEP 2:** Calculate the effects’ rate of growth: $g(R)_L$, $g(A)_L$, $g(E)_L$, $g(R)_C$, $g(A)_C$ e $g(E)_C$

Ex:

$$g(R)_L = \frac{\bar{R}(t+x) - \bar{R}(t)}{L(t)}$$

$$g(R)_C = \frac{\bar{R}(t+x) - \bar{R}(t)}{C(t)}$$

- **STEP 3:** Calculate the effect of each component of ESR

Ex:

$$g(R) = g(R)_L - g(R)_C$$
SIMULATION

- Projection Period: 1970 to 2100
- Scenarios:
  - Three scenarios with the same dynamic demographic conditions (fertility, mortality, and migration); the only difference is the educational context
  - Scenario 1: Educational attainment follows a general global development trend – medium variant
  - Scenario 2: Assumes that educational attainment is constant – low variant
  - Scenario 3: Assumes rapidly expanding educational attainment, similar to the experience of South and Southeast Asia – high variant
- Decomposition applied to each five-year interval
Population Composition by Education Level between 1970 and 2010

Source: Own calculation based on WICD data (2015)
SIMULATION

Dependency Ratio of Brazilian Population between 1970 and 2010

Source: Own calculation based on WICD data (2015)
Dependency Ratio of Brazilian Population between 1970 and 2010

Source: Own calculation based on WICD data (2015)
SIMULATION

Labor Income and Consumption Age Profiles, 2008

Source: Own calculation based on POF data (2008)
SIMULATION

Labor Income and Consumption Age Profiles by Education Level, 2008

Labor income

Consumption

Life cycle deficit

Source: Own calculation based on POF data (2008)
SIMULATION (THE SAME PROFILE IS APPLIED TO ALL FIVE-YEAR INTERVALS IN THE PROJECTION)

Labor Income and Consumption Age Profile, by education segments - 2008

Source: Own calculation based on POF data (2008)
RESULTS

Economic Support Ratio, age and education effects: 1975-2100

Source: self elaboration based on the POF data (2008)
THANK YOU!